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AGRICULTURE SEMINAR

May 1989

INA/Rural Industries Council



**INSTITUTE OF NATIONAL AFFAIRS
DISCUSSION PAPER NO. 38**

**I.N.A./RURAL INDUSTRIES COUNCIL
AGRICULTURE SEMINAR**

**Papers submitted and presented to a seminar
(together with edited discussion)
held in Port Moresby on 2 and 3 May 1989**

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FOREWORD

This discussion paper presents the proceedings of a seminar on agriculture held on 2 and 3 May 1989. The seminar was conducted jointly by the INA and the Rural Industries Council as input to a White Paper on Agriculture currently being drafted by the Department of Agriculture and Livestock.

The seminar was divided into six sessions: Productivity, Research and Development, Land Tenure and Production Mode, Products and Markets, Financing Agriculture, Agricultural Employment and Macroeconomic Issues. Some 20 papers were presented by representatives from most facets of the industry, statutory bodies concerned with agriculture, agricultural research institutes and government departments. Six papers were prepared for publication only.

The INA and the Rural Industries Council thanks all those who participated, particularly those who prepared and presented papers.

John Millett
Port Moresby
5 July 1989

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Productivity, Research and Development

- Manning:** If you have people in isolated places and they are growing cash crops you have to put roads in so that they can bring the cash crops into the market and as soon as they get the roads they go to town with the crops and stay there. I don't see any easy answer and I really don't think anybody else does but we have to recognise that this is the problem.
- Samana:** I do not object to plantations or nucleus estates but whatever policy emphasis we put must consider the concept of land tenure very critically. Land tenure is going to be the key factor in how far we go in promoting large-scale and nucleus type development as opposed to small-scale development. Efficiency in marketing and infrastructure are the key problems for smallholders; whereas the nucleus estate and large plantation provide these themselves. Though there is a positive relationship between them the emphasis we give will depend on land tenure. Where you have customary land ownership and your objective is employment and income for the rural population then I would emphasise, in our case in Morobe, smallholder agriculture where people own plots of land. But we need to define what we mean by smallholder. I don't think we have a definition of a smallholder. The bank (Agriculture) definition of a smallholder is probably 20 hectares; but that does not really suit the smallholder in the village with 500 trees down to 200 trees, which is what we are looking at. To the bank these kinds of endeavours are not feasible so this is where we need extension packages to meet the needs and requirements of the smallholders. These are the policies that need to be defined carefully. I quite agree with the speaker that extension services in the rural areas are non-existent. What is going to be the model of extension to support our smallholder; or is the plantation going to initiate development?
- Gillbanks:** My own experience in various parts of the country seems to indicate that no single mode of land tenure will meet the requirements of the people in the future. Maybe some sort of ad hoc approach is needed. On his point we might call on Professor Knetsch to give us a comment on land tenure.
- Knetsch:** I incline to the views that some other people have expressed on tenure - somehow evolving customary land laws into something that approaches common law - the sort of thing where you develop a body of consistent land law so that people have some consistent means of resolving disputes and so forth. It seems that that sort of evolution has to proceed. With that will come the security that people need to make the investments; and that is at least a path. I don't think that any sort of major restructuring is going to do. I certainly agree with the comment that the land tenure issue is at the root of agricultural development.
- Gillbanks:** We need to recognise Papua New Guinea's position in the world of agricultural production - our cost structure as was pointed out by David Freyne. There is the need for further research on cropping levels which was stressed by Peter Turner. We also need to look at domestic market

structures; there is probably research needed in those areas for domestically consumed crops. They are relatively quite important in the economy. Take crops like betel nut for example. I don't think there are any statistics on it but it seems probable that that crop is the third most important cash crop; it may even rank second. There should be research on new crops, active research on food crops. Now this research is not going to be funded by the commercial sector. Whilst it may be relevant to call on the industries - cocoa, copra, coffee and oil palm - to partially fund their own research, it is still a national requirement to fund research for the future benefit, the long-term future benefit of the country and that must include adaptive research on other crops. It seems to be widely recognised that the whole extension in Papua New Guinea has been failing for many years now and that Coffee Development Agency (CDA) represents a new approach to extension. Maybe satellite monitoring will produce a new focus for extension i.e. identifying where the crops are and where you need to make the input. It may even be able to tell us what the relative health of the crops is in various areas of the country. I think it holds fascinating prospects. I would like to look at our plantations from that point of view.

Wayi: I would like to direct a question on costs to Mr. Croome.

Croome: The cost of the Landsat satellite image for the 185kms x 185kms with seven channels was \$A5,000 and you can get a quarter scene for half the price. The processing time required for a project such as the coffee one that I did involves about 3 or 400 hours before writing up. The level of processing required depends on what you are interested in looking at. If you are just interested in finding the difference between coffee and not-coffee then it takes hardly any time at all. It is when you want to tell the differences between crop type and management strategies applied to each one that it gets a bit more complicated.

Temu: If you have to go back to the field to verify what you have on the picture isn't it more cost effective to use the field information in the first place rather than going through this more expensive exercise of getting the pictures.

Croome: When you field check satellite imagery 3, 4 or 5 times and make sure the reflectance value means coffee and not any other ground cover, you can assume that wherever that reflectance value occurs it will be coffee and so it reduces the amount of field work needed to cover a very large area. If you were to do the whole 185kms x 185kms on foot it would probably take you six or seven months and you probably wouldn't see everything anyway so from that point of view it is very cost-effective -it's timely and it's cheap so it has two advantages.

Millett: I would like to direct a question to Dr. Turner. Is there not a difference in the research requirements for the low-input low-output method of the smallholder and the high-input high-output ones of the largeholder and what implications does that have for funding.

Turner: I don't believe in the low-input low-output approach to agriculture. I think the majority of smallholders are very capable; given the right instruction, the right information, the right encouragement they will go for the high-output material.

Gillbanks: Smallholders follow an example, they may be slow in doing so, but they certainly follow an example. If you look at the productivity of say a Malaysian rubber smallholder now compared with when I was starting the Malaysian rubber industry in 1955 you would find that he has quadrupled his crop. Now he hasn't done that by any other way than adaptive use of research findings which are first generally implemented on plantations. You would find the same thing in palm oil and in cocoa I have no doubt at all. Cocoa production in Malaysia is now nearly 200,000 tonnes and a lot of that is coming from the smallholder sector. That crop has developed in the smallholder sector in the short time span of 16 or 17 years on quite a massive scale. Here we are just beginning to see the results of a century of research. The new planting material in cocoa, the new hybrids (which I suppose are not really new but they are relatively new in Papua New Guinea), have given the impetus to redevelopment both in the smallholder sector and the largeholder sector here - they are growing in parallel. After 15 years of practically static production the Papua New Guinea industry shows an increase to 40,000 tonnes and there is no doubt that our crops are going to double over the next very few years. We now have to learn in both the smallholder and the largeholder sectors how to reduce the cost of that output. The smallholders' perception of cost may be different from the largeholders' perception of cost. His perception of cost is, generally: how much effort, how much work have I got to put in to get a certain result, a certain financial result. If that work does not measure up in his terms then he won't do it any more. Hence we find production dropping with falling prices - he doesn't increase his efforts to maintain his income he just gives up, doesn't do it any more. But we have to find ways of increasing his productivity and of course better planting material does that, better ways of managing that planting material does that. If he can get the same yield from 50 trees that he used to get from 500 he is going to tend to do that because it economises his input. These are ordinary human factors. The plantation owner is going to do a similar thing from a slightly different motivation and in slightly different ways but by and large the plantation and the smallholder both want high-output material.

Manning: I would like to direct my question to Mr. Geroro. On the coast we are particularly interested in the experiment of the CDA and I have just had the privilege of going through the Highlands and talking to quite a number of people about it. But what we were unable to ascertain is what is it costing; and the major criticism of the Agency seems to be that it is doing a very good job but at enormous cost. I also believe that your accounts are not published and not available. Is there any attempt to compare the Agency in terms of increased tonnage, or increased hectares being looked after, with what used to happen under the Department of Primary Industry (DPI). We are all full of criticism of DPI and we would like to see some way of improving extension and obviously we are watching with interest the experiment, and the politics that goes with it, in CDA.

Geroro: I will just comment generally, not disclosing any figures, because that would have to be done through our board of directors; it is a legal requirement. Generally speaking in the field I don't think the cost factor is the main thing. There is an observation being made that the production has already increased by three times for a given unit input on a given unit size. We are looking at a 300-tree smallholder and with something like 1,000 kg per hectare green bean following our rehabilitation package he has actually increased his production by three times. There has been a study done - the results should be out by June - looking at our coffee management divisions. There will be variations in the inputs depending on where you are, the Highlands, or the lowlands, that sort of thing. But generally speaking our input has increased production by about three times.

Manning: We believe there has to be a change from the current system. The split between the provincial Department of Agriculture and Livestock (DAL) and national DAL has left us in the worst of all worlds so far as the industry is concerned, certainly as far as extension is concerned in the cocoa and coconut industries. Some form of privatisation is going to be necessary and we believe that the funding has got to be done quite differently from CDA. The sort of thing that we have talked about in the Planters Association, which I again emphasise is not just plantations but whose membership is more than 50 per cent smallholders, is that the government would have to transfer funding for the activities that it was passing over to the private sector with some form of reasonable control and hence I asked the question about your accounts. So I think you have the worst of all worlds. You have a statutory institution which is not publishing its accounts and therefore not in anyway accountable to the industry which funds it. You are laying yourselves wide open to tremendous criticism. We are thinking that if there is going to be a transfer of functions there has to be a transfer of funding; but there has also got to be proper measurement of performance so that government is getting performance for its kina.

Gillbanks: I am going to call on Paul Barker to make some comments on that issue and also to give us a view, if there is a view, on the funding of research in the non-cash crop sector and how that might be managed by government.

Barker: The largeholder sector was very much involved in the design of the CDA in the first place. The CDA was designed very much as a collaborative exercise involving the provincial governments, national department and the plantation sector. Unfortunately as it evolved certain parts got dropped. I think the plantation sector has very much remained a supporter of the concept but as people have said here the funding area has become very controversial. It is an issue that people have been aware of. The books are audited and the proper accounting systems are followed. Then the books are provided to the various shareholders who are the provincial governments, the national department and the Coffee Industry Board (CIB) who collects most of the finance through the levies. Those parties may then make available the financial details to the community; but it seems to date that perhaps they have been a little bit reticent considering how much the community is wanting to know the details of those finances. The idea was

mutual financing, and it could be said that maybe the national government's and provincial government's contributions haven't been what was originally hoped for. The idea of passing various responsibilities across to the industries to take care of is favoured; but when the actual funding side gets raised it gently slips to the back of the agenda. It is something that the industries are continually having to battle for and I think one has to be realistic about that. The Prime Minister made statements in the Working Group Meeting last October in Goroka that the government would be committed to a stronger support for research. But research is a difficult area. Politicians who tend to have a slightly short perspective on the world tend to ignore the long-term benefits of research. The research institutions are going to have to work on that attitude. The extension side is important to the farmers but you have also got to be able to market yourself to the decisionmakers to demonstrate that the benefits outweigh the costs. Certainly the comment that your books have to be effectively made available is very much a valid comment.

There have been various comments on the suitability of DAL for various roles within the provincial government model. I think we have to accept that the whole situation since provincialisation has changed. Institutions have got to evolve and adapt to changing social and economic demands. Domestically and internationally there is an acceptance that certain institutions function better than others. Government has a very important role in providing policy but government bureaucratic institutions may not be the best means to provide services. The concept of service delivery via agencies - research institutions, organisations that are effectively more flexible, more dynamic, more spontaneous - is accepted increasingly internationally. Now we have established research institutes in cocoa, coconuts, coffee and we have effectively got a research institute in oil palm which has been going for somewhat longer. In the other side of research, which is adaptive research, food crops research, we are not able to attract or retain staff. We are not providing a sufficiently dynamic environment to attract either international funds or the researchers needed in this particular area and I think we are going to have to modify the system somewhat. We are talking about the need, with the low commodity prices, to look at alternative crops in the cocoa-coconuts area, additional crops say peppers, spices, etc. There is room for a more dynamic system to be introduced and maybe there is also a need to be looking at a broader spectrum of land use generally. One has got to somehow bring in the concept of agro-forestry and maybe the need for an umbrella institution like a farming systems research council that can encourage better communications between the different research institutes so that they don't all go off in their own different directions. This is something that people have been talking about for some time; researchers in DAL seem to favour a less rigid system. It may be a case of marketing the idea again. There is a certain amount of favour in some areas of government for the concept, though as Roger Gillbanks suggested earlier, the government would really have to put up the majority of the funding.

Samana:

I would endorse Dr. Turner's requirements for research in cocoa in particular. I speak for one of the cocoa growing provinces in this country and there is a need for adequate funding for research in cocoa, and also for coffee. There is indeed a need for long-term research in our commodity crops. So that requirement should be endorsed by this seminar. Secondly, as someone has already mentioned there needs to be proper linkages between research and extension. If you have very weak extension at the provincial level, you cannot have that effective linkage - up-to-date information, scientific knowledge - about crop maintenance, pruning, etc. passing down to the farmers who are going to do the producing, and increase production and quality thus maintaining our markets overseas. So effective linkages between research and extension is vitally important. On the question of extension models I am very pleased to hear from CDA about some of the concepts and approaches. Those approaches need to be looked at fairly carefully and, in the case of CDA, it is too early to say whether or not it is doing a good job. Accountability is important in getting political support. Much of the criticism of CDA is perhaps more political and coming from one sector of the nation, the Highlands, where a lot of politicians are making politics out of what I believe is an extension model specialising in one commodity, which is an innovation here. This is the first time in the country where we have specialisation in extension. Mostly we have generalist extension services. Someone had to be an expert on bulamakau, coffee and everything else. When you send someone who is trained in bulamakau to a coffee growing area he cannot give expert advice on coffee, he only knows about bulamakau. This is the first effort in trying to specialise in particular commodities so we should try to see how that model is working and try to improve on it rather than trying to kill it. That would be my attitude on CDA - less politics because extension services are very important if we are to reach the 90 per cent of our population in the villages.

Land Tenure and Production Mode

Gillbanks:

Firstly it depends what we mean by plantation mode. A plantation can be anything from a part of a hectare up to what is generally recognised as a plantation which may cover 100, 1,000, or several thousand hectares. When we talk about land tenure for tree crop plantations we are talking about making that land available for long-term development. There is often talk about the reason for this being the need for having security to offer banks so that they will lend money for development; but that is not the sole reason. For the developer himself, in order for him to be prepared to put in his own efforts, his own time and his own money he will require security of tenure for at least that crop cycle - probably for several crop cycles. So tenure of land is very important from all points of view if we are going to see long-term tree crop development; and that is true whether we are talking about a very small plantation, a smallholder, or a large plantation. There may be different ways in which this can be achieved and there is

much talk currently about the mobilisation of customary land for plantation-type development, or permanent tree crop development. I think it should be said that the former method which generally involved the government buying out the traditional interest in the land and turning it into State land doesn't work at present; but there maybe other ways in which land can be mobilised on the lease-lease back system, for example, for long periods of time. There may be ways in which the customary landowners may be involved as partners in the long-term use of that land. Those methods of mobilising land are just beginning to be developed within Papua New Guinea and I think we will probably need to discuss that in our discussion session. One banker member of our Institute has written "it is highly questionable whether the land evaluation and demarcation project will be effective. If every province was to enact legislation along the lines of East Sepik, administration from a lending viewpoint would prove very difficult. It is usually found where difficulty abounds nothing tangible emanates. Land, whether national government leasehold or otherwise, especially in remote areas or near settlements, frequently can be adjudged useless as security for borrowing. If the lender has to foreclose in practical terms it becomes almost impossible for a mortgagee in possession or a new mortgagor to work on land. Consequently additional security will regularly be sort where borrowing is substantial, management ability is not proven and past track record is questionable or non-existent. The government has tried to overcome this problem to some extent with provision of a form of insurance through Credit Guarantee Schemes. This has not proved completely successful."

Now there are many perspectives on land tenure. Tenure may be quite secure for the present holder but if he has to offer it as security it may not be possible for the mortgagor to take possession of the land. Recent East Sepik proposed legislation whilst it has much merit proposes a very short period of time in which a mortgagor can be in possession of that land - three years - so that effectively makes the provisions useless. But the fact remains that land tenure is a developing question. There are transactions, we came across this in a study in the East Sepik recently involving customary land, where both the vendors and the buyer, regardless of what the law says, believe that a permanent transfer of ownership of the land has taken place. And of course we must remember that in Western society the land law developed in much the same way - from the common lands of England to the enclosed farms, for example.

Millett:

Mr. Wayi introduced the concept of a land use authority which may be able to solve some of the inter-departmental problems; and then Mr. Mitio referred to the problems between the national government and the provincial governments; and we have been talking earlier about the CDA. The whole thing seems to be related to a change in the way that public services are delivered. The reference to the inter-dependency between agriculture and forestry reminded me that in just the last couple of days a report from the World Bank to the Forestry Minister has suggested the establishment of forestry boards, an umbrella board and regional boards I think. Are there any thoughts on this sort of thing that we could direct to the White Paper designers.

- Gillbanks: It impinges on land tenure because most of the land we are talking about is in customary ownership and therefore any national land use board would have to take account of the wishes of the customary owners.
- Wayi: I introduced the concept of a land use authority as I think it is a step in getting various departments involved in rural development to work together. For example, suppose that you have a piece of land somewhere in West New Britain, which is State land of 10,000 hectares for which a survey has been done showing 5,000 hectares suitable for agriculture and 3,000 for agro-forestry. How should we go about developing that land? Should forestry go ahead and convert that 3,000 plus 5,000 into 8,000 hectares for agro-forestry or reafforestation and forget about agriculture; or should agriculture say we will take 5,000, the other part we leave as it is? What I am putting forward is a system in which groups of technical people come together and decide on the best form of land use. I think if we approach planning in this way it will minimise conflicts in land use.
- Gillbanks: Though there are some inherent problems with that idea, identifying the best use for land ahead of promoting uses for land is very sensible. As an example, I was recently in the East Sepik in an area which would grow excellent rubber but which is extremely fragile when used for gardening. Gardens revert to very impoverished grasslands very rapidly. Under rubber the fertility is maintained.
- Makara: I would like to make a comment on land tenure and land use. In the last seminar in Resource Management System one of the points made was that there is always a conflict between forestry and agriculture on land use. There is an economic factor at work. What we can get out of this or that plan is more important than who is important in that conflict. I think the conflict is basically caused by the people not the factors that determine the use of the land. For instance Moitaka land used to be cattle raising land. When Moresby city developed we tried to hold it for cattle raising but we couldn't because government said we can get most out of the land as a university and a centre of government, so we had to give it up to those needs. We held another station for agricultural purposes but when the need for town development came we had to give it up. Arawa used to be a coconut plantation but when the need came to develop the township then that had to be given up. We always think that land disputes are stopping economic production; but I believe that the dispute is not really important by itself in determining the land use. If people are taught properly why we want the land I think people will give up their land and allow it to be used for their benefit. For instance, two years ago, the land use section was asked by myself to do a feasibility at my place and I expected some dispute to arise from the survey. The land use team arrived a day before my arrival so they went ahead doing the survey and people started getting confused and thinking that this land is going to be claimed by the surveyors so they started to dispute the whole idea. But when I arrived I saw that it was going to cause a bit of a problem so we discussed this and then found out that the survey was just to study the potential use of land rather than doing the boundaries. So what happened was that they all agreed that

the survey could go ahead. Sometimes people misunderstand the actions of organisations and I feel that the credibility of the extension fellows among the community is most important. I feel we should be understanding our people more rather than just blaming people for causing the land dispute.

Mitio: Where does the speaker come from?

Makara: I come from Central Province.

Mitio: The situation is not the same. In the Highlands if you bring in a surveyor you will probably get a confrontation and before the work begins they all want to know how they will benefit. Though the people will understand the value of using the land I think there is more to it than explaining the situation to them. For example in coffee when we want to put up a coffee block development landowners would organise themselves into business groups and put the land in; but within these groups there are always conflicts on how much money an individual should get from the portion of land he has put in, either through dividend payments, or through other payments that he anticipates receiving from the business activity. If that does not take place then he will cause more conflicts among the shareholders when the dividend payment is made; or he will organise a factional group to manage the business on his own and then interfere with the management and so on. So we find there are more problems in getting land, or surveying for commercial purposes as well as other investments on the land.

Underwood: A question to Mr. Mitio. The land owners' equity scheme - could you perhaps outline a little bit more about this so that we can compare the two different concepts.

Mitio: The discussion was about the approach to utilisation of land for commercial purposes. A lot of the conflicts that occur have risen from land ownership. One of the ways to prevent these is to increase the land owners' equity in the business group or in land development. This may be done either by putting a value on the land itself or by asking the land owners to provide free labour and material like timber for fencing, to prepare the land for planting out, to prepare nurseries and to plant out into the field free of charge. If they can increase these components it will save on the cost of development in the early stages leaving dependence on loans till a later date. So that is the sort of idea that I had. I mentioned earlier about trying to arrange the land that is owned in the villages into family-owned land or clan-group owned - in fact clan is too big actually, it should be split further. At the moment if you go within the village and within the clan and within the family there are boundaries as to where they can plant their food and so on. What I am proposing is to organise this into a registration system. For example in the Kainantu district, land mediators and kiaps more or less established authority in certain land disputes and allocated land to the original land owners, etc. All this could be formalised now if the Lands Department would act. About 50 per cent of the area in

Kainantu district is already allocated under this scheme. People know exactly where their boundaries are and they can use it for title and commercial purposes.

Gillbanks: The question of ad hoc registration of land was raised in a couple of INA papers some time ago and it seems to be a totally logical development from pure customary tenure through to some form of individual tenure.

Are there any questions on Mr. Marmelstein's paper on rubber development. I think this is very interesting - the potential for rubber development and the very large areas of land which are suitable. I think one of the things that we have to bear in mind when we talk about suitability for agriculture is that agriculture is a many-faceted operation. Perhaps rubber is a modified form of forestry. Cocoa is really orcharding, if you like. There are very large areas of land which are perfectly suitable for rubber but unsuitable for the more popular crops like cocoa and arabica coffee and rubber is very kindly to the environment, especially the soils.

Van Kamp: When Mr. Marmelstein talked about rubber, smallholders and nucleus estates, he limited himself largely to the processing aspects of it. In the case of oil palm nucleus estates we know that the smallholders are all conveniently located around the nucleus estate and the processing is essentially done in the factory. One of the features is the regular collection - almost on a calendar basis - on that day we will be in that sub-section collecting the fresh fruit. Now in rubber can you see something similar developing particularly if the smallholders are physically removed from the nucleus estate.

Marmelstein: Yes, providing that it is not latex but cuplump, it can be organised. To illustrate, the Kunico project is in many ways (not in the terms of Agriculture Bank) quite a successful smallholder project. They have their own ways of doing things but I can say that the trees look nice even after many years. After it failed, we came in, established regular picking up and in this particular case we actually went as far as collecting latex. Now as long as we did it ourselves it was alright; but when we started to get a local man to do the collecting the people who did not have transport became jealous and did not want him to make money on the transportation. So the latex thing was a bit difficult in the end. Then we just went out twice a week to collect cuplump. That ran into no problems at all until we got some political interference and at the moment the whole scheme is dead. If there is a big enough area it is worthwhile sending special personnel and special transportation to collect. If it is too small you just have to depend on the local forces. So whenever someone is planning smallholder schemes somewhere where there is no factory, collection has to be arranged for - there must be enough rubber to make the organisation of the collection possible.

Gillbanks: There have been around this country so many small schemes and projects (I generally call them toys but I am a very rude person sometimes). I have seen toy sago factories, for example, toy coconut oil mills to make

dieseline at four times the normal cost of dieseline. These things are fine as trials but it is no good ever pretending that they are commercial. A scheme has to have a certain size in order to be economically viable.

On the point of equity in development through land values, it is interesting that this is beginning to happen and in some areas of the country you can identify an opportunity value for land and perhaps convert that into an equity in a project. In earlier days the actual opportunity value for land in many areas was very small because of transport constraints, the lack of infrastructure and so on. But as industries develop and as infrastructure develops so too does the underlying value of land increase and so therein lies opportunities for participation by landowners in sizeable projects, with sizeable equities.

Millett: Mr. Marmelstein, did I understand you correctly when you said the movement from manufacturing RSS to TSR actually resulted in lower production because of lower prices to the producer?

Marmelstein: Yes, though the World Bank comments that the volume went down from 5,000 to about 3,000 tonnes because of bad prices. I think that that is a mis-statement; it is because we changed from one type of product to the other. The RSS is really very simple to make and everyone was doing it with a little hand mill. Then it suddenly came to a stop when we switched to TSR.

Millett: Tomorrow morning's session is devoted to this sort of thing -what is the appropriate level of processing in agriculture -so perhaps you might care to make that point again tomorrow. The other question I have - an open one - relates to the proportion of land devoted to the different production modes or the proportion of output deemed appropriate from the different production modes. Is there any need in policy to attempt to address such issues?

Gillbanks: You cannot have an absolute policy on that. In a rubber scheme, as long as commercial management for the factory can be assured the entire production could be smallholder; but you then come against the problems which Mr. Marmelstein pointed out, of somewhat irregular production from smallholder schemes. The same is true in oil palm. From my experience if we depended entirely on smallholder crop we would have an awful logistics problem in the factory because there are times when they cut everything available and other times when there is an absolute dearth of fruit and you can balance out with your own production.

Millett: We have had statistics for the proportion of production of the various crops which comes from the largeholder sector and the smallholder sector. Would policy be looking to move that balance in any direction and if so what direction? A greater proportion of smallholder production or a lesser proportion?

Hoyle:

One of our projects was designed as approximately 50/50 smallholder estate production; but the way it has turned out ten years later is very much 70 per cent estate and 30 per cent from the smallholders. Smallholder production is well below what was forecast many years ago. I tend to favour that sort of balance, 70/30, 80/20, rather than the schemes which try to go for equal production on both sides. When you have a factory relying on a very large smallholder input and prices go down, as they have done, I think we are very conscious of this over the last three or four years, there is very little that the nucleus estate can do to subsidise or assist the smallholder maintain his fruit levels. With a smaller smallholder scheme the estate can carry them to an extent. In putting together new schemes I have gone for smaller smallholder projects, about 20 to 30 per cent of the overall requirement for fruit. Also I am not relying on yields which approach anything like the estate sector itself. I would discount the yields by at least 30 per cent, possibly more. One of the problems here is the quality of extension services. We don't provide management for the smallholders, the DAL does; but I don't think that is the entire problem.

Gillbanks:

Mr. Hoyle's comments related specifically to oil palm schemes and I must say from experience that the discount, 30 per cent on optimal crop levels, is probably relevant and the actual balance is something which each investor would work out for himself. But in other crops quite different balances might be the case. Mr. Marmelstein has made the case for rubber but in yet other crops, e.g. coffee which Mr. Mitio was talking about there is no balance. There is no absolute need to have a largeholder sector at all from that point of view although from many other points of view it may be highly desirable. The largeholder sector often takes the lead in developing new materials and methods which the smallholder sector may follow.

Bodman:

The discussion on production mode to some extent has been begging the question of economics. There have been suggestions that rubber prices have been fairly good so you can support the estate and keep the smallholders going too. As the Chairman mentioned in coffee there isn't any ideal combination of plantation and smallholder production to run a factory. But I think that in coffee, the situation is being rewritten by the prices that we have at the moment and the forecast prices that we see over the next ten years or so. While today we might have 30 per cent of our coffee production from the largeholder sector and probably 50 to 75 coffee factories would be processing some smallholder coffee, virtually all the plantations would not even be covering operating costs this year and the situation will get worse as we reduce the bounty we pay. There is clearly a danger in the future that the plantations sector as it stands at the moment is not going to be viable; and so we have to be looking maybe at subdividing plantations and the landowners going back onto the plantations and a new mode of production developing. The balance between plantations and smallholder very much depends on the economics. The position of rubber and the position of coffee are quite different.

Gillbanks:

I would like a comment from Mr. Mitio but first I would like to pick you up a little bit. Historically the plantation sector has proved rather

adaptable and certainly in cocoa we know there is only one course for us and that is to increase production efficiency which means capitalising on research and increasing yields and increasing overall productivity.

Mitio:

I mentioned the ability of Papua New Guinea to sustain both modes of production, that is the smallholder system of low-input, low-output and the high-input, high-output plantation system. For example in the coffee industry the high-output, or as we call it the managed sector, mode of production is expanding in the middle scale in the development of coffee estates. The large estates have been developed previously by mostly Australian settlers who developed large-scale plantations but these have been taken over by national groups. As people have seen the example they have ventured into traditionally-owned land through business groups and a lot of these developments have yet to be tested as commercial entities. People have gone ahead and invested in them as a business proposition but because of lack of commitment by the people themselves they haven't really got the benefit out of them. Some people take part for prestige purpose, bigmen sort of thing, and develop the land and they say they are the papa of this big business. Others would like to get a return on their investment through dividends. That concept has not yet been settled in the thinking of the land owners so that is why I said that the middle-scale or block-type developments have yet to be tested. Other speakers have highlighted the problem of viability under the current depressed prices and rising costs. We have yet to test the feasibility of this sector. That is why I emphasise that there is great potential for small-scale cash cropping. If we can re-organise government extension support or follow the CDA type approach we can support our small-scale people to turn out large volumes of cash crops for export.

Natera:

Early this morning Mr. Samana mentioned that it was very important that we come to some sort of definition of who and what is the smallholder. The smallholder in the context earlier on had been related to some form of project or nucleus estate. More and more we are relating to a village farmer and we say he is a smallholder and we say the traditional farmer is a smallholder. A lot of the decisions about land and production will come down to whether we are talking plantation or smallholder. We need for policy, from this seminar, a definition for a smallholder - who and in what area we are talking about - because it affects lending policy and credit facilities, etc.

Gillbanks:

Traditionally a smallholder is someone holding a small area of land, generally on some form of recognised title; and that would appear to be happening in the Eastern Highlands where land has been broken down into family group possession. It is a bit difficult to talk of a smallholder who holds land on uncertain title as a member of a group in a traditional holding, in some areas. Yet in other areas within that traditional structure there are very strong individual ownership of land even if only for a lifetime. That concept of participation within a group ownership is a difficult one for bankers and people of that nature to get their minds around.

- Kuimbakul: A recent World Bank agriculture assessment review defined a smallholder as a person who has land up to ten hectares.
- Gillbanks: That is the traditional view of a smallholder of which I was speaking; but then we have people who within village groups own perhaps tens of thousands of hectares but have 200 cocoa trees, so obviously an area of land is not a definition in this case. It must be an area of crop and it must presumably relate to the tenure under which he holds that crop.
- Anaman: Whether a farm is small or big would depend on the type of crops, on the type of land and the type of area so there is no clear definition. The World Bank definition is normally used as a start but we shouldn't put too much emphasis on it; rather you should look at the specific crop and the specific area you are talking about. If you take the Bank's definition as the ultimate definition you are going to have a lot of problems when you are trying to classify different crops or different areas.
- Gillbanks: Perhaps we should define the smallholder, if we need to define the smallholder, as that person running an area of crop or land which can be run by one family, i.e. without the need to employ outside help; but even then the boundaries are very shadowy.
- Millett: One of the INA's authors, Goldthorpe, drew the distinction between plantation mode and smallholder mode of production along those lines - that the smallholder makes the decision about what to do and actually does it; whereas in the plantation mode the decision making is separated from the actual activity.
- Van Kamp: I would like to go back to what Mr. Mitio said earlier. He attributed a high-input, high-output mode to the large or commercial sector and to the smallholder, a low-input, low-output one. I just wonder whether Mr. Mitio was condemning smallholders to a low output forever. We have talked about it quite a few times today - the poor quality of extension services. Isn't the essence of extension to bring the small producer to a higher output through a higher input mode of production?
- Gillbanks: We were talking earlier about research benefits and saying that research should aim to give the smallholder a greater return for his efforts - as indeed the largeholder expects to benefit from research. So we are not necessarily condemning him to that mode but of course he does start off from that mode in many cases. It is an interesting point and I wonder whether Dr. Turner would like to add something.
- Turner: If you aim low you finish up even lower. If you aim high you may get half way there and that is a very good philosophy for smallholders. Smallholders are very capable. In the oil palm schemes some of them did much better than the estate did. They started off with a very good extension service. Later there was a change from experienced extension workers to the less experienced and at Bialla the smallholder side was going back under bush at one stage. But one excellent DAL man over there got his team together,

worked out what to do and pulled Bialla right up. There are some very good extension people around but not enough.

Gillbanks: I would like to expand on one point. In the Hoskins Oil Palm Scheme with which I was associated for fifteen years, in all of those fifteen years 10 per cent of the best settlers actually outproduced the plantation irrespective of the level of input from the extension services. The big difference was in the middle majority who performed at about the 70 per cent level and there was a tail end who did not perform at all, who produced nothing. These figures support Mr. Hoyle's 70 per cent.

Mitio: I would like to expand on what I said earlier following comments by Mr. Van Kamp. The idea of low-output, low-input mode I was trying to get across was of the mass of people turning out large volumes of a commodity using family-based labour, rather than getting the smallholder to adapt to large-scale farming systems for which he has to become dependent on other higher management inputs. I raised the question about the future of the business group concept - whether these will remain as an entity in the future or will disintegrate. If we choose to keep the smallholder cash cropping then we should design our extension support services and other inputs to encourage them, using their cheaper labour to keep their small-scale farming systems as they are and turn out a more consistent product in terms of quality and volume so as to put more benefit back to the rural people.

Land Mobilisation

Gillbanks: You mentioned that the restrictions on title-converted land can be lifted by the minister; however it then becomes freehold land and there are still restrictions on who can own freehold land which do limit its availability as security to banks and other organisations. Would you like to comment on that aspect?

Ovia: Yes, the Land Freehold Act defines citizens. A citizen is usually defined in the constitution and is clarified in that Act. Now if their organisation is a citizen company it can take that freehold land but if it is not, if it is foreign owned, then it cannot take that particular land.

Gillbanks: I thought it was only an automatic citizen.

Anaman: I would like to ask a question concerning land demarcation. What about trying to demarcate village land - boundaries between different villages as a first step. Once you have defined boundaries for villages and towns then you have solved a major part of land registration. Then with time you can go into registering individual clan land within the village. Would you like to comment?

Ovia:

You are talking about the methodology by which we register the land. Now we hope to go down the following track. First, you take a particular province, you look at the particular people living in that particular province and there are broad language groups, you might have for instance (recalling from the area I know best), the Rigo people, the Koiari, the Doura people, the Gabadi, the Nara, and the Mekeo people. Now those people are large tribal groups. Having demarcated those particular areas you then come down within those particular areas to smaller groups or villages so in the Mekeo village you might have several villages. In the Rigo area you might have several villages. So demarcate the boundaries between those particular villages. Then you come down to the clan and groups within it. The clan groups, with the assistance of the government and the people of the area, demarcate that land together. What happens within family groups is no concern of the government. We leave that to the village land mediators to settle those particular areas and those will be then registered if there are known individual ownership to particular areas. So we come down from the larger group to smaller, smaller and smaller groups in time and this is why we are giving it to the provinces where it will be more localised and the people understand their system. Rather than using helicopters, qualified surveyors and photography by air, which is very costly, let the people identify their own land and the boundaries and government will assist with the training of special land magistracies. At present criminal magistrates are used to demarcate land for the village people but we would like to see specially trained land magistrates who could actually demarcate those particular areas with the surveyors and the village people. That is the basic methodology.

Anaman:

My second question is on the equity for the Rigo land project. You said that the land contributed by the Rigo people was used to get shares. I would like to know how you determined the value of their land and how you hope to get the shares, because the value of land is changing.

Ovia:

The Rigo cattle ranch was a joint venture between the Rigo people and Agriculture Bank. We simply got in there and surveyed the land. Now since the area was very large we used aerial photography. Having surveyed it the Bank then went out and said to them you own so much of this land and you own so much of this land, and you own so much of this land. Based on present day values, they were given those proportions of shares. Having done that the Bank then negotiated with the Australian Government for a Brisbane-based farm manager to come up and the Australian Government also contributed some 3,000 cattle. The local people were used as cowboys and fencers. The manager is actually employed by the people and the people actually formed the company. The particular land they contributed forms part of the company so if the land appreciates in value they share in the appreciation from their share in the company. It is their own company.

- Gillbanks: People involved in the East Sepik LEAD project or evaluation following therefrom suggested that the actual problem of demarcating land was considerable and that the personnel resource available to do it was pretty limited. It was suggested that satellite imagery might be helpful in this.
- Ovia: The East Sepik Provincial Government have been working very closely with us. We informed them that registration is a complex task and that their proposed land registration and land act should wait. However after passing the legislation they realised that they do not have the resources to implement the legislation. Under the Land Mobilisation Programme continuous assistance will be provided to the East Sepik Provincial Government to develop their register and their capacity. Remote sensing comes in under component 6 and Land Resource Inventory. In order to build up capacity, Australia will be supplying the National Mapping Bureau with the all the equipment worth in the vicinity of K6 million, under a World Bank project. Two people have returned from training, one from France on spot imagery and another from Japan. But when you talk about title, and Torrens Title in particular, where State guarantees title you cannot have satellite imagery as a survey plan.
- Wayi: Coming back to alienated land. I understand that for most parcels of alienated land in PNG we don't have proper land evaluation in terms of agriculture or forestry. My question is how do you propose to tackle the evaluation of all these parcels of land?
- Ovia: Evaluation of land must be done by the DAL. Our task is to let you know where those particular lands are. The information we will provide will say that these are all the areas of land that we have acquired. The soil and other resource evaluations are done by your organisation with some information taken from Weather Bureau and other areas. DAL evaluates the land and classifies it and that information is held in the central repository. They are the custodian of that information and as such no other department or organisation is able to change it; they may view it, they may use it, but they cannot change the custodial information. DAL is the custodian and the only one that can change that particular information. About seven levels of security checks have been implemented into the system. DAL puts in the information and is the only one that can alter it.
- Wayi: I asked that question because with the limited resources at DAL at the moment it is going to take several years to go through all those parcels of land and I also understand that DAL's part of the LEAD project was scrapped and I just don't know how we are going to study and evaluate all parcels of alienated land.
- Gillbanks: A lot of alienated land is, shall we say, in the private sector; the present lessees of that land have made their own evaluations (value is developed in various crops) and there is a great deal of information available from those organisations which could probably be made available to the Department for incorporation in your data base.

Freyne:

I am a bit concerned about some of the terminology used by Mr. Ovia, such as "one stop shop" for land use planning, and the economic mission that the Lands Department is on, and the central repository and land information systems. Let's say that there is a central repository for the type of information that Mr. Wayi was talking about and it is in the Lands Department. Is there any advantage for someone who wants to develop an area having to go up to Lands Department to get the information, then having to take it across town to Mr. Wayi to interpret it with him? Or does the Lands Department have plans to develop this capacity in house? If so how is it going to handle the questions of agriculture, forestry, town planning, rural electrification, etc. I don't believe you can do that. I would go back to the original comment Mr. Ovia made: that the function of Lands is administering land and its land administration improvement is central to that role.

Hoyle:

Over recent months we have been approached by three or four groups of customary owners of land from various parts of the country. I think most of the areas have had a soil survey or at least a land use survey and we know something about these areas, not necessarily enough but enough to know that certain types of development could probably take place there. Do you think that there is any chance that we could, within a reasonable time frame, negotiate with customary owners and get an agricultural lease over 7 to 10 thousand hectares of land? You were commenting on this question of equity, equal participation: I put it to you that to develop 10,000 hectares of land costs quite easily K80 million. How could you have an equal participation; have you any thoughts or views on how participation even might be handled by land owners. What would they contribute apart from their land, what value would you put on their land?

Ovia:

First of all Section 23 of the law forbids any person from negotiating in land directly with the people. It says that customary landowners have no power to deal in land; any action to do so by them is null and void. Which means that you only deal with the State. How do you do that? First, a survey plan has to be lodged with the Department with a statement of your intention to lease that land. The State, having agreed with the customary landowners, then leases it in one of two ways: either to the people and they lease it back to you; or to the State and the State leases it back to you. So either one of those formulas could apply under the circumstances you are talking about. Let me give you an example. An organisation proposed a land management scheme under which it made arrangements so that it could take the crops, it gave them all the facilities, then took the crops and sold them; but that organisation's action was seen to be null and void. Consequently it had to come to us to negotiate because it was dealing in a lien aspect of land in other words it was placing a charge on crop and that crop is part of the land and it was therefore completely ruled out. Now with respect to your particular question relating to customary land and equal participation. We want to uplift particular encumbrances so that you are then able to deal directly with the people. Their land and their sweat equity or other equities which they and the company begin to work out is their share in the development. As you can see these particular

questions do arise in major projects like Porgera. The opportunity cost is valued by the Surveyor General and can be equated to their share equity.

- Gillbanks: I think that illustrates quite clearly why there has been little development on customary land, on the larger scale; and why it is very very difficult to fund development on customary land for customary landowners with any form of commercial loan with normal type of security. It is encouraging that government is looking at ways of freeing up this system but one fears that it will still be an unavoidably, long-winded and bureaucratic process and most private investors do not have that kind of patience. The questioner belongs to an organisation (CDC) which has more patience than most if I may say so. What sort of time scales are we looking at from the first identification of a project to actually getting a title to the land under the new ideas of land mobilisation?
- Ovia: Under the new arrangements the person brings a survey plan forward; that gives three months notification. If no objections are lodged the land is registered; but if objections are lodged then it is referred to the Land Court and provided the Land Court clears that particular matter, then it comes back for registration. Now that would take, probably, if it is done in the quickest possible time, four months. Delay that can come about in terms of disputes and dispute settlement could take it up to a year or so.
- Gillbanks: Thank you. I am actually involved in a proposal in which there are no such disputes - in fact the whole idea is the idea of the customary land owners themselves. It has taken two years so far but with modifications to the processes one might hope that this may be speeded up.
- Anaman: You mentioned that landowners will put some market value on the land and that will form the equity of the land owners. But there is another way to put this problem. Suppose you put the value of the land at K1,000 per hectare and the landowners then get say 30 per cent equity. Private investors can also raise production cost in the long run so that you have the situation whereby the landowners equity is no longer 30 per cent it is 10 per cent. In other words just putting the value of the land will not necessarily ensure equity. It depends so much also on the cost of production or the cost of developing the land which ultimately will be determined by the investors. The main point I would like to make is that you may be putting the value on the land for the land owner but it does not necessarily mean that they are going to get an equal equity for the land contributed; it depends more on bargaining power than on the land contributed.
- Gillbanks: Our speaker has pointed out that the Valuer General can value land and the question of what then happens if the traditional owners get equity in a company really is a matter of the Companies Act, the auditors, the accountants, and so on to ensure that they get a fair deal for their proportion of the equity and I don't think one should always assume that the private investor is out to rip off his partners. I think that would be a mistake.

- Hoyle: I agree with the questioner; I think what he is saying is that you can fix a value on a piece of land and that's your percentage of initial equity. But you can't always determine the total amount of equity that the company is going to require. If that goes up then your percentage decreases. I don't have any answers to that. K1,000 a hectare frightened the heck out of me I might add. I take the view that there is quite a lot of land with what value? It has no value unless you have tens of millions of kina to develop it; one is talking of a large development and an awful lot of expertise to go with it. Government vacant land generally is not valued; government merely passes it to developers to develop - except that there has to be some value on the land. I wouldn't go exciting imaginations as to what that value should be, I think it is a very limited value unless you have these other two essential ingredients to create something out of it.
- Gillbanks: Land in Port Moresby city would obviously have a high opportunity value while land on the top of a mountain in the Southern Highlands would have a great deal less.
- Temu: I don't agree that land has no value in this country -as we have realised in many of the projects that have been established. The question of land is very complex and governments in the past have not done enough to address it. The land mobilisation idea is a good one in that it clears up a lot of the legislative and administrative procedures in dealing with land; but the ultimate aim is one of trying to mobilise the land so that it can be put to the best productive use. That should be the ultimate aim and just improving the administrative and legislative procedures is not enough. People have to see that they will benefit from projects - only then will they be willing and able to give up their land. I have a question on compulsory land acquisition. Is it still around or has it gone?
- Ovia: Compulsory land acquisition remains and it is the power of any State exercising its power of emanant domain. The power is to develop land for public purposes. It has to buy that land. The minister sends the owner of that land a Notice to Treat, and the person comes to the minister and negotiates with him; but if he refuses in totality the minister then has the powers to take land and pay compensation.
- Mitio: A supplementary question about land ownership transfer by the land owners for commercial developments. For example more and more people who do not wish to develop their land are selling it to other people who have the capacity to develop the land. What is the land title ownership arrangement in this regard?
- Ovia: It depends on the type of title you are holding. If you are holding a freehold title then selling that land means selling all the rights, and all the privileges and all your powers over that land to the next person. You say I have this particular freehold title and I am going to lease it out to another party for 50 years, and as soon as the 50 years lapses your land then comes back to you. Or you can say I lease it for the party's lifetime, in other words while that person is still alive he owns that land, and as soon as he

dies the land automatically reverts to you and so your powers are called powers of re-entry which are effective at a future time. So there are various ways in which land can be held and transacted; but people do not know about these so they do not put the land to the maximum use.

- Manning: Could you tell us a bit more about this barefoot surveyors idea. What is the difference between what a surveyor is actually doing now and what the barefoot surveyor is going to be able to do in terms of the definition of the land and why is it going to be cheaper than an existing surveyor is now and would an investor get the same title as he gets from an existing surveyor now?
- Ovia: There are three classes of survey. The first is called a Class 1 Survey. It is undertaken by a surveyor who holds a degree in surveying. A Class 1 surveyor has undergone theory and practical examinations. A Class 2 surveyor is a person who uses an instrument called a Wild compass. It is much more accurate than the compass that the army use, the ordinary fluid compass. He is specially trained and is called a technical officer in the survey profession. The other surveyor is the person who uses an ordinary compass, so the accuracy of that survey (Class 3) is not as precise. We have introduced this particular class of survey for customary land as the State only guarantees title, it does not guarantee boundary. The boundary could be plus or minus several metres. Under the Certified Measurers' Act or amendment of the survey act he is considered a practitioner and his survey will be registered. But the accuracy from Class 1 Survey to Class 2 and Class 3 differs greatly.
- Gillbanks: May I clarify a point there. So, if it is a Class 3 survey it would be subject to boundary dispute?
- Ovia: In the village areas people mark boundaries by physical objects - a road, a river, a tree, or a mountain top. The surveyor simply reads bearings of those objects and demarcates that particular area for purposes of registration and we simply guarantee title to the area within the boundaries. The Torrens concept does not guarantee boundaries, it guarantees title to an area.
- Manning: What is the purpose of a Class 3 survey - stopping tribal disputes or land disputes; or is it legal for a bank to accept?
- Ovia: That is a title. It gives the holder a freehold title, or absolute title over that land. It guarantees title only, it doesn't guarantee you the boundary. It doesn't say precisely this is your boundary. It is saying I am guaranteeing you this much area of land -but it could shift this way or that. If the area proves to be less then you are able to apply for compensation.
- Gillbanks:subject to restrictions as to transfer, presumably it is?
- Ovia: We are trying to get government out of the scene and allow people to transact in their land because they have power over that land and they

know what to do with that land. Some failures may occur but these failures will teach people lessons and they will then begin to appreciate how to use the land.

- Bodman: These titles, whether they are Class 1, 2, or 3, are they granted to groups as well as individuals? If, for example, the group includes minors, what happens when they become of age?
- Ovia: Groups must be land groups as defined under the Land Act, or business groups defined under the Business Act or a company. Minors' rights within the group are determined by the group in the group constitution, which also provides for a dispute settlement mechanism which allows the resolution of those particular issues. Basically a group must have some legal personality so that its existence can be recognised in law.
- Freyne: Going back to these certified measurers, do they actually put any permanent markings on the ground? Second question. Am I right in believing that you can achieve the same purpose if you can get agreement on aerial photography without actually going on the ground?
- Ovia: That depends, yes they put in permanent markers in the field but the people must actually accept them. If you use aerial photography you have to cut out areas, you have to set control points so when the aircraft does a strip run, the areas are clearly identified by permanent markers or say a white cross on the ground. Boundary corners are thus indicated and the draftsman can outline the boundary on a map. For systematic registration aerial photography would be a fine tool. But registration is sporadic in nature and therefore we resort to this particular third class survey.
- Gillbanks: I can see this being a very useful tool but may I pose a question which I think may be at the back of several people's minds. We are talking about devolving land powers to the provincial government, who actually issues the title in that case, and who stands behind it? The national government or the provincial government?
- Ovia: When the provincial government issues the title it issues a State title it does not issue a provincial government title.
- Freyne: Is mapping from aerial photography acceptable or do surveyors actually have to go on the ground and put in permanent markers - not white crosses, or other temporary identifiers? Can you map from aerial photography without actually putting permanent markers on the ground?
- Ovia: You can do aerial photography and not put in permanent markers. The white crosses which I mentioned are fabric set in an open space cut out of the bush, and appear on the photograph so that the draftsman then knows when he puts it under the stereoscope and begins to plot, that the boundaries go from that cross to the next cross to the next cross. So it is not required that you have permanent markers. But the certified measurer must set permanent markers.

- Gillbanks: The answer to your question would appear to be yes, a title can be issued but purely on the basis of aerial photography, is that correct?
- Ovia: Either method will lead to issue of title. If we were to issue titles over the whole of Central Province then we would not use these individual surveyors because it would be costly, we would use aerial photography because they are just as accurate provided of course their control points are set in by geodetic network.
- Turner: Can the barefoot surveys be used to get a loan. It costs us something like K12,000 to get a survey done in North Solomons; if we have the same thing for K500 can the PNG Banking Corporation accept it for K2.5 million loan?
- Ovia: All we can do, is to say that this is a valid title, we cannot compel banking institutions, financial institutions to invest.
- Millett: Mr. Ovia you spoke about freehold and the transfer of title. As I understand it the concept of land, and all of the power attaching to the land, passing to another party from the clan is not really understood in customary law. Will the umbrella law and the provincial laws which you are proposing allow for freehold to pass from the clan?
- Ovia: The freehold limitation has been placed by the Constitution defining a citizen company. All we are defining here is a freehold and that on transfer all the powers within this particular freehold estate actually pass from this organisation to that organisation. Other Acts or the Constitution further limits those transfers in terms of foreign companies.
- Barker: You may have a situation where the majority of a clan or group accept a particular project, are participating in it, but let's say 5 or 10 per cent are not participants. Now what happens under those circumstances if the bank was basically going to pull up the strings on the project what would the power of that 5 or 10 per cent?
- Ovia: The Act says that you must have a legal personality to hold land. As a group legal personality you have an executive to manage your affairs. Whether and which project is a matter for them to resolve within their own affairs. That is an internal organisational matter. Government must get away from being a father all the time. We are trying to lift government's restrictions and to allow a more flexible approach to the use of land so that land can be developed. The issue raised is an organisational issue for resolution within the group constitution based on dispute resolution mechanisms defined under the Land Groups Act or the Business Groups Act.
- Gillbanks: I think in reality a title cannot be issued unless there is consent from the landowning group and once it is issued that problem is resolved, at least in theory. In reality, around the country you will find very widely varying attitudes to all of this. There are some areas of the country where

traditional land owners take a very relaxed view to alienation of land, in other areas of the country they won't hear of it.

- Millett: I can imagine a situation arising in which the clan today exercises its rights to sell the freehold to its land and then in 20 years' time the children, who are by then grown up, are short of land and they want to get that land back and they will go to the State and they will ask to have their land back and the State will say "No you can't have it, you have sold it; or your father sold it 20 years ago." The State guarantees that title and would presumably be prepared to use the force of law to do so?
- Ovia: Whatever the State has bought, it has bought, and as far as the Department is concerned if it's acquisition was right then it has a firm foundation in law. Take Newtown for instance, the State's title has been challenged in seven courts up to Australian High Court and back again and it has started again. The State holds valid title so the original landowner can't do anything about it. They tried to burn down several buildings over the land and the State intervened and brought them to justice. Where developments have taken place the State guarantees title and guarantees safe working under a good environment and therefore it will stand firm.
- Millett: Would the State adopt that same attitude to land which was not acquired by the State but acquired by another citizen of PNG but not the traditional landowner?
- Ovia: That would be a private deal and the State will not guarantee it but State will observe law in the form of contract binding.
- Gillbanks: In reality one does encounter considerable problems in enforcing valid title to land in the face of strong opposition, frequently with very little support from the State - although the law is quite clear.
- Freyne: Have I got the story right when I believe that the land mobilisation project will only introduce one new Land Act, devolving powers from national government to the provincial government? You stated that the land mobilisation project will affect the Land Tenure Conversion Act on the lease-lease back system, and I am wondering what was the problem with patrilineal and other lineal titles to land when to my knowledge none of the Land Acts discriminates between the sexes. Perhaps you could clarify that.
- Ovia: No, the Land Tenure Conversion is an interim measure only until we revise the laws under the land mobilisation programme. There will be immediate amendments, for instance, approved financial institutions will not require the ministerial approval of their mortgages in order to proceed with loan requirements. They will simply transact the particular matter and send a copy to the Registrar for recording. Once the Registrar has that particular transaction registered then they get the money without having to go to the Minister for Lands under Section 69. There is also the revision of laws. Presently in the Department of Lands we have at least 132 legislations to deal with and we are hoping to consolidate these to just a few.

Products and Markets

- Bodman:** I would like to clarify a couple of points which Mr. Hafmans has just mentioned about coffee. Papua New Guinea has a quota allocation which restricts coffee exports to the main consuming countries. The quota is not just for green coffee; it is available for roast coffee, instant coffee, any type of coffee and the Coffee Board doesn't restrict it at all. There are ten registered exporters and coffee exports in excess of 10 kilos can only be made by those ten exporters. So it is up to an exporter to decide whether he prefers to sell a large volume to, say, Nestles Australia at a green bean price of say K2.40 per kg. or to attempt to get maybe K5 or K6 per kg. roast coffee to compete with Nestles products in Australia. Clearly they have got to weigh the economic benefit of selling a small quantity of high value and value-added product such as roast or instant coffee against the difficulties of competing with a major buyer overseas. That is one consideration for exporters. In terms of value-added there has been a tremendous upsurge of interest in roasting and grinding of coffee for export in the last twelve months. Before then total exports of roast and ground coffee would have been about 150 bags per year out of a total export of over one million bags in most years. This year we have, I suppose, eight new companies that have come to us but until they get an export licence, which for various reasons are restricted, they are only going to be able to export this coffee on a mail order basis, in small volumes. Obviously a lot of people also ask why we don't produce instant coffee in Papua New Guinea. You see a lot of instant coffee sitting on the shelves but we don't have a factory in Papua New Guinea yet. A proposal was approved in 1987 for a local Papua New Guinea company to go ahead and set up a factory but so far this has not happened. I think it is a question of the economics of the operation, with a domestic market of less than about 500 tonnes a year then it is a marginal business at best.
- Manning:** It is extraordinary that wherever you go in the world and you take Papua New Guinea roasted coffee, the people you give it to absolutely rave about it and yet they are unable to buy it. This applies even in Australia. Every time I go to Sydney I try to buy Papua New Guinea coffee just as an exercise and you cannot buy it, it is unobtainable, except for Robert Timms New Guinea Blend which tastes nothing like Papua New Guinea coffee. I was told the other day that you can buy it in Cairns.
- Hafmans:** We feel that the Coffee Industry Board should quickly approve as many exporters of roasted coffee as possible. I don't think that the Coffee Board has made a decision on this question. We would like to see a policy decision by the Board.
- Bodman:** There is nothing to stop an exporter shipping roast coffee; it is simply a question of him working out the economics of it. There have been exports of roast coffee for a number of years and this year it will probably be at its highest level ever. The new companies will certainly have to wait for the present review of the Board's exporter guidelines. These were

introduced in October 1986 and were in effect for three years and froze the number of exporters at ten. The guidelines are up for review between now and September and part of that review will address the questions of whether there should be more exporters, whether there should be an auction of part of the coffee quota so that any new company could come in if they felt they could make a better job of it. The possibility of giving licences for just roast coffee exports, those types of questions will certainly be addressed and we are keen to hear everyone's views in this area. No decision has to be made until August or September when the Board's guidelines would go to DAL and the Minister for approval.

Bai: With coconut or copra, we are following some of the government's policies but it is going to take a long time before going into finished products of copra, into crushing coconut oil. We advertised a few months ago for interested companies to submit proposals to the Board for copra crushing. The response was very poor and showed that none knew anything about copra crushing. There is very little response from within the country itself from people who have the capabilities to produce that kind of commodity. In the long run we will still export copra; we find that it is more profitable.

There is a small-scale coconut husk factory using coconut husk and fibre and producing weather mats. They are having some difficulty and we have assisted them to promote their products at various trade fairs but there has been very little progress. It is difficult to find markets for by-products of copra especially charcoal and coconut fibre. The only viable project that we can do is what we are now in, marketing copra.

Turner: There was a recent ACIAR study done on the potential market in Australia for coconut products and this showed clearly that given a little extra education for the Australian food producer and the ordinary domestic household there was a tremendous potential market for desiccated coconut and coconut milk which has been dehydrated, provided the quality was right. This was in addition to shipping ripe coconuts in refrigerated containers down to Australia and selling them at about \$A1 per nut. The requirement is not all that easy to meet for these coconuts because you have to have your coconuts on the wharf exactly at the right time; so if the ship is a week early or a week late, the trade won't develop. I think for the other products we should really try to tap into some of these ACIAR studies which are being done at the Australian National University (ANU). They have been doing studies in other South Pacific countries and these show potential for other coconut products. For cocoa, the final flavours, or the final special qualities which chocolate manufacturers like to call their own, are produced in the final stages of manufacture. I was only talking to a major buyer last night about potentially producing chocolate product here or cocoa product and he said whatever you do don't touch it. He quoted the Equadorian story. They had brilliant cocoa (Papua New Guinea's cocoa is not far from it - based on Trinidadian fine and flavour) at one time they were getting £200 premium on the London market. They decided to go downstream and produce their own and they are now having to sell at 20 per cent discount on the London market. I would be very very cautious about going downstream on cocoa.

- Manning:** I think there are processing plants lying idle in Equador. Rodney Cole have you any comments on the work that is being done at ANU on coconuts and other usages for coconuts?
- Cole:** This is work being done by Dan Etherington from the School of Pacific Studies who has I think concentrated largely on looking at taking fairly simple technology into the villages in the Solomon Islands and processing coconuts into desiccated coconut and moving away from dry copra meat and coconut oil. He looked first at processing on-board a ship which went around the Solomon Islands collecting nuts. But the quantity of nuts was not available so he has now moved to looking at desiccated coconut, dehydrated coconut milk, coir and the shell to make some special carbon that is used in the gold mining industry. The study is available. The ultimate test is going to be taking a trial unit into Solomons under an Australian aid programme and just seeing how feasible it really is. On paper it looks excellent but the proof of the pudding is in the profits.
- Manning:** Jack Diuvia would you like to tell us anything about the desiccated coconut that Coconut Products was involved in 10 years ago.
- Diuvia:** Coconut Products had a factory on my estate, it is nearly 12 years now since it has closed down. The problem then was I think the struggle for independence and it was affecting the workers that is why the factory closed down. But the product was good and it was earning good money for the company. To set it up again now I think would cost a lot of money. At that time it cost my company roughly one million kina.
- Gillbanks:** I thought those three papers were particularly interesting; but it is disappointing that we can't discuss them in the light of the DAL White Paper which we had hoped would be presented at this forum so that discussion could be based on government policy proposals for agriculture. Most of us realise that most of these commodities have been subject to a downward price trend since the 1950s and of course this has emphasised the need for Papua New Guinea to catch up with the rest of the world in research and productivity. If we are going to compete we have to compete on reasonably even ground in the areas where we have a comparative advantage. Looking at cocoa for example, a few years ago the normal level of production was somewhere about 300 kgs per hectare; now many of us are moving up to two tonnes per hectare, in both the smallholder and largeholder sectors. The potential of the planting material has dramatically improved. The oil palm has become a much more efficient industry over the last 30 years. Looking at the markets for agricultural produce domestically which is Mr. Marmelstein's paper there does seem to be a very great need for an improved market chain for the local producer of foodstuffs. On the question of going downstream in agriculture one has to be very aware of the traps. There are many collapsed refining factories in Malaysia which were based on differential export tax, i.e. they were in place at the cost of the producer, and their notional value added was in fact really value detracted. If you are producing a very high quality product as we are in many cases here you are better to concentrate on improving that quality

still further and establishing your markets, e.g. the Chairman of this session and myself are involved in doing that in cocoa and trying to establish long runs of reliable quality cocoa placed with consumers and hopefully becoming a necessary part of their recipes.

Manning: The Malaysians, who are very large producers of cocoa, have built a very new and modern factory in Parat and that factory has made consistent losses for the last ten years. I would like to change tack a little and direct a question to Mr. Marmelstein. I am aware that a fairly large retailing chain based in Rabaul has a crying need for good quality beef. It seems there is a breakdown in the supply chain, certainly in the Islands Region, people are no longer concentrating on beef. As far as we were able to understand the only really good source of supply was in the Markham Valley. Would you like to comment on that?

Marmelstein: Markham Valley is the big producer and here on the Papuan Coast we are much smaller but there are some very good cattle ranches and some very good meat. In fact the best meat is produced here and not in the Markham Valley. There is a sort of separation between the two. The Papuan producers benefit from the fact that the main market is actually in Lae and to bring the meat from Lae to here costs money, and the prices here are higher. Recently people have found a way of getting the meat around rather cheaply so the advantage is being lost. There is the other advantage that Australia has to pay money to bring their beef here. We find that a good producer can actually compete with Australia, though shelf-life is a weakness. As a cattle producer, I would not know how to get beef to Rabaul from here. There is here in Port Moresby a meat packer, Medallion Meats which is supported by the Agriculture Bank, and they should look at this question. We are not downstreaming; we sometimes think we could but then you need to be much bigger again. All we do is try and upgrade the beef we have now. We have now graded in A1, A2, and A3, B, C, and D. Now A1 is always known to be the best. A1, A2, A3 are what you can call prime beef and if you buy it you can really eat it and enjoy it and I don't think it is worse than the Australian beef which you get (which by the way is not A1 anyway). You normally get your beef from Queensland which is of a lower quality than Southern Australian beef and I have recently heard that very little beautiful steer meat is imported into Papua New Guinea. The A levels therefore compare very well in tenderness. A1 is from a steer with two teeth. These animals go up to eight teeth and a two teeth animal is about one and a half to two years old. If you get your steer ready then it is everything you would want, tender, tasty and a little bit of fat. If they have four teeth they tend to be a little bit tougher and the more teeth the worse it is. What you get here in this area is four teeth which is actually achieved at the right weights. This is important for the butchers for what they get out of a kilo of carcass. The Markham Valley produces most likely C and if they try very hard B grade. Ramu Sugar hopes to produce B grade in the feed lot. It is only through grading the herd itself and improved management that one can move from B to A grade. Now this is the sort of thing that the whole grading structure is trying to achieve - to force people into doing the right thing. Producers

who sell eight teeth steers are getting rewarded for eight teeth, they are not getting good prices.

Brandon: Will there be a further premium for grain fed beef or for lot fed beef?

Marmelstein: If you try very well you will get into A1. Mind you it is all between producers and butchers in the end. At the moment, as long as there is no posted price, it is a matter of talking and agreeing. But there is potential; if you pick up your young stock and you put it into grain lot feeding you will reach A1 category for which the price indication is K2.15 per kg carcass rate, 20 toea on top of A2.

Manning: You have also got to take into account consumer resistance; meat prices are reasonably high already and there is already a large amount of substitution for beef as a source of protein, and that is probably likely to continue.

Brandon: You are quite right except that the beef here is terrible. I have some experience in the lot feeding industry and I know what can be done with feeding. I would encourage anyone who has the facilities to do something about it here because if you produce this meat people will pay for it.

Gillbanks: Ramu have been doing a lot of work recently on supplementary feeding to improve breeding rates and now on lot feeding using not imported grains but coconut meal, molasses and chopped cane, i.e. locally available feeds. This is having quite a dramatic effect and is expected to increase supply quite dramatically. From being a pretty marginal operation it is becoming quite viable. One of the problems seems to be, and I have struck this in other parts of the tropical world, that the quality of the grass is generally rather poor. I suspect it might be better in Papua because of the strong dry season but I don't know for sure.

Marmelstein: I have been investing in pastures a little and the results are really quite dramatic. I now have to keep certain steers off the place otherwise they get too fat. That was just sowing in with brachia and it is quite amazing what you achieve as against ordinary kunai; the finishing time on my ranch definitely lies one year earlier than that of a ranch up at Sogeri. I think it is one and a half years to two years earlier than in the Markham Valley.

Grace: For grading of beef will there be a colour coding? The grower is going to be paid on the number of teeth but butchers set the price to the consumer. It is going to defeat the purpose if the butcher is selling C grade as B grade.

Manning: The problem is that the retailer with such a small volume rings up a farmer and says I want five beasts this week and then the farmer goes out and unless he is a particularly good farmer gets the first five beasts that he sees and sticks them on a truck and away they go. That is one of the problems we have with beef in this country.

- Marmelstein: That is only part of the problem. As well, we cannot see what the butchers are doing. We have a cattleman's organisation, a very simple sort of thing, and we want our beef to be right. At this stage all we try to do is get the grading going. Once we know that that works and we get the price for the right quality, we will, as cattle people, also see that it is identifiable in the markets.
- Marmelstein: I would like to say something about rubber. I agree that the trend of prices generally is down and as has already been mentioned when you get more volume from an area it is natural that you can accept a little less. As well, when something becomes more available the price must go down. For rubber the graph was not long enough; it missed the good year and the relatively good period currently. Rubber is the only one of our tree crops that you don't eat, it is a pure industrial product. Now it has had its battle over the years with synthetic rubber and has come to the division of the market. The market for natural rubber is actually growing every year. It is a quite insignificant percentage but if the world market goes up 3 per cent then natural rubber goes up. Rubber has generally been cut down and been put to cocoa and palm oil. Only Thailand has gone up significantly with rubber and now West Africa is coming up. The rubber price is intimately interwoven with the price of mineral oil. Contrary to expectations that the price would by this time be up significantly, it is still rather down. Nevertheless, it should be going up. When it does the direct competitor of rubber, isopreen, which is directly made from oil, will have to go up in price.
- Millett: I would like to ask Mr. Johnson something about the MUV, the manufacturers' unit value. The effect of technology on the manufactured product offers more quality, more features as time goes on and I am wondering whether that has any impact on measuring the relative prices of a raw commodity and a manufactured product?
- Johnson: Yes, there are two effects. One is with the quality of manufactured goods and the second is reduction in the unit cost of transport because the world market prices are c.i.f. prices. Those effects would make the overall decline slightly less but not significantly so.
- Millett: Would you be able to extract out of the global basket of manufactured goods, a smaller basket which is more relevant to Papua New Guinea's needs and re-run the analysis to see what impact that might have.
- Johnson: I chose the Australian CPI to overcome that problem and as the analysis showed, using the Australian CPI actually made the trend worse.
- Manning: About four or five years ago the last review was made of the cocoa threshold price. Prior to that it had been based purely on the MUV which in fact showed that costs of inputs were going down.
- Gillbanks: The cocoa market you showed did not in fact show a distinct trend downwards but it showed a highly volatile market and indeed it is a highly

volatile market. But there are some strange perceptions around the market. The growth of the international cocoa market is really quite steady between 3 and 4 per cent a year. The growth of stocks because of "temporary overproduction" has been dramatic and stocks are at the highest level ever. They may even reach a million tonnes. However as a percentage of the overall market they are by no means at record levels. They are less than six months' supply. They have been as high as seven or eight months' supply. The last time they hit three months' supply the market panicked and we saw that enormous peak in the 1970s. Quite relatively minor events, for example, a drought in Sub-Saharan Africa can change that market perception very rapidly. Let's hope it does; not that I wish ill on the Sub-Saharan African countries but actually if that happened they would produce less cocoa and would probably get more for it. All sorts of events influence these markets. In the palm oil market, similarly, a perceived 1 to 2 per cent drop in world stocks can really send the market flying.

Johnson: The widening geographical spread of production of cocoa to areas such as Malaysia and Indonesia is likely to reduce the potential for one single geographically-specific supply shock to affect the market in the same way as has been the case in the past.

Manning: Papua New Guinea has got a vastly better quality cocoa than Malaysia and we are not competing with Malaysia, we are looking at an entirely different market. Papua New Guinea cocoa is into the fine and flavour market; people use our cocoa to flavour other chocolates or to flavour the chocolates which they are making. We also have a tremendous advantage over every other country in the world in our quality control, our export quality control. Customers know that when they buy a bag of export quality Papua New Guinea cocoa they are going to get a bag of export quality Papua New Guinea cocoa - they are not going to get half a bag of nails or half a bag of sand which they sometimes get from other countries.

Hoyle: I think we are competing with other producing countries; the market might be slightly different but the prices that we get are very much the same as the Malaysians and Indonesians are getting. There are variations based on quality but the prices come down in sympathy with other producers.

Manning: We are getting in excess of £100 a tonne more than Malaysian cocoa and we have maintained that margin by and large. It is squeezed from time to time but by and large it is retained. In fact we were getting more during January and February.

Turner: There is very intensive work going on in Europe at the moment to genetically engineer a particular plant which will produce oleic oil. At the moment the only sources of this oil are palm kernel oil and coconut oil. I think the genetic engineering people are going to win, which means that any project that we might look into for alternative uses of coconut has to go ahead pretty quickly.

Manning: It is a pity we have not investigated alternative crops in Papua New Guinea. As an industry we would like the government to include in the White Paper and give extremely high priority to the matter of alternatives. What are the other things which we can grow in this country as cash crops? I know that various people are looking at various things but as we said earlier we are competing for the same types of products with a number of very large and very advanced countries. If you compare the research effort that Malaysia is putting into its crops, into cocoa, coconuts, palm oil, rubber with what Papua New Guinea is putting in per capita or as a share of the budget, it is clear that we have really got to make a very big plea to the government to do something about increasing levels of research into the crops that we have and to increase the levels of research into alternative crops and food crops.

We have seen a great deal more effort and a great deal more liaison between the Department of Trade and Industry and primary producers over the last twelve to eighteen months and whilst nothing concrete has come out of it as yet, we are very grateful and hopeful that somewhere we will get a winner out of it.

Financing Agriculture

Johnson: Perhaps we need to be more specific about what we mean by viability (in regard to Hoyle's paper) with your emphasis on job creation and so. I get the impression you are leaning more towards economic viability as opposed to a financial viability. Would you like to make a few comments about that.

Hoyle: No, the thing has to pay its way. You have to assess the economic viability, looking at the pros and cons, but really it is going to have to service its capital. We are prepared to go on being a development organisation on a rate of return, I won't quote figures, but which perhaps would deter others. But it has really got to be sensible, it has to have a fairly good chance because we are using other people's money as well as our own. We are using British government money and we are creating jobs for well over 1,000 people you can't do that in a cavalier fashion you have to be very careful about what you are doing. Raising expectations and employing people in any event, bringing government with you and using government funds, and getting all that infrastructure put in, you have to be very careful. I am awfully sorry that I was late and missed what you had to say which is most unfortunate but prices have been appallingly low for most of the four years that I have been here certainly for the last 3-1/2 years. I have only one operating company, Higaturu, and simply when you have got a thing like that in place, you have the palms planted, you have the factory, we also have some excellent cocoa, if others in other countries can make an adequate return then so do we have to do the same. I feel that this country has sufficient advantages to enable it to do that but I won't say it is easy. It is a question of trimming your costs and restructuring debt equity ratios from time to time.

disciplined job, you do the same thing every day for as long as you are employed. You can't be slack one day and decide to do the job the next day. It takes a long time to train anyone to accept that sort of discipline. Because DAL extension services are not effective, to expect smallholders to do the bulk of export cropping is a risky strategy. The plantation type or large-scale plantation industry has to be supported somehow.

Mitro: Thank you Mr. Eri. We have heard today two papers, palm oil employment and Ramu Sugar employment, and yesterday we were talking about the form of agricultural development. We looked at the smallholder economy, the managed plantation-type development and the nucleus estate type development. Today, we looked at the form of employment available in the nucleus estate type development. So I would like to open the discussion on rural labour. Also we had speakers from the Police Department who outlined the police role in rural development.

Millett: I would like to address a question to the Constabulary. You mentioned in your paper the problem with resources and it is a story that we have heard from different government agencies over the last day and a half. There is always a shortage of manpower, money and equipment. Is there any idea within the Police Force just what size of police force would be necessary in order to provide the level of law and order that would be required in the rural areas to make it a more attractive place for investment and employment.

Tryer: It is difficult really because with a growing population and with the police having to extend in various areas it would be difficult for us to say what is the number of officers and policemen we need. We have lived for so long under a false economy where our establishment should have been something like 6,000 but the government has actually funded us for only 4,000 approximately and we actually employ about 5,000. Really it has all been rather a mess up to this point. We now have from the government a figure, they have agreed to a figure and we have actually tied particular people to actual jobs, in existing rural areas yes, but mainly I am talking about urban areas. With each new development we must go to the government and say there is a new development in such a such a place, we need more men. This is the crucial problem - negotiating with the government for greater funding for that increase in manpower. Unlike a developed country where you know roughly what your population is going to be and you roughly know what funds there are going to be and there is a set establishment. Here it is difficult.

Hoyle: CDC has been involved in setting up a few nucleus estates around the country, concentrating populations, and views have been expressed that this can in fact cause law and order problems. I wonder whether you would be able to comment on whether this concentration of people has caused you undue problems and whether in certain provinces - West New Britain, Oro, Milne Bay - you have found an increase in law and order problems.

Samana: You have described the benefits of nucleus estates to the economy, management, productivity and so forth but we must also realise the impact of such large-scale development projects in the country. They directly affect the migration patterns - moving people from less developed to enclave-type development projects in selected parts of the country and therefore you are contributing also to the law and order problem. Secondly, they also impose a stress on the traditional people around the nucleus estate project therefore contributing to ethnic conflicts. Apart from the question of equity and participation these are general issues which need to be addressed carefully. The other problem is that because you want government equity to guarantee your long-term relationship and participation in agriculture development in the country you put pressure on government's limited resources. Because of the lack of planning in the various economic departments and at the provincial level, and because CDC does have effective planning its projects attract government attention and divert government resources towards selected projects in which there is no broader participation of the population or regions. In other words, your contribution indirectly causes regional imbalances in development. These are some of the side effects of large-scale nucleus estates. You cited Ramu Sugar; but in fact there are no smallholder sugar growers in the Ramu Valley; production is monopolised by one company. I would also ask you to indicate whether or not the smallholder oil palm growers are better off than the labourers on the oil palm estate itself.

Hoyle: Thank you Mr. Samana for some very interesting points. The question of labour, bringing in people from outside provinces. Yes, this happens, we don't have any significant difficulties in recruiting sufficient labour or in stabilising villages. I suppose you might say the nucleus estate itself is a large enclave but it is in fact made up of a number of small villages. We have avoided what is, I think, the Malaysian pattern of a massive compound of hundreds of houses. Higaturu is broken into three neat little villages of approximately 100 units per village and we have found that that has been a much more successful way of housing the labour force. As to contributing to law and order problems, I am sorry but I am slightly at a loss on that one. We do have problems because we carry large amounts of money like all other estates and plantations on pay-day. Recently, we had a nasty spate of them and there is an appropriate speaker this afternoon on this topic. Whether you feel we are causing that by developing and creating employment is really not for me to say. I am pursuing what has been put to me as government policy. As to government's limited resources I think it comes down to effective use of funds. I agree that any government has a limited amount of cash. I would say from my experience living here that developments like this are effective employers. We don't have difficulty in recruiting. We have very significant political clamour from the provinces in particular. I have a number of enquiries from provinces right now for similar developments to those that we run. In developing a country you have to start somewhere and then you have to start somewhere else, you can't cover the whole country at once. As you only have limited resource, this limited cash resource, you have got to use it in those areas where you are going to get the better return rather than in a more remote, difficult

Tyrer: It is difficult to judge what a particular law and order problem is. What do you judge it on, crime figures for instance? Do you say because there is more crime in Rabaul than there is in Mt. Hagen we put more men over in Rabaul? Next year it may be different, the situation might be reversed. It is difficult to judge where the problems are and then compare them with other areas. For instance most of the manpower in the constabulary is situated in the National Capital District, it has most of the men, most of the equipment, because we can expect that there will be constant problems here because it is a larger population. The constabulary deals with problems elsewhere on a sort of ad hoc basis. For example, in Bougainville at the moment I think there are two mobile squads. Mobile squads are squads that fly in and in a short time deal with a problem. Lo-Met in 1988 was another example. Crime problems escalated in the Highlands, so we had a three month purge to supplement the already established police post.

Gillbanks: I would like to make a comment on the employment of rural labour. I think Mr. Eri painted a rather gloomy picture of the problems currently incurred at Kapiura. Those problems can occur and they occur particularly at new developments at new sites. We have found over 17 years involvement in that area that new plantations always have a temporary problem of high labour turnover which settles down with time. It also settles down as you get a larger element of married labour in the labour force. Long lines of single men coming down from the Highlands very often can be, but are not necessarily, somewhat temporary residents; but as you start to get more people coming back a second time because they liked working there then the problem tends to disappear. We employ within the group that I manage, approximately 3,000 rural workers mostly in the Islands Region, some in Papua and some in Madang. We find that some plantations have a higher turnover than others and we try and look for the reasons for that. But once you have an established situation, generally speaking, it becomes a lot easier as people return, come back to a place. Starting off from scratch is difficult.

Gilling: We heard this morning that one of the critical constraints to development in less developed areas was lack of infrastructure. My question to the Police Department is how would they see the Department becoming involved in less developed areas. Clearly if a policeman or a couple of policemen were just put in one of these less developed areas on their own they may experience problems. How does the Police Department see its liaison with other government agencies in providing an infrastructure in association perhaps with the extension service and the health service which might provide a basic background for some social and economic development within the area?

Tryer: I looked through the files, back to 1974, when I received the brief for this paper. I checked through thirteen developments that we have been informed about or were asked to contribute in discussions on. One of them, the Vanimo Timber Project 1974, was going to be the best thing that happened to timber and police were called in to the initial discussions.

But there was a distinct lack of knowledge and a distinct lack of fact. How big was the population going to be, how big was the commercial venture going to be? We were being asked to produce a manpower plan, buildings, cars, etc. based on very slim data. Though the project didn't proceed then, it did so in the early 80s. We do have a police presence in Vanimo but what I am saying is that in the early stages of these commercial ventures we do get involved, and we do like to plan our police presence and plan an escalation as the actual commercial venture escalates itself but it is often difficult to do so. Our second problem is getting the money to fund the extra manpower. The government under the PIP programme will probably give us the money in the first instance. But after the first year they won't often listen to us in the second year. We would say, for example Ok Tedi is still going and you did say you would fund it again and the reply is "Oh budget priorities have changed, we can't do it". So we then have to handle that ourselves within our current budget. That is a real problem. Still, we do like to get involved in the initial stages of a project but please give us hard facts about what the population is going to be, what sort of area it is going to be, and then we can plan our police presence accordingly.

Marmelstein: Can you put a figure on this. You mention a number of population, 1,000, 2,000, what is it?

Tyrer: No sorry I couldn't at the moment. I am not in the planning section of the constabulary. I am sure that in principle 2,000 people means so many policemen. But I couldn't say what the number is.

Gillbanks: I really don't want to criticise the police in any way but the reality is that it is extremely difficult to get a new police presence anywhere. In the major developments that I have been involved in, I have yet to succeed at all and they are major developments, employing many thousands of people. The other big problem for us in the rural areas is if we do have a problem and we do contact the police and it is often rather difficult to contact the police, we can't get them to go anywhere near the problem. They always claim that they have no transport, so we say, we will send some transport in. Oh! no policemen on duty - that is more difficult. Really it is very difficult to get police to come out to attend to a problem. We try not to call on them. I think most plantation people try and resolve problems without calling on the police but there are occasions when it is necessary. We do appreciate that the lack of transport is real in many cases. However, the control of transport is not very good either. Would you like to comment on that?

Tyrer: Yes, certainly be critical please because it is about time people were. I have just done a study on transport. The Constabulary has about 750 vehicles throughout the country. You wouldn't think so because when you ring the police up and if you get through they say oh we have no transport. No transport when there are 750 cars! The answer is in what you said in your final remark. It is control. From Port Moresby it is very difficult to control the rest of the country. Senior officers are here in Port Moresby and the problems are out there. We have had problems with training,

selecting good officers for command in the provinces. At the moment the police are in one of those situations that government organisations get themselves into, we have a lot of people coming up, finishing their 20 years' service, and we have a lot of good people down below who are Grade 10, a lot have been to university and have a lot of experience. In the next few years when the top people retire and we get the good young officers into command positions then we will see a difference. Communications are also bad. If you ring up the police you don't often get through. About K350 thousand has just been spent on communications equipment to improve the situation.

Diuvia: It seems that the police are doing fantastic work; but on the other side, the justice is not that hard. For example, someone steals a bag of coffee worth say K60 and he is fined about K15 so he goes back and steals more.

Turner: We are going to develop 700 hectares over in North Solomons very shortly. We have set aside 200 of those hectares to be developed by people from the corrective institutions. We have gone along to the corrective institutions there who are pleased that we have offered this opportunity. Obviously they won't be hard core criminals but we think this will provide a little rehabilitation exercise on how to grow cocoa and coconuts.

Underwood: On the employment of labour, from the point of view of the projects that DAL is sponsoring, it gets back to the question of conditions. Unfortunately we are criticised because we are having to build houses and provide transport. Private enterprise is expected to do that, government is generally not. It is easy enough to build new houses and any new project gets new houses but the problem is maintenance of houses. For some time I have suggested that maintenance is not in the Papua New Guinea system. For example, when a tree falls down nobody does anything about clearing the road, they walk around the tree. When a house needs repair you let it fall down and build a new one. As a cultural system there is nothing wrong with this except when you are dealing with more economic issues and with so called permanent material houses - you can't just renew them as easily. You can't just get new money and renew them. We need training for the people in the houses to look after them and also for the various institutions to properly maintain them. It was pleasing to hear this morning that there will be extra money in the recurrent budget for maintenance. Another point: who at present is in the business of rural development in Papua New Guinea, especially from the government's point of view? In the Department of Agriculture we have been told that we are in agricultural development within rural development. The smallholder market access and food supply project is an integrated rural development project but we are not allowed to call it that because DAL is in agriculture not rural development. We are splitting hairs a bit but there is a problem; who in government is responsible for integrating rural development and, hence, addressing a lot of these problems.

- Herman: To give credit where it is due, the Justice Department recognises the problem and we have asked them whether they could set up a village court system and they have given us their support and we have set up a village court system at Ramu. We have one representative, a village magistrate, from each province. A lot of the problems are being solved at the employee levels, at the grass roots level. Also the Police Department has been very supportive and helped us set up a reserve police system and 25 or so of our employees are members of the reserve police and they tend to be very well motivated. There is a long way to go but it is a positive step in trying to solve some of the problems.
- Bodman: The impact of minimum wages on the plantation sector and on migration of labour from province to province hasn't yet been discussed.
- Gillbanks: I would like to comment on that from the perspective of the RIC because we are very concerned with labour rates. First recognise that actual labour wages under the minimum wage system here are much higher than in any competing country we know of, the closest being Malaysia which is only a little bit below the wage here but of course is a far more developed labour system and environment. Admittedly the cost of living is also high. But when you put people on piece rates which would enable them to double their wage within a normal 8 hour working day, you find they come in with inputs which give them a wage below the minimum wage. Why? Their cash needs in many cases, it is obviously impossible to generalise, but their cash needs in many places are quite low and they really don't want to work for more than three or four hours in the day. On the other hand, there are other people who respond extremely well to the system and earn well as a result. But the average productivity of the workforce is not high. The actual wage is not the major factor; the availability of employment is more important. There are a lot of people wanting employment and increasingly it is industry policy to offer employment first to people in the area. In fact we are getting increasing numbers of workers from people from the area where the plantations are. There is no simple answer. Motivation is what it is about; how to motivate people is the tricky bit.
- Sabel: Certainly, if we were to have any significant enhancement in the present rural minimum wage there would be an immediate wide-ranging reappraisal of our labour system. We simply could not contemplate absorbing it and remaining where we are. It would give an enormously powerful fillip to the whole question of better labour utilisation, mechanisation, introducing new capital intensive processes. Let's face it -the Australian sugar industry uses a much lower labour force and so do many other countries. We might also have to examine fringe benefits, particularly housing and services which are presently provided free; we would assess pretty conservatively that these cost about K66 per fortnight at the present time. We would have to contemplate some charging system for those. We would have trouble and strife trying to change the system. In the end the worker would not be much better off. I am not saying that the system will remain as it is in perpetuity; but I think the productivity improvement has got to come first, rather than emerging as a response to even higher wage costs.

Millett:

Looking at the matter of rural employment in a very broad sense, how should government concentrate its spending when it comes to promoting rural employment? Throughout the two days we have heard the theme that the government has a lot to do with limited resources and it has got to make choices. One of the fundamental choices is whether it should be doing things specific for agriculture or whether it should be doing things which are more general, providing an environment and services in the rural areas so that the rural community wants to stay where they are rather than migrating to the towns where the services are better. It could mean that from a policy point of view and giving a direction to government as to where to concentrate its spending it should probably spend on the normal sorts of services that it traditionally provides rather than think up new things to do which are specifically agriculture.

Gillbanks:

I would like to address that a little bit from the perspective again of the RIC and also as someone who is involved in agricultural development. I do believe that government should concentrate its efforts on infrastructure and extension - not only agricultural extension, health extension services and other extension services - that is the proper role of government, to facilitate development. However, as Mr. Hoyle pointed out earlier, for major developments, which can often be a focus for minor developments, (I am thinking of a potential project I went to look at in the East Sepik under an AIDAB study recently, which needs a nucleus plantation of rubber, building on a previous project which is too small to be self-supporting), it is exceedingly difficult to raise equity capital either inside or outside of Papua New Guinea. For a start we are perceived as a high cost environment; you go to the next door country and you are paying a third of the wage - things like that are constraints. So perhaps within Papua New Guinea itself government will have to allocate some form of funding towards new equity investments in major project development in the private sector. Now it need not be direct. One way would be to establish capital markets within the country. These are almost totally lacking at present. Another way would be for government to capitalise on its present investment in agriculture and related industries; maybe we need an agricultural investment fund of some sort. But, at the end of the day and further down the track, a healthy market within Papua New Guinea would be the answer to some of the development priorities at least.

Macroeconomic Issues

- Van Kamp: I was very pleased that finally the exchange rate policy was raised by all three speakers. Mr. Bodman emphasises what a lower value of the kina in comparison to the US dollar could possibly do to the profitability of the estate sector. I wonder whether he could make some comments on what the likely response could be in terms of supply by smallholders to a higher kina price for their coffee.
- Bodman: In the last three years we have seen production boom quite substantially in coffee even though prices have not been all that encouraging. As the graph showed we have still seen good production from the smallholder sector despite coffee rust as well which we might have expected by now to have had a detrimental impact on production. Higher prices are likely to at least maintain that production trend if not produce a somewhat better output from the smallholder sector as it becomes more worthwhile to put in the extra effort that CDA and now provincial governments are suggesting.
- Weiss: A correction with regard to the basket. From 1st November, if I remember correctly, it was changed to a trade-weighted basket from an imported-weighted basket. Second point. There is a lot of talk about the impact of exchange rate on exporters' income which is justified to some extent but let's not delude ourselves about import substitution. There is not much call for import substitution in Papua New Guinea at this stage. There is no extensive manufacturing sector in existence and we are not in this sense comparable to Taiwan or Korea or to other countries which use the exchange rate to boost their economies. Third comment. It is very dangerous to emphasise exchange rate as a solution both to high input costs and low exporter's income. Look around and study the developments in South America and some of the African countries to see exactly where they got with it; so let's not rush it. I don't think that the solution is mainly resting with a change in the exchange rate. The problem is efficiency of the different industries including the plantation sector in agriculture. You showed us the figures from 1985 to 1988; it is worthwhile to look at this study in its preliminary stage and it seems that the costs increase faster than any other variable. So it doesn't seem that there was too much done towards efficiency in this sector. Maybe we overestimated some of the cost factors. The only way exchange rate might be used is in a coordinated effort between the cost, the wages, and the exchange rate. Then to some extent we may get some results in the long term with exchange rate changes because what you are talking about is not the nominal change but the real change and you don't get real changes in the exchange rate without having some impact on the cost factors. In Papua New Guinea at present with the linkage between wages and inflation, I am not sure whether you can get a real change in the exchange rate. If you get one it will be for a very short while and we will follow the experience in all other countries that have tried to use the exchange rate, that is they devalue and devalue again and again to keep the real exchange rate in place.

Anaman: I would like to support the last speaker wholeheartedly based on the African experience with the exchange rate. The Economic Commissioner for Africa, who is from Nigeria, has raised the points that Weiss has raised. Several countries in Africa and Latin America have been used to test devaluing the exchange rate to see whether they would have a boost in their production. There is a critical point which must be noted. The cost structure we looked at just now, is the past cost structure; we do not know what will happen if there is a massive devaluation, what will happen to that cost structure. It may be that the unions may be so militant that the government may not be able to keep to minimum wages so the whole cost structure might change drastically forcing wages to go up much more than the plantations can afford. So I think there are two sides to the coin. It is very important that we look at this question very carefully: to avoid it going up too much, yes, but the tendency to suggest massive devaluation, that is where we must be careful. The dollar has come down almost 5 per cent in the last two weeks but no-one has really noticed, there is no call for increased wages; but the moment we have massive devaluation everyone is going to shout. There are two sides of the coin and some adjustment in the exchange rate should be made but it should be gradual.

Bodman: Yes I take on board both comments. Certainly there has to be consideration of what will be the response on the cost side and the indexation of labour is critical. Probably 30 or 35 per cent of plantation costs, in coffee, are direct wage-related and we are paying three or four times the minimum wage of our competitors, certainly four times the Indian rate for example. Probably the same situation applies in management. This question really does need to be looked at closely. But this year the majority of plantations will not manage to repay any of their long-term debt and a large number of them will probably lose money on operating costs. We are being backed into a corner where the indexation of wage rates continues and no-one really seems to be addressing this problem. Meanwhile, there are some potential improvements that could be made in terms of improved efficiency. There are new cultivars such as the semi-dwarf varieties of coffee which would allow yields to increase from maybe two tonnes a hectare to three tonnes a hectare. However, you again come back to wage rates. You have to pick all that extra coffee. As well overheads and other costs are probably going to rise in proportion, and so you are not going to get very far ahead. I don't think it is going to make enough difference to remove the losses that are being made and to put the plantation sector back into a profit position. I think that the firm kina and the level of wage rates have been driving the plantation into a corner which it might not get out of. This question of indexation and its relationship to exchange rates I think does need to be looked at very closely. I am not saying one should rush into a devaluation tomorrow but I think it needs to be looked at closely.

Bossom: We are not talking about devaluation of the kina per se; we are talking about the weakness of the American economy and consequently the weakness of the American dollar. It is not that the kina is strong: it is that the American dollar is weak. Over the last four years the American dollar

has weakened by some 20 per cent which means that agricultural producers of export crops in Papua New Guinea are, all other things being equal, 20 per cent worse off in terms of their kina income. As well, over the last four years, commodity prices have fallen on average by another 20 per cent. In addition to that there has been inflation in the rural sector of about 6 per cent and my figures show that the small rural producer who is dependent on export income is over 50 per cent worse off today than he was four years ago. At the same time there has been a real increase in incomes in the urban sectors, something approaching 30 per cent, not through income per se, but through rapid promotions through the ranks, which don't count as income increases in the statistics but are, in fact, increases in income. When you look at these two together what you are heading for is total anarchy and there has to be some kind of adjustment - be it in the exchange rate or be it in the transfer of mineral wealth to the rural sector. We have to do something. I say devalue against the American dollar, not necessarily against all currencies. You go part of the way by doing that. I think it is very important that we do so.

- Manning: I would like to make a comment in relation to cocoa and I am not terribly sure how it applies to coffee. There has been some talk of efficiency as measured by the ACIAR study. We in the cocoa industry totally discount that study. If you read the figures the cost of production in New Ireland was supposed to be K2,400 per tonne; so you wouldn't get terribly many producers in New Ireland. The study was done right in the middle of redevelopment and yields were therefore very low. We are expecting them to double or perhaps treble over the national average at that time which was 250 kgs per hectare. Quite a number of people are hitting in excess of 1-1/2 tonnes per hectare and some people have achieved two tonnes per hectare of commercial production. We believe we are working very very hard to improve efficiency and our feeling in the cocoa industry is that we can probably survive in an K800 to K1,000 per tonne market.
- Mitio: I would like to ask Mr. Gumoi to expand on his suggestions for reducing labour costs indirectly.
- Gumoi: Basically I was saying that instead of going for a direct reduction on wages rates, government should minimise the factors that contribute to the high cost structure of the economy, transport costs and other factors that contribute to the high structural costs of the economy.
- Millett: The country looks to the agricultural sector to provide rising rural incomes. There are a lot of other things that the sector can do, export earnings, etc. but there are other sectors which can probably do these things better than the agricultural sector. The specific role of the agricultural sector is to increase rural incomes. A starting point would be to increase the proportion of the population in the exchange economy and the way ahead there would seem to be to get the people to use their land to grow crops for which markets have been established and to sell those crops overseas. Doing this would give them a cash income. But what do they do with that cash, what is the incentive to come out of a subsistence style of agriculture

into a commercial style of agriculture? The incentive would be to be able to purchase trade goods, most of which are imported. It is not clear to me that the bulk of the population, the rural people, are going to be all that much affected by what we do with the exchange rate. If we devalue they will certainly get more kina for their exports but it will cost them more to buy the trade goods which is their incentive to come out of subsistence into the exchange economy. It has never been clear to me how the overall objective of increasing rural incomes and getting more of the population into the exchange economy could be advanced through exchange rate management.

Bossom: The objective would be advanced quite considerably because an increase in income through a devaluation against the US dollar would result in an increase in all incomes. On the other hand, almost all our imports come from Australia. One wouldn't devalue against the Australian dollar; one might in fact revalue against the Australian dollar to make imports even cheaper.

Anaman: One way to increase rural incomes is for the government to pump more money into rural investment especially with the boom coming from the mineral sector. Concerning the exchange rate, the last speaker said that in terms of the kina the dollar has actually been devalued by 20 per cent or so; but if you track what has been happening in the last few years you can see that the kina is falling. What we should try to do is make a gradual adjustment. I think the trend is that it is falling. The major fear is of a drastic devaluation of maybe 20-30 per cent. We should not be panicked into it.

Hoyle: I would like to put a question to Dr. Weiss if I may. I am not sure that I fully understand how the value of kina in relation to the dollar, the yen, Australian dollar is arrived at.

Weiss: Until November the basket of currencies which was used to decide on the daily change of the kina was import-weighted. Say we imported 80 per cent from Australia then the Australian dollar had an 80 per cent weight in the basket, 10 per cent in US because the US had 10 per cent in the basket etc.. We changed in November to an overall trade related basket. You take the weight of each currency in your imports and exports and this is the weight it will have in the basket. I am disagreeing with the basic notion of a hard kina or firm kina -there is no hard kina or firm kina policy, the kina value is decided by the cross currency changes between the currencies included in the basket. So if the Australian dollar is weakening and the US is strengthening what you will find is that we have a devaluation against the American dollar and a revaluation against the Australian dollar and the other way round if things change. Now this is the way the value of the kina is decided on; no one is tampering with it; no one is saying we want a harder kina, a firmer kina or a lower kina; every day we look at the cross currency changes weighted by the currencies in the basket and the value of the kina is automatically fixed.

- Millett: Mr. Gumoi's address implied that the hard kina strategy really died in 1979; but it did live for four years or so when we had successive revaluations as an inflation-fighting tool.
- Bodman: This is an open question. The government feels that rice and tinned fish are so important that people shouldn't pay import duty. This policy is obviously influential in setting wage rates and might be indicative of policies for other input costs. On the output side we have declining real product prices for coffee and cocoa. Aren't we going to find ourselves in a very difficult position, first with the higher-cost producers under pressure and being forced out and being left with the smallholder sector alone, because we have input costs which are stable in real terms or maybe rising but declining output prices. This is the fundamental question: where does export agriculture go, if that is the outlook.
- Manning: Input prices have declined and they have declined through increased efficiency, again. For example, the price of Gramoxene in Rabaul if I remember rightly it was about K6 a litre in 1984 and we are now getting it for just over K4. I haven't got exact figures but we have had substantial declines just through shopping around throughout Asia, finding better markets, finding cheaper products.

SUMMING UP

Paul Barker
Department of the Prime Minister

The government had asked the INA and the Rural Industries Council (RIC) to organise a seminar basically to provide input into government policy and planning for the agriculture sub-sector. The situation affecting agriculture is changing very fast and it is important that government be able to respond meaningfully and to fulfill its various long-term objectives for the sector, that is the renewable resources sector as a whole as agriculture has many areas in common with forestry and fisheries. It has to respond to what has been termed earlier in the seminar as a time bomb- a time bomb resulting from the number of people entering the workforce and the population growth generally exceeding the rate of employment creation. It is very easy for government to get out of touch - lost away in Waigani ivory towers or in the case of agriculture in decaying Konedobu warrens - and it is very easy for various bureaucratic issues to absorb much of staff time and energy.

I think this workshop has been a very valuable exercise. It was intended to be a two-way flow allowing industry to make its suggestions and views known and to comment on government policy as it is presented to them. Various government representatives having insights into policies and actions in their respective areas could also contribute. Unfortunately, we have not been privy to the draft agriculture White Paper which was deemed to be in too premature a state to be publicly made available at this stage, although everyone has been invited to make their various comments on it. I think many people have a copy of the draft anyway so they can read through that and feed their comments back to the government through the INA or directly. As John Millett and the Acting

Agriculture Secretary, Oscar Natera, said, the ideas presented here will be incorporated firstly in the printed proceedings of this workshop and, secondly, into the policy documents coming from the Department of Agriculture and Livestock - both in the White Paper and through various other venues like the Renewable Resources Working Group which exists as part of the government's new system for formulating policy.

When the seminar was first conceived it had a somewhat narrower focus; it was particularly aimed at the provision of services in the agriculture sector and how to improve them, but it has been subsequently expanded to cover the whole sub-sector. This is obviously a very large area for a two day seminar but I think we have covered an enormous array of subjects and I think we have done this fairly successfully, although obviously some participants may be frustrated that some issues of particular concern to them were not discussed in more detail. From a workshop like this, however, it is important to try to identify areas of consensus and not get bogged down with detail. I believe that despite the range of views presented, there certainly have been significant areas of consensus.

The focus of the meeting and much of the discussion has related to the big challenge facing agriculture now. How does it provide for the needs of the growing population, avoiding social and economic disharmony in the light of various changes affecting the sector - notably depressed or apparently declining agricultural commodity prices and the potential impact of a possible mineral boom with its host of possible ramifications; how can the sector best respond to the expectations, and what policies should the government pursue and how can it best utilise its resources to respond to this challenge which particularly requires creating the right conditions for the private sector, consisting of both smallholders and largeholders, to adequately invest?

Generally it has been acknowledged that despite some positive developments not enough has been achieved in the sector over the last few years. Although substantial investment has occurred in cocoa, coffee and oil palm, overall progress in agriculture has been inadequate. It has been felt, I think, throughout the seminar that we are going to need some fairly radical action based on clear vision, if we are going to break free from the various clamps that have been holding the sector back. These are social and economic clamps. They are clamps in relation to access to funding and other resources, bureaucratic clamps for example. Oscar Natera talked about the difficulties in implementing the Agricultural Support Services Programme. We have heard about similar problems elsewhere also.

Some constraints we obviously have to live with for the time being. There are various institutional constraints; we cannot instantly expand manpower capacity to the extent we would like and the land issues are not going to vanish overnight; we have heard of opportunities in land administration but we have also heard of some of the problems and there is, naturally, skepticism over the Land Mobilisation Programme's optimism for dramatically sweeping them all asunder. The constraint of generally low, fluctuating commodity prices is likely to remain for the foreseeable future. A viable processing sector cannot be created overnight through legislation or through unrealistic pipedreaming, but should be based upon realistic financial and economic criteria.

We have discussed, therefore, the various needs of the sector, its opportunities but also the pitfalls of being too rash, such as with inappropriate processing.

Papua New Guinea is often said not to be short on ideas, but rather is poor on implementation. It is the land of good advice with consultants' reports growing dusty; or it is tripped up with its own red tape or by lack of commitment on the part of the bureaucracy to development objectives.

Some of the papers in this workshop focused on innovations, where action has occurred and where the clamps mentioned earlier have partly been shaken loose, as with the setting up of the agricultural research institutes and the Coffee Development Agency.

Generally there seems to have been good support for these innovations shown during the workshop with the feeling that we should build upon the innovations showing success while breaking further institutional barriers in the future in order to create more effective systems of research and service provision, but only as long as Government provides its fair share of the financing of the institutions and as long as they are both cost effective and open to routine financial scrutiny by growers as well as government.

Research and extension received considerable attention during the meeting as they are deemed such critical activities, with research able to provide high returns on investment if appropriate institutions are in place to implement research findings. However, most conventional extension services are seen to be very ineffective owing to lack of direction, supervision, finance and training and that the problem will not be resolved by just throwing more money at it.

Papers and discussion have focussed upon the rather gloomy price trends affecting much of the agricultural sub-sector, but a strong belief has been expressed by various participants that for many of our major export crops Papua New Guinea does have a comparative advantage in production owing to good growing conditions, planting material and other factors and that this relative efficiency should ultimately ensure viability in industries like cocoa, oil palm and coffee.

This future viability, however, is dependent upon continued competitiveness which requires effective research and development, which requires in turn a greater and more effective government contribution.

Participants have also emphasised the need for research and development into new crops to provide alternative long-term prospects and to spread the risk.

We have also held lively discussions on the social aspects of agricultural development. Particularly discussed has been the bias against agricultural work and rural living being exhibited especially by the young, and how, partly through appropriate education, rural opportunities can be increased and the anti-rural bias reduced.

While the nucleus estate schemes have received some criticism for their enclave nature, generally it has been accepted here that they have a positive contribution to make, both as reliable development investments and as job creators. If the rural sector is to provide attractive opportunities there will need to be a range of development initiatives; nucleus estates are one form, but there need to be others, particularly with the ability to improve lifestyles where villagers already live. Some models such as the Anga Development Authority and smaller projects elsewhere have been discussed and should be considered

further. The government would like to see greater private sector financing of agricultural projects including nucleus estates, but these estates for the time being require continued government part-funding.

Discussion has focussed on ways to boost the mobilisation of domestic savings and what conditions need to exist to encourage investment in the rural sector. The government is seen to have the major role - particularly in infrastructure development and in setting the right macroeconomic conditions. The most appropriate ways of combining government and private sector resources should be pursued, including joint investment, and some ideas have been discussed during the workshop.

Various government agencies have a role in better coordinating government and private investment. The one-stop-shopping referred to by the A/Secretary for Trade and Industry, for streamlining the whole foreign and domestic investment procedure has great potential if effectively initiated.

It has been generally felt that the estate and village sectors in agriculture are compatible, having many similar needs, but that they also have some specific requirements.

It has been felt that much emphasis by government needs to be given specifically to "smallholder" producers because they dominate numerically and in terms of production and because they have less access to information and other private sector services.

It is also realised that even with infrastructural investment, for example in roads, some parts of the country will remain disadvantaged, being isolated and with poor soils and that there is a need to spread the opportunities of development through schemes such as the nucleus estates located in advantaged areas.

Education has been seen as a priority during the meeting and it has been particularly noted that those who are more educated are not only better able to gain formal employment but also to take advantage of rural opportunities. Government has the primary role in education but it is accepted that the private sector can contribute also, not so much financially, but through other means like collaboration in field training, etc. The government's greater emphasis on training and manpower development has been seen as a move in the right direction.

With the complex issue of land tenure the workshop has emphasised the need to retain some of the best aspects of the present system, such as equitable access, while instituting various changes to allow more development opportunities. The comprehensive programme detailed by the Lands Department has attractions but some concern has been expressed by participants here that the Department should not be over-ambitious, or even those necessary improvements in alienated land management might not be achieved.

Other constraints receiving attention in the meeting related to the rigidity of the labour market and the prerequisite of law and order to be able to undertake or sustain any investment.

The controversial issues of exchange and wage rates were discussed. It was accepted that exchange rate is often considered oversimplistically and that it should not be taken in isolation, particularly from wages and prices. It was generally accepted that, though the

be taken not to allow the kina to overvalue if we are to ensure agriculture's survival or if any import substitution industries are to develop here. Different schools of thought exist over whether exchange rate adjustments should be made by drift or swifter action, but if any shift is envisaged it should only occur as part of a bigger package, including wages, preferably by agreement.

Various new approaches for the sector were discussed such as new techniques like satellite imagery, new institutions like the CDA and new ways for improving inter-departmental coordination, such as the Land Use Development Committee. Some of these approaches may provide models to be built upon so long as the teething problems, such as the CDA is now experiencing, can be resolved.

Other new approaches include the Public Investment Programme (PIP) and the Resource Management System aimed at rationalising the government's planning and budgeting system, the Land Mobilisation Programme for land management and, in DAL, various programmes like SCCREP and SMAFSP each with potential but also with limitations imposed particularly by institutional capacity.

So what does it all amount to? It amounts to a very big challenge with government having to take a very key role: to be dynamic enough to respond to the needs of the industry, take on new ideas, escape bureaucratic confines, make appropriate commitments to agricultural development and collaborate closely; the private sector, the national government and the provincial governments are going to have to work somewhat closer together than they have done and utilise their resources rather better, rather than continually duplicating. The sector must accept long-term trends in commodity prices and be able to adjust to them through increasing efficiency as a result of the industry's own operations and through the efforts of research and development. At the same time the industry and government must both be able to see beyond the short-term fluctuations and pursue a firmness in economic management particularly if and when this hallowed minerals boom does occur. We certainly have enough examples from elsewhere in the world - such as Nigeria - to look to and learn what not to do.

The government may set the right framework for agriculture but it is the private sector (smallholders and largeholders) who must do the farming, so it requires the industry advising the government, keeping them "on the ball" in terms of policies and in the best use of funds. You, the industry, must come up with ideas about crop diversification and be willing to innovate. Sometimes the bigger projects, some pilot project involving, say spices, fruit and nuts or agro-forestry could be tried, because while the smallholders have often tended to dominate in terms of total crop production it is certainly true that the plantation sector has had a particularly major role in innovation and marketing. The largeholder sector must be willing to undertake further innovation; you have more information on world production systems and world markets. Overall the agriculture sector as a whole must take a positive line about its future, not be over-bullish, but it should be positive if there is to be progress; and progress is needed and opportunities are certainly there, though maybe not for those unwilling to adapt.

OPENING REMARKS

R. Gillbanks
President
Rural Industries Council

I would like to welcome you all on behalf of the Rural Industries Council and the Institute of National Affairs.

The roots of all civilisations lie in agriculture for it is necessary to have tradeable crop surpluses before other specialist trades can be engendered. Agriculture in its various forms is by far the most important business conducted in Papua New Guinea and provides a livelihood for most of its people. For most people, however, that livelihood is only just over the subsistence level. For them cash incomes derived from farming and gardening are very small and their capacity to participate in the material benefits of late 20th century life is correspondingly limited. It would be a mistake to think that their ambition for participation is similarly limited. People throughout the country are seeking opportunities to increase their cash incomes and to participate in the good things alongside their more fortunate brethren.

What then is stopping them? What are the constraints? Where are the entrepreneurs who will provide the infrastructure and who the finance? How is land to be mobilised and land tenure rationalised? Research into existing cash crops, adaptation of new crops and the commercialisation of traditional crops all present opportunities, but how are they to be funded? Who will set the ball rolling? Who then will carry it forward to social and economic success? These are all the areas which we hope will be addressed during this seminar. There will be varied views and contradictions but we hope that some broad paths will emerge which may be of assistance to those leaders charged with the task of policy making and setting a framework for future development by the people.

I have great pleasure in introducing our first speakers Messrs. Jack Diuvia and Mike Manning of the Planters Association whose paper introduces many issues of concern to those of us who derive our living and our job satisfaction from agriculture in Papua New Guinea.

PLANTERS' ASSOCIATION SUBMISSION TO AGRICULTURAL SEMINAR

Jack Diuvia and Michael Manning
Planters' Association of Papua New Guinea

The Planters Association of Papua New Guinea represents growers of copra and cocoa in the coastal areas of Papua New Guinea. The Association has members representing plantations, smallholder blocks and village blocks. As such the Association sees these forms of production as being compatible.

Purists tend to take set and dogmatic views about the way in which future agricultural development will take place. Plantation owners and large investors tend to support the plantation mode of production. They see the solution as the marriage of capital, labour and land on a large scale to obtain high yields from high technology, maximum input modes of production. At the other end of the scale is the person who espouses the concept of the village farmer who lives royally on his subsistence block and may or may not want to enter the cash economy. If he does enter the cash economy, it is on a minimum input, minimum labour basis because he can't afford inputs and is not well enough educated or motivated to use them.

In the middle of these extremes is the smallholder or resettlement blockholder who ranges between the two extremes.

The Planters' Association thinks that there are still large tracts of fertile soil in Papua New Guinea that remain unused. It supports the use of this land for large-scale agricultural projects. The ownership and questions of land leasing (i.e. government land or traditional land under some form of customary land usage agreement) are not important. What is important is that any agreement is fair to both parties and able to stand the passage of time because agriculture is a long-term investment. The main reason the Association supports large-scale agriculture is that it is the only hope for Papua New Guinea to **significantly** increase employment.

Not only is agriculture the fastest growing industry but it is the largest employer. It has been estimated that it costs about K3,500 to provide a rural job and K30,000 to provide an urban job. The largest employers in agriculture are plantations and they are the most easy to expand if all other matters are equal.

Population growth in Papua New Guinea is variously estimated at between 2-2.5 per cent with 2.3 per cent most often quoted. This rate of population growth means there will be a requirement for 80,000 new jobs per year, yet there was a decline in formal sector (excluding mining) jobs between 1980 and 1985 of 16,000. Clearly there is an urgent need to create more jobs and the plantation sector has a role to play.

There are those who would argue that the unemployment problem can only be solved by concentrating on the small modes of agricultural production. This argument says that much more emphasis should be given to small-scale agriculture to keep people "back on the

Table 1
Employment classified by industry (March 1978 = 100)

Year	Rural Production	Timber	Food, drink tobacco	Concrete	Fabricated metal	Other manufactures
1983	111.0	90.0	113.0	101.0	111.0	187.3
1984	115.7	83.0	118.4	162.7	112.6	110.1
1985	120.6	78.7	115.7	141.6	127.4	137.7
1986	130.5	76.5	115.6	144.1	121.0	154.1
1987	119.9	86.5	115.3	175.3	125.3	147.4
1988 (Sept.)	152.1	81.0	114.7	135.5	135.4	185.4
% change	+27	-11	+1.5	+25.5	+19.1	-1

Source: Bank of Papua New Guinea Quarterly Economic Bulletin (September 1988 p.544)

Table 2
Wage employment in the private sector (excluding mining)
by industry group (persons), 1976-85

Year (Dec)	Agric- ulture	Constr- uction	Commerce	Transport	Financial Instns.	Other	Total private (excl. mining)
1976	38,466	..	..	..	6,346	..	118,710
1977	46,150	..	..	..	6,890	..	128,893
1978	43,728	20,905	19,247	12,636	6,966	26,571	130,053
1979	45,032	22,042	20,725	13,541	7,814	26,957	136,111
1980	48,059	25,971	22,053	14,667	8,469	33,132	152,351
1981	50,900	25,586	21,960	12,161	9,324	26,397	143,328
1982	47,500	15,000	21,343	11,128	9,800	25,410	130,181
1983	51,691	16,433	17,453	11,290	9,752	36,140	132,759
1984	53,880	14,011	17,514	11,429	10,097	35,319	132,250
1985	56,162	23,722	17,242	11,452	9,808	17,723	136,109

Source: McGavin P. A., The Labour Market in Papua New Guinea (INA 1986, p.20).

farm" rather than migrating to the towns and cities. Unfortunately it may be too late for this to have any significant effect. All over Papua New Guinea people are complaining that youth no longer want to work on subsistence or small family cash gardens. The reasons are many and mostly sociological but it does point to the fact that modern Papua New Guinea youth does want wage employment and we have to find it.

A very successful method of combining large-scale agriculture and smaller scale is the nucleus estate concept. So far this has worked mainly in oil palm although the Agriculture Bank had a successful pig project just out of Port Moresby and Niugini Table Birds is based on this concept.

Land tenure has been addressed in a number of articles. Basically a system of leasing of customary land which is fair to, and protects, both the landowner and the lessee is essential to the further development of Papua New Guinea be it for agriculture or urban development.

Savings

It is true that the non-alienability of land makes agriculture higher risk than it would otherwise be. However, it should be emphasised that tropical agriculture is, in itself, an extremely risky business. We are subject to the vagaries of world markets, we are competing among dozens of larger, older and more established countries for a market that is growing slower than supply. On top of that we have the vagaries of weather, nature and pest and disease. It's a wonder there are any farmers left!

Up until now the government through the Agriculture Bank has provided very high levels of loan funding (up to 95 per cent) for larger scale development. For smaller scale development there has been the opportunity for farmers to contribute sweat equity of about 15-20 per cent of the total amount of a development loan. These loans have been made to farmers with customary land. There are two issues involved here. One is whether banks will lend for tree crops and the other is what level of equity should be required. The first issue is complex. The Agriculture Bank obtains funds from the World Bank and the Asian Development Bank. These banks are reluctant to lend for any tropical tree crop currently being produced in Papua New Guinea. Therefore any loan funds for these crops will have to come directly from the government and be channelled through the Agriculture Bank.

As an aside, the banking system tends to operate totally irrationally as far as agriculture is concerned. When prices are high and an industry buoyant, banks rush to lend money. Production increases and prices fall making loan repayment difficult. When prices are low, banks don't lend, people stop producing, prices rise and those left in the industry have surplus funds to repay loans. Therefore banks should lend in the bad times and stop in the good times!

The example is simplistic but it has an important connotation for Papua New Guinea. I believe that Papua New Guinea has a comparative advantage in both cocoa and coffee and could develop one in coconuts. Papua New Guinea production is amongst the most efficient in the world in oil palm. The trouble is that it is going to take some time and a

lot of money for us to demonstrate that comparative advantage. An essential adjunct to this is research which will be dealt with below.

Any tropical tree crop agriculture, large or small, cannot be run on a stop-start basis. Gestation periods are long and often the economic cycle will change during that gestation period. There are no other available, proven, crops that growers can adopt. Papua New Guinea is stuck in the short run with existing crops. Therefore the government is stuck with providing funding for these industries. That funding will need to be provided in the form of price support and in the form of development assistance.

The nation's savings will have to be mobilised in order to maintain and develop agriculture. This will be so much more important when the so-called mineral boom takes off. Many nations ignored their agriculture sectors when they had booming oil-based economies. When the oil ran out or prices dropped they had nothing to fall back on. Papua New Guinea must think carefully about that example and keep a firm sight on the industries or sector that will continue to employ most of its people.

Equity levels are a vexing question. At a time when the government and the people of Papua New Guinea wanted to transfer resources and the means of production to its citizens there was a compelling argument to keep equity to a minimum. The reason was simple - Papua New Guineans didn't have the money and the transfer would not have taken place otherwise.

Today that argument has much less validity in mining, agriculture or any other sector. There is a class of middle-income to wealthy Papua New Guineans now. They can afford to put up equity and they often benefit from the present low equity provisions at the expense of the smaller or poorer investor. It is entirely reasonable to expect that investors have to put up a substantial level of equity of the type that would be expected of a commercial bank. It is important that provision be maintained for small farmers to be able to contribute sweat equity.

Having established a desirable level of equity, it is equally important that the Agriculture Bank be funded and instructed to continue lending to tree crops. It should be remembered that the Agriculture Bank used to be called the Development Bank and a function of development banking is that it takes more risks than a commercial bank would take. This must be recognised by government and explicit guidelines given. It does not mean that the Bank should give money away.

Although the Bank and the government denies it, its lending guidelines, as expressed through the prices it compels potential borrowers to pay, restricts it from lending for tree crops. There is no more lending for tree crops and one wonders what it will lend for in the future. It is ironic that an Agriculture Bank cannot lend for most agriculture in the country.

Law and Order

Law and order is in every newspaper and receives continual publicity and discussion. In the cocoa industry it affects all growers. By far the worst effect is the incidence of theft

of cocoa which affects both village grower and plantation alike. Some villagers claim up to 50 per cent losses from their gardens and this is obviously a very strong disincentive to invest.

Fear and apprehension figure largely in the minds of most plantation workers and management. This means that people are reluctant to go to isolated plantations. It means that elaborate and expensive security precautions have to be taken. It means that a pay day is a day of fear until the pay has been delivered and paid out. Even then workers have been held up after they have received their pays.

In the New Guinea Islands police have become quite responsive to the problems and provide escort services for payrolls where they have the resources. Unfortunately they do not have the resources in some instances and the criminals seem to know where and when to strike.

The Planters' Association has taken an active role in the quest for solutions to the problem. We recognise the socio-economic problems as the seat of the evil. However, we believe that a few simple measures would go a long way to lessening the short-term problem. They are :

- . a proper maximum security jail
- . more funding for, and more recruitment of reserve police
- . more rural-based police with better resources
- . better use of police resources especially transport
- . better facilities for policemen including housing and recreation facilities
- . harsher penalties
- . more even handling of court cases and sentencing.

Stabilisation

The Planters' Association has argued elsewhere for the maintenance of the stabilisation schemes. On balance it considers that stability is a vital factor in confidence in an industry. It affects both lenders and potential investors.

The main argument against stabilisation funds is that a farmer can probably do better with his surplus funds than a fund would do and therefore the farmer should invest for the bad times. Of course, industry wide, there is a range of farmers from those who are prudent and do put away for a rainy day to those who spend everything they get as soon as they get it.

The most common complaint about stabilisation funds is that bounty payments are not passed on to the grower. In the cocoa industry this is simply not true. The level of competition amongst the 90-odd registered buyers in East New Britain means that buyers are forced to pass on the bounty to the small farmer. In provinces where there is little competition the case may be stronger e.g. the price for wet bean in early April 1989 was 35 toea/kg in East New Britain and 20 toea/kg in East Sepik.

It is likely that the level of competition would compel coffee buyers to pass on the bounty and the copra fund is distributed through the Copra Marketing Board.

The object of stabilisation in Papua New Guinea has varied at different times. In 1977 there was a very strong macro-economic incentive to government to reduce liquidity; in 1989 there is a production motive to maintain the cocoa stabilisation fund to ensure that cocoa production continues. At all times it has affected incomes.

One thing that Papua New Guinea can be proud of is that it is one of the few developing countries that has maintained a successful set of stabilisation funds. This is because the funds have been outside the hands of politicians. They have been governed by clear sets of rules that have been understood and followed by both government and growers alike. It is essential that this continues in the future. The world is full of failed stabilisation funds where governments and politicians have felt obliged to interfere and inevitably the funds have disappeared.

Commodity Boards

The Planters' Association has one very strong complaint about these Boards. Recently governments have made appointments to commodity boards on purely political grounds. We have people on the boards who are not involved in the industry concerned, have no knowledge and even less interest in anything other than their wages cheques. Sadly the present government has shown by its appointment of the Agriculture Bank board (few, if any, agriculturalists on the board) that it will follow the same trend.

The Planters' Association has asked, and been promised by successive governments, that growers be given at least 50 per cent of the representation on commodity boards. Ideally this would be by an industry-wide election. Due to the fragmented nature of the smallholder sector this would be virtually impossible. Therefore it has been recommended that the representatives be appointed from a panel to be submitted by recognised grower organisations. It acknowledges that government has the final right of appointment but suggests that these appointments must be made on the basis of knowledge of the industry and potential contribution.

It is time that the government reviewed the composition and the terms of reference of commodity boards. As industries grow and world conditions change the functions of the boards must change too e.g. should boards all be more active in marketing? Should they be more active in extension etc.?

Import Replacement

As an exporting nation Papua New Guinea should be very wary of import replacement. If an industry is viable it will set up anyway and should be encouraged to do so. Most import replacement industries require protection e.g. Ramu Sugar, meat canneries, etc.

There is only one valid argument for protection. That is the infant industry argument which says that a new industry will have to compete with existing overseas suppliers and they will make it hard to break into the market. Provided protection is given for an import parity price for an equivalent quality product and for a finite time (no more than five years) there is an argument.

Any form of protection which raises prices eventually comes back to the primary producers. All other people can pass on the increased charges but the farmer cannot. His costs are increased and his profits are reduced.

Companies seeking to set up import replacement industries are often very persuasive. They talk about employment and balance of payments and politicians love them because the projects are always very visible. However, the employment cost per job is always high and the real cost to the economy is also generally high.

The same arguments apply to value-adding. In most cases we are competing for a world market with sophisticated and very large companies. If it was naturally profitable to do so these companies would be here processing or manufacturing our raw materials. Every encouragement should be offered but it should be made very clear that the producer and the Papua New Guinea consumer are not going to subsidise the industry. The world is littered with attempts to start processing plants that have not worked and we need to be very careful.

Extension

As an Association we are deeply concerned about extension. Recently we held some field days in East New Britain Province and we visited a number of smallholder blocks. It was generally agreed that the standard of Agriculture Bank extension was better than that of the government.

The Agriculture Bank should not be an extension body. It should be a lending institution.

We have followed with interest the Coffee Development Authority (CDA) experiment and believe that it is the right way to go. We think it has imperfections which need urgent attention but we firmly believe that a non-government framework is the only route to follow. Institutional rigidities and lack of sticks and carrots mean that the existing Department of Agriculture and Livestock (DAL) services whether national or provincial are beyond redemption.

Whatever its faults the CDA has got results and it appears to have generated a new enthusiasm. We think that a similar experiment could be tried on the coast but only if adequate government funding was made available. Any function transferred to the private sector will save the government money and that money must go to fund the new activity. We see an alarming trend for government to divest itself of functions with no corresponding reduction in expenditure or staff levels.

Research Institutes

The government recognised that there were problems involved with government-run research through the then Department of Primary Industry (now DAL). It helped or allowed the various tree crop industries to establish their own institutes for research. In this way research was taken out of the public service and privatised.

There are now moves afoot within the government to return research to government control. However, before this is taken too far we should examine the government's record

in research. It is not good and over the last 10-15 years it has deteriorated. There was no research going on in Papua New Guinea on coconuts before the Cocoa and Coconut Research Institute (CCRI) was established.

The argument put forward goes under the vague heading of "accountability" and says that the institutes as presently constituted are not helping the small grower. There has been no example of how the small grower could be better served by the institutes (which have only been in existence for two to three years) despite many pleas by the boards of those institutes for direction. Government through DAL is represented on the boards. Commodity boards are represented. The Planters' Association feels that representation on the CCRI should come from growers. It feels that the research board disproportionately favours the commodity boards and not the growers who are funding more than 80 per cent of the cost of the institute.

Much of this paper has dealt with the future of the cocoa and copra industries. As an association of growers we obviously believe the industry has a future. We believe that agriculture is vital to the future of Papua New Guinea and it is vital to the solution of many of the social problems of the country. We are appalled that successive governments can talk so much about their commitment to agriculture and yet give so little to research into agriculture. The research institutes are under-staffed and we have many years of research to catch up on our competitors in other countries. We are doing virtually no research into alternative crops and not nearly enough on food crops.

The government must be prepared to put its money where its mouth is. It must be prepared to at least match industry kina for kina. To do so would amount to less than .001 per cent of its billion kina budget. When government subscribes less than .001 per cent of its budget to research into the most important industry in the country it is small wonder that we doubt its sincerity in its belief in agriculture.

Labour

Labour presents different problems to different modes of production. For the plantation sector the main problem is continuity. This has been worsened by law and order problems such as in Bougainville currently and the periodic calls by various premiers around the country that their sons should return to their home provinces. These premiers also make it difficult for people to recruit labour in their provinces.

The main reason for concern seems to be racist. People see that plantation workers from their provinces are working to make people in other provinces rich and they don't like it. There is also a hangover from the colonial days where labour was treated badly and paid very poorly. Today the plantation industry is acutely conscious of the welfare of workers. Housing and living standards are being upgraded, health and recreational facilities are being provided. Most importantly married couples are being encouraged to settle on plantations.

The reason for this is that the industry is becoming much more sophisticated and skills are required. These skills require training and supervision to ensure that such things as pruning, weeding and pest and disease control are carried out properly.

Earlier this paper has drawn attention to the role of agriculture in providing employment in Papua New Guinea. An essential adjunct to this is a free market for labour. This means that labour should be free to move around the country to find work. Those who wish to restrict movement of people throughout the country must bear this in mind when taking whatever steps they plan to take.

It would also be helpful if some of those who criticise their clansmen for leaving were to visit plantations and see that the conditions that people live in are often better than they would have in their home villages.

Smallholder and village producers face a different set of problems. These are to mobilise the youth of their villages to take part in either cash or subsistence farming. The problem is throughout Papua New Guinea and throughout the developing and developed world. More and more villagers and blockholders are being compelled to employ outsiders to enable them to continue with their farming. In many cases these people are paid in kind rather than cash.

It is difficult to see an answer to this problem. Obviously it stems from education and attitudes and a major effort must be made to change the attitudes of the youth of Papua New Guinea. They must be made to think that agriculture is the honourable calling it is and that there is a place for subsistence and cash cropping. All of this is bound up in the overall social problems that contribute to law and order and other social problems. These stem from the breakdown in traditional values and leadership and require deep-seated changes to the society.

IMPORTANCE OF RESEARCH IN THE COCOA AND COPRA INDUSTRIES

S. Yarbro and P. D. Turner

Papua New Guinea Cocoa and Coconut Research Institute

Introduction

One of government's major policies concerns the agricultural sector, in which cocoa and coconut growers feature significantly. The objective is to stimulate growth in both the smallholder and plantation sectors. Through such growth, the agricultural sector would contribute towards achieving government's national objectives of:

- . increasing the contribution of the agricultural sector to gross domestic product and government revenue, and maintaining a surplus in the balance of payments. During 1988, export values of cocoa and coconut products were K45.3 million and K38.1 million, respectively;
- . expanding employment opportunities and improving income distribution;

- increasing the incomes and living standards of rural households, and
- broadening and strengthening agriculture as the country's main economic base.

The current situation

Currently, cocoa and coconut smallholdings are largely characterised by low yields, low levels of newer cultivation technologies such as fertilisers and improved planting materials, little tree management and financial inputs, and correspondingly low returns to labour. By contrast, much of the plantation sector cocoa has been rehabilitated with newer and more productive planting material and new areas have been developed. This sector has thus improved productivity and reduced unit costs of production.

However, plantation production costs are high by international standards and there is a real possibility that the sector may not be competitive, especially in cocoa, as the world cocoa economy undergoes major structural changes, particularly with the emergence of large producers as Malaysia and, in the near future, Indonesia.

Consequently, there is a need both to improve productivity and reduce production costs of cocoa and coconut growers in all sectors. This applies especially to smallholders, who account for about two-thirds of the country's cocoa and copra production. This is the ultimate aim of all research carried out by the Institute.

A major improvement in cocoa productivity, particularly in the smallholder sector, could be quickly achieved by greater labour input into all agronomic aspects of cocoa growing. Cocoa is simply not a low (or zero) management tree crop if it is to yield reasonably well over a number of years. Given an efficient extension service, much could probably be achieved quite quickly. The Institute does not subscribe to the view sometimes expressed that the smallholder sector is incapable of implementing correct cultural techniques. Extensive experience in the oil palm smallholder sector has shown that this large population of small growers demonstrates the complete range of human effort, ranging from zero inputs to such good management skills that yield performance is greater than that of plantations.

However, extension work is not a direct function of the Institute since extension is a separate profession, requiring appropriate training and experience, and the Institute does not have the resources for this. The Institute's main function is, through research, to provide information to be passed on to growers. It also supplies high-quality planting material to all grower sectors.

It is believed that major advances in the cocoa and copra industries can only be achieved through research programmes primarily aimed at increasing production and reducing production costs. In this way the Institute is assisting in achieving government's national objectives.

Current research effort in cost reduction

There are numerous areas of cocoa and coconut research which contribute to increased productivity and reduced production costs. A brief summary of these areas is as follows:

Agronomy. Correct spacing for new types of planting material, establishment techniques, weed control, crop nutrition and fertiliser requirements, pruning and shade policies are obvious aspects of reactive research, all requiring long-term research inputs. As an example of potential benefits, recent experimentation has shown that, in Tavilo Research Centre environment, there has been no response to fertilisers either in immature or mature phases of cocoa development. Hence, growers in similar situations, of which there are many in the Gazelle Peninsula, and who regularly spend significant amounts in fertilisers could reduce costs through fertiliser control, at least in the short term.

Breeding. For both cocoa and coconut, high yield combined with required quality characteristics are both aims which take many years to achieve, with coconut in particular being a long-term programme. Incorporation of pest and disease resistance is another requirement. Current indications are that, given good management standards, the latest planting material is capable of yielding 3 tonnes of dry cocoa per hectare under Tavilo Research Centre conditions. The national average is about 0.3 tonnes per hectare. Of particular value is the precocity of the new material, which contributes significantly to early cash flow and loan repayments. A recognised disadvantage of the new material is its considerable vegetative vigour, requiring high inputs into tree management. One research project is to produce trees with a better harvest index, i.e. high yield with low vegetative production, with concomitant reduced management requirement.

Pathology. Research is centred on improved and more cost-effective methods of disease control. Long-term trials include assessment of new material for disease resistance and the heritability of such resistance but, of necessity, shorter-term research projects are based on chemical control of diseases.

All growers, large and small, suffer disease problems to some extent. Annual losses from *Phytophthora* pod rot (Ppr, black pod disease) across Papua New Guinea have been estimated to average 20 per cent, whilst in some locations in certain years disease incidence can reach 60-80 per cent. There can be no doubt either of the value of past research into disease incidence reduction or the potential value of current investigations. For example, there are indications that neutralised phosphorous acid injected into cocoa gives long-term protection against both *Phytophthora* pod rot and canker. Given that some problems can be overcome, this could result in greater productivity per unit area and reduced disease control costs.

Entomology. Research is still carried out by the Department of Agriculture and Livestock. Should this service to the cocoa and copra industries be withdrawn then the industries would be placed in a precarious position since current Institute finance is inadequate to take on entomology research. There is a wide range of insects, etc. which cause damage of varying severity, affecting all grower sectors. The situation is unstable; pests which previously were of minor importance, or new pests, can become of major economic significance. Whilst chemical control methods are updated as new and safer compounds become available, the emphasis is to encourage natural (biological) control wherever possible. This is done either through introducing predators or disease agents, or enhancing the development of those already present. Such an approach is particularly required by smallholders, whose chemical spraying capabilities might be limited. Again, there can be

no doubt as to the past value of entomological research or to the potential value of current and planned research. For example, cocoa and coconut replanting schemes of Smallholder Coconut and Cocoa Rehabilitation and Expansion Programme (SCCREP) will be endangered unless efficient methods of controlling the rhinoceros beetle, *Scapanes*, can be developed; *Scapanes* was the pest which caused the failure of government's hybrid coconut scheme.

Cocoa quality. Although Papua New Guinea cocoa exports represent only about 2 per cent of the total world market, this small share is of considerable importance to the country's growers. In a situation of ever-increasing competition, it is felt that improvements in cocoa quality will feature prominently in retaining, and possibly improving, marketability. As with cocoa field production, it is likely that overall quality could be improved rapidly if all fermentaries would follow the fermentation regime laid down by the Cocoa Board. This would provide the uniformity required by manufacturers. In the longer term, removing adverse qualities of Papua New Guinea cocoa is required, especially acidity and weak chocolate flavour. Having taken cognisance of work in other countries, the Institute's approach to quality improvement is largely that of manipulating the environment of the fermentation box to improve quality through preventing or minimising the formation of those compounds which give "off" flavours or other undesirable properties. Linked to this research should be research into drying techniques, particularly power-assisted solar drying to reduce production costs, but the Institute's resources are inadequate for this. This also applies to copra. At present the Institute is incapable of any consideration of higher-value products as alternatives to copra and raw vegetable oil.

Research constraints

The above summary of research activities is to some extent based on the premise that the ideal cocoa tree or coconut palm should have the following characteristics:

- . high yield
- . requisite level of vegetative development
- . resistance to pests or pests controlled biologically
- . resistance to diseases or low-cost control measures
- . requires little maintenance
- . has all the necessary product quality characteristics.

Such plants are sought by both smallholders and plantations. However, despite extensive research inputs, such plants do not yet exist.

Much of the required research cannot be undertaken because of financial constraints. Currently, of a total annual budget of about K1.4 million, cocoa growers contribute about 70 per cent, copra producers about 10 per cent and government most of the balance, together with limited income from overseas aid funding. In 1988, based on the export value of produce, 1.63 per cent went to cocoa research and only 0.6 per cent went in coconut research. Through its own borrowings to develop approximately 1,250 hectares of cocoa and coconut, the Institute had hoped to become financially self-sufficient in 7-10 years but newer projections on cocoa price forecasts have dashed this hope. In the interim, the great need is for additional finance to expand the current research programme.

For a complete research organisation, estimates have been made that it would require approximately K1.7 million for capital costs and an additional K0.6 million annual recurrent costs.

The Institute needs additional funding for the following reasons:

- . The present number of research workers, both Papua New Guinean and expatriate, is inadequate to cover all research disciplines and full research programmes. Whilst the total area planted to cocoa and coconuts in Papua New Guinea may be small by comparative world standards, the problems requiring research are as wide-ranging as those experienced in major producing countries. Currently, there are four overseas scientists and five Papua New Guinean graduate scientists, two of whom will be lost for long periods for further training through higher degree studies. Some individual commercial research organisations elsewhere would consider this research input meagre and inadequate.
- . The cost of research anywhere in the world is high. In Papua New Guinea, for various reasons, costs are above average.
- . A scientific liaison officer is urgently required to act as the link between the Institute and both extension workers and growers. Other senior research appointments, together with Papua New Guinean graduates as their potential successors, are required in the fields of physiology, agronomy, entomology, pathology, economics, and agricultural engineering. There are 13 approved positions for overseas research workers. This number was based on requirements for a fully-functional Institute. With only four taken-up, this provides an indication of the degree to which research is under-funded.
- . A major drawback of the present research situation is that virtually all research is centred in East New Britain. Therefore, results of trials are applicable only to that particular environment, which is excellent for cocoa and coconut development, especially in soil fertility and rainfall distribution. Some experimentation has already commenced in North Solomons Province and future plans are to develop Duncan Research Station into a major research centre. However, if all growers are to be satisfactorily served, funding for development, and facilities for research sub-centres, are required for cocoa areas on the Papua New Guinea mainland, especially East Sepik.

As with other investments, there are risks attached to increased research funding. Two major risk factors are:

1. A lengthy period of low cocoa and copra prices could reduce both the incentive and ability to maintain existing plantings and deter further new investments. However, research can influence the viability of the cocoa and copra industries by improving their technologies.

2. A more important risk is that the poor state of the extension services will limit the accessibility of smallholders to research findings.

Research benefits

Quantifying the returns on research investment is not straightforward. For many research projects, much initial basic study is needed which may not lead to direct benefits. For example, the current coconut hybrid breeding programme requires collection of germplasm, identification of genetic factors, multiple crossings of which only a small proportion are likely to be useful, and field testing in various locations before widespread distribution - a period of some 10-20 years. With an export crop such as cocoa, actual production and income are readily measured, but for coconut, export data represent only a proportion of production. Quantifying local benefits through improved coconuts is extremely difficult because of the wide usage for various purposes within Papua New Guinea.

A recent ACIAR project has attempted to quantify the benefits of research investment based on expected production improvements from the introduction of cocoa hybrids in the early 1980s in particular. Had no cocoa research been carried out during the period 1965 to 1980, K11.4 million could have been saved at the expense of not earning some K94 million between 1977 and 2000. National benefits are 8.3 times the costs, and the internal rate of return (i.e. the effective earnings on funds used) is close to 22 per cent (Antony, Kauzi, Loh and Anderson, 1988).

The beneficiaries of an expanded cocoa and coconut research programme include:

- Growers, particularly smallholders, who in many locations do not have alternative sources of cash income but are faced with numerous pest and disease problems, loss of soil fertility and declining yields from senescent plantings. A 1980 census calculated that of the 315,915 households in the fourteen cocoa and coconut-growing provinces, 70,063 households were involved in cocoa production and 106,515 in copra production. Many households produced both cocoa and copra. A 1990 census is likely to reveal that a much larger number of households are similarly involved since smallholders have increased their share of total cocoa and copra production and the population has been growing at a rate of 2-3 per cent annually.
- Papua New Guinean research workers would gain in-service training, as well as opportunities for higher qualifications.
- The Institute's financial position would be firmer.

Uncertainties of income make research planning difficult, especially for tree crops which necessitate trials being carried out over a term of years. Increased funding would permit future research directions to be more clearly defined, as well as enlarging current research programmes and extending these to other provinces.

Conclusion

It is generally agreed world-wide that agricultural research is both essential and shows a good return to investment; Papua New Guinea is no exception. In this paper it is shown that not only is return on investment good but the effects of implementing research results would be directly in keeping with government agricultural policy and national objectives, particularly with regard to incomes and living standards of rural workers.

The current situation of widespread low yields could be rapidly improved through implementation of already-proven practices, as could consistency in cocoa quality, but further improvements are dependent on research to provide better planting material and reduced production costs. This involves input not only from plant breeding but also from agronomy, pathology, entomology, chemistry and microbiology.

Constraints to an expanded research programme are largely financial. In the absence of a high cash input to meet immediate requirements, it has been proposed that the simplest method of supporting research would be for government to match grower research support, kina for kina. The Institute is making great efforts to become self-financing, but the current need to reap the potential benefits is for adequate funding, without which a research institute of this type cannot function smoothly.

Since this paper was proposed, revised financial forecasts have been made for the Department of Agriculture and Livestock White Paper. Just to maintain the **current level of research and development**, very significant non-grower contributions will be needed for the next seven years, averaging about K800,000 per year. If **expansion** is to take place over a three-year period and include more research outside East New Britain Province, then the additional amount required during the 1990-1995 period averages about K1.8 million per year.

Therefore, in the absence of considerable outside support, the future of cocoa and coconut research is bleak. If Papua New Guinea wishes to have the necessary research levels, then much greater support is essential.

COFFEE RESEARCH : POTENTIAL BENEFITS FOR THE INDUSTRY

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Papua New Guinea Coffee Research Institute

Introduction

The international competitiveness and ultimate viability of the Papua New Guinea coffee industry will depend largely on our ability to improve efficiency in terms of increased output per unit of input and at the same time effect an improvement in quality.

As far back as 1982 industry representatives recognised the need for a rejuvenated research effort, with funding shared by government and growers, if the coffee industry was

to progress or indeed maintain its existing status. In order to ensure continued industry support for research it was accepted from the outset that the resultant "new arrangement" would have to be free from government bureaucracy and should provide the flexibility necessary for recruiting appropriately qualified and experienced specialists and termination of staff who did not measure up to the expectations of the industry.

Following exhaustive discussions, and a number of trial operations, the Papua New Guinea Coffee Research Institute was incorporated as a public company in March 1986 with membership held by government and the industry. The affairs of the institute are managed by a board of directors which in turn established a Coffee Research Advisory Committee to provide technical support and advise on research matters.

Currently, four main areas of research are underway with three support departments as back-up, namely:

Research	Support
Agronomy and Physiology	Farm Operations
Pathology and Entomology	Scientific Liaison
Soils and Plant Nutrition	Finance and Administration
Coffee Processing	

This paper looks at the major problem of the industry, namely, high cost of production relative to the price received at point of export, and discusses how research is expected to make the industry more competitive.

Costs of Production

The Papua New Guinea Export Tree Crops Study, Volume 1, Largeholder Coffee (1987) provides the most up-to-date and reliable published data on the costs of production of arabica coffee. It should be kept in mind that these figures cover that period prior to the discovery of coffee leaf rust in the country.

Table 1 gives a breakdown of the costs of production on plantations and blocks managed by management agencies which constitute over 60 per cent of the area under coffee in the Eastern and Western Highlands Provinces.

By comparing our field variable costs with those of Kenya, Table 2, it is possible to obtain a relatively clear idea of the additional costs of field production imposed by control of coffee leaf rust. It should be kept in mind, however, that during the survey period the minimum rural wage in Papua New Guinea was some three times that of Kenya. This, in part, allows for the higher labour inputs required in the production of Kenya coffee for agronomic practices not necessary in Papua New Guinea, such as, mulching and irrigation.

Adjusting these figures for costs of production in Kenya to account both for differences in wage rates and labour input as well as crop protection due to the presence of leaf rust suggests an increase in field variable costs in Papua New Guinea of approximately 15 per cent or some K200 per tonne. This is in agreement with costs of crop protection quoted

by the plantation sector. Table 3 outlines the additional costs of processing in the factory.

Totalling the different types of costs it is obvious that, on average, production costs in the plantation and managed block segment of the coffee industry is in excess of K2,000.00 per tonne and while the smallholders costs are obviously lower due to lower overall inputs, essential inputs such as crop protection and labour will still be high and most likely represent a higher proportion of the total costs.

Table 1
Management group field costs - 1982 to 1984

Item	K/tonne	Per cent of total
Variable		
Labour	225.4	15.2
Wages - field maintenance	261.2	19.1
- picking	261.2	19.1
Total wages	486.6	34.3
Field materials - fertiliser	241.3	17.1
- weedicide	57.9	3.6
Total field materials	307.7	21.3
Repairs and maintenance	69.6	4.3
Fuel, oils and lubricants	40.1	2.5
Miscellaneous	12.7	0.8
Total field variable costs	917.0	63.4
Fixed		
Management fees and costs	205.0	13.9
Professional services	44.5	2.8
Miscellaneous overheads (incl. insurance, office costs)	57.6	3.9
Depreciation	62.5	4.1
Interest on capital	187.2	12.0
Total field fixed costs	556.9	36.6
Total field costs	1,473.9	100.0
Yield (T/ha)	2.2	

Source: Queensland Department of Primary Industry (QDPI) and Papua New Guinea Department of Agriculture and Livestock (PNGDAL) 1987.

Table 2
Percentage breakdown - field variable costs
Papua New Guinea and Kenya

Item	Papua New Guinea	Kenya
Wages - field maintenance	26.9	23.4
- picking	33.8	26.4
	60.7	49.8
Field materials - fertilisers	30.2	14.5
- weedicide	6.5	3.3
- crop protection	0.3	30.8
- miscellaneous	2.2	0.6
Total	100.0	100.0

Source: (Kenya): Roe and Whitaker 1985 after QDPI and PNGDAL 1987.

Table 3
Factory costs - 1982 to 1984

Item	Costs (K/t)	Percentage of total factory costs
Variable costs		
Wages	88.2	24.8
Factory materials - fuel		
- other	75.0	21.1
Repairs and maintenance	51.3	14.4
Other	25.5	7.2
Total variable	240.1	67.5
Fixed costs		
Management	20.4	5.7
Depreciation	52.8	14.8
Interest on capital	25.9	7.3
Other	16.5	4.6
Total fixed	115.6	32.5
Total Costs	335.7	100.0

Source: QDPI and PNGDAL 1987.

Research Programme

All research projects are presented to, and require approval from, the Coffee Research Advisory Committee before being forwarded to the board of directors for funding. This helps to ensure that as far as possible programmes address the most pressing problems facing the industry. Tables 4 to 7 give an outline of individual departmental programmes.

Not all projects can be expected to produce dramatic results or cause major changes in the industry; however, a number of projects should result in marked improvement. These are discussed in broad terms in the next section.

Table 4
Agrophysiology department research programme for 1988-89

Project No.	Title	Year started
1.40	Nursery potting mixture observational trial	1988
2.10	Introduction/Collection of coffee varieties and Cultivars	Continuous
2.20	Section and evaluation of compact resistant varieties	1987
2.20(a)	Catimor adaptability trials in smallholder areas	1988*
2.20(b)	Catimor adaptability trials in plantations	1988*
2.30	Selection and evaluation of Aiyura Catimor Rust race	
2.50	differential cultivar trial	1984
3.30	Density*Field Arrangement* pruning trial with compact resistant varieties	1988*
4.20	A pruning trial to determine the optimum bearing heads/stems per tree	1986*
5.30	Observational trial on the effect of shade trees on coffee growth and yield	1987
6.10	Survey of the weed control methods used in PNG plantations	1988
10.10	Rehabilitation plots in coffee growing areas	1987
10.11	Rehabilitation/pruning trial	1987
10.20	Maximum/optimum yield plots	1988*

* new projects.

Table 5
Pathology department research programme 1987-91

Project No.	Title	Year started
1.10	Epidemiology of coffee rust at medium altitude	1987
1.20	Epidemiology of coffee rust at low altitude	1987
2.10	Laboratory evaluation of new fungicides	1987
2.21	Field assessment of new fungicides	1987
2.22	Field assessment of effective fungicides	1988/89
2.50	Spray timing trials for leaf rust control	1988
3.10	Evaluation of spray techniques and equipment for leaf rust control	1988
3.20	Evaluation of droplet spectrum and physical properties of fungicides	1988
3.30	Compatibility of fungicides with other chemical materials	1989
3.40	Effect of fungicides on foliation and yield	1989
3.50	Redistribution of fungicides in coffee	1989
5.10	Microflora of coffee leaf surface	1988
6.10	Laboratory assessment of new hybrids for rust infection	1989
6.20	Field assessment of new hybrids for rust infection	1987
6.30	Identification of rust races	1987
7.10	Field assessment and control Pink disease	1988
7.20	Field assessment and control of <i>Cercospora coffeicola</i>	1988
8.10	Biological control of green scale	1987

Table 6
Soils and plant nutrition research programme 1988-90

Project No.	Title	Year started/ completed
1.01	Fertiliser trial - unshaded, Koban Estate	1987
1.02	Fertiliser trial - shaded, Koban Estate	1987
1.03	Fertiliser trial - unshaded, Aiyura	1987
1.04	Timing of fertiliser application, Ondu Estate	1989*
2.01	Smallholder coffee fertiliser trial	1987
3.01	Christmas Island rock phosphate (CHIRP) Nursery trial and soils	1986/88
3.02	CHIRP - Nursery trial - organic material	1986/88

4.01	CHIRP Planting hole follow-up	1987
4.02	Planting hole - P-level trial	1987
5.02	Soil sample pretreatment investigation	1986/88
5.03	Study of soil surface charge characteristics	1989*
5.04	Study of clay mineralogy of coffee soils	1989*
6.01	Village farming systems site survey	1987
6.03	Eastern Highlands land suitability report	1989*
6.04	Land resource inventory - HAES	1988
7.01	Coffee nutrition database	1987
8.01	Foliar nutrient level studies - HAES	1987
8.02	Foliar nutrition level studies - smallholder	1987
8.03	Foliar nutrient level studies - WHP	1987

* = new projects

Table 7
Processing department research programme 1987-91

Project No.	Title	Year started
1.2.1.	Survey of range of equipment used by smallholders	1987
1.2.2	Inventory of equipment used by estate sector	1987
1.3	Survey of processing practices, grading, fermentation, washing and drying	1987
2.1	Evaluation of conventional hand pulpers	On-going
2.2	Evaluation of Columbian vertical drum pulper	1987
3.0	Effects on quality of:	
	. Cherry ripeness of picking	On-going
	. Delayed pulping	
	. Fermentation methods	
	. Soaking	
	. Drying methods	
	. Re-circulation of water	
5.0	Processing "waste" disposal	
6.0	Factory design for 20 ha blocks	1988
7.0	Assessment of coffee quality	On-going

Discussions

The research programme outlined above is aimed at improving the efficiency of the industry through reduction in costs and/or improvement in quality. A general discussion on some of the more important areas of current research and possible future avenues of investigation is presented here.

1. Leaf rust resistant varieties, when properly evaluated for both sustainable production potential and quality, will provide the coffee farmer with planting material not requiring regular spraying with costly fungicides. Careful testing will be necessary to ensure that these varieties are not susceptible to other diseases previously not a problem, e.g. *Corcosphora*.

There is some evidence to suggest that the Catimor variety will perform satisfactorily under Papua New Guinea conditions giving both improved yield and acceptable quality. Therefore, in order to speed-up the evaluation process, prior to commercial release, adaptability trials have been established across a wide range of environments.

2. Compact varieties are generally grown on a single stem system with a slightly higher population of plants per hectare. Information to date suggests vastly improved yields can be expected.

Since these varieties are grown on the single stem system there is a considerable reduction in labour requirements for pruning and handling, currently accounting for approximately 37 per cent of labour costs for field maintenance (QDPI and PNGDAL 1987).

The Catimor variety has compact growth characteristics in addition to being leaf rust resistant.

3. Shade removal from conventionally spaced coffee has led to a considerably increased labour and/or chemical input for the control of weeds, amounting to some 18 per cent of maintenance costs (QDPI and PNGDAL 1987). It is expected that current research will ascertain the most appropriate planting densities and configuration, with and without shade, to reduce weed to insignificant levels.
4. Studies of the epidemiology of leaf rust and evaluation of fungicides have already led to the Coffee Research Institute (CRI) being able to recommend spraying programmes offering large reductions on those practices adopted from overseas after the discovery in Papua New Guinea of leaf rust. For example, in the major coffee growing areas it is now clear that **three sprays** per annum of a copper fungicide gives adequate control of rust and where rust is initially severe one initial spray of a systemic fungicide as a curative followed by two sprays of copper formulation is sufficient. This is in contrast to the current recommendations in Kenya for the 1989 season (Kenya Coffee, January 1989) which recommends sprays at three to four week intervals with a minimum of five sprays per annum required for effective control.

This leads to reduced costs of fungicides and reduced labour requirement for application.

5. Initial results on response to fertilisers and surveys of fertiliser use, particularly in the plantation and managed block sector, suggests that major savings can be effected by better planned fertiliser programmes. For example, the use of standard compound N.P.K. fertilisers on all soil types is a luxury which the coffee industry will not be able to afford in the future. Detailed recommendations on the use of "straights" will be possible by 1990 and is expected to reduce fertiliser use in some areas by up to 20 per cent if adopted.
6. Quality of the 70 per cent of the coffee crop which is produced by smallholders has been a concern for many years and is likely to attain greater significance in the event of the collapse of the International Coffee Organisation agreement. Evaluation of methods and design of equipment appropriate to this sector will have a major impact on future developments.
7. One new area of research not yet included in the CRI programme is the evaluation of **mechanical harvesting**. Wages paid to labour for picking accounts for some 30 per cent of field variable costs; therefore, any reduction in costs which might be obtained if mechanical harvesting was shown possible would be welcomed by the industry. Besides, apart from costs there is some evidence that labour for this task is becoming increasingly difficult to obtain. It is also worth noting that the survival of the tea industry in Papua New Guinea was dependant on developing suitable harvesting by machines.

Conclusion

Although contrary to the national goal of employment creation in the rural sector it would appear that a reduction in labour input for coffee production might prove to be the key to long-term viability. It is certain that higher returns to labour will have to be achieved. More efficient use of chemical inputs, such as fungicides and fertilisers, need to be achieved both from a cost reduction viewpoint but equally as important for environmental reasons.

Current research being carried out by the Papua New Guinea Coffee Research Institute in terms of new varieties, fertiliser and spraying programmes are designed to address these issues and are expected to make a major impact in the not too distant future. However, adoption of improved practices, particularly by smallholders will ultimately depend on the existence or otherwise of an efficient extension service.

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COFFEE EXTENSION SERVICE - THE PRIVATE ENTERPRISE APPROACH

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Introduction

Thank you for inviting me to attend this important seminar and to share a few ideas and participate in deliberations of future policy direction in agriculture development in Papua New Guinea.

The Coffee Development Agency (CDA) has been established and operating successfully in Papua New Guinea for two years, and I am sure the experiences in the field of extension in coffee will be of great value in the efforts towards development of extension policies in the agricultural sector in Papua New Guinea.

In this paper, I will address four major areas, namely:

- . brief review of developments in developed countries;
- . new trends in agricultural extension;
- . some observations on the Papua New Guinea extension and directions;
- . some observations with CDA experiences for discussion.

The private enterprise approach is discussed here because **firstly**, it is one of the accepted and most successful extension approaches used now in Papua New Guinea. **Secondly**, it is easily adaptable to a wide range of agricultural environments as well as its administrative setup.

Brief review of developments in developed countries

Several authors have reviewed agricultural development in developed countries including Naisbitt (1982) and Dillman (1986) in the U.S.A., Jones (1986) in Europe and Chamala (1987) in Australia. Several conferences have been held to examine the new developments and trends emerging at national and international levels that are affecting agricultural developments. The most important general trends and changes in the agricultural sector are briefly summarised here.

General megatrends. Naisbitt (1982) reviewed various changes that are taking place in developed countries in general and in the U.S.A. in particular. He identified ten megatrends. These are:

1. industrial society to information society
2. national economy to world economy
3. forced technology to hightech/high touch
4. institutional hierarchies to institutional networking
5. institutional help to self-help
6. centralisation to decentralisation

7. short-term to long-term
8. representative democracy to participative democracy
9. from North to South
10. from either/or to multiple options.

These megatrends have a major impact on national development in general and in the agricultural sector.

New trends in agricultural development. Several changes are taking place in national economics and agricultural developments in the industrialised world as well as in the developing countries. Major trends that affect agricultural policies and extension are briefly described here.

- **Institutional changes.** Institutions dealing with agricultural research, teaching and extension are under enormous pressures to adjust to changed environments. For example, calls for budget and tax cuts; privatisation of research and extension and charging for certain government extension services, are considered seriously.

Australia and New Zealand have introduced fees for extension services and are moving into user pay-user say extension services. Tasmania was the first with South Australia and Victoria in the pipeline whilst State agricultural departments are changing their names such as North Territory Department of Industrial Development, etc.

- **Changes in extension research, teaching and actual field extension.** Extension as a social science research focus has been undergoing considerable change. There has been a shift from single innovation adoption, diffusion and resistance to change (Social Science), to present knowledge systems incorporating research, extension and industry (producers, consumers, exporters, processors, suppliers, bankers etc.) as a synergistic whole, with a socio-economic focus.

- **Management focus on development.** Similarly dimensions of extension have been undergoing changes and **extension is seen more as managing change and development not just technology transfer.** Strategic management with clear goals, through participative planning, organising, coordination and implementing development programmes is increasingly being used. This can be achieved in various ways, namely, informal education, communication, providing services including technology, markets and incentives, legislative and regulatory functions and more importantly, enabling farmers to achieve their personal and national goals.

The classical example here in Papua New Guinea is the operation of public sector agencies since 1984, covering regulation (Coffee Industry Board), industry, extension and coffee leaf rust control (Coffee Development Agency) and research (Coffee Research Institute) with finance from the industry (growers), government and external sources.

- **Changing structure of the farming community.** Part-time or hobby farmers are increasing whilst the numbers of full-time commercial family farms are decreasing at

an alarming pace, e.g. in Australia. The reasons for these changes are worth taking note of.

Changing food habits. In many developed countries, there is a shift from animal to plant protein, red to white meat, decreased consumption of preserved food and increased consumption of sea foods and fresh fruits and vegetables; there is a shift also from inorganic to organically grown food for health reasons. Whereas in some developing countries, including Papua New Guinea, the trend seems to be the opposite, such as increased consumption of canned food, ready-made junk food and drinks, meat and polished rice.

Changes in training and teaching of extension. Training and teaching extension in Papua New Guinea is now existent in agricultural colleges and universities as a subject addressing rural development. Dramatic changes have occurred in Australia, U.K., U.S.A. and Europe as well as Asian countries in training and teaching of extension and rural development in colleges and universities. Suggested changes in training and teaching extension and rural development were summarised by Geroro (1983). They are:

- include extension as a subject of its own in the Diploma of Tropical Course in agricultural colleges in Papua New Guinea;
- introduce post-graduate diploma in agricultural extension at the university level;
- follow from post-graduate diploma in agricultural extension to master and Ph.D. programmes in agricultural extension and rural development;
- introduce agriculture as a compulsory subject for community school, high schools, colleges and universities; teach survival skills - not European history.

Agricultural development within the context of national goals. Agriculture is the "economic backbone" of Papua New Guinea, being the main provider of livelihood for the large majority of the population of more than three million. It is the source of a third of the total export earnings of the country. While agricultural policies, research and extension achieved considerable progress in the export crops sector such as coffee, cocoa, copra, rubber and to some extent tea, expansion in the output of smallholders has levelled off.

The subsistence food production is lagging behind, food imports are excessive, and the incidence of malnutrition is quite alarming. There is also a danger that the traditional food supply system, which is the lifeline of the bulk of the people, could break down in the coming decade. It would require the dedicated efforts, calculated decision and risk-bearing activities of farmers, extension agencies, research institutions, educators, semi-private and private institutions, businessmen and policy-makers to avert this danger (Flores and Temu 1983).

It is therefore important to clearly and realistically define agricultural extension policies within the framework of national development goals and strategic objectives.

In addition to understanding the linkages between national goals and strategic objectives, the political, economic, technological, socio-cultural environment must be understood as well as the system of agriculture (exporters, suppliers, processors, farmers and industry extension and research agencies).

This is important if extension policies are to realise their full potential through motivation, active involvement and organisation at the grass roots level of rural people.

Agricultural Extension Strategies in Papua New Guinea. Several authors including Lamrock (1962), Crouch (1981), Kesavan (1983), Chamala (1983), Lahis (1985) and Geroro (1987) have reviewed agricultural extension's history and highlighted the following features:

- . a shift from one extension service to nineteen extension services after independence with localisation and decentralisation;
- . unfortunately, the national Department of Agriculture and Livestock (DAL) was slow, even reluctant to adapt to the realities of decentralisation (Lahis 1985);
- . structural weakness between national and provincial levels;
- . functional divisions and approaches were different;
- . little evidence was found of effective feedback through extension that influenced or directed research priorities;
- . scientists tend to be discipline-oriented rather than problem-oriented (Chamala 1983 and Kesavan 1983) and expected extension officers to put it all together.

Papua New Guinea would be well advised to look first at the problems the farmer faces and services he needs then consider how most effectively to organise research and extension to relate to those problems and needs as well as structural framework to implement extension policies. Taking the strategic management approach Figure 1 examines the linkage between the five national goals and nine national public expenditure strategic objectives.

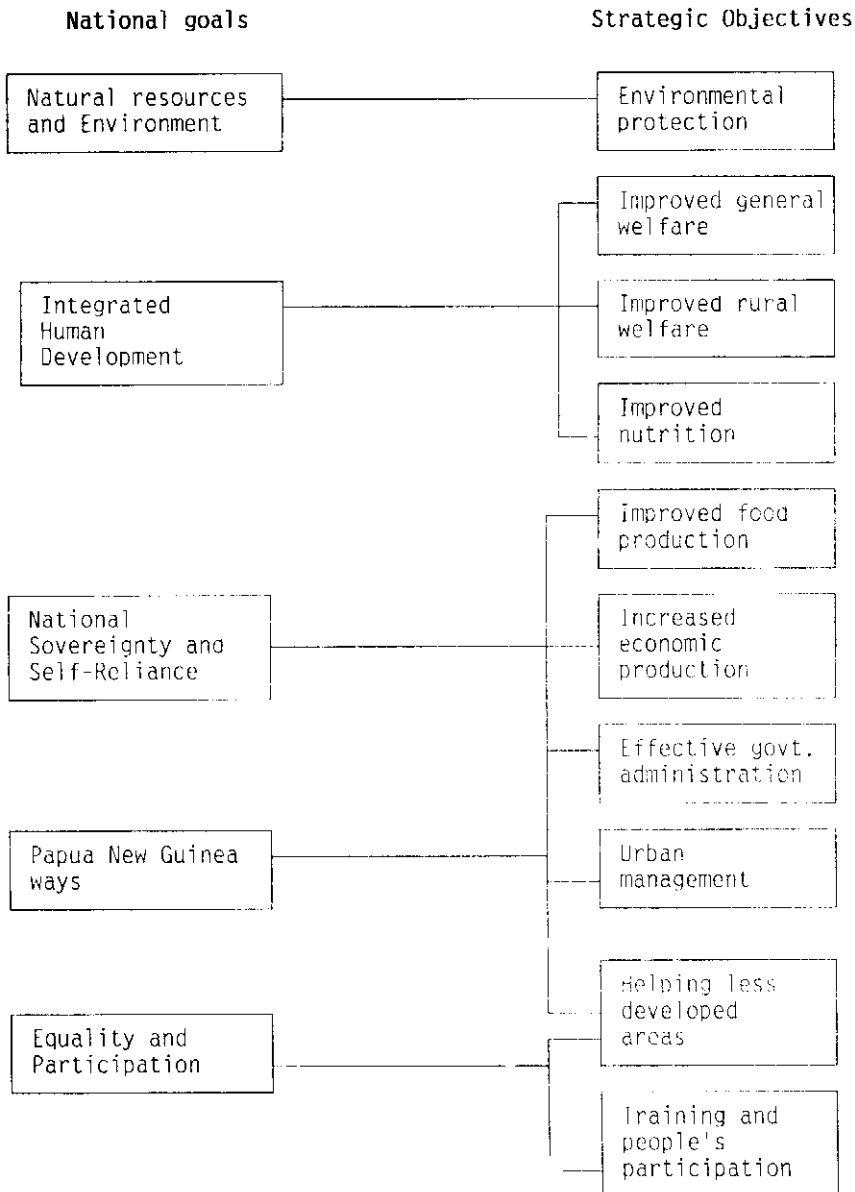
Coffee extension - the private enterprise approach

Increasingly private or semi-private extension approaches are being adopted in both developed and developing countries for reasons outlined earlier. As well as reducing the cost to the public, management can respond quickly to changing conditions and experience, redirecting resources, altering strategy and implementing the necessary changes.

The CDA's approaches are briefly discussed here.

The organisation. CDA was incorporated under the Company's Act in January 1987, and has now been in operation for over two years. It has a board of directors which determines the Agency's major decisions on operational plans, expenditure and other management matters.

Figure 1
 Linkages between the five national goals and the nine National
 Public Expenditure Programme strategic objectives (1976)
 cited in Lok (1983)



The Agency was established to address two main areas:

- to implement technical advice provided by the Coffee Research Institute on the best approach to combat coffee leaf rust;
- to provide and impart information and techniques on coffee husbandry to the farmers to enable an increase in production.

The focus is mainly on the smallholder sector which makes up 70 per cent of the nation's coffee industry.

Achievements. After over two years of operation, the rehabilitation results to date show that out of approximately 300,000 smallholder coffee growers throughout the country, a total of 147,000 farmers received garden demonstrations, 88,637 gardens are being rehabilitated and 67,000 farmers have had their gardens fully rehabilitated. The number of gardens that have received free spray totalled 50,000.

Primary objectives achieved. Coffee rehabilitation has been successful with an estimated 31,000 hectares of smallholder coffee either fully or partly rehabilitated. On the basis of smallholder yield of 300 kg per hectare, the corresponding production is 156,000 bags (60 kg) of green bean or 13 per cent of estimated national production of 1.2 million bags for the 1988-89 coffee year.

The outbreak of coffee leaf rust has been well contained through a very competent extension approach. Approximately 50,000 gardens or 10,000 hectares of affected coffee have been sprayed. Although it is difficult to quantify, it could be assumed that CDA's extension assistance to smallholder farmers has assisted in the increase of national production to record heights in the 1987 and 1988 coffee seasons.

Management approach. The CDA is basically a farmer-trainer organisation. It is training farmers to become good coffee managers. In the long term, the farmer will stand on his own two feet as an independent coffee manager. The CDA's immediate objectives are:

- coffee rehabilitation and rust control;
- quality improvement programme.

In an attempt to achieve these two basic objectives, an extension management concept known as Coffee Management Division (CMD) has been adopted. Its broad aim is to identify the scattered smallholder gardens and merge them into a logistically feasible management unit. Site preferences for CMD have been in the major coffee-growing provinces which are a combination of coffee zones, clearly defined by the existing census division boundaries.

CDA in the last two years has established 33 CMDs. A further twelve would have been established this year if CDA had received funds from the national government. Due to uncertainty in funding and the future of CDA, future CMD developments have been frozen.

These CMDs are the nerve centres of CDA's operations and accomplishments. Its 151 field officers operate from these CMDs and are always at the farmer's immediate disposal for advice and assistance in coffee rehabilitation and rust control. They are supported by 200 farmer trainers (village-level extension workers). Also there are more than 200 support staff in regional offices and the head office who are available for consultancy on matters regarding the industry.

CDA's existence. The idea of an extension organisation such as CDA was contemplated by the Coffee Industry Board in 1985. It became a reality in 1987.

The CDA as an extension service is widely accepted within the industry and elsewhere. Many experts within Papua New Guinea and abroad have expressed their opinion that the CDA could be considered as the model operation for other cash crops in Papua New Guinea and elsewhere in the South Pacific and Asian regions.

Major coffee extension tasks in Papua New Guinea

As outlined earlier, agricultural extension is seen more as a **management of change and development** in the environment of strategic planning and **not** just transfer of technology as in the previous extension services.

Major coffee extension tasks are defined and specific CDA approaches are discussed to enable better understanding of the linkages between national goals, the strategic objectives and the environment of strategic planning.

Technology. Research on current technical information for garden rehabilitation, rust control, quality control and appropriate tools and equipment. This should provide growers with correct information, methods, etc. The CDA approach is to use the Coffee Research Institute (CRI) which is jointly funded by government and the private sector to conduct research and provide basic information for dissemination to smallholders. Government cannot do this as well as a joint venture.

Credit. To provide smallholders and block owners who have a genuine need with lines of credit for rehabilitation, rust control and quality control, until they are able to fund themselves. CDA uses the Agriculture Bank which is a statutory body to service people's needs. Government cannot do this as well as a joint venture.

Manpower development. To train and develop extension staff in technical, management, extension and other aspects of the CDA package and give them the skills, methods and techniques to pass on this knowledge to the growers. The CDA approach is to develop a training unit to interpret CRI materials into training modules for in-service training of CDA field staff. Training is offered to other organisations to offset costs or develop the size of the training unit. CDA is also considering management advisory work for fees, for those who can afford it and benefit from it. Government operations are academic not vertically integrated or grower based.

Supplies. To provide growers with the tools, equipment and other farm inputs they require for implementing the package. Supply points should be as close as possible to the village-

level structure and network to provide the cheapest and most reliable supplies. CDA will develop village retailers to service growers with recommended farm inputs. Bulk supplies of inputs will be tendered through the CDA network on behalf of smallholders until other supply organisations can take on the task. CDA network capital relies on government passing on levies and funds. Small margins of surplus will be considered over time to offset the costs of building the supply network.

Government cannot undertake such a task because it is too inflexible and lacks the discipline to prevent stealing, etc. Private enterprise cannot act quickly enough because of the capital outlays required and the necessity to make an annual profit, and the uncertainty of government policy on coffee leaf rust implementation.

Transport. CDA's approach is to support private enterprise development at the village level, and to encourage village-level entrepreneurs by making them aware of opportunities as they arise.

Governance (institutional building). In order to strengthen and build village-level institutions and organisations so that growers get a fair representation and actively participate, CDA offers economic opportunities to villages in the farmer service sector, e.g. supplies, marketing, transport, etc. CDA also assists growers to form groups to discuss and solve problems or to represent each other within the industry. CDA encourages smallholders to exercise their rights as members of the Coffee Industry Association and other organisations.

Government is unable to do this because it is in the industrial arena and must be developed by associations. Governments will not generally organise groups to represent themselves into pressure groups. Government would not have the current smallholder unrest surrounding CDA if the smallholders had been properly represented or assisted to properly represent themselves.

Technology. Possible introduction of rust resistant varieties. CDA believes in the user-pays approach - the costs of developing and distributing our services to be paid for by the grower. Any surplus would be used to offset other costs of the CDA-government joint programme.

Product quality and marketing. CDA will provide a stimulus to the present marketers to seek and pay premiums for quality coffee. CDA will introduce lower-level pulping technology for the smallest growers. Group pulperies will be organised for better processing and higher quality control. CDA will liaise with the CIB, buyers and exporters to secure international markets for premium quality coffee.

Government cannot do this. The industry has its own organisations to represent it. Government's problems can be seen in current roles and funding support for the industry.

While government has a responsibility to fund aspects of extension activities related to coffee, it finds it difficult to implement these extension activities itself because of its lack of flexibility and discipline. Private organisations are more flexible and are more able to discipline staff because of their ability to hire and fire.

The correct approach as CDA sees it is:

- . Government provides capital expenditure for infrastructure costs (e.g. buildings, etc.), and some recurrent developmental costs (e.g. vehicle, early staffing costs, etc.).
- . CDA implements with flexibility and discipline
 - . extension functions of coffee
 - . a commercial arm basis.

In other words a joint venture approach between government and industry organised on private sector lines will not only reduce costs to the public but improve services to the farmer.

Conclusion

An overview of general megatrends and new trends in agricultural development in developed and developing countries were identified and discussed as they have a major impact on national development, agricultural and extension policies.

Some important new trends noted were: (1) institutional reforms from institutional hierarchies to institutional networking; (2) shift in the agriculture extension approach from single innovation, adoption, diffusion and resistance to change (social science) to the present knowledge system incorporating research, extension and industry (producers, consumers, exporters, processors, suppliers, bankers, etc.) as a synergistic whole, with a socio-economic focus; (3) agricultural extension seen as managing change and development and not just technology transfer.

Agricultural development and agricultural extension strategies in Papua New Guinea were discussed and some weaknesses were highlighted. Amongst others, the five main weaknesses were: (1) extension is a provincial function with 19 provinces; (2) structural and networking weaknesses between governments and industries; (3) weak extension, research industry linkages that influenced or directed research priorities; (4) scientists tend to be discipline-oriented rather than problem-oriented; (5) inadequately trained personnel in management, extension and rural development.

The private enterprise approach to coffee extension service was discussed using CDA as a case study. Major coffee extension tasks in Papua New Guinea were identified and again CDA was used as a case study in how it approaches each task. Some eight major coffee extension tasks were identified and discussed. These were: (1) technology; (2) credit; (3) manpower development; (4) supplies; (5) transport; (6) governance (institutional building); (7) product quality and marketing; (8) technology (resistant varieties).

In the discussion of coffee extension tasks in Papua New Guinea the paper showed that -

- . straight private enterprises have problems, and
- . government by itself has problems.

The paper concludes that the best approach is therefore a joint venture which to be effective has to shield itself from political interference, get effective representation and reduce the cost to the grower (or public).

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AGRICULTURAL MAPPING AND MONITORING IN PAPUA NEW GUINEA USING SATELLITE IMAGERY

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Introduction

This paper presents an introduction to remote sensing and reports on the potential of Landsat multispectral (MSS) and thematic mapper (TM) data to map and monitor small and largehold cash crop production in Papua New Guinea. This paper is a summary of a paper (Croome 1989), produced as part of ACIAR project 8734, "The design of monitoring systems for smallholder agriculture in Papua New Guinea (PNG)". The primary aim of the project was to develop cost-effective methodologies for monitoring smallholder production. Satellite data being easily and cheaply acquired (\$A5,000 for a 185 km by 185 km area) was identified as having the potential to satisfy some of the information needs of a monitoring system. As such Landsat TM data was tested over the Madang and Goroka areas of Papua New Guinea to determine whether accurate area estimates could be calculated for coconuts, cocoa and coffee. The results indicate that the area and the management practices used on these cash crops can be calculated using satellite imagery on slopes that do not exceed 20 degrees, and that are not shadowed.

Introduction to remote sensing

Characteristics of the Landsat orbit. The Landsat satellite orbits the earth approximately 913 km above the surface moving in a north-south direction. While the satellite is tracking it collects data over a 185km by 185km strip of the earth (see Figure 1). At the completion of an orbit the satellite then begins a new orbit adjacent to the previous one. Complete coverage of the earth takes sixteen days. A characteristic of the Landsat orbit is that it is sun-synchronous. This means that every sixteen days the satellite revisits the same spot at the same time. This feature of the orbit results in the sun angle varying during the course of the year, particularly at the higher latitudes. In Papua New Guinea, however, this effect is negligible. In addition the satellite is programmed to cross the equator at midday when the sun is at its highest. For mountainous Papua New Guinea this means that topographic shadowing is minimised and much of the data is useful for resource inventories.

Characteristics of data collection. Each 185km by 185km image is made up of hundreds of thousands of squares or picture elements often referred to as pixels. The pixel size of the older Landsat MSS sensors is 79m. by 57m. The area that each pixel covers is known as the spatial resolution of the sensors. The newer Landsat TM sensors have a spatial resolution of 30m. by 30m. (see Figure 2). The spatial resolution of the TM sensors is therefore much higher than MSS and provides much sharper definition of ground features such as roads and rivers. Landsat MSS has four sensors. Each sensor measures the average intensity of reflectance for each 57m. by 79m. Each sensor is designed to collect information over a specific part of the visible and near infrared portions of the electromagnetic spectrum (see Figure 3). This information is then stored as a digital

number. The width of the spectrum (10nm or 30nm), which is sensed, is known as the spectral resolution of the sensor. The narrower the band width the higher the spectral resolution. The first three MSS sensors cover the visible portion of the electromagnetic spectrum and span 10nm each, while the near infrared channel (channel 4), spans 30nm. The TM scanner has seven sensors. Other technical advancements featured in the TM sensors include higher spectral resolution of the blue, green and red channels (the old MSS channels 1, 2 and 3) (now 8nm instead of 10nm) and the inclusion of three additional sensors which cover the middle (1.55nm-1.75nm), thermal and far infrared (10nm-12.5nm) regions of the electromagnetic spectrum. Landsat TM is therefore a superior scanner because of its smaller square pixel, its increased spectral resolution and the increased number of sensors.

Figure 1
Characteristics of the Landsat orbit

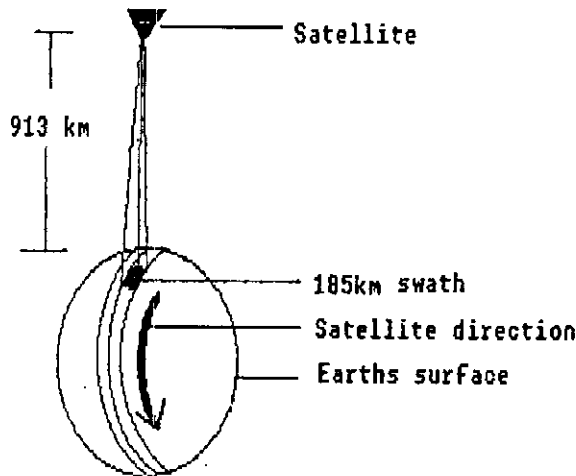


Figure 2
 Characteristics of data collection
 Each grid square (pixel) represents 30m by 30m.
 The data is collected in digital form and is measured
 as the average reflectance for each 30m by 30m.

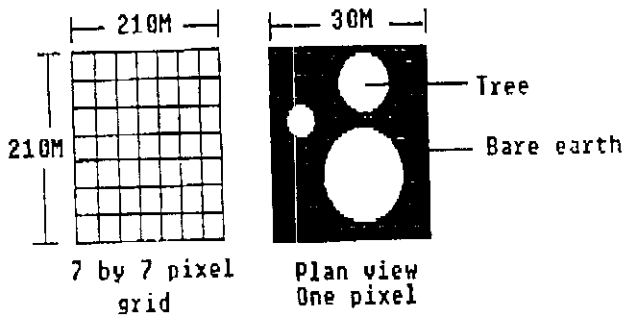
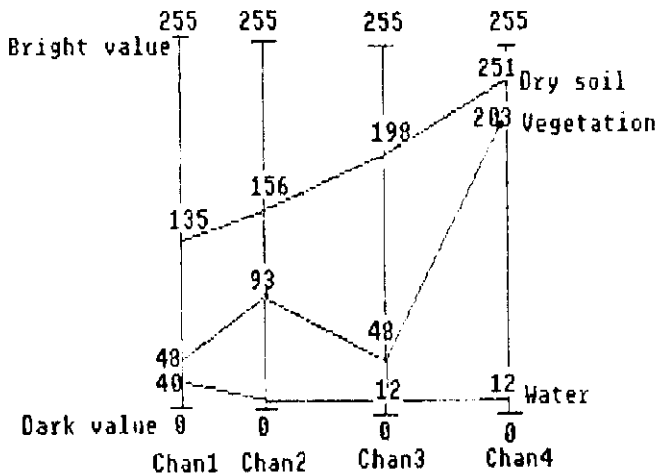


Figure 3
 Typical Signature for soil, vegetation and water



Processing of satellite data. The secret to Landsat's success is that it collects information about the reflectance properties of objectives. Also Landsat data is digital. This means that the various ground cover types (such as soil, water and vegetation) which have different reflectance properties can be distinguished statistically because of their different digital values (see Figure 3). The seven values (produced by the seven sensors) for each TM pixel is known as its "signature". Blue water reflects blue light and absorbs all other colours. Its signature is therefore characterised by a relatively high value in the blue region or channel 1, and almost nil in the others. Healthy vegetation however reflects green light, absorbs red light and reflects infrared light. The signature for vegetation therefore has a peak in channel 2 or the green channel, a low response in channel 3 or the red channel and a high response in channel 4 or the infrared channel. An example signature for each of the major ground cover types on earth is represented in Figure 3 using the first four TM channels.

Image enhancements. To extract the most from satellite data it is important to first identify and enhance the data range of interest. In the case of agricultural crops this means enhancing the data around the four vegetation nodes illustrated in Figure 3. Image enhancement is most commonly achieved on a computer and involves statistical manipulations such as histogram stretching. Usually channels 2, 3 and 4 of the MSS sensors are used because they are most useful for distinguishing vegetation. The stretched histograms are displayed as red, green, and blue composites on the computer. Where the data is of no interest it is either white (if its value is very high) or black (if its value is very low). In the range of interest the data is a combination of red, green and blue and the resulting colours (which relate to the digital values of each pixel) may be visually interpreted with a high degree of confidence. For agricultural crops this is particularly true because of the geometric shape of plantations and the data homogeneity within them.

Image classification. Classification in remote sensing usually refers to the clustering of pixels that represent one ground cover type. This is commonly achieved by manipulating the data statistically within a computer. The two most common clustering approaches are termed unsupervised and supervised. Unsupervised classifications involve the user "telling" the clustering algorithm how many samples it should use to evaluate spectral variability within a chosen area, how many classes to form from the sample group, what standard deviation to allow for each class and what the minimum size of each class as a percentage of the total will be. Unsupervised classifications assume, therefore, that the analyst is unaware of the spectral similarity or dissimilarity of the classes of interest and the spatial distribution of those classes. This classification method is now almost obsolete because of the improvements in computer graphics over the past few years. It is now possible using current technology to display a satellite image such that the quality is comparable to that of a 1:500 colour aerial photograph. This feature of the latest image processing equipment has been instrumental in replacing what used to be the first step in an image classification (unsupervised) and has improved the efficiency of supervised classifications.

Supervised classifications. Once the relevant data channels have been transformed (i.e. histogram stretching), displayed as a colour composite, and the initial visual analysis completed, the process of supervised classification may begin. Unlike unsupervised classifications, supervised clustering assumes that the user is familiar with at least some of

the study area and is able to visually locate at least one occurrence of each class of interest. Having achieved this the analyst interrogates an area of interest (i.e. a cocoa plantation) to determine the range of values for each channel for that particular area. The information commonly obtained from such an inquiry includes the mean value for each channel, standard deviations and similarity to any previous area that may have been interrogated. Each area that is interrogated like this is termed a "training area". Ideally one is looking for training areas that have small standard deviations and that are dissimilar to other training areas. Once the analyst is satisfied that the data for all the training areas which have been interrogated are representative of the classes of interest, the data from the training areas may be used as signatures to classify an image.

Algorithms (such as maximum likelihood) are commonly used to classify an image. A classification is achieved by "telling" the algorithm that you are using, that the training signatures previously identified are to be used to cluster the entire data set. The algorithm then interrogates each pixel and, based on the statistical information contained within the "training signatures", each pixel within the entire data set is assigned to a class. The result at the end of this process is that the entire data set is divided into as many "classes" as there were training signatures. These classes may then be displayed by the analyst and the result analysed. It is uncommon to produce an accurate classification first time. Because of this, fine tuning of the classification is often necessary. This involves the deletion, replacement and sometimes the addition of some training signatures. Classification accuracy, however, is largely a function of the analyst's familiarity with the area being classified. It is therefore important in any remote sensing project to include several field trips. When the classification is complete the data may be rectified to conform to one of the many recognised map projections and converted into a map by a cartographer. Alternatively the classification may be stored within the computer and updated at regular intervals using the method outlined above. The latter alternative is fundamental to all remote sensing monitoring projects.

Applications of remote sensing in agriculture

Monitoring coffee, cocoa and coconuts in Goroka and Madang. A Landsat 5 TM image, covering both the Madang and Goroka areas, was analysed on a Wyse 286 IBM compatible computer supporting the microBRIAN software to determine whether the information contained within the data was useful for mapping and monitoring cash crops in Papua New Guinea. The four TM channels selected for analysis included channel 2 (.52nm - .60nm), channel 4 (.90nm - 1.1nm), channel 5 (1.55nm - 1.75nm) and channel 7 (10.4nm - 12.5nm). These channels were selected after viewing linearly-enhanced grey scale images of all seven channels for the Madang township and environs. Channel 6 (the thermal infrared channel) clearly identified the drainage lines in the landscape; however, the 100m resolution rendered it too coarse for this mapping application. Channel 3 encompasses the transition zone between red and near infrared where vegetation reflectance increases dramatically and channel 1 encompasses the blue region where much information is lost due to absorption by the atmosphere. For these reasons these channels were omitted from the analysis.

Data subsets, each 512 by 480 pixels (standard microBRIAN subset size), extending from the southern section of the Asaro valley to the northern portion of the Bena valley near

Goroka and from Cape Barschtsch to the Gogol river in Madang were analysed to evaluate the potential of Landsat TM to map and monitor coffee and copra production in Papua New Guinea.

Processing of the Madang subsets. Initially the histograms of the channels for each subset were linearly enhanced using the microBRIAN interactive enhancements program, mPIC. The three channels chosen to make up the false and true colour composites were TM2, TM5, and TM7. TM4 was omitted from the analysis owing to considerable striping in that channel. An evaluation of the true colour composite revealed that the TM scanner greatly exceeds the mapping capabilities of the MSS scanner. The reduced bandwidth and smaller square pixel of the TM data allows for greater mapping accuracy in undulating to flat country; both spatially, by distinguishing all major roads and some tracks and spectrally by discriminating all the coconut plantations identified in the 1973 1:100,000 Madang topographic mapsheet. In addition to this a number of plantations not present on the map sheet were also identified.

Processing of the Goroka subsets. The four TM channels used in the processing of the Madang subsets were also used for the Goroka area. Initially the raw data was linearly stretched to evaluate the discrimination capacities of each channel. TM2 was by far the most useful channel in terms of distinguishing coffee from other vegetation types, and also at identifying spectral variations within plantations. Little improvement over TM2 was achieved with the other three raw data channels. In addition visual interpretation was hampered by the lack of visible roads in the data. The raw data displayed in red (TM7) green (TM2) blue (TM5) did however identify all the plantations indicated on the 1973 1:100,000 Goroka mapsheet as well as many more that have been planted since then.

Having identified four channels, each highlighting the coffee plantations and the variation within them, the channels were merged using the microBRIAN program mMULTI. The four channels merged were the original data channel (TM2), an affine transformation of TM2 and TM7 and PC2. The histograms for each channel were then linearly stretched to enhance visual interpretation and displayed as a true colour composite. The result was a very complex image in which three classes of coffee were present in the plantations while a large portion of the remaining agricultural land appeared to be under smallhold coffee production.

The images created within mMULTI were displayed individually. Using the microBRIAN zoom function within the display module or mJLAT, the images were enlarged such that the boundaries of each pixel were clearly visible. At this resolution it requires nine photos to completely photograph a 512 by 480 pixel image. The images were photographed from the screen using a tripod, 100 ASA film, an aperture of f/16 and a shutter speed of 2 seconds. The photos were developed into both standard and 8" x 12" enlargement prints. Because the standard sized prints all contained overlaps on their boundaries they were matched and mounted to give a broad-scale view of the areas of interest while the 8" by 12" prints were used for micro-scale fieldchecking.

Fieldchecking the data. The processed Landsat TM images were fieldchecked from January 11 to February 5, 1989. Thirteen days were spent in Goroka and 12 in Madang.

Methodology. In both Madang and Goroka the initial fieldchecking of the data involved visiting large plantations (identified in the 1973 1:100,000 topographic mapsheets) to establish a first order estimate of the accuracy of the data. These plantations' areas represented by large homogeneous blocks of data were visited to establish the extent and number of spectral classes for each crop type. Once the number of classes and the reliability of each was determined for the large plantations, fieldchecking was extended to the smaller plantations and finally to village gardens. Fieldchecking in Madang was aided by the presence of a telecommunications tower which when climbed, offered a birds-eye view of the areas of interest. In Goroka fieldchecking efficiency was improved through the use of colour and black and white 1985 1:20,000 aerial photography for sections of both the Asaro and Bena valleys.

Fieldchecking results in the Madang region. The results for the Madang area indicated that the three coconut classes identified in the MULTI images related to (1) sparsely planted coconuts with pasture understorey, (2) densely planted coconuts with a pasture understorey, and (3) densely planted coconuts with either young coconuts or cocoa as the understorey. The understorey differences in the third class were not discriminated in the images. The first two classes are restricted to the coconut plantations while the third class extends into the rainforest. Few smallhold coconut plantations occur in the Madang environs so little can be said regarding Landsat TM's potential for monitoring smallhold copra production in Papua New Guinea.

Robusta coffee plantations are clearly identifiable in the Madang subset and are spectrally distinct from the rainforest communities. Unlike the coffee identified in the MSS data most of the coffee around Madang has been recently rejuvenated. This increases the amount of exposed soil within the plantations and produces a spectral signature more similar to roads than to rainforest. No smallhold coffee was identified in the image or on the ground.

The common cocoa shade tree "Gluracidia" is easily distinguished from all other landuses in the Madang subset. Apart from one plantation which is at an early stage of development (no cocoa has been planted under the shade trees) there are no other plantations devoted entirely to cocoa production in the vicinity of Madang. The result, however, is encouraging as the potential to map cocoa by association with its shade tree appears good.

Fieldchecking results in the Goroka region. The results using Landsat TM in the Asaro and Bena valleys near Goroka suggest that both smallhold and largehold coffee production can be accurately mapped and monitored in flat to undulating country where the slope does not exceed 20 degrees. In terrain characterised by steep slopes topography-induced shadowing obscures most of the variation related to the age and health of the coffee and the presence or absence of shade trees.

In the undulating terrain coffee is represented by six spectral classes. They are: (1) mature coffee with a dense shade component, (2) mature coffee with a minimum shade component, (3) mature coffee with no shade component, (4) newly planted coffee unweeded, which promotes the spectral appearance of grassland, (5) newly planted coffee

that has been weeded which gives the spectral appearance of bare earth, and (6) recently rejuvenated coffee. The spectral signature for this class lies between those for the weeded and unweeded coffee. The three classes relating to the young and rejuvenated coffee extend into the grassland and recently tilled food gardens and are not reliable classes for mapping and monitoring coffee. Further pine plantations appear spectrally identical to mature shaded coffee plantations.

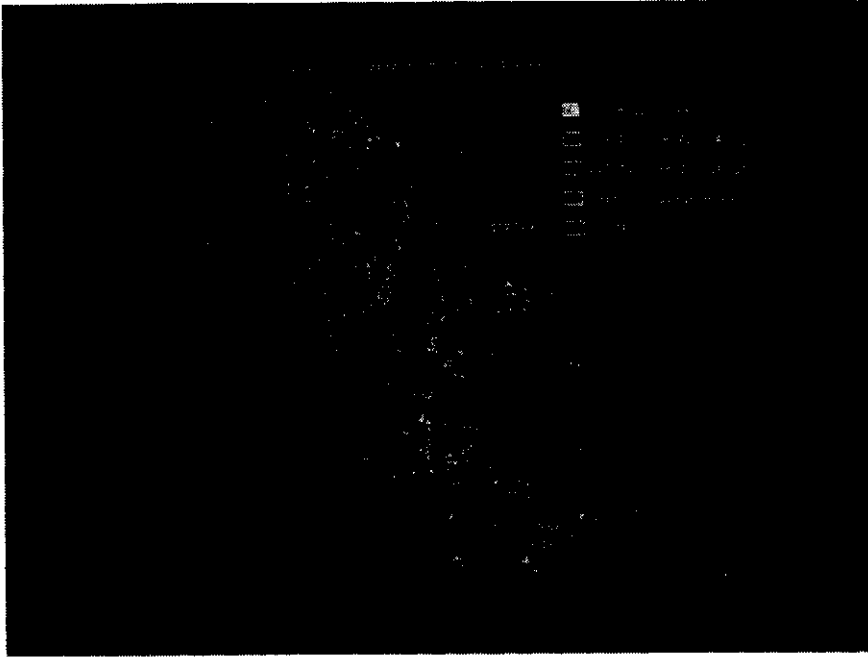
Classification of the TM Goroka data. It was found that seven themes were required to map the three mature coffee classes. However, when the associated seeds were input into the microBRIAN maximum likelihood classifier the area mapped also included most of the mountainous country, the pine plantations, some of the food gardens and some of the grassland areas surrounding the streamlines. Because of this, five seeds were selected from the mountain terrain, one from the pine plantations and four from the food gardens and grassland areas in an attempt to restrict the classes associated with the coffee seeds to within the coffee plantations. The seeds obtained from the mountain terrain and the grasslands surrounding the streamlines, however, were all within one or two digital values of the coffee seeds. When classified and displayed within the program mPAINT; designed to display the spatial extent of the classes associated with each seed, it was found that the mountain, streamlines and coffee seeds were all interspersed. Because of this mDIGIT was used to mask out all the country represented by steep terrain and the streamlines (Figure 4). Fine tuning of the classification was achieved by computing the Mahalanobis distance between each seed and by displaying the minimum spanning tree for all the seeds. In this way the coffee seeds which were spectrally similar to the food gardens were restricted to the coffee plantations by selecting further seeds from the food gardens. This resulted in the gradual elimination of the coffee classes from known areas of food gardens and other land cover types to produce the final coffee classification which contains three classes based on shade differences amongst coffee plantings. Table 1 exhibits coffee land use in percent for the Goroka environs within the limits for recognition already explained.

Table 1
The percentage of areas under coffee for Figure 2

Total area under coffee:	44.3		
Of the total area under coffee:			
Per cent smallholder coffee	29.2		
Per cent plantation coffee	70.8		
		Smallholder	Plantation
Of the 44.3 per cent area under coffee:			
Per cent densely shaded	16.9	14.7	85.3
Per cent sparsely shaded	21.8	29.4	71.6
Per cent unshaded (all plantation):	5.6		

Figure 4

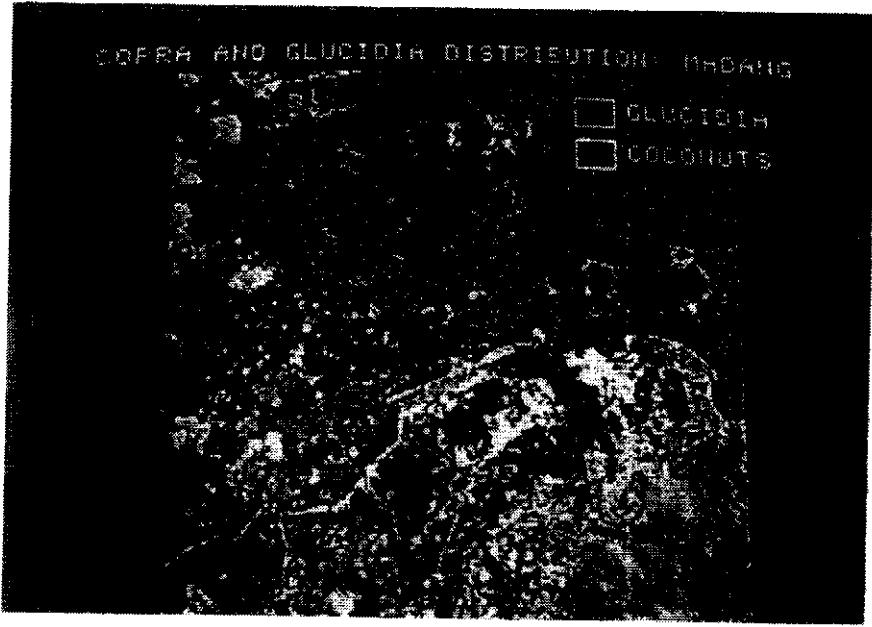
A three class stratification of both small and largeholder coffee production in Goroka. This image demonstrates the potential to monitor trends in coffee management practices in defined areas



Classification of the Madang subsets. The method employed to classify the Goroka data was used to classify the coconut plantations in Madang. Thirty-seven themes and seeds were necessary to include all the spectral variation within the plantations. The large number of seeds required appears to be related to the variation in plantation density and crop composition. The high spectral variance within the plantations made it impossible at a statistical level to accurately classify the crop variations within the plantations interpreted from the multi images in the field. It was possible, however, to discriminate coconut plantations from other ground cover types (Figure 5). Landsat TM data is therefore useful for determining area inventories of coconut plantations, however, for a more detailed inventory including variations in planting density and understorey crop composition, visual interpretation of the Landsat imagery is necessary.

The recently rejuvenated robusta coffee plantations clearly visible to the eye in the imagery, produced a spectral signature (when manipulated statistically) similar to bare earth and roads and could not be accurately mapped using the microBRIAN classifier. The young "Gluracydia" plantation could be accurately mapped using statistical classification techniques and demonstrates that cocoa mapping and monitoring by association with the overstorey shade tree is possible (see Figure 5).

Figure 5
The extent of copra production around Madang.
The rainforest has been masked out to maintain mapping
accuracy in the copra production areas.



Discussion

The accuracy of the data as outlined above indicates that great potential exists for mapping all of Papua New Guinea's cash crops on flat to undulating country using Landsat TM imagery. Further, the sixteen day return time of the satellite and the digital nature of the data suggests that timely and cost effective monitoring programs can now be developed in Papua New Guinea. Limitations related to the influence of shadow in steep terrain and also spectral confusion with other land uses in the undulating country, however, need to be addressed if the full potential of remotely sensed data as a tool for monitoring cash crop production in Papua New Guinea is to be realised. This section addresses these problems and proposes a methodology for eliminating them such that an economically viable monitoring program may be developed.

Topography-induced shadowing, particularly on western slopes, presents the greatest hurdle to mapping cash crop production in Papua New Guinea using multispectral remotely sensed data. Shadow significantly reduces the spectral variation in the data and serves to mask out all the information relating to crop type. It is therefore important that research directed at identifying the relationship between shaded cash crops and multispectral data be undertaken. In this way the use of multispectral data could be expanded to include the whole of Papua New Guinea.

Digital elevation models (DEM) are computer models of the landscape. Commonly they are constructed within Geographic Information Systems (GIS) and contain information relating to slope, aspect and height above sea level. DEMs are a powerful resource management tool as they can be used to calculate streams, ridgetops, distance from streams, height of the horizon and visibility from any point. DEMs can therefore be used to accurately identify all floodplains and wetland areas in Papua New Guinea's valleys and by doing so significantly improve mapping accuracy. Also, by combining environmental variables such as soils and rainfall with the information contained within a DEM, it will be possible to extend the scope of the monitoring project to include an evaluation of site suitability for those areas already cultivated. By the same token it will also be possible to map areas not presently cultivated that are most suited to coffee, tea, cocoa and copra production. The advantage of this kind of information is that it facilitates more effective resource utilisation and gives an indication of the country's production limits in terms of the area available to each crop.

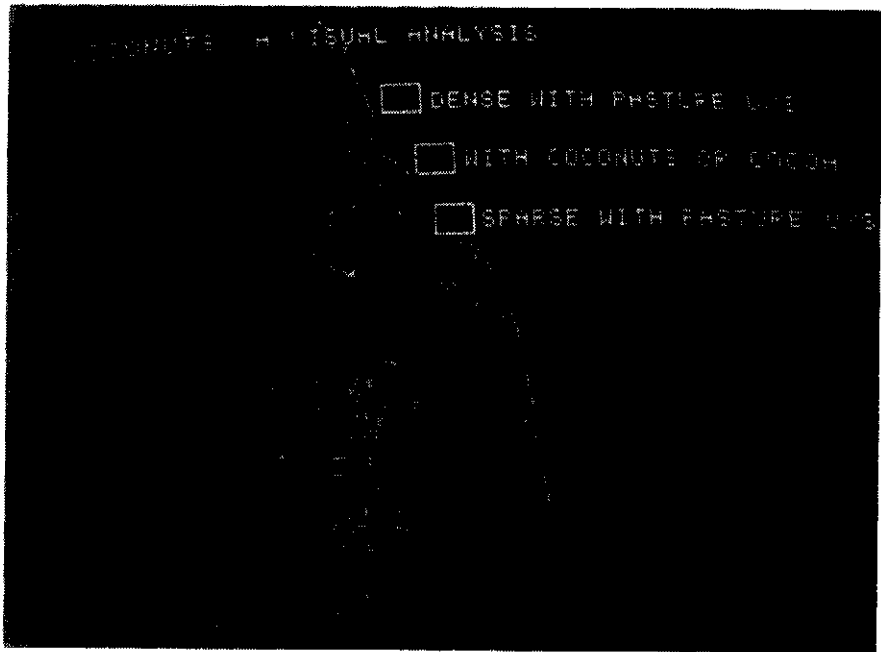
With respect to copra production in the Madang region, the major factor limiting high-level accurate classifications is the amount of spectral variation in the data. The plantations are not homogeneous and if all the spectral variation within the plantations is used to map copra, considerable spectral overlap between coconut plantations and other landuses occurs. Statistical classifications are therefore only useful in so far as mapping copra versus non-copra production areas. Fortunately microBRIAN graphics allow for high-level visual interpretation of true colour composites which are further enhanced by the improved textural content of TM data. In exploiting this attribute of MicroBRIAN, the textural and colour differentiation capabilities of the eye, combined with ground information can be used to produce a far superior estimate of the spatial distribution of the variation within plantations (see Figure 6).

Visual interpretation of remotely sensed data is an extremely cost effective method of mapping and monitoring areas. Up to 185km by 185km (depending on the scale and resolution required) may be interpreted in one day (to obtain a first order area estimate) by an analyst familiar with the area and the spectral properties of the crop of interest. The plantations can then be stratified into the categories of interest (by placing a transparent stable base over the imagery) and digitised into a geographic database suitable for cartographic output. The time taken to produce the final map is dependent on the experience of the analyst, the quality of the hardware and software available to them, and the level of mapping detail required. Compared to aerial photography, however, satellite remote sensing is extremely cost effective. The factors that make remote sensing an attractive proposition for mapping and monitoring the world's resources include: (1) a recurrent data source, (2) a cheap data source, approximately \$A5,000 for a 185km by 185km scene, (3) quick turnaround times between ordering and receiving the data (a catalogue of scenes is kept at Lae University of Technology), (4) consistency of data format over time, and (5) availability of sophisticated IBM compatible software for processing the data. In addition, the time required to ground-truth satellite remotely sensed data is only a fraction of the time required to achieve a comparable result with aerial photography. For example, when fieldchecking digital satellite data, a spectral class (such as coffee) need only be investigated in four or five places to determine the accuracy of the signature. Once satisfied that the signature is confined to that crop all other areas represented by that signature may be assumed to represent the same crop.

After the initial inventory, monitoring of the areas of each crop under cultivation requires significantly reduced processing and analysis time and fieldchecking becomes a minor component. This occurs because the primary interest during the monitoring phase is to identify those crop areas that have changed since the last inventory. Change in the landscape can be quickly and efficiently detected in satellite remotely sensed imagery by means of visually interpreting transformed images. From this type of analysis large-scale changes such as the establishment of a new plantation can be immediately identified. However, to detect more subtle changes, such as planting density or the health of a crop a classification of the more recent data is required, and differences outside the limits of seasonal change can then be investigated on the ground.

Figure 6

An illustration of the visual analysis technique. The colours in the legend are representative of the mean for each class. An in-depth knowledge of the area being interpreted is essential to the production of an accurate map. U/S refers to understorey.



Suggestions for future research

This pilot study has shown that the potential exists to map and monitor Papua New Guinea's cash crop production using satellite remotely sensed data. In addition it has identified the limits to satellite multispectral data in Papua New Guinea. In the interest of accurate inventories it is now necessary to investigate the potential of other data sources to complement and improve upon the information contained in Landsat imagery. This section outlines the research areas which should be given priority in any future projects concerned with broad acre agricultural inventories.

The scope of this project did not allow for a detailed analysis of the accuracy of the maps produced. To obtain maximum mileage from the research already completed an intensive field survey of one or more of the maps needs to be undertaken to accurately assess the error margins. To achieve this would take two weeks in the field.

At present no multi-temporal data in Papua New Guinea has been evaluated to assess the improved discrimination that may result from having data from different times of the year. In a monitoring project the number of scenes for one area would increase over time. Information relating to the increased mapping accuracy resulting from multi-temporal data would facilitate an assessment of the limits to mapping accuracy.

The information contained within a digital elevation model provides the resource manager with a very powerful tool for modelling the environment. Its direct application to this project should be to accurately identify all streamlines and wetland areas so that they can be digitised out in the coffee producing areas. Digital elevation models combined with environmental variables such as rainfall and soils constitute a data base capable of predicting site quality for a given area. The advantage of this kind of information is that it facilitates more effective resource utilisation and gives an indication of the country's production limits in terms of the area available to each crop. It is suggested that a pilot study to demonstrate the utility of such a data base for Papua New Guinea should be undertaken using the regional mapping units database.

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BENEFITS OF RESEARCH BY THE PAPUA NEW GUINEA PALM OIL RESEARCH ASSOCIATION

**H. L. Foster, Director of Research,
Papua New Guinea Oil Palm Research Association**

Introduction

The Papua New Guinea Oil Palm Research Association (PNGOPRA) was founded in 1980 by the three companies then owning oil palm plantations, in conjunction with the Department of Primary Industries representing the interests of smallholders. The declared purpose of the Association was to carry out agricultural research and extension work on oil palm throughout Papua New Guinea with the objective of improving profitability and reducing the cost of oil palm production both in the estate and smallholder sectors. Since 1980 two more companies have joined the Association (see Table 1) and the planted area of oil palm in Papua New Guinea has more than doubled, increasing from approximately 20,000 hectares to almost 50,000 hectares in 1988. The activities of the Association have increased in proportion, since funds are largely generated by a cess on production. Nucleus estates account for approximately half the area currently planted to oil palm and smallholdings surrounding these estates make up the other half. Accordingly research activities are equally directed to estate and smallholder concerns.

Table 1
Current members of the Papua New Guinea
Oil Palm Research Association (1989)

Members	Current area planted with oil palm
Founder	
Department of Agriculture and Livestock (representing smallholders)	22,716 hectares
New Britain Palm Oil Development Ltd.	7,897 hectares
Higaturu Oil Palm Pty. Ltd.	4,599 hectares
Hargy Oil Palm Pty. Ltd.	4,022 hectares
New	
Milne Bay Estates Pty. Ltd.	3,661 hectares
Kapiura Plantations Pty. Ltd.	6,150 hectares
Total	49,005 hectares

PNGOPRA history and structure

The first major oil palm development in Papua New Guinea was started by New Britain Palm Oil Development Ltd in West New Britain in 1967 and an Oil Palm Research Station (OPRS) was established by this company at Dami near Hoskins, in the same year. In 1980, the Papua New Guinea Oil Palm Research Association (PNGOPRA) established its headquarters at Dami adjoining OPRS, and took over the ongoing agronomic trials from the latter who now concentrate only on commercial breeding, seed production and tissue culture.

PNGOPRA staff based at Dami headquarters and a small sub-station at Hargy Plantations, Biella, are responsible for all trials, demonstrations and services to oil palm growers in West New Britain. A major PNGOPRA sub-station at Higaturu Plantations, near Popondetta and a small sub-station at Milne Bay Plantations, carry similar responsibilities for mainland oil palm areas. The PNGOPRA staff establishment, currently consisting of eight executive officers and 27 non-executive officers, is deployed as shown in Table 2.

An early research success

Before 1981 natural pollination of oil palm in Papua New Guinea was negligible and production depended upon the laborious procedure of hand pollination by teams of men. This was expensive for the estates and fully occupied smallholders for approximately two days every week. Moreover as the palms grew older and taller, hand pollination became more difficult and inefficient and yields rapidly declined.

In 1977 it was discovered in the Cameroons that oil palm is insect-pollinated and subsequent research partially funded by Papua New Guinea identified a weevil as the most efficient pollinator.

In 1980 this insect was imported into Papua New Guinea and after exhaustive testing in co-operation with PNGOPRA, the pollinating weevil was fully released in local plantations in 1981. It quickly established itself in all oil palm areas and hand pollination was thankfully abandoned. Moreover not only was the considerable expense of hand pollination eliminated but yields of older palms in West New Britain increased by approximately one third. It has been estimated (Antony *et al* 1988) that the cost of research into insect pollination by Papua New Guinea was approximately K300,000, which resulted in a net profit over five years (1982-86) of approximately K89 million. This is an exceptional rate of return compared with most documented cases of return to research.

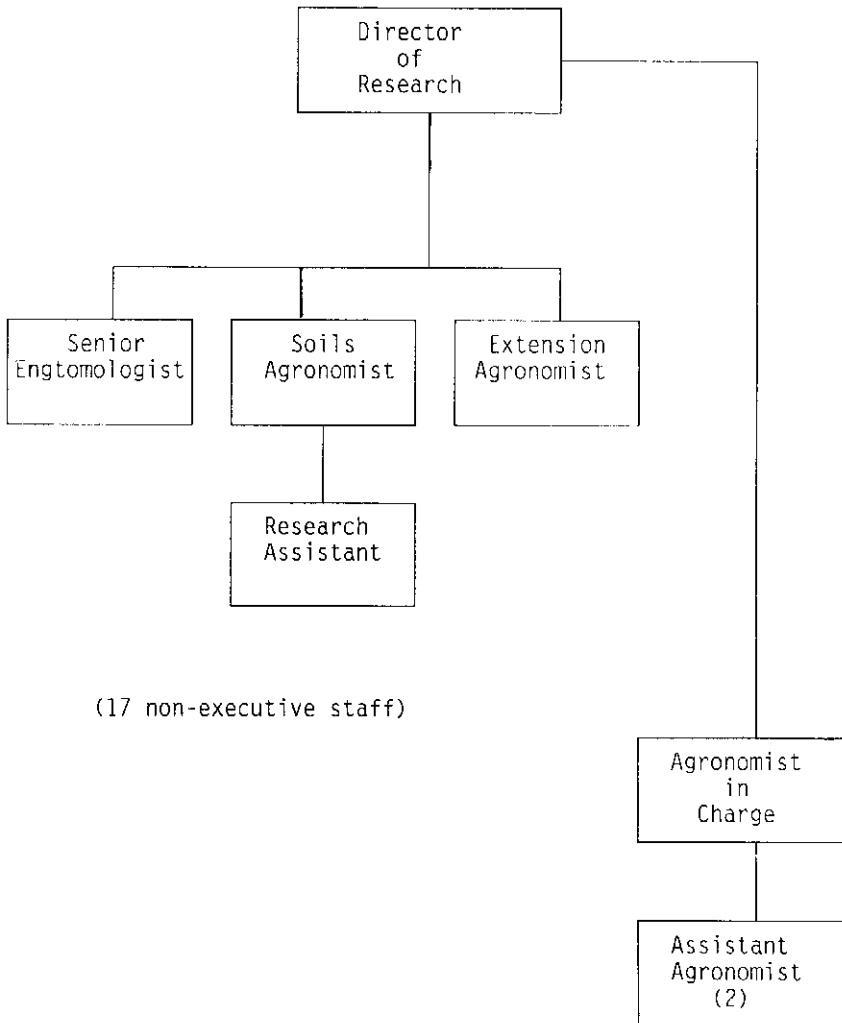
Current nutrition research

Before the introduction of the pollinating weevil in 1982, yields were limited by poor pollination and hence responses to fertiliser in Papua New Guinea were negligible. The advent of the weevil considerably raised maximum oil palm yield potentials in the country. As shown in Figure 1, high initial yields are now obtained which are followed by a rapid decline if fertiliser is not applied. Consistent high production now depends on maintaining optimum fertility - hence nutrition now has the highest priority in PNGOPRA's research programme.

Table 2
PNGOPRA staffing structure 1989

WEST NEW BRITAIN
(Dami HQ & Hargy sub-station)

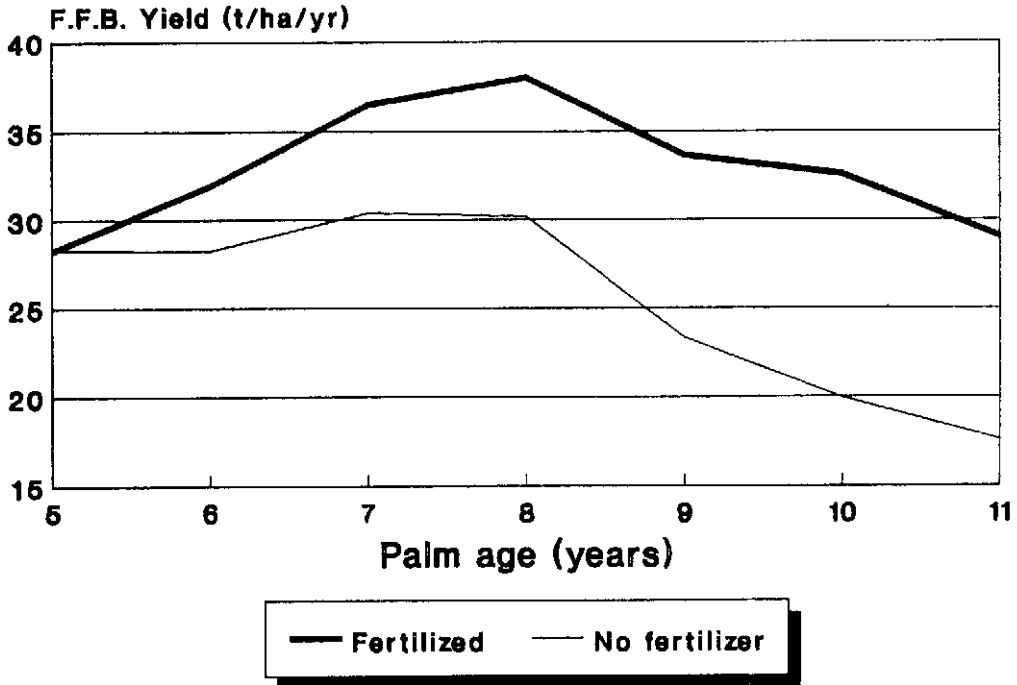
MAIN LAND
(Higaturu & Milne Bay sub-station)



(17 non-executive staff)

(10 non-executive staff)

Figure 1
Yield changes with time



Oil palm in Papua New Guinea is mainly grown in very high rainfall areas on soil derived from volcanic materials. The nutritional requirements of oil palm in this unique environment are largely unknown. Thus the Association is currently conducting 18 major fertiliser trials with oil palm to determine the optimum nutritional requirements in different regions. Early results have clearly identified nitrogen as the major limiting nutrient and fertiliser recommendations to apply nitrogen have already been made. It has been established that the availability of nitrogen in most oil palm soils in the country is fragile and yields will soon crash if management and fertiliser input are not correct. Trials have shown that not only inorganic fertiliser, but also organic manures such as empty oil palm bunches are very effective in maintaining soil fertility and nitrogen availability - their use is thus strongly recommended.

In some regions supplementary applications of other nutrients as well as nitrogen is needed and this requirement is also being determined through trials. The major nutrients, phosphorus, potassium and magnesium are all needed in certain specific geographic areas, which are being defined. Palms are unusual in having an appreciable requirement for chlorine which they appear to need for optimum moisture control. Research by PNGOPRA has shown that the availability of this element is extremely low in unfertilised soils in Papua New Guinea and it is essential that the fertilisers which supply nitrogen and other major nutrients should also contain this anion.

As shown in Table 3, average estate yields in West New Britain and the mainland are predicted to rise by approximately 25 and 13 per cent respectively as a result of the implementation of current nutrition research during the next three years. Without an increase in extension effort, smallholders are unlikely to make use of these research findings, and their yields are predicted to decline by 8 and 15 per cent in the two areas respectively. The total research cost over three years is estimated to be K1.03 million and the return from this research due to higher average yields has been calculated as K20.65 million. The internal rate of return on this research works out at a very healthy 142.3 per cent.

Extension effort

Whilst the estates can be expected to adopt new research findings on their own initiative soon after they are released, smallholders are quite a different case. A smallholder is only likely to adopt a new technique if it is clearly demonstrated to him as being valuable and if the materials to implement this technique are made readily available. This extension work is primarily the responsibility of the Department of Agriculture and Livestock (DAL) in Papua New Guinea.

However PNGOPRA works closely with DAL staff to ensure that the correct information is provided and to demonstrate recommended techniques. PNGOPRA has currently established a total of 30 demonstrations on smallholdings, widely distributed throughout the oil palm schemes in West Nakanai, Popondetta and Milne Bay areas. These demonstrations illustrate the benefit of correct management and fertiliser applications and promote appropriate recommendations for specific areas.

Table 3
Estimated yield improvement and financial returns to nutrition research

Period	Yield production (FFB t/ha/yr)		Returns to research		
	West New Britain estates smallholding	Mainland estates smallholding	Research costs (K/m)	Net benefit (K/m)	Internal rate of return (per cent)
Present	19.1	23.4	13.1		
After 3 yrs of new research (without extension effort)	24.0	26.4	11.1	1.03	20.65 142.3
After 3 yrs of new research (with extension effort)	24.0	26.4	16.3	1.42	30.87 141.3

It is hoped that with a strong extension effort by DAL, supported by advice and demonstrations from PNGOPRA, up to 50 per cent of smallholders may improve their management and apply a minimum application of recommended fertiliser. An increase in yield of 23 per cent on smallholdings in both West New Britain and the mainland is then predicted (Table 3). The combined research and extension effort by PNGOPRA is estimated at K1.42 million over three years, which it is calculated would bring a combined return to estates and smallholders of K30.87 million. The internal rate of return in this case would be 141.3 per cent.

Crop protection services

PNGOPRA is responsible for monitoring and providing advice on the control of pests and diseases.

The main potential pests of oil palm in Papua New Guinea are leaf-eating insects, particularly leaf hoppers and bagworms. The policy emphasised by PNGOPRA is to encourage natural biological control of these pests - so sprays which would reduce natural predators and parasites are not recommended. Instead trunk injection of an insecticide which kills leaf-eating insects, plus the release of parasites which attack their eggs, is the strategy adopted. To date this policy has successfully prevented major pest damage to oil palm in Papua New Guinea at very minor cost.

Luckily no major disease problem has yet appeared in oil palm in Papua New Guinea, so PNGOPRA's role here is a watching brief.

Conclusion

The PNGOPRA carries out research and extension for the benefit of growers in both the estate and smallholder sectors throughout the country. The current research programme gives highest priority to nutrition whilst extension efforts are largely directed to increasing fertiliser use. The cost of PNGOPRA's effort in these two fields is estimated at K1.42 million over three years for which a net return to growers of K30.87 million is expected. PNGOPRA is also active in other fields concerned with oil palm management, particularly pollination improvement and crop protection and provides advice on all aspects of management to growers on request.

RESEARCH AT RAMU SUGAR LIMITED

**D. Eastwood, Agricultural Manager
Ramu Sugar Limited**

The dramatic increase in world agricultural output over the past 50 or so years is the result of continuation of the innovatory era in agriculture which began in early modern Europe and which has revolutionised plant genetics and the application of chemicals, machines and management practices to crop production. Agricultural innovation has arisen in part from trial and error on the farm and in larger part from privately and publicly funded formalised research and extension.

In Papua New Guinea, as in many other countries, agricultural innovation has also occurred through technology transfer embodied in such development projects as oil palm nucleus estates and Ramu Sugar. Such direct transfer can be beneficial but the wholesale transfer of technology which exists elsewhere is not always possible, or if possible may not be appropriate, and local adaptation is then required which, in turn, requires a commitment to research.

In this context "research" is a multi-faceted activity encompassing not only scientific and technological study but also extension, management, marketing and product-use investigations. Needless to say such activities are far from inexpensive and questions arise as to whom is to pay and for what.

A strong argument can be advanced that the often scarce public funds available for agricultural research should be devoted largely towards basic foodstuffs, with the intention of bringing benefit to the public at large. In Papua New Guinea the efforts of the Department of Agriculture and Livestock (DAL) would, thus, be directed to food and minor crops research into smallholder farming systems and extension services. It is important to recognise the public need for an effective extension service and the interplay between research and extension. Agricultural research which does not have some application is a waste of resources while an extension service which derives nothing from, and contributes nothing to, a research programme is unproductive.

A similar research-extension continuum applies to the major export crops but with these major roles ought to be played by centralised, industry-based research organisations funded by a levy on producers supplemented, where necessary, by a contribution from government. Such organisations ought to be important in the cocoa, coconut, oil palm and coffee industries where a (well funded) central unit can carry out a clear research programme, prevent duplication of effort in dispersed production units and where government can represent smallholder interests in determining research priorities.

Industry-based research organisations are not uncommon in the sugar cane industries of the world as witnessed by the Sugar Industry Research Institutes of Jamaica and Mauritius, the Hawaiian Sugar Planters' Association and the Queensland Bureau of Sugar Experiment Stations (BSES). Ironically, it may be doubted if the Papua New Guinea sugar industry, i.e. Ramu Sugar Ltd., could, as a single production unit with minimum smallholder involvement, justifiably put forward a claim for direct support of research by government.

This is not to imply that there is no requirement for research in cane production, it is however to suggest that it is likely that Ramu will continue to be the major source of funds for such research. The need for this research arises not only from the need to adapt imported technology to local conditions but also to overcome the problems commensurate with the establishment of a sugar cane industry in one of the major centres of origin of the genus Saccharum.

Although it may be difficult to justify direct government support for research at Ramu this does not exclude the possibility of indirect support. Indeed, specialists from the DAL have contributed to some studies, particularly in the fields of soil science and cane nutrition, and could perhaps have made much greater contributions had the DAL been better organised to provide such services to a private-sector organisation.

One consequence of the high degree of self-financing has been to isolate the Ramu Sugar research programme from the mainstream of agricultural research and development in Papua New Guinea. As a result, much cooperative research has been, and still is, carried out with overseas institutions such as BSES (cane diseases and entomology), Rothamsted (Ramu stunt disease) and the British Museum (Natural History) (Atherigona ramu) but very little with either government or private institutions in Papua New Guinea. It would be pleasant to establish such links, particularly with the universities, but, other than in the soil sciences, the agricultural problems posed at Ramu do not seem to have excited any interest within the Papua New Guinea research establishment.

The principal fields of research at Ramu cover:

- . sugar cane cultivar assessment
- . sugar cane disease studies
- . sugar cane entomology
- . sugar cane nutrition and soil studies
- . weed control practices in sugar cane and cover crops
- . assessment of cultivation practices
- . assessment of legumes for suitability as cover crops.

In addition the research unit monitors the sucrose content of sugar cane in each field to advise management of the optimum time of harvest, monitors cane growth and manages a weather station which contributes information to the National Weather Service. The emphasis is on field experimentation but with increasing attention to laboratory studies, particularly in entomology, over the past two years.

At present there are four senior research officers, two expatriates and two national graduates. The research officers are supported by three research assistants, all of whom are graduates from agricultural colleges, and field and laboratory assistants for a full staff establishment of 42 permanent employees.

The research programme and its associated budget are prepared by the senior research staff for approval by management and since 1986 (when Ramu stunt disease drastically reduced sugar production and the availability of funds) there has been a steady increase in funds budgeted for the operating and capital expenditures of the research unit.

Table 1
Budgeted funds - Ramu research unit

Financial year	Total research expenditure (kina)	Per tonne of cane (kina)	Total agriculture budget (per cent)
1987	280,000	0.57	4.6
1988	331,000	0.61	4.7
1989	411,000	0.82	5.0

There will be in 1989 the first major capital expenditure for nearly 10 years to improve research facilities. It had been hoped that foreign aid could have been sourced to improve the research facilities by the construction and equipping of a new research building. Unfortunately the proposals put to aid donors, with the support of the DAL and Department of Foreign Affairs, were not sufficiently persuasive and Ramu will now fund a somewhat scaled-down facility from its own resources.

Clearly, Ramu does not carry out a relatively expensive research programme purely for the sake of carrying out research. There has to be some expectation that the work will contribute to the more efficient production of sugar and these expectations have been justified. A few examples are sufficient to demonstrate this:

- The cane grub Lepidiotia reuleauxi is estimated to have caused losses equivalent to K500,000 in 1984/85. Studies into the use of Suscon (sustained control) technology have resulted in the introduction of control measures which have, over the past three years, reduced L. reuleauxi to the status of a minor pest.
- The variety selection programme enabled the rapid identification of cultivars resistant to Ramu stunt disease, and with other acceptable agronomic characteristics, for multiplication and commercial introduction at a time when it appeared that the disease would end sugar production at Ramu. The effects of this variety introduction programme on cane yields after 1986 are shown in Table 2.
- In 1987 the moth borer Sesamia grisea caused damage to the crop equivalent to about K2,500,000. A detailed study of the life-cycle and population dynamics of this pest have enabled a monitoring and control system to be established with the result that losses in 1988 were estimated not to exceed K100,000 and in 1989 are expected to be of the order of K500,000. This does not represent complete control but by managing cultivation, harvest and insecticide application schedules there have been significant reductions in losses.
- Studies into the use of Ridomil fungicide formulations for the control of sugar cane downy mildew disease have increased the flexibility of the variety extension programme

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LAND USE AND THE INTERDEPENDENCY BETWEEN FORESTRY AND AGRICULTURE

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Introduction

Papua New Guinea's natural resources are intrinsically fragile, but have been in a balanced ecosystem for many generations. This balance is now coming under some strain not only from the increasing population in some areas but also from the development in agriculture, forestry, mining and infrastructure (World Bank 1987).

In a traditional Papua New Guinean setting land usage for agriculture and forestry were inseparable and interdependent. Both are sustainable systems and provide man's basic needs for food, energy and shelter. In fact shifting cultivation or long forest fallow as practised in this country is essentially a rotation of farming and forestry to provide the basic needs. The linkage between the two systems is generally weak in the Western form of land use in which mono-culture such as the plantation sector in Papua New Guinea is practised. However, over the last decades greater emphasis has shifted to the integration of forestry and agriculture. In some countries, like New Zealand, the results of such exercises have been fruitful (Ferguson et al 1978).

Agriculture - forestry development

The total land area of Papua New Guinea is 46 million hectares of which only 15 million hectares is accessible and has exploitable forest resources. Some 2.5 million hectares of these forest resources are under timber rights purchase and currently being selectively logged or clear felled. In fact, some 37,000 hectares had been clear felled by 1983 (Saulei 1983) and only about 3,000 hectares of forest plantation has been established by the

government (Asian Development Bank 1988). Essentially the forest resource is being depleted at an alarming rate with virtually no follow up land use.

In terms of agricultural potential, Papua New Guinea has some 4.4 million hectares (9.5 per cent) of land suitable for arable crops and 9.3 million hectares (20 per cent) suitable for tree crops and silviculture (Bleeker 1975). Whilst these 9.3 million hectares are largely held under customary ownership it is essential that agriculturalists and foresters consider seriously the possibility of joint ventures in the exploitation of timber and subsequent follow up land use. Joint venture projects which will result in increased productivity and profitability should be given priority for funding instead of conventional mono-cultures.

Land use planning

Large-scale development in agriculture and forestry in this country have occurred almost independently over several decades. This trend is likely to continue unless those involved in agricultural and forestry planning take an orderly and systematic approach to rural land use planning. A more coordinated and positive approach to agriculture and forestry planning must be adopted urgently in order to prevent rapid depletion of forests resources, to minimise land degradation problems and to reduce the risk of conflicts in land use. Planners must realise that the land resource of this country is finite and therefore whatever land is available must be allocated to the most appropriate form of land use.

To effectively plan rural development it is necessary that further large-scale forestry developments in Papua New Guinea be guided by data from comprehensive mapping from aerial photographs and ground surveys at suitable scales e.g. 1:100,000 for broad regional planning, 1:25,000 for scenario planning, and 1:10,000 for management and working plans. Rapid survey and collation of existing data by multidisciplinary teams involving (whole or part-time) foresters, biologists, ecologists, hydrologists, geomorphologists, pedologists, economists, anthropologists, etc. could provide sufficient total detail about broad land capability patterns and social implications within five years (Webb 1977).

It is therefore important to view the integration between agriculture and forestry in the general land use scheme. How should these two activities be integrated; in what proportion; which areas favour each; and how is the best mix obtained? These are important considerations, not only for social or economic values, but also for other factors such as aesthetic quality of the landscape (Batini 1978). To illustrate this point I would like to highlight the Open Bay case where some conflicts have arisen between Department of Agriculture and Livestock (DAL) and Department of Forests over the use of some 20,000 hectares of state land.

- Facts:** Soil survey work undertaken by Howlett (1987) show that only 8,600 hectares could be reforested or alternatively put into cocoa or oil palm development. The remaining 11,400 hectares is unsuitable for agriculture development due to major constraint of steep slopes, high erodibility risks, poor drainage, etc.
- Case 1:** Department of Forests want to reforest 14,000 hectares initially, later on increasing it to 20,000 hectares, i.e. virtually all of the state land at Open Bay.
- Case 2:** DAL wants to develop 6,000 hectares for an oil palm-cocoa smallholder project.

Such conflicts in land use over the same tract of land can be handled conveniently by a committee such as the land use development committee suggested by the Land Evaluation and Demarcation (LEAD) project or the proposed land use planning authority discussed below. The committee will have to determine the best possible scenario of land use. Personally the ideal land use plan for such an area would be 6,000 hectares for cocoa-oil palm and 2,600 hectares for reafforestation. The main advantages for such a joint venture integrating forestry (silviculture) with agriculture are:

- . complementary production from cocoa-oil palm and forest plantations;
- . maximum revenue is generated in terms of profits generated per hectare per year over the economic life-span of the trees;
- . loss of revenue from one operation can be compensated for by a gain from the other;
- . soils are utilised according to their optimal capability;
- . problem soils are left under natural forest thus minimising land degradation problems.

The Open Bay case clearly demonstrates the need for integration of forestry with agriculture in order to contribute to a greater level of total productivity or profitability than could be achieved with conventional mono-cultures. To use all the land for reafforestation would be an uneconomic use of the limited prime state land. A comparative analysis of land usage for agriculture (tree crops) and forestry shows that the total net income derived from a joint agriculture and forestry venture (e.g. cocoa and sustainable forestry - 25 hectares rotational harvesting, one hectare per annum) can be quite profitable (Sargent 1988).

National land use planning authority

Although several committees such as a land development committee and a renewable resources committee have been talked about, no one really knows their functions and responsibilities. In fact these committees have not been formally set up and to date they operate on an ad hoc basis. What's more their terms of reference are yet to be drawn up. It is also important that such committee charged with responsibility for determining the optimal economic and sustainable use of land resources should be the sole authority for land use planning in the country. The committee should be free from political influence and must make its decisions based on facts and not on political affiliations or sectionalism. Webb (1977) recommended that a national land use planning authority be established in Papua New Guinea. Its terms of reference should include:

- . coordination of relevant departments and consolidation of the role of the Department of Environment and Conservation;
- . organisation of multidisciplinary task forces for ecological, sociological and other necessary surveys and pilot projects in particular regions before decisions for specific forms of development are made; and
- . promotion of the recognition, classification, presentation, and conservation of those elements of the cultural and natural environment which are significant for the national heritage.

It is timely to suggest that perhaps a land use planning act similar to the New Zealand Town and Country Planning Act should be given serious consideration for enactment by parliament prior to the setting up of the land use planning authority.

Conclusion

Land suitable for follow up land use after selective logging or clear felling is restricted to some 9.3 million hectares. It is, therefore, essential that a well-coordinated and systematic planning for agriculture and forestry be initiated in order to increase productivity and profitability, minimise land degradation, reduce over-exploitation of forest resources and protect and control environmental degradation. It is timely to suggest that, the enactment of a land use planning act and the setting up of a national land use planning authority charged with the responsibility of allocating the land resources of this country to the most economic and sustainable form of land use be given the utmost urgency.

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RUBBER PROCESSING SMALLHOLDER AND NUCLEUS PLANTATION INTERACTION

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Introduction

It has been recognised for some time that the production of rubber lends itself very well to smallholder operations. In many countries where rubber growing is important, a very great proportion is produced by smallholders. In Papua New Guinea, smallholder schemes were started many years ago by mission agencies and government and more recently new schemes have started. There was a time when serious thought was given to redistribution of existing rubber plantations into smallholder plots. There were, of course, disadvantages to such an operation and experience has taught those concerned with managing smallholder schemes and redistributed or government-acquired plantations that, contrary to expectations, rubber production in the full sense is so difficult to achieve and manage, that the whole concept of rubber production by smallholders on economical grounds is doubtful. This experience is not uncommon in other countries too and it has much to do with the incomplete attention to marketing and final crop processing. Once these matters have been planned for and executed properly a smallholder rubber scheme can be successful. When considering the concept of smallholder rubber production it is necessary to consider along with it the role industrial plantations or independent processors can play to make a smallholder scheme guaranteed successful.

Rubber processing changes and the market's requirements

As is the case with many agricultural crops, rubber is not directly valuable as a product as it comes from the plant. It needs to undergo processing before the world market can accept it. In recent years the processing of rubber has been made more "technical", by the introduction of Technically Specified Rubber (TSR), which aims to offer the end consumer a type of rubber with specific physical and chemical properties in a form directly comparable to synthetic rubber. Before this, from the inception of the modern rubber-growing industry to around 1964, rubber was exclusively processed to standards that involved no more than visual grading. Rubber was normally presented in the form of Ribbed Smoked Sheet (RSS) of various grades and crepes of various ranges and qualities. It was thought that natural rubber would be a loser against synthetic rubber unless it could be presented in a more technical form so that the product was readily substitutable. Not all consumers were convinced there was any necessity to make such changes as they had already arranged the RSS production to be somewhat "custom-made", such as the well-known "Michelin Sheet", popular with producers from well-controlled processing factories, as the process was more straightforward yet attracted a premium. However, many other advantages besides the "improved" marketability of TSR were foreseen.

Spearheaded by Malaysia with its SMR scheme, other countries or international companies involved in the production of rubber followed with national or company schemes. Papua New Guinea with its relatively small rubber output but with very serious marketing and quality problems decided to follow suit and by 1980 companies were producing TSR rubber.

An almost complete switch-over from RSS to TSR was achieved in 1982 and by 1985 Papua New Guinea counted five factories capable of producing rubber to technical specification standards set out by the PNGCR scheme. Only three small producers continued with RSS.

In the hurry to switch over from RSS to TSR the policymakers missed something and this had serious consequences for the export volume of around 5,000 tonnes hitherto reached by Papua New Guinea. The numerous schemes of informal nature, or even the formal ones, turning out RSS with hand-mills and simple smokehouses were suddenly left without a market or marketing arrangements.

In Papua New Guinea the switch-over from RSS to TSR was done quickly because it was believed RSS was bad rubber, and if we may believe the literature there was good reason to qualify a lot of Papua New Guinea's RSS as bad. However, what was not realised was that good RSS is very good rubber and with proper guidance and routine inspections the product even at the simplest farmer's level can be upgraded to top quality very quickly. Moreover, the simple manufacturing process gave farmers a chance to add value to the product in its raw form. The reasons of economy of scale and labour-saving inducing the plantation industry to make the switch-over to TSR did not in fact apply to smallholders. The switch caused the smallholder farmer to retreat from the exploitation of his rubber trees entirely, or if he saw a way of continuing with RSS for some time, to see the fruits of his efforts piled up in the stores of non-professional dealers without revenues being realised. By 1984 most smallholder rubber had been abandoned except where private enterprise came to the rescue with the help of Department of Primary Industry's officers. There a good marketing arrangement was made and farmers could sell their cuplump against a fair price or for fast money.

In hindsight one must conclude that the change-over from RSS to TSR was totally unnecessary. To this date Japan imports about 60 per cent of its natural rubber requirements in the form of RSS and any RSS now still produced in Papua New Guinea finds a ready market, at a premium, in Europe, provided quality is good. Indeed, since 1985 one smallholder group has been assisted to bring its sheeting factory back into operation and with great success technically and commercially, until quite recently when some local politically-inspired interference took place. One large commercial producer brought back into production an RSS factory to take advantage of the far higher price of RSS over TSR ruling in 1986-87 and maintains the factory to bring back into production whenever the margins warrant it, as is currently the case.

Having allowed the RSS production facilities operated by Papua New Guinean smallholders to be either abandoned or fall into disrepair, it is not advocated to start up the old process again. By this time the forces of commercial marketing have pulled back the majority of smallholders with rubber into more or less regular production of cuplump.

Assured regular off-take by buying agencies, Department of Agriculture and Livestock (DAL) stations and commercial factories has opened new roads for the farmers. There is now talk of opening up all abandoned rubber and starting to expand existing smallholder schemes or creating new ones.

There is good commercial reason for this. The international rubber market has now stabilised its position as an indispensable high-quality commodity with a slice of 35-36 per cent of the total rubber market. The future for this commodity is likely to be bright even without the special effects that are exercised by the extra demand for latex in concentrated form that is suddenly required to protect healthy people against AIDS.

Planning for processing facilities

With the resurgence of smallholder production and the plans to boost output by improved extension advice and by actual expansion, the question of what to do with the extra production volume is now a matter for urgent consideration.

It is obvious that there must be sufficient processing capacity in the country to deal with the rubber and that the quality of the final product must be excellent to compete successfully on the international market. Modern rubber factories need a good production flow to make them economic as there are more fixed and semi-fixed costs than variable costs.

Government-sponsored schemes tend to overlook the risk in rubber processing. Such rubber factories run on a very thin margin particularly if the smallholder who is to be served, is to make a steady and reasonable return for his efforts and ownership costs.

In the schemes planned so far by government agencies the production in the field has been planned too optimistically and factories and associated infrastructure have been planned with excess capacities. In some cases the phasing of the production capacity, though neatly planned, has failed to realise that some machines age so fast unless they are meticulously maintained that by the time the expansion phase finally takes place the early-used plant and machinery needs to be replaced just when additional plant is required. Financially, this means a great wastage through unnecessary initial outlay and in a continuing drain on operations. Consequently government officers controlling the finance of these operations view the ownership of a rubber factory with ever-growing apprehension. It is no surprise that rubber processing purely for smallholders within a formal scheme frequently runs into trouble. The picture rapidly turns worse when such factories suddenly try to go "commercial" by "competitive", or let us state more plainly, "speculative" purchasing. Even if the operation is conducted relatively effectively, it tends to run into problems as government cashflow methods are different from the methods required to provide revolving funds for a commercial purchasing operation.

This gloomy picture of rubber processing for smallholders can turn much brighter if a different path is taken.

A rubber factory, for successful technical operation and quality stability, needs a basic dependable throughput, and the volume must be such that the factory can operate every gazetted working day with two shifts of eight hours at least. If there is no such volume there is likely to be wastages of fixed costs. Since all machinery on the market is fairly standard, it is rather difficult to build a factory that deals economically with less than 1,500 tonnes per annum. This is quite contrary to the old RSS factories which could be scaled to outputs as low as five tonnes per annum.

When smallholder schemes are set up a good planner usually recognises the need to tailor the size of the factory to the size of the scheme but, unfortunately, he can only guess at the intentions of the smallholders who are to deliver the produce with which the factory has to work. The planner tends to use parameters, such as age of planting, surface planted and the usual yield obtained from the planting material used or perhaps with a small discount, to arrive at a crop volume offered per year and per day. In countries where the smallholder population is quite familiar with rubber production or where the schemes are organised in a very strongly disciplined fashion such reckoning is realistic. However, where this is not the case and smallholders have priorities other than full-time farming, such calculations may be unrealistic. In the current rubber schemes the farmer has much freedom in choosing his production pattern. Unlike cocoa and oilpalm, rubber in cuplump form is very robust. It does not really spoil, it merely dries out and only after some time will there be quality-reducing ageing effects. For the factory planned to serve a smallholder scheme all this means in the end irregular volume supplies, irregular consistency of produce age and presentation. The factory can overcome some of this by stockpiling but then its machinery must have been suitably chosen to deal with the mixture of fresh and very old stocks at the same time in one blend. Though a good product can then be achieved, it is not simple unless the strictest discipline is exercised. There remains the problem of throughput. In a plan it looks rather odd to provide for a factory the size of which appears to service only half the theoretical yield of the hectareage under rubber trees and frankly, it is difficult to "sell" such a plan to the international financing agencies. Thus, it is more likely that a smallholder scheme in Papua New Guinea is executed with too much capacity too early and too heavy an infrastructural set-up. This translates itself into uneconomical costs any time the price for the final product falls to relatively low levels.

In a number of countries with problems similar to Papua New Guinea a simple alternative has been used. Forget about the factory, see what happens and let a commercial firm deal with the matter. It is not difficult to imagine where the fruits of the smallholders' labour tend to go in such a case. It is, in fact, exactly like the old Papua New Guinea smallholder schemes, suddenly deprived of their RSS product outlet.

When considering smallholder schemes for rubber it is wise to see what private enterprise can do to assist. The concept of a nucleus estate with smallholders around it in a formal scheme is well known. It works very well for rubber if the nucleus is large enough, say 2,000 hectares at least. The factory can be neatly planned and can be so designed that the seesawing smallholder production can be easily catered for until the forces of discipline assure a regular average volume. Since rubber is patient and has a tar of not more than 35 per cent when fresh, only 20 per cent when somewhat aged, the nucleus estate need not be a real nucleus, it can be located away from the smallholders. In other words a smallholder scheme could be a satellite on a waterway or highway connecting it to an existing factory or to one that is planned to go on stream in synchrony with the coming into production of the smallholder scheme. Of course the closer the growers and the factory are the better but quite large distances can be bridged - even at the outrageous transport rates charged in Papua New Guinea - before the extra transport cost exceeds those of an underfed factory. If transport rates charged in Papua New Guinea by transport and shipping companies were reasonable, then semi-aged rubber could be

transported all over Papua New Guinea without economic losses. At present there are three TSR factories in place that can handle a considerable volume of rubber; in fact one of the factories could handle all of Papua New Guinea's rubber production and does currently handle about 75 per cent. In addition there are two smaller factories. Now that this over-capacity exists there is no need for quite some time to think of setting up more factories, even when the areas of smallholder rubber are doubled. Minor adjustments will cover all requirements for quite some time. New schemes can therefore be established with great savings and factories could be established when a scheme actually achieves optimal production level.

Marketing of rubber

No picture of smallholder rubber can be complete without mentioning the problem of marketing the finished product. Until February 1987 it was customary for Papua New Guinea's rubber to be sold to Australia and indeed until 1984 when one of the major producers started to open markets in Europe for Papua New Guinea rubber, all rubber went to Australia.

The flow of rubber to Australia was a legacy from the time when Australia agreed to offer Papua New Guinea producers protection against the fierce competition from Malaysian producers. The level of competition at the time had less to do with price than with quality failures of Papua New Guinea rubber. There was a special bye-law which allowed Australia's rubber consumers to import rubber from sources other than Papua New Guinea free of import duty, provided all of Papua New Guinea's rubber, purchased against a favourably drawn up pricing formula, was fully taken up as offered. The bye-law was repealed in October 1986 and as from February 1987 Papua New Guinea exporters were no longer offered protection. This caused problems to all producers who had exclusive links with Australian purchasers. The Australian consumers had found Papua New Guinea rubber relatively expensive, somewhat sub-quality, cumbersome to obtain reliably and moreover they were more interested in CR20 than in CR10 grade, which forms the bulk of Papua New Guinea's production. This is not the place to go into further details of marketing except to point out that the protection has been actually quite unnecessary since the putting in place of Papua New Guinea's CR scheme. It was probably counterproductive as Papua New Guinean producers were not exposed to international competition.

As mentioned earlier, the marketing of RSS, the traditional finished rubber product of the smallholders, had almost completely disappeared by 1980. The few farmers and small estates that continued to produce RSS could still dispose of their rubber by delivering it to one of the traditional shippers, who would retain the bales from all sources until they could make a 16 tonne full container. Since the volume had gone down so much it meant the rubber would lie in stores, practically uncared for, for about four to six months before shipment could be effected. This did no good to the presentation and quality of the RSS, which in the international rating would by then hardly qualify for the RSS5 qualification. Still worse was that the producer would receive no payment until the 16 tonne was accumulated and sold. It is no wonder that practically all producers gave up. By 1986 there were only three small producers remaining. Of these there was only one, the Kuniko scheme for smallholders, which with expert advice and supervision was able to produce to

international standard. Kunico could secure favourable marketing arrangements in that the rubber was paid for on delivery on an f.o.b. world market price formula. For all other smallholders the market for finished rubber was closed and the only possibility was to convert from the latex production process, which under smallholder conditions can only be turned into RSS, to cuplump production. It took some time for the smallholders to appreciate the value of this possibility and neither were the new TSR producers always prepared to purchase smallholders' cuplump. It took to 1984 and through to 1986 for smallholders and small estates to find their way through the maze of problems and obstacles and to deliver in some reasonable volume to the established factories far removed from their location. Unfortunately prices started to decline and in 1986 there were very low prices indeed. These prices could have been lower were it not for the fact that two factories were bidding for volume and were prepared to subsidise smallholders.

Since the end of 1987 prices for rubber have been quite reasonable and smallholders receive steady and economical prices. Moreover, there are arrangements with the buying factories which allow for shipment of the raw rubber from source without the problem of having to pay for freight up-front. Payment is within a few days of delivery except in official schemes when payment may take longer.

Though not institutionalised officially in a pricing formula, the current pricing system is fair to all parties as it is based on the world price, allows for shipping and processing costs and only gives the processor a small direct profit margin. If the pricing formula were to be institutionalised it would not be very different from the system in force now.

Price stabilisation

A more favourable system of pricing could be devised if the total value of rubber exports increased to qualifying levels under the Stabex scheme. It would remove the stabilisation responsibilities as exercised in 1986 from the processors who naturally are also in difficulty in a low price period.

A stabilised price would be easier on the smallholders who find it difficult to appreciate price falls below small adjustments and who tend to respond with production cuts. This is a healthy reaction of course but with the relatively small volume of Papua New Guinea's rubber production, and any production drop plays havoc with the economies of scale in processing factories, which as we have seen, work well below capacity anyway.

It would be beneficial if a modest scheme for stabilisation of prices to smallholders could be established. If it is considered that the current output capability of smallholders in the country is in the region of 2,100 tonnes only, an established fund of K200,000 would go a long way in keeping the pay-out to farmers at attractive levels. It would seem that if government, now embarking upon a revitalisation and expansion programme of smallholder rubber, could set aside this sum as part of the overall programme for development, profitable production could be more or less guaranteed for smallholders over any period that market prices are relatively depressed, usually a period not exceeding 1-1/2 years.

Conclusion

Much has been said and written about the effect exercised by the requirements for natural rubber to prevent the spread of AIDS. It has been mentioned only very briefly in this paper. Nothing has been mentioned about processing and catering for this market. This must seem strange to all who thought rubber was a dead agricultural product and who were led to believe by articles in the press that rubber has been given a new lease of life on the back of the dreaded disease. The main market where demand for natural rubber really grows is in tyres (aircraft and heavy equipment tyres are practically 100 per cent natural rubber, steel casing radial tyres are at least 60 per cent natural rubber, and can in fact not be made without natural rubber) and belting, if it comes to great volumes. The market for latex-based products has indeed grown enormously but its share of the total rubber market is still small. To set up a latex concentrate facility is of course perfectly possible but to apply it to smallholders would be practically impossible until schemes have been established for many years, which should be interpreted as the time required for farmers to reach almost instinctively the very high field standards required to produce latex that can indeed be used in a concentrate factory. Moreover, others have gone before us and in this case so many others, jumping on the bandwagon, may in fact mean missing the through-train. The interests of smallholders are better served by making steady arrangements for backbone marketing of a simply produced primary product which can be processed into a high-quality product of the least speculative grade and simplest marketability. The instituting of a price stabilisation scheme would widen the base on which the smallholder can assuredly build his future in rubber, which is after all a 25-30 year commitment.

AGRICULTURAL PRODUCTION SUPPORT SERVICES WHICH PRODUCTION MODE SHOULD WE PURSUE?

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Introduction

The agriculture sector provides Papua New Guinea with renewable resources that are capable of sustaining economic growth on the longer term by creating competitive investment opportunities. This sector consists of agriculture, forestry and marine resources. With prudent management practices, the resources can be productive indefinitely - whilst the mineral-based resources have a limited life.

The mineral boom will further pressure agriculture-based projects by competing for funds within our financial system. The inflationary trend from competition for goods and services can only add to the spiralling production costs in the agriculture sector.

Agricultural policy strategies should therefore be designed to protect or maintain investor confidence from such "temporary" circumstances which may not be sustainable after they (mineral boom) have been exhausted.

In this discussion paper we look at various scenarios concerned with the mode of production for agricultural resources - a high input for a high output developmental strategy or a low input and a low output strategy. When formulating national policy we should prioritise and target both production modes. Papua New Guinea has the resources and can quite comfortably accommodate both systems of agricultural developments.

If our desire is to expand income-earning opportunities to the population mass the limiting factors that inhibit that sector's performance has to be addressed fully. We shall attempt to discuss some of these in this paper.

The high input-output development strategies are guided by the profit motive. However they rely heavily on there being some degree of predictability about the cost structure with reliable management systems. Support for this sector should come in the form of incentives by the government attempting to remove the constraints that affect them, some of which are discussed here.

Private sector involvement

Incentives for private sector investment run the risk of losing out to short-term investment industries with high turnover, commonly called "short-term money spinners", understandably attractive to financiers. Export tree-crop industries are long-term investments and subject to regular and unpredictable market fluctuations. Some of these industries have insured against market fluctuation through establishment of stabilisation funds. However, recent experience has shown that these can be depleted rapidly in times of low commodity prices.

The management agencies through their involvement have engendered a degree of confidence in the financial institutions lending to the agriculture sector. This has resulted in more funds being committed for land development. The Coffee Industry Association has established general guidelines which standardise management practices and monitor performances to ensure costs are minimised.

The nucleus estate development of major cash crops like oil palm and rubber have set a precedent for foreign investment in Papua New Guinea agricultural development. Landowners participation should become an essential part of this scheme to avoid disruption or land conflicts at a later date. National Investment and Development Authority regulations dealing with investment in the agriculture sector needs to be reviewed. Landowners in the remote areas can benefit more if the government encourages new investors into the less developed areas by supporting them with incentives such as tax relief arrangements or exemption of import duty on farm equipment, etc.

Are production support services designed to meet the style of agricultural development we pursue in Papua New Guinea?

Labour. Rural wages policies are not conducive to agriculture development. Is Papua New Guinea living beyond its means? Minimum wages submissions from the commodity industries have expressed their objection to artificial wage increases without any link to increased productivity. Money has to be made somewhere to enable Papua New Guinea to support the wage structure we pursue in this country. Already there is ample evidence to suggest that the agricultural sector cannot afford to meet the rising production costs.

It is suicide to propose bringing rural wages up to urban rates. Instead of promoting a wider distribution of wages, current policies are creating a social class hierarchy in Papua New Guinean society by limiting employment opportunities.

The problem is further exacerbated through an education system which turns out school leavers with no job prospects. Social unrest will increase as more youths are put on the streets and resort to illegal occupations.

Our export commodities compete on the international market with countries which are capable of producing the same products at a relatively cheaper cost. Wages in Papua New Guinea for the rural industries will therefore have to be slashed by 20 per cent from the present rate to make it viable. We have established, for example, that labour costs alone account for 33 per cent in coffee production. Our competitors in Africa, India and Central America pay about one-third of our costs. Quality of agricultural produce has to be of a high standard to offset production costs, let alone labour costs.

Agricultural extension services. The traditional farming system of the rural farmers should be exploited to maximise cash-crop productions. The people already know the land tenure system. We should expand on it by carefully incorporating cash cropping into their farming systems. It does not alter their lifestyle and the population mass have the capacity to produce in total large volumes for export at minimal cost. Why should we make them adopt large-scale commercial-type developments for which they have to rely on foreign technology and capital and be faced with increasing labour costs when we can encourage a relatively cheaper smallholder-type agricultural development?

If we are going to be successful in maximising grower participation we need to interest the farmer. How can we keep his interest? Organising farmers to be responsive to technical and extension support services is the key to achieving positive response among rural farmers. We should be aware that it is not an obligation for the smallholder to be concerned about cash-crop production. It is not his priority. If he feels he is being ignored by the system he will not harvest the crop.

In the coffee industry rust outbreak taught us that we can no longer sit around and wait for government services to correct a serious problem that threatens the livelihood of those dependent on coffee. Grower sacrifices have to be made in order to protect a cash crop that has become part of the daily lifestyle of the rural people. Thus, in search of a workable alternative the Coffee Development Agency (CDA) concept was formulated and put into operation. A colleague of mine has discussed the CDA concept earlier.

Agriculture extension services throughout the country are too generalised and lack objectivity. A privatised approach has proven effective if the government is prepared to recognise growers concerns. It creates specialisation of functions and is more responsive to growers needs and aspirations.

If the desire is to keep extension functions within the bureaucracy, the government departments responsible should be reorganised to be responsive to the national policies. The national government should then support the provinces with technical advice, logistics, monitoring, coordination of programmes and training in specialist services or appraisal of

financial commitments. The provinces could then tailor the programmes to meet their individual circumstances prevalent in the provinces.

The provincial government system has to be restructured to facilitate a mechanism by which inputs and outputs can be effectively monitored with an accountable system or the present weaknesses in the provincial bureaucracy will continue. Although political debate is not our subject here it would be a fair reflection of majority-held view that some stability in the provincial government system is necessary if the process of nation building is going to be shared mutually by the people with the political leadership.

Infrastructure facilities. The less developed areas scheme for bringing development and distribution of economic activities to these areas can be described as a positive proposition. But many of these areas have poor infrastructure facilities such as no roads, bridges, transportation, etc. to make it viable for the potential investors.

The government should continue to place emphasis on the development of infrastructure facilities capable of minimising high costs of the middleman bringing the goods and services to the rural areas. In the highlands and elsewhere, people have learnt that to bring development to the "haus-line" they have to make their roads and build bridges. These initiatives should be utilised by the government by providing equipment and material so that free labour can be used to expand rural communication networks.

Agricultural credit facilities. Capital funding for new developments or for takeover of existing businesses by local groups is limited. Increased demand for funds has pushed the interest rates up to the extent where borrowings are expensive. If the land tenure system can be secured (as suggested later) the government should review the banking policies with the view to reducing the interest rate factor for the agriculture sector. This approach may call for smaller parcels of loans tailored to the farmer's capacity to repay.

The other problem is that the banking services are all located in the main commercial centres. The rural farmers are made to pay extra fares for PMV, passenger ship or aircraft to come to town to get these services. The banking institutions should bring these services to rural areas where the bulk of the population live. The Agriculture Bank's rural representatives should serve this purpose but the current administrative system needs to be reviewed because many farmers experience frustration with it.

Where can Papua New Guinea find new funds to meet this short fall? On present indications millions of kina are tied up in loans. Some of these loans may never be repaid. This in turn caused some projects to be aborted. Liquidity problems will place more burden on the banking services throughout the country. Government budget forecasts will not meet its target through short fall in agriculture export revenue. Perhaps income from the mineral boom could offset decline in the agriculture sector's performance but the long-term damage will be done as it could take some years to recover.

Agricultural chemicals and equipment. Farmers today are increasingly dependent on agricultural chemicals, fertiliser, tools, etc. for production. Companies involved in these services have a great deal to offer to the farmers if they can organise a reliable distribution network.

Use of chemicals and machinery will have to replace increasing cost of labour. Setting up fertiliser plants or local manufacturing of tools and equipment should encourage the farmers to maximise production provided costs are kept low.

Market access. Most of the rural economy still suffers from high costs of market access. Transportation facilities such as shipping, road haulage and air freight reduce the net income of the farmer. Even if the farmers carried their own products to the nearest marketing point, freight costs from there on make it impossible to get the maximum price they deserve.

The takeovers and amalgamation of major trading houses can only restrict the marketing of our commodities overseas. Meanwhile the commodity boards continue to issue more export licences diluting the negotiating position of Papua New Guinea even further. Major commodity markets are depressed with surplus production inducing low prices. Substitute or alternate products are making the trade more competitive internationally. Unilateral trade agreements and protective tariff or trade barriers also make significant impacts on free trade.

The present market situation, if it continues, will see the plantation sector collapse in the next two to three years. Stabilisation funds would all be exhausted. Additional funds must be found to subsidise producer prices or maintain their cost of production even if it leaves no profit margin.

Research and technology

Agricultural research, technology to improve agronomical practices and quality control were boosted by direct industry intervention. New techniques or cost-efficient husbandry practices should improve production and return to the farmers. The setting up of joint research institutions for cocoa, coffee, and oil palm are good initiatives.

The government should encourage their operation by committing adequate funds to these institutions. Recommendations have been made elsewhere for a kina for kina funding between the government and the industries concerned. We would fully endorse them for government consideration.

Small-scale cash crop production - efficient, sustainable and cost effective mode of production

The smallholder, apart from being the cheapest mode of production, has the greatest potential for developing a strong cash crop industry. Small-scale cash crop production provides income earning opportunities to individual families. Self-sufficiency in food production is a priority for rural farmers.

Labour is guaranteed at minimal cost if an acceptable farming system can be organised. Benefits are shared equally to meet their immediate needs and people are motivated to spend time and effort in cash crop production.

Cooperative agriculture has not worked well in Papua new Guinea and therefore the business group concept has yet to be tested. The farmers have to meet the demands of

modern living like paying for school fees, clothing, PMV fares, etc. They can participate but need guidance and support from the government.

Land tenure

If we choose to expand smallholders' production, landowners equity schemes in agricultural development should be instigated. This scheme should be designed to get maximum input into land use by the traditional landlords.

Rural landlord schemes should make inroads for cash crop production. For example, all customary-owned land should be surveyed, subdivided into clan or family ownership and registered accordingly. It should virtually formalise the land ownership system that exists today and give security to the landlords. A lengthy exercise it may be, but once done consider the peaceful environment it can bring about in solving many social conflicts associated with land today. When in place a small-scale cash crop production scheme tailored to meet individual family labour capacity can be pursued. As stated earlier this scheme could provide the security for farmers to get small bank loans where required.

The mentality of being dependent on government handouts has to stop. By yielding to the demands and claims on land the government has set a bad precedent and is only successful in creating high expectations among the people. People knew that they had to work hard to get what they wanted in the traditional society before but the handout mentality is making the people lazy and beggars on their own land. Evidence is everywhere today and it would appear we cannot escape from this phenomenon. People should be reoriented towards achieving results through hard work and commitment.

What is the future of traditionally-owned land being used for commercial purposes?

The business group concept of developing traditionally-owned land for commercial-scale production is a good innovation for distribution of benefits to the majority. Indications are that sharing of benefits from communally-owned businesses creates high expectations among the shareholders leading to landowner conflicts. There is every indication today to suggest that the group-owned business investments, particularly in the Highland areas, are likely to disintegrate, leading to neglected developments and abandoned plantations. If this does not take place first the ever-increasing compensation claims coupled with rising costs of production will, no doubt, force them to resort to closure.

For example, the future ability of coffee block developments to remain as commercial entities is not guaranteed. Some K50 million committed to these developments run the risk of not being repaid on time. Landowners' confidence and momentum in land development will be lost. Management will collapse thus leaving the banks with no security over their loans. This includes developments with government involvement. The quality of coffee produced from these blocks will drop from a potential good X or A to Y grade with subsequent drop in value of income and export earnings to the country.

The shareholders or their immediate beneficiaries do not see and have yet to accept these investments as a business proposition. There is no commitment among the shareholders. Sweat equity contribution has to be increased to a proportion where land development is shared by the shareholders. The people will then see these entities as their own and thus take more care and pride.

Concluding remarks

By pre-determining what mode of production we wish to pursue enables both the government and the private sector to define their investment priorities. If we choose to pursue high input, high output development of renewable resources then national policy strategies should be geared towards intensive development of these resources. The low input, low output farming system also has a high potential but needs re-organisation of support services and farmer-responsive incentives to maximise output.

Industry support services are too generalised and badly in need of re-organisation of functions and agencies. The working relationship between the national and provincial governments, both at the political and bureaucratic levels needs a major shake up. Privatisation of extension services is a step taken in search of a working alternative. Joint efforts in research development and technical support are initiatives that have brought confidence to the producers.

Schemes such as that for the less developed areas can induce commercial-scale agricultural development using foreign investment. But government needs to provide basic infrastructure. Commercial investments cannot be made in isolation.

The commodity industries are heading for a rough time. Some problems we cannot avoid but many others are of our own making and should be corrected before major disaster strikes to the detriment of the majority of people whose lives depend on agriculture. Papua New Guinea cannot afford to allow stagnation of agricultural development when caught in the rush to exploit the mineral-based resources and regret the consequences in the long term.

LAND MOBILISATION PROGRAMME EXECUTIVE SUMMARY

G. Ovia

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Objectives and strategies

Programme goal. The Department has designed the Land Mobilisation Programme (LMP) to enable land administration to assist customary landowners in their desire to participate in the development of their own land.

The LMP will orientate the activities of the Department of Lands and Physical Planning (DLPP) to promote and facilitate land development and encourage optimum usage.

The goal of the LMP has been established as:

"To contribute to economic growth through the more productive use of land throughout Papua New Guinea (with equity, employment generation, land-owner participation and social stability)".

Programme objectives. In support of the goal of the LMP the Department has established a series of objectives to be achieved in the medium term (a ten to fifteen year time frame). These objectives are:

- a. A clear and conducive policy and legislative environment exists to promote investment in land.
- b. Customary landowners are actively participating in the development of their own land.
- c. Effective land services are being provided to all land users, (these services include physical planning, surveying, title registration, valuation, land transfer and disposal, land acquisition, dispute settlement and mapping).
- d. Land administration responsibilities are transferred from the national government to the provincial governments and the supporting procedures simplified.
- e. The stock and use of alienated land is optimised.
- f. Cross-sectoral links are established and support programmes are developed to facilitate land development and complement the LMP.

Programme priorities. Central to the programme is the introduction of programme management techniques to improve the management and institutional capacity of the department.

The programme provides a viable means for decentralising the land administration process in support of existing government policy.

The programme will provide additional resources to support the lease-leaseback system and other existing methods of providing land registration services to customary landowners in the short to medium term.

Concurrently, the programme will provide research and technical resources to establish customary land registration in the provinces in the medium term.

Programme components. To facilitate management and the implementation of the programme the LMP has been organised into a number of components:

Component 1. Programme management - provides for improved management to the Department and the programme, performance monitoring, staff accountability and the maintenance of quality control; an element of capital works is included.

Component 2. General institutional building - this component will assist land use planning and administrative institutions to upgrade their performance by improving the policy formulation and staff development and training capacity of DLPP.

Component 3. Mobilising alienated land - this component will improve the efficiency in the mobilisation and administration of alienated land and will include a survey and evaluation of the current and potential use of the existing stock of alienated and freehold land.

Component 4. Mobilising customary land - this component will expedite the mobilisation of customary land by the active promotion of lease-leaseback, improvements to group incorporation procedures, survey improvements and provision of research and technical resources to establish customary land registration mechanisms in the provinces if proved cost effective.

Component 5. Decentralisation - this component enables land administration powers to be transferred to the provinces together with the necessary resources required to establish an administrative capacity in the province; five provinces will receive full decentralisation over the first five years of the programme.

Component 6. Land resource and information - the national land information base will be improved including the updating of maps for development purposes and the further development of the computerised land information system (PNGLIS).

Highlights of the issues and options

1. Investment in the Department of Lands and Physical Planning.
The Department is institutionally weak and, in particular, has difficulty in servicing the rural sector and responding to land requests in general.

Options

- (i) Support the Land Mobilisation Programme which will improve the institutional capacity of the department and establish a receptive and responsive department which will actively promote and enable the participation of people in the development of their own resources; or
 - (ii) accept a weak land sector with little capacity.
2. Decentralise land administration
At present the land administration process is centralised and many delays are experienced because of this. If decentralisation is not undertaken, provincial governments will almost certainly legislate to fill the vacuum.

Options

- (i) Decentralise land functions; or
 - (ii) maintain the centralised land administration that exists today.

3. Existing title registration

A variety of semi-legal and legal packages exist to assist customary landowners in securing a form of registered title (including lease-leaseback and land tenure conversion). The existing mechanisms successfully address the requirements for customary land registration.

Options

- (i) Allocate additional resources to meet demand and to promote existing proven systems; or
- (ii) direct resources to promote new untried forms of securing titles.

4. Customary land registration

Customary land registration may offer a means to provide a registered title to customary landowners. Issues highlighted include the preferability of group registration, or individual family registration, the cost of introducing customary land registration, who meets the cost of maintaining customary land registration, will customary land registration freeze dynamic customary tenure or will it preserve it?

Options

- (i) Investigate the form of customary land registration most appropriate with a cost/benefit analysis and establish whether it is required or even desirable; or
- (ii) introduce customary land registration on a national basis; or
- (iii) introduce customary land registration on a province by province basis.

5. Cross-sectoral links

Currently cross-sectoral links and provincial links are weak which leads to uncoordinated use of resources.

Options

- (i) Improve cross-sectoral and provincial links; or
- (ii) leave the current functional arrangement as is.

Major Recommendations

1. It is recommended that the Land Mobilisation Programme be supported.
2. The government's decentralisation policy be applied to the land sector.
3. Prior to the introduction of customary land registration the existing mechanisms of land title registration be strengthened and their use promoted.
4. Customary land registration be further investigated before it is introduced on a nation-wide basis and that a cost/benefit analysis be applied.
5. The importance of cross-sectoral links in promoting economic activity is recognised and the linkages strengthened.

Budgetary implications

Initial estimates indicate the Land Mobilisation Programme will require K11.3 million in budgetary expenditure in 1989 and the period 1989-1993 will require K65.6 million plus K4.9 million in technical assistance and K3.9 million in capital works, totalling K74.4 million, whilst generating an anticipated K59.4 million in revenue.

Papua New Guinea - Land Mobilization Project

Logical Framework Analysis

Narrative SummaryOverall Goal

TO CONTRIBUTE TO ECONOMIC GROWTH THROUGH THE MORE PRODUCTIVE USE OF LAND THROUGHOUT PNG (WITH EQUITY, EMPLOYMENT GENERATION, LAND-OWNER PARTICIPATION, AND SOCIAL STABILITY)

Process

- Land-users (clan groups, joint ventures, companies, individuals, Government agencies) are encouraged and enabled to invest in appropriate land-based activities.

Program (Subsector) Objectives (Impact)
(to be achieved in 10-16 years timeframe)

- a. To create a clear policy and legislative environment to promote investment in land.
- b. To enable customary land owners to increasingly participate in the development of their land.
- c. To provide effective land services to all land users (surveying, title registration, valuation, land transfer and disposal, mapping, land acquisition, dispute settlement and physical planning).
- d. To transfer land administration responsibilities from the national government to the provincial governments.
- e. To optimize the use of the stock of alienated land.

Indicators and AssumptionsOverall Goal Indicators

- % of alienated land parcels used productively (i.e., in accordance with lease conditions)
- % of customary land with development potential used productively.

Linking Assumptions

- a clear policy and legislative environment combined with effective delivery of land services will encourage land users to invest in land-based activities.
- registration of tenure is a prerequisite for investment by external (i.e., non-customary owner) parties in land based activities.
- the equitable rights of individuals are preserved upon registration of tenure.
- appropriate land based activities in PNG will involve customary landowners as equity participants and will enable their participation in the design and implementation of those activities.
- appropriate land based activities (such as agriculture, forestry, mining and industry) will result in employment generation.
- tenure registration must support the dynamic nature of customary ownership and hence assist in the preservation of social stability.
- appropriate land-based activities will be predominantly productive in nature.
- productive land use results in economic growth through the use of land resources.
- financial resources, management and technical assistance are provided to land users by other agencies.
- planning and land dispute settlement mechanisms are in place and effective.
- decentralization of land administration will result in a more efficient and responsive delivery of land services.

Impact Indicators

- Effect 2a
- Effect 4c
- Effect 2a
- Effects 5a & 5b
- Effect 3b
- % of parcels with usage complying with lease conditions.

NOTE: This chart should be read from the bottom (Page 4) to the top, to follow logically the process whereby individual program activities contribute to overall program objectives. Descriptions of key processes are inserted between the tiers in the "hierarchy of objectives", to indicate how the achievement of sub-objectives is expected to lead to the achievement of higher-level objectives. Key assumptions are also shown, that must hold true if these processes are to result in the achievement of higher-level objectives.

Narrative SummaryProcesses

- Legislative and statutory bodies endorse and assist DLPP initiatives for development of the lands sector.
- DLPP and provincial governments promote the use of title registration mechanisms by customary landowners.
- Customary landowners form corporate bodies (clan land/business groups or companies) to secure title registration.
- Customary landowners seek funding for the development of their land.
- Land services are progressively decentralized and made more efficient.
- Provincial Land Management Committees identify, prioritize and coordinate land initiatives in the province.

Component Objectives (Effects)
(to be achieved in 5-7 years)

1. Program Management
 - a. To improve management of land administration in PNG.
 - b. To improve and maintain professional standards and the quality of land services.
 - c. To provide the necessary physical facilities.
2. General Institutional Strengthening
 - a. To establish improved land policies, legislation, and procedures.
 - b. To improve DLPP's capacity to:
 - develop policy;
 - promote land registration for development;
 - deliver land services;
 - generate revenue from these services.
 - c. To improve PNG's land dispute settlement capacity.
3. Mobilizing Alienated Land
 - a. To introduce an improved and cost-effective system for administration and mobilization of alienated land.
 - b. To rationalize and mobilize the stock of alienated land.
4. Mobilizing Customary Land
 - a. To develop an acceptable and cost-effective method of customary land registration and mobilization.
 - b. To expedite the mobilization of customary land.

Indicators and AssumptionsLinking Assumptions

- DLPP has a sound policy making capacity, and can mobilize the support of legislative and statutory bodies.
- Title is acceptable to financial institutions or investors to support economic activity.
- Awareness of these mechanisms will result in their use.
- Customary landowners are willing to incorporate
- Individual rights are equitably represented upon incorporation
- An efficient and cost effective incorporation process exists.
- Title is acceptable to financial institutions or investors to support economic activity
- Financial resources are available for land devt.
- Provincial management of these services will result in a more responsive and efficient delivery thereof
- These committees interpret provincial government land policies and are representative of various interest groups
- Government sectoral policies assist to provide conducive investment environment.
- Simplified legislation and procedures will facilitate land mobilization.

Effects Indicators

- Outputs 1.1 a-e
- Published standards and quality measures in place
- Outputs 1.2 - 1.5
- Outputs 1.1/2.3a
- Enactment of revised legislation by PNG parliament
- Outputs 2.1
- Outputs 4.0
- Outputs 2.2; lease issuance period reduced
- % of all land parcels generating revenue
- Number of unsettled disputes.
- Consolidated national land legislation enacted
- Direct unit cost for lease issuance
- Number of leases issued per year
- Allocation of alienated land parcels meets demand.
- % of mobilized (i.e., allocated and revenue-generating) land parcels is increased from 23% to -% by PY().
- % of land parcels used for appropriate uses (i.e., in accordance with lease conditions).
- Number of provinces with established policies.
- National framework legislation for customary land dealing and registration is enacted.
- No. of applications unprocessed/processed.
- No. of provs. with effective land mobilization capacity.

<u>Narrative Summary</u>	<u>Indicators and Assumptions</u>
<u>Component Objectives (Effects) (cont'd)</u> (to be achieved in 5-7 years)	<u>Effects Indicators (cont'd)</u>
5. <u>Decentralization of Alienated Land Administration</u>	
a. To develop an acceptable and cost-effective system for decentralizing alienated land administration.	- Outputs 5b and d.
b. To expedite the decentralization of land administration functions to the provinces.	- Output 5 c.
6. <u>Land and Resource Information</u>	
a. To provide an up to date information base for customary and alienated land (with title, land-use, geodetic and topographic information).	- Outputs 6.1 a, d & e, 6.2 a-e.
<u>Processes</u>	<u>Linking Assumptions</u>
1. <u>Program Management</u>	
- DLPP 5-year program is implemented as a pilot exercise in program budgeting/management. - Program Management Committee and quarterly Review meetings provide a context for accountability and problem solving.	- Central agencies will provide necessary support - National Land Management Committee (NLMC) & Resource Management system is functioning. - Appropriate technical assistance is provided in a timely fashion with a private firm providing support in recruitment and administration of consultants - Technical assistance results in the transfer of skills capacity to DLPP staff.
2. <u>General Institutional Strengthening</u>	
- Consultants' study recommendations are considered, and appropriate actions are initiated by DLPP. - Draft legislation is introduced and expedited. - Policies conducive to investment in land-based activities are developed - Land dispute settlement mechanisms are strengthened - Adequate and suitable personnel are secured.	- DLPP's draft legislation is enacted. - Strengthened Pol. & Prog. Division able to develop policies. - DLPP-initiated proposals to improve land dispute settlement mechanisms are accepted, funded, and implemented. - Effective staff development, training and recruitment will lead to enhanced DLPP capacity to develop policy and deliver services.
3. <u>Mobilizing Alienated Land</u>	
- Establish work programs in liaison with provincial Land Management Committees - Undertake appropriate mobilization action in support of evaluated potential.	- Provincial governments are supportive. - Land-revenue generation mechanisms are improved.
4. <u>Mobilizing Customary Land</u>	
- Landowners' participation in the development of their land resources (through incorporation into land/business groups or companies) is encouraged. - Suitable titles are provided to meet the demand of customary land owners wishing to have equity participation in the development of their land.	- Provincial governments support LMC formation. - LMC membership includes representatives of customary owners and other interested parties. - Publicity program is in place and effective. - Administration of land/business group registration is improved. - DLPP's draft legislation is enacted. - Land dispute settlement mechanism in place. - Resources are provided to the provinces to establish their land administration capacity.
5. <u>Decentralization of Alienated Land Administration</u>	
- Provision of resources to support delegation of land administration functions. - Provision of technical support to maintain standards of land administration.	- Mechanism for delegation is improved. - Provinces meet delegation qualification criteria. - DLPP supported by central agencies per MOU. - Provision of PNGIS processing systems. - DLPP strengthened through LMP to provide support.

Narrative SummaryIndicators and Assumptions6. Land and Resource Information

- Introduce a responsive mapping policy.

- Cross-sectoral priorities are established.

- NLWC and Mapping Council are established.

COMPONENT OUTPUTS

} Refer to detailed input/output worksheets which were prepared for each of
 } DLPP's 16 work units. They are in Project file, Document 1.1.

PROCESSES

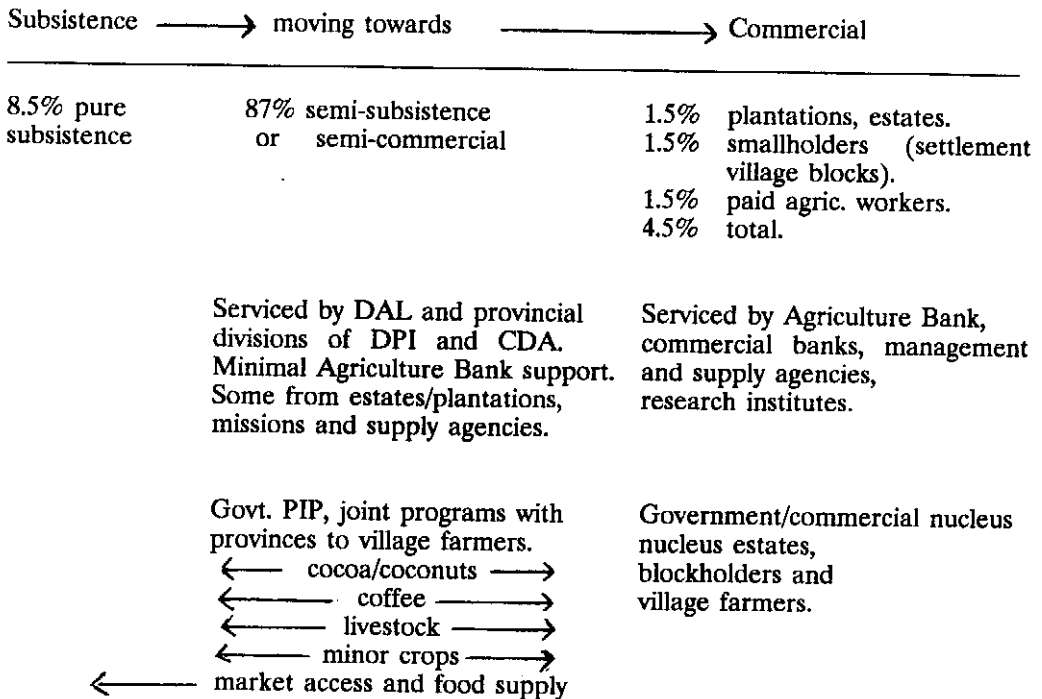
} An example of the three worksheets for Work unit Personnel Services Division

COMPONENT INPUTS

} (Component 2: General Institution Building, Subcomponent 2.2) are in Annex 1,
 Tables 1, 2, 3).

A CONTINUUM OF AGRICULTURE IN PAPUA NEW GUINEA

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- Notes:**
1. Figures based on 1980 Census which classified 87 per cent of the total population as "village rural".
 2. DAL = Department of Agriculture and Livestock.
 3. DPI = Department of Primary Industry.
 4. PIP = Public Investment Programme.
 5. CDA = Coffee Development Agency.

Public Investment Programme - Agriculture

Food production

Resource allocations here are directed mainly at the semi-subsistence sector. Production from this sector is food for home consumption and the domestic market. Livestock, fruits and vegetables are the main components of this programme. This area of resource allocation has the greatest potential for broad-based economic growth.

Programmes for village-based smallholder production for domestic markets include:

The Smallholder Market Access and Food Supply Programme (SMAFSP). The objectives of this programme are to increase smallholder production of food crops and livestock; to improve market access; to increase incomes and employment opportunities through improving access to the cash economy; to assist in the improvement of incomes in the nutritionally disadvantaged areas and to introduce an effective extension package for food crops and livestock.

SMAFSP is envisioned as a rolling programme of projects directed at least developed areas. The projects include provision of better road access; better agricultural extension by training village level extension workers; nutrition education through women's associations and demonstration/distribution centres for planting material and livestock.

SMAFSP projects are being implemented in Western Highlands (Upper Jimi District), East Sepik (Wosera District), Central (Goilala), and Gulf (Kaintiba). Another two are being prepared in Madang (Upper Ramu) and Eastern Highlands (Okapa). The programme is intended to include most least developed areas but because of limited resources only two new districts would be covered each year.

The Marketed Fruits and Vegetables Project (MFVP). The Public Investment Programme (PIP) includes two projects dealing with fruits and vegetables, the smallholder marketed fruits and vegetables project and a citrus pilot project. MFVP aims to improve the production and marketing of locally grown vegetables (including exotic vegetables such as lettuce, carrots, broccoli, cauliflower, potatoes) for the major urban markets.

Village Livestock Programme (VLP). This project aims to breed sheep, goats, poultry and other small animals for distribution to the smallholders through provincial DPIs. A small component of this programme includes the introduction of draught animals (buffalo) and a farmer training programme.

Cash Crops

Resource allocation to village-based smallholders of export crops is undertaken jointly with provincial governments. The export crops include coffee, cocoa, coconuts, rubber, and minor crops.

Programmes for village-level development include:

The Smallholder Cocoa/Coconut Rehabilitation and Expansion Programme (SCCREP) is a national DAL and provincial DPIs joint project. SCCREP commenced in 1987 and now covers five major cocoa producing provinces (North Solomons, Madang, New Ireland, East New Britain and East Sepik) and four other provinces - Oro, Milne Bay, Central and West New Britain. By 1990 all the other coastal provinces with potential for growing the crops will be covered in the programme. Revitalisation of the provincial extension services is a key component of this project.

The Smallholder Coffee Rehabilitation and Expansion Programme (SCREP) is designed to control the rust disease, rehabilitate and expand smallholder production. It involved some 97,000 smallholders to the end of 1988 while CDA was responsible for resourcing and implementing the project. The responsibility was given back to the provincial extension services in 1989.

The Minor Crops Expansion and Diversification Programme (MCEDP). A joint programme designed with the objective of expanding the production and improving the quality of cardamom, chillies and pyrethrum commenced in 1988. A study was recently completed on the possibilities for diversification and the draft report indicated potential for crops such as ginger, tumeric, japanese mint and nutmeg. European Development Fund grant funding is being sought for parts of this project. The programme commenced in 1988 with projects in East New Britain, Central and Simbu provinces. The programme is being expanded to Oro, Milne Bay and Enga provinces this year.

The New Ireland Village-based Oil Palm Development Project involves 400 growers cultivating 1,200 hectares of oil palm. It is funded by a Stabex allocation. This is a relatively cheap project because it makes use of existing infrastructure, minimising new investment in capital works.

Smallholder settlement schemes for export crops

Resource allocations of this kind are regarded as one of the most efficient and cost-effective forms of investment in terms of increased export production, creation of productive employment and income earning opportunities, as well as making a positive contribution to foreign exchange earnings and the gross domestic product.

As a result of past commitments with international financing agencies such as the World Bank and the Asian Development Bank (ADB), about 31 per cent of budgetary allocations to the agriculture subsector over the five year period from 1989 to 1993 will be for smallholders associated with nucleus estates and settlement schemes. These smallholders are mainly located on alienated land.

Programmes for smallholder settlement schemes for production of export crops include:

The East New Britain Smallholder Development Project (ENBSDP) aims to develop a total of 2,310 hectares of smallholder cocoa and coconuts and was started in 1988. Incremental output at full development is projected to be over 2,500 tonnes of cocoa and some 2,400 tonnes of copra per year. It funded through an ADB loan.

The West New Britain Smallholder Development Project (WNBSDP) which aims to develop 8,100 hectares of smallholder oil palm, half in village plantings, started in 1987. Some 2,240 smallholders are involved and projected output by year ten is expected to be 32,000 tonnes of palm oil and 6,400 tonnes of kernel and it is to be funded through an ADB loan.

Other proposed smallholder schemes include:

- . Oro Smallholder Oil Palm Expansion (Oro);
- . Open Bay Smallholder Cocoa/Oil Palm Development (East New Britain);
- . Collingwood Bay Smallholder Cocoa/Oil Palm Development (Oro);
- . Mamai/Baibara Smallholder Oil Palm/Cocoa Development (Central).

LONG-TERM TRENDS IN PAPUA NEW GUINEA'S REAL COMMODITY PRICES : AN INEXORABLE DECLINE?

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Introduction

Primary commodity prices have been declining steadily since the commodity boom of the mid-1970s. The decline was particularly sharp in the 1980s. Between 1980 and 1987, the International Monetary Fund (IMF) index of commodity prices dropped by 38 per cent in real terms (deflated by the price of manufactures). By 1986 real commodity prices had reached their lowest level this century. A feature of the 1980s price collapse was that it was largely unexpected. There had been a strong upturn in economic activity in the mid-1980s and it was anticipated that higher growth would lead to higher demand and higher prices for primary commodities. In every year actual commodity prices have turned out to be consistently lower than the forecasts of organisations such as the IMF and the OECD.

These developments have serious implications for the many countries which rely heavily on primary products for their export revenue. Primary products accounted for 72 per cent of the export earnings of low-income countries in 1985, and 51 per cent of the export earnings of middle-income countries (World Bank 1988, p.24). Amongst middle-income countries, Papua New Guinea depends particularly heavily on primary products for over 95 per cent of its exports. In 1987, 69 per cent of export earnings came from minerals and around 28 per cent from agricultural exports (Bank of Papua New Guinea 1988).

The steady decline of prices has led to renewed interest in theories concerning a long-term decline in real commodity prices.

The Prebisch-Singer hypothesis

The proposition that primary product prices suffer a long-term secular decline, relative to the prices of manufactured goods, is associated with the work of economists Raul Prebisch and Hans Singer. Prebisch set out to examine the terms of trade facing producers of primary commodities in developing countries. His analysis was based on the net barter terms of trade, determined by dividing a price index for exports by a price index for imports. Prebisch conducted an empirical study of the net barter terms of trade facing Britain between the late 1870s to 1938. Since Britain mostly exported manufactured goods and imported primary commodities, the terms of trade were seen as a reasonable proxy for changes in the relative prices of manufactures and primary products. His research found that the terms of trade moved in favour of Britain. In other words the prices of manufactured goods (exports) improved in relation to the prices of primary products (imports).

Two main reasons were given to explain this phenomenon. First, demand for primary commodities was weak in comparison to the demand for manufactured goods. Second, increases in labour productivity for primary commodities tended to be passed on in the form of low prices, while strong labour unions in the industrial countries captured gains in labour productivity for manufactured goods in the form of higher money wages, which led to higher prices for manufactured goods.

Since the declining commodity terms of trade theory was put forward there has been extensive discussion about which way the terms of trade have actually moved. There does not appear to be a conclusive answer however, as the results of empirical tests are highly sensitive to such factors as the period selected for analysis and the construction of price indices. Spraos (1980) found that there had been a deterioration in primary producer terms of trade between 1870 and 1940 - but not as large as that suggested by Prebisch. Other studies have produced mixed evidence, with the terms of trade for primary producers declining over some periods, but rising in others. For example, Edwards (1985 p.62) compiled price indices from a number of sources, but found no clear evidence of an overall deterioration in the primary commodity terms of trade between 1880 and 1980. However, Killick (1988b) observes that most recent studies do find a significant downward trend in real commodity prices.

The evidence

In this study, an attempt is made to use the Prebisch-Singer framework to examine the commodity terms of trade facing Papua New Guinean agriculture. Thus, the world market prices of Papua New Guinea's main export crops are used as an index of export prices. Import prices are represented in two different ways, first the United Nations Manufacturing Unit Value (MUV) Index, which is an index of the prices of a selection of manufactured goods imported by developing countries from industrial countries. Second, since over 40 per cent of Papua New Guinea imports originate from Australia, the Australian consumer price index (CPI) has also been used as a proxy for Papua New Guinea import prices.

Commodity prices are examined at two levels of aggregation: price indices and individual commodity prices. A selection of price indices have been chosen to gain a broad picture of price movements amongst non-mineral commodities, while individual commodities are

chosen on the basis of their importance to Papua New Guinea. The analysis is based on data from 1948-1988.

Price indices

Four price indicators were selected covering: beverages, vegetable oils, non-food agricultural products and total agriculture. The exact commodity composition of the indices is given at the bottom of Table 1. The price indices have been deflated by MUV index to obtain the "real" or purchasing power prices of primary commodities. The results are presented in graphical form in Figure 1.

Both the non-food index and the total agriculture index show an unambiguous and steady decline. The total agriculture index reaches its highest point in the early 1950s after which it falls steadily for two decades although there are some small cyclical fluctuations. In the early 1970s there is a significant upturn corresponding to the commodity prices boom. However, in the 1980s, the index falls again to new historical lows. The agricultural raw materials index also reaches a historical peak in the period immediately after the Second World war after which the index undergoes a steady decline aside from minor upturns such as in the 1970s. By the 1980s the index is also at an all time low.

The beverages index and the vegetable oils index show considerably more instability. The vegetable oil index shows an overall decline from the 1950s through to the early 1970s although there are strong cyclical upswings in the early 1950s and 1960s. In 1973 the index rises dramatically to the levels prevailing in the early 1950s following which there is an equally dramatic price collapse in 1975. There are two further upswings, in the late 1970s and in the early 1980s, before vegetable oil prices crashed to their lowest prices ever in 1986.

The beverage index seems to be qualitatively different from the other indices. The cyclical patterns do not seem to be closely correlated with the cyclical movements of the other indices, and the overall declining trend is more equivocal. The price of beverages recovered strongly after the war until the mid-1950s, after which there was a long period of decline. Beverage prices do not seem to have been affected by the 1973 commodity boom, however, between 1975 and 1977, prices climbed from a post-war low to a post-war high, largely influenced by the 1975 Brazilian frost which drove up coffee prices. The index fell to pre-frost levels by the beginning of the 1980s. There was a more muted upturn in prices in the mid 1980s, but by 1987, beverage prices were at historical lows.

Trend lines for the indices have been estimated using Ordinary Least Squares. The trend line estimates are contained in Table 1. The results show a significant downward trend for all the indices, which is evident from the price graphs. However, the estimate for beverages is the least satisfactory. Although the coefficient estimates are sound, the coefficient of determination is very low indicating that beverage prices are not well explained in terms of a linear trend. This would reflect the greater instability shown by the beverage index and the less discernible trend shown by the price graph.

Table 1
 Ordinary least squares estimates of constant price trends

Beverages			
Y = 30.08	-	1.132 (t - 1948)	R ² = 0.181
(14.51)		(-2.935)	SEE = 29.224
Vegetable oils			
Y = 160.407	-	2.006 (t - 1948)	R ² = 0.556
(24.062)		(-6.992)	SEE = 21.734
Non-food agriculture			
Y = 176.223	-	2.758 (t - 1948)	R ² = 0.663
(24.077)		(-8.755)	SEE = 23.863
Total agriculture			
Y = 144.706	-	1.637 (t - 1948)	R ² = 0.626
(30.758)		(-8.084)	SEE = 15.338

Notes: The figures in parenthesis below the coefficient estimates are 't' statistics, R² is the Coefficient of Determination and SEE is the Standard Error of Estimate.

Beverages: coffee, cocoa, tea

Vegetable oils: palm oil, coconut oil, groundnut oil, soybeans, copra, groundnut meal, soybean meal

Non-food agric.: cotton, jute, rubber, tobacco

Total agric.: Beverages + Vegetable oils + Non-food agriculture + Cereals (maize, rice, wheat, grain sorghum) + Other foods (sugar, beef, bananas, oranges).

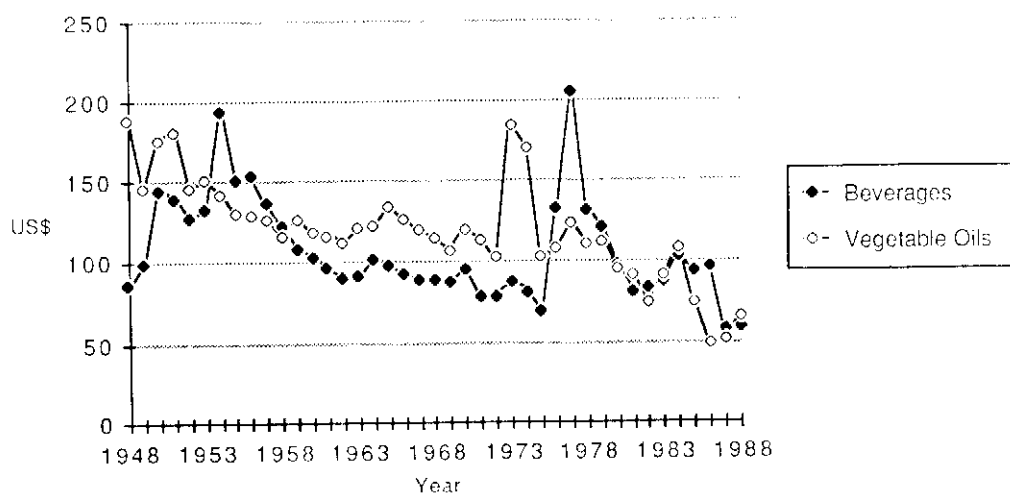
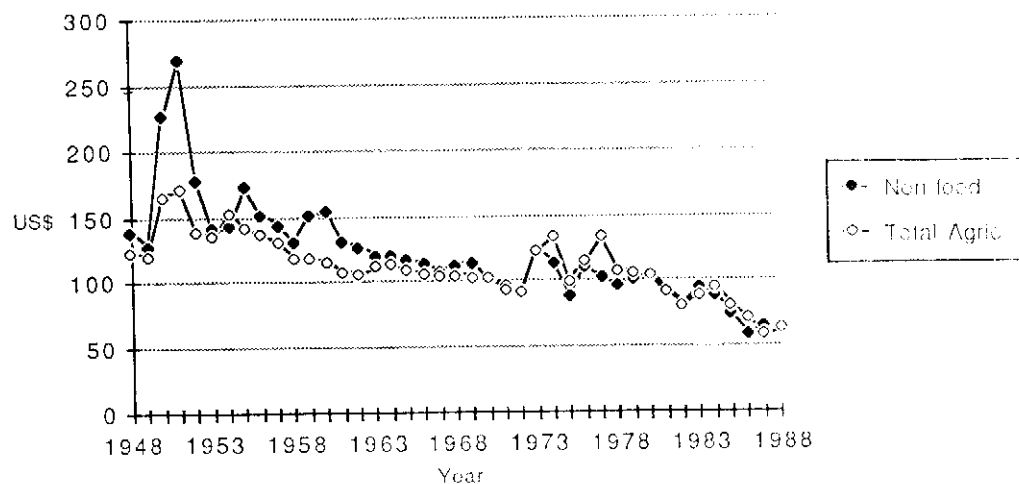
Individual commodities

One of the problems with using indices is that whilst they provide a useful overall picture, they also tend to mask important differences between the individual components of the index. For example in 1976, the effects of the rising price of coffee and the falling price of sugar would tend to cancel each other out in a single representative index. In order to mitigate these effects, the prices of individual commodities have also been examined. The commodities are: coffee, cocoa, rubber, copra, palm oil and palm kernels. In order to obtain "real" or purchasing power prices, current prices have been deflated by both the MUV index and the Australian CPI index. The results are set out in Figures 2, 3 and 4.

All of the six commodities show declining real prices over the period 1950-1988 to varying degrees. Such results are consistent with the broad picture provided by the price indices. The clearest and most even decline is shown by rubber (Figure 2), which Figure 1 is at its highest level in real terms in the early 1950s and at its lowest level since the War

Figure 1

Primary commodity price indices 1948 - 1988 - deflated by
the manufacturing unit value index: (1980 = 100)



in the second half of the 1980s. In 1988 the real price of rubber was less than a fifth of its real price at the beginning of the 1950s. The vegetable oil products such as palm oil, copra and palm kernels do not fare any better. The prices of such commodities tend to move closely together because vegetable oils are substitutable in a number of industrial applications. By the mid-1980s real palm oil and copra prices (Figures 2 and 3) were a mere 13 per cent of what they had been in 1950. However, cyclical fluctuations are much more pronounced in the case of vegetable oil products. For example oil products enjoyed a strong upswing between 1972 and 1974 during which time prices were as high in real terms as they had been in the 1950s. There were two further pronounced price cycles between the mid-1970s and the mid-1980s, although during each downswing real prices sunk to progressively lower levels.

The real prices of coffee and cocoa (Figure 4) do not show the same regular pattern of decline shown by the other commodities. In the case of cocoa it is not even clear that there has been an overall decline over the period 1950 - 1988, although coffee seems to show a more obvious decline over the period. This may be partly explained by the fact that coffee and cocoa are more susceptible to weather-related supply fluctuations than other crops. These short-term supply shocks have led to substantial price fluctuations and have also caused beverage prices to move independently of other commodity prices. Both cocoa and coffee price trends are characterised by two short periods of comparatively high prices, in the mid-1950s and in the mid-1970s, with fairly stable prices in between.

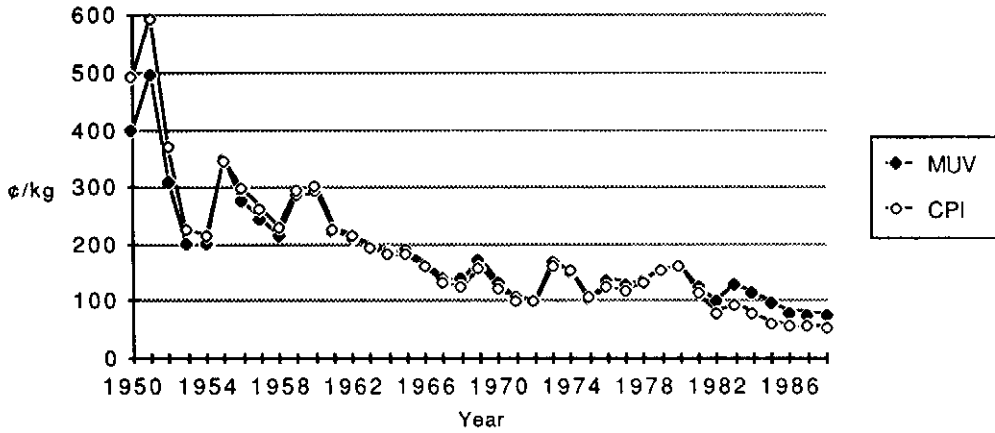
Cyclical movements in the real price of coffee can be closely correlated with Brazilian supply shocks. Coffee growing areas in Brazil are subject to periodic frosts and drought, and the resulting reductions in supply are rapidly reflected in higher prices. This phenomenon is most dramatically illustrated by the 1975 frost which reduced the Brazilian annual crop by 70 per cent, from 22.4 million bags in 1974 to 6.6 million bags in 1975. Prices rose to record levels in real terms. However, the rapid growth in production that resulted from the high prices caused prices to fall to below the pre-frost level within a few years. Prices stagnated in the 1980s, aside from a short-lived boom in 1985/86 resulting from a Brazilian drought. In the case of cocoa, world supply has historically been dependent on the cocoa producing areas of West Africa. Supply shocks resulting from drought have produced the strong cyclical patterns shown by cocoa prices. The prices of both coffee and cocoa fell to historical lows in the second half of the 1980s.

Cocoa and coffee also clearly demonstrate the effect of the two differing indices of import prices. Deflating prices with the Australian consumer price index tends to accentuate price declines. The reason being that Australian prices rose by less than the MUV index in the 1950s - producing higher real commodity prices - while Australian inflation was markedly higher than the MUV in the 1980s meaning lower real prices. As the deflated prices are higher at the beginning of the period and lower at the end, the overall decline is greater. Arguably, the Australian CPI provides a more realistic portrayal of the purchasing power of Papua New Guinea's primary commodity exports.

Figure 2

Real commodity prices 1950 - 1988 - deflated by
the manufacturing unit value index and the Australian
Consumer Price Index (1980 = 100)

Rubber: RSS No.1 in bales, spot, New York



Copra: Philippines/Indonesia, bulk cif NW Europe

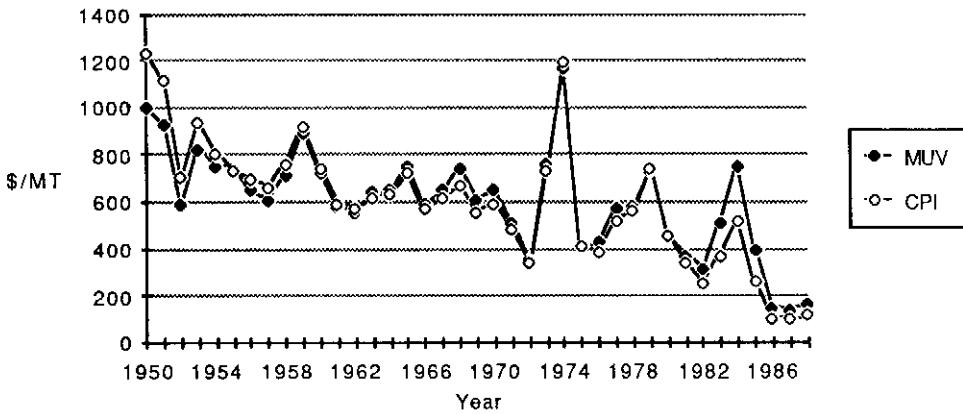
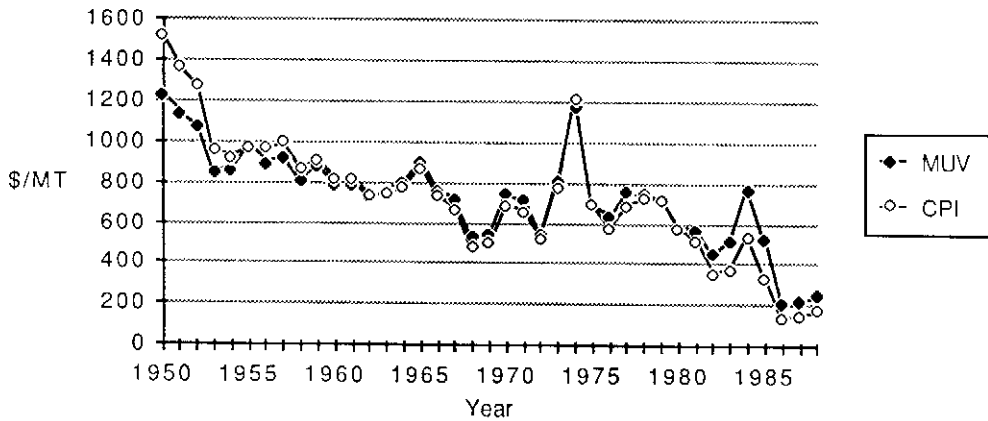


Figure 3

Real commodity prices 1950 - 1988 - deflated by the
manufacturing unit value index and the Australian
consumer price index (1980 = 100)

Palm Oil : Malaysian 5%, cif NW Europe



Palm Kernels: Nigerian, cif UK

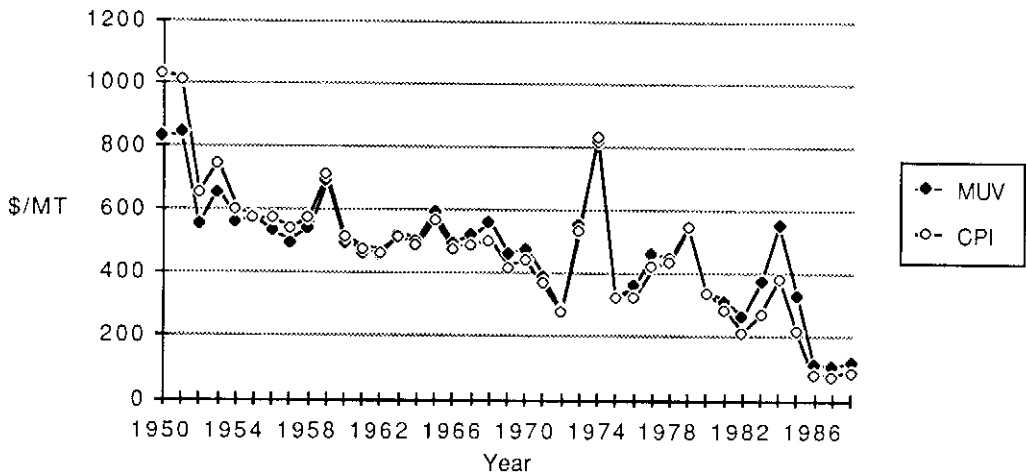
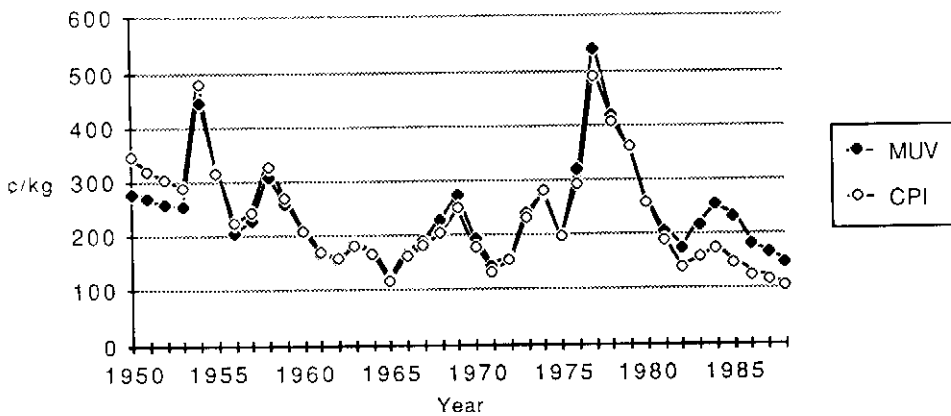


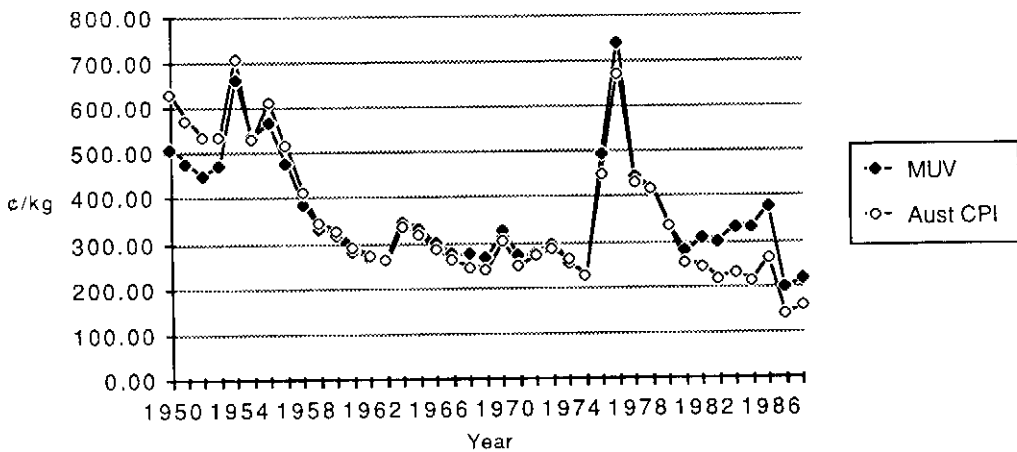
Figure 4

Real commodity prices 1950 - 1988 - deflated by the manufacturing unit value index and the Australian consumer price index (1980 = 100)

Cocoa: Annual Average ICCO Daily Price



Coffee: ICO Indicator Other Mild Arabicas



Trend lines have also been estimated for each of the commodities using ordinary least squares. The results are given in Table 2. Once again, all commodities show a declining trend in real prices. The effect of the Australian CPI is clearly demonstrated, as real prices show a steeper decline when deflated by the Australian CPI in all cases. Only one coefficient estimate is not significant at the 5 per cent level, that is cocoa deflated by the MUV index. Neither of the cocoa estimates show a high coefficient of determination, which would corroborate the indications from the graph that no clear trend exists. Coffee, when deflated by the MUV index also shows a low coefficient of determination. These results reflect the greater price instability shown by beverage crops.

Will the decline continue?

The analysis has shown a clear downward trend in the real prices of Papua New Guinea's export crops since the 1950s, with the possible exception of cocoa. In order to assess whether this trend will continue, commodity prices must be analysed within the wider context of the world market for primary products. On the demand side, the single most important determinant of demand for primary products is the level of economic activity in the industrial countries. The industrial economies provide the largest markets for both industrial raw materials such as rubber and vegetable oils, and for consumer commodities such as coffee and cocoa. The dependence on industrial markets is well illustrated by the example of Papua New Guinea which sent 83 per cent of its exports to industrial countries in the first three-quarters of 1988 (Bank of Papua New Guinea 1988).

Falling income elasticity of demand

An unfortunate aspect of the demand for primary commodities is that they tend to have low income elasticities of demand in comparison to the demand for manufactured goods and services. In other words, when income rises in the industrial countries there is a less than proportional expansion in the demand for commodities. Table 3 presents income elasticity estimates compiled from a variety of sources. The estimates are all less than unity and are generally closer to 0.5. Furthermore Killick (1988a) points out that the income elasticity of demand for primary products may actually be falling.

Changes in technology

The reasons for a falling income elasticity of demand include technological advances in industrial production techniques which permit more efficient use of primary commodity inputs. This process of "downsizing" has led to a substantial reduction in the volume of primary products used per unit of industrial production. A related issue is the well-documented development of synthetics. Man-made products may be used wholly or partly as a substitute for the primary commodities. Examples would be synthetic rubber and fibres. Another aspect of technological developments is that primary products can increasingly be used as substitutes for each other. For example, in vegetable oils, processing advances have rendered individual oil characteristics less important, making price the key determinant of which oils are used in production. Also non-cocoa fats and non-chocolate "fillers" have also been used in confectionery production, while grains can be substituted for oil meals in animal feeds.

Table 2
Ordinary least squares estimates of constant price trends
for individual commodities

Coffee				
MUV Y =	451.324 - (12.72)	4.466 (t - 1950) (-2.780)	R ² = 0.173 SEE = 112.92	
CPI Y =	516.408 - (14.290)	8.377 (t - 1950) (-5.1990)	R ² = 0.415 SEE = 115.01	
Cocoa				
MUV Y =	254.456 - (9.191)	0.670 (t - 1950)* (-0.535)	R ² = 0.008 SEE = 88.11	
CPI Y =	292.966 - (10.302)	3.113 (t - 1950) (-2.418)	R ² = 0.136 SEE = 90.50	
Rubber				
MUV Y =	312.163 - (18.877)	6.698 (t - 1950) (-8.945)	R ² = 0.684 SEE = 52.63	
CPI Y =	349.711 - (16.890)	8.593 (t - 1950) (-9.165)	R ² = 0.694 SEE = 65.90	
Palm oil				
MUV Y =	1035.283 - (21.762)	15.823 (t - 1950) (-7.345)	R ² = 0.593 SEE = 151.41	
CPI Y =	1156.751 - (21.434)	22.535 (t - 1950) (-9.221)	R ² = 0.697 SEE = 171.76	
Palm kernels				
MUV Y =	684.058 - (17.917)	10.809 (t - 1950) (-6.252)	R ² = 0.514 SEE = 121.51	
CPI Y =	762.464 - (18.686)	15.153 (t - 1950) (-8.201)	R ² = 0.645 SEE = 129.86	
Copra				
MUV Y =	842.694 - (15.567)	12.382 (t - 1950) (-5.051)	R ² = 0.408 SEE = 172.29	
CPI Y =	937.013 - (16.923)	17.719 (t - 1950) (-7.067)	R ² = 0.574 SEE = 176.229	

Notes: Current prices have been deflated by both the MUV Index and the Australian CPI index.

The figures in parentheses below the coefficient estimates are 't' statistics, R² is the Coefficient of Determination and SEE is the Standard Error of Estimate.

* Not significantly different from zero at the 5 per cent level.

Table 3
Aggregate estimates of commodity demand elasticities

Commodity group	Survey of commodity studies	Bond	IBRD	IMF
Income elasticity of demand				
Food	0.50			
Beverages	0.35			
Agricultural raw materials	0.80			
Cocoa	0.40		0.55	0.30
Coffee	0.50		0.51	0.45
Price elasticity of demand				
Food	-0.42	-0.22		
Beverages	-0.45	-0.33		
Agricultural raw materials	-0.44	-0.52		
Cocoa (short run)			-0.20	-0.20
(long run)	-0.40	-0.24	-0.30	
Coffee (short run)				-0.19
(long run)	-0.60		-0.23	-0.23
Rubber	-0.80			
Fats and oils	-0.50			

Notes: Survey of commodity studies contained in Bond (1987).

Sources: Bond (1987), World Bank (1988), IMF (1988).

Changes in tastes

Beverages such as coffee are less likely to be affected by technological change as processing is more limited in scope and there are no widely accepted synthetic coffee alternatives. However, over the last two decades, the demand for coffee has been strongly affected by changes in consumer tastes. These effects are particularly evident in the United States where links between caffeine consumption and cancer, fibrocystic breast disease and heart attacks have led to a decrease in the popularity of coffee. A number of consumer studies conducted by the International Coffee Organisation have shown per capita coffee consumption falling for the last twenty-six years in the United States. Average per capita consumption was 3.12 cups per day in 1962. The number fell to below two in the 1980s and was 1.67 in 1988 (Bodman 1988, p.3). It appears that soft drinks are gaining in popularity at the expense of coffee, particularly amongst young people. The percentage of people drinking soft drinks exceeded the percentage drinking coffee for the first time in 1984. However, it is worth noting that soft drinks receive considerably more advertising than coffee. Despite these trends in the USA, global consumption is still

World consumption rose by 0.7 per cent per year between 1971 and 1985 (Economist 1987, p.45), because falling demand in the United States continues to be offset by growth in the European and Japanese markets.

Low price elasticity of demand

One might expect that if the prices of primary products are falling, this in itself may stimulate demand. However, a number of studies demonstrate that primary commodities exhibit low price elasticities of demand. In other words a fall in price will produce a less than proportional increase in demand for the product. Table 3 shows a number of price elasticity estimates. They are all less than one in absolute size, with some estimates as low as -0.2.

Another factor which has affected demand for commodities has been the high levels of protection enjoyed by agricultural producers in the industrial countries. At the beginning of the 1980s, agricultural producer prices were 2.44 times higher than world prices in Japan, 1.54 times higher in the European Community and 1.16 times higher in the USA. This has implications for those commodities which are produced in both industrial and developing countries, such as grains, oilseeds and sugar. From Papua New Guinea's point of view it is likely to affect the prospects for oil palm and copra as Papua New Guinea exports will be in direct competition with the subsidised oil seed industries in the industrial countries.

Supply

On the supply side, a major part of the explanation for low and declining commodity prices has been the global tendency towards oversupply. One of the main reasons has been the strong pressures on developing countries to increase exports, and as we have seen, many developing countries are highly dependent on primary products for the generation of foreign exchange. Balance of payments problems and debt servicing obligations have been two particular pressures that have encouraged export production. Furthermore, a number of countries have undergone adjustment programmes devised by the World Bank and the IMF, in which devaluation and export promotion have been integral parts. Expanding primary product exports is not undesirable in itself as a means of increasing foreign exchange receipts. However, if a number of countries try to increase exports of the same crops at the same time, the end result is likely to be self-defeating as a price fall may offset the revenue gains from higher export volumes.

Low elasticity of supply

A feature of Papua New Guinea's agricultural exports is that they are all produced from tree crops which have a long gestation period between planting and the time that the crop can be harvested. In other words they have a low price elasticity of supply and response to price changes is likely to be slow. Thus if prices are rising, there will be a significant lag before there is an increase in supply to the market. Part of the reason for the large oversupply of many crops in the 1980s is the delayed response to the high prices of the mid and late 1970s. Table 4 shows a number of estimates of supply elasticities. All of the estimates are less than one with the exception of oil products, which is a special case as vegetable oils are derived from both perennial tree crops (e.g. oil palm and coconut) and annual crops (e.g. soybeans, sunflowers), which can be taken in and out of production relatively quickly.

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Commodity group	Survey of commodity studies		Bond	IMF	
	short run	long run		short run	long run
Food	0.43	0.80	0.70		
Beverages	0.27	0.46	0.66		
Agric. raw materials	0.33	0.51	0.43		
Cocoa	0.38	0.79		0.15	0.36
Coffee	0.37	0.53		0.06	0.30
Rubber	0.18	0.31			
Fats and oils	0.49	1.06			

Source: Bond (1987), IMF (1988).

It has also been observed that tree crops are subject to a "ratchet" effect in which production goes up much more easily than it comes down. This is especially the case when much of the crop is produced by smallholders, as it is with coffee and cocoa. The reason is that once a tree is planted and economically productive, smallholders will usually harvest something from it, even if the price is comparatively low. As a result supply will persist at low prices. In an extreme case, where producers are highly dependent on the cash income from their tree crops there may even be a perverse supply response, whereby more must be harvested at low prices in order to maintain a fixed level of income. The continuing supply of agricultural products at low prices is illustrated by Table 5 which shows the world commodity balance for Papua New Guinea's major export crops. It can be seen that world production of all crops has continued to climb during the 1980s even though real prices fell by almost 40 per cent over the same period.

Oversupply and commodity agreements

This persistence of oversupply has also presented problems for attempts to control prices through such means as international commodity agreements involving both producers and consumers. Commodity agreements have been tried for a number of crops. However, in almost all cases world production has tended to exceed the specified quotas, putting downward pressure on prices. At present both the cocoa and coffee agreements have been effectively destroyed by excess supply. In cocoa the buffer fund has been exhausted, thus a "floor" price can no longer be defended. In coffee, persistent sales of discounted coffee to countries outside the agreement have reduced consumer country interest in a new agreement.

Table 5
World commodity balance : 1981-87

Year	81/82	82/83	83/84	84/85	85/86	86/87	87/88
Major oil seeds (oil equivalent) millions of tonnes							
Production	45.1	47.3	45.2	51.5	54.4	54.0	56.6
Consumption	38.6	39.8	38.4	41.9	44.6	46.0	47.9
Closing stocks	6.7	6.9	6.1	8.0	9.9	9.9	9.4
Major oil seeds (meal equivalent) millions of tonnes							
Production	106.0	113.0	102.7	119.2	122.2	121.4	127.4
Consumption	88.1	91.4	84.8	94.7	96.9	101.6	105.7
Closing stocks	16.2	18.1	15.4	19.3	23.8	21.5	20.1
Coffee (in millions of 60 kg bags)							
Production	91.2	90.8	85.9	88.0	89.8	77.7	97.9
Consumption	84.6	86.5	84.9	85.8	85.0	85.5	86.6
Closing stocks	62.0	64.9	64.5	64.3	68.7	59.4	69.1
Cocoa (000's of tonnes)							
Production	1710	1510	1490	1940	1940	1960	2040
Consumption	1580	1630	1750	1850	1820	1870	1920
Closing stocks	790	670	460	550	670	760	880
Rubber (000's tonnes)							
Production	3700	3750	4030	4260	4330	4440	4470
Consumption	3700	3660	3990	4240	4350	4400	4500
Closing stocks	1630	1720	1760	1780	1760	1800	1790

Source: IMF (1988).

Biotechnology

The problem of oversupply is likely to be aggravated by developments in biotechnology. High-yielding varieties are already commonly used and have had the effect of increasing output per unit of land. High-yielding varieties also substantially reduce the unit cost of production and have resulted in large overall increases in supply. These trends are likely to be intensified by developments in tissue culture and genetic engineering where specific yield or disease-resistant characteristics can be more rapidly incorporated into new crop material (Henk 1987). From the point of view of developing countries, a disturbing feature of technical advances in this area is that they are highly concentrated in the industrial countries. Consequently, the benefits of the falling costs of production may accrue exclusively to industrial country producers. This will have implications for areas such as oil products where developing country and industrial country producers are in competition.

Conclusion

The combination of weak demand and continuing oversupply provide the main explanation for falling real commodity prices. It appears that these fundamental conditions are unlikely to change much in the medium-term future, which leads to the conclusion that real prices are likely to remain low or even fall further. It is likely that there will be supply disturbances, inducing cyclical patterns in price movements, but even the effects of these are likely to be minimised by the widening geographical spread of tree crop production. Moreover, the past cyclical patterns of oil products and rubber can be superimposed on a declining trend.

The projections for OECD economic growth contained in Table 6 do not provide much prospect of a demand-led price recovery. Projected growth in GDP and industrial production in the OECD economies is lower than in recent decades, and population growth rates have also been declining. However, there remains the possibility of demand growth in the new markets of Eastern Europe and the Asia-Pacific region. Nevertheless, the overall implications for Papua New Guinea commodity planners are that low real prices for primary commodities must be built into future production decisions.

Table 6
Trends in key demand variables :
annual percentage increase

Industrial countries	1965-73	1973-80	1980-87	Projected 1987-95
Real GDP	4.70	2.80	2.50	2.30
Industrial production	5.30	2.40	2.00	2.00
Population growth	1.00	0.70	0.60	0.50
Real interest rates	-1.20	1.30	5.60	2.60

Notes: Industrial countries = OECD excluding Greece, Portugal and Turkey.
Source: World Bank (1988), IMF (1988).

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POLICIES FOR FURTHER PROCESSING OF PAPUA NEW GUINEA'S AGRICULTURAL EXPORTS

**J. Hafmans, Acting Secretary,
Department of Trade & Industry**

My speech today will focus on the Department of Trade and Industry's approach to increased processing of agricultural exports. But, first, a little history to set the scene. Until the seventies, primary agricultural exports were seen as the only significant viable way to earn foreign exchange. This changed in the early seventies with the establishment of a major mining project and from that time on agriculture and mining were seen as the two main pillars of both economic activity and exports. However, in drawing up our constitution we see that our statesmen were even then starting to think about greater industrial activity both in agricultural processing and manufacturing, as will be seen from the following extract from the constitution's Eight Aims:

- ".....a more self-reliant economy, less dependent for its needs on imported goods and services and better able to meet the needs of the people through local production".

It took another eight years to develop a government policy paper on the industrial sector. This was the White Paper of 1984 which addressed goals and objectives and gave some guidelines. These also stressed the increased processing of agricultural goods.

While a useful first effort, the White Paper was, however, found to be rather short on specifics. We therefore commenced work recently on a revised version which we trust will better focus the Department of Trade and Industry and government efforts on sectors of particular interest such as agricultural processing. This will include an analysis of the strengths and weaknesses of significant sectors, the potential for growth and diversification and also applicable incentives.

The next step will be to prepare profiles of specific projects for promotion both here and in overseas countries which have the necessary skills, technology and marketing connections

to succeed. Where interested investors have been identified we will also assist with feasibility study preparation and in carrying the project through the approval process, particularly within government. (Given the continuing review of the National Investment and Development Authority (NIDA), I must note that there are still general bottlenecks in this area which will take special efforts from our department and other agencies to resolve.)

Another concern of mine is that there are various investment divisions throughout government all trying to address the same audience. This leads to much overlap and dissipation of resources. Surely it would be more effective to combine efforts within one strong investment body i.e. a one-stop shop, with the Department of Trade and Industry responsible for industrial and trade policies to properly coordinate government action in this area.

Concerning incentives I must note that as Secretary of the Department of Trade and Industry, I am currently chairing a government committee which is urgently reviewing the complete situation regarding business incentives. Although I cannot speak for the findings of the committee, I personally favour targeting incentives to specific sectors and I must say that agricultural processing would be one of the prime candidates for particular attention. Why do I feel this way?

For one reason agricultural products as well as fish and forest products remain major export items and, if properly managed, have the potential due to their renewable nature to continue to be so, long after our big mines are exhausted. The second factor is that benefits from agriculture typically go to a wider number of people than those from other forms of productive activity. Unfortunately, the third more sombre reason is that prices for agricultural products show signs of continuing their descent in real terms, as was demonstrated by the previous speaker.

We in Trade and Industry therefore feel that extra effort must be given to locate niche markets for by-products or for products more highly processed than at present, even though current operations are limited. (The only significant example I can think of is the use of coconut and palm oil in soap, besides, of course, the broad efforts to produce packaged foods for domestic consumption.)

To illustrate my positive feelings on the sector I will now give a brief assessment of a few promising areas we are trying to assist, including ways in which we feel constraints may be offset. These will also be included as part of our White Paper review to identify specific projects which are considered worthy of further examination and possible assistance in feasibility study preparation.

Coffee. We have seen positive response to our promotion of premium quality roasted arabica coffee as a specialty item in Japan, Australia and New Zealand and feel that forthcoming efforts in Europe will be similar. Availability is, unfortunately, currently limited to individual mail shipments of 10 kgs since all the International Coffee Organisation (ICO) quota is currently allocated to green coffee shipments. We would therefore like to see 10-20 per cent set aside for roasted coffee to allow more aggressive penetration into these and other markets, unless of course ICO can be convinced to permit an open quota.

- in the breeding rate, generally assumed to be around 45 per cent, a totally unacceptable figure;
- growth rate and finishing time - generally do not match those required in competition;
- inherent quality - even well-finished carcasses miss the quality of the imported product;
- pre-slaughter handling to avoid stress and bruises.

The first three points need more than just attention, they require investment and sacrifices; they are the basic reasons for the unfavourable cost-price equation that plague most cattlemen now.

In the present market climate an investor confronted with a decision to upgrade his cattle enterprise sees little reason to spend a lot on the improvements required - there is no incentive offered by the market. As a first step a simple beef quality grading system should be introduced with a price system that rewards quality and discourages low quality. Such a measure has been proposed for the Papuan region¹. This measure costs nothing and may actually make lower quality prices low enough to increase consumption of beef by the lower wage-earning category. At present there is at the grassroot level price resistance to consuming any beef at all.

The grading exercise can form the base on which a protection measure can be added successfully. Protection can take several forms and most are likely to be counterproductive. Producers cannot as yet provide top-quality beef generally and, on the other hand, are not willing or financially capable of producing for the manufacturing and canning industries. Increasing the import duty on selected categories, though possibly a justifiable measure to encourage improved local production, is cumbersome to administer and will lead to exploitation through loopholes. General duty increases will increase costs to the consumer on all levels and give the producers a false sense of comfort. Perhaps protection is better arranged by limiting importation to match a proven up-take of local beef. This may not be simple and would have to be supported by monthly tabulations on availability, off-take and price levels. Nevertheless, it should be possible in the current situation where so little of the total volume required can be supplied by local producers.

A further protective measure could be the instituting of an officially posted floor price for the top grades based on the cost of imported beef with a theoretical import duty of 35 per cent rather than the actual current 8-1/2 per cent. This would leave the actual import cost price unaffected and would have, for the time that it takes the producers to improve their herds to cater for the top grade, relatively little effect on the price level in the supermarkets, except on the most prized cuts. To be an incentive rather than a plain protective measure, the posted price differential on imported cost price should be reduced by 3 per cent every year, until in nine year's time the equalisation with the current import cost price would be reached and this protective measure automatically phased out. In this package the lower categories of beef would only enjoy protection in the form of an assured

¹. Since the production of this paper in March a proposed grading system has been accepted for introduction on 1 June 1989 in Port Moresby. After some experience has been gained it will be implemented in the Lae abattoir.

volume up-take. For this category a minimum price level could still be posted to prevent exploitation of defenceless grassroot producers.

Supportive measures besides protection

Given that some measures of protection and encouragement are introduced the cattle producers can sort out their problems, hopefully by enjoying some increased support from government extension services. In this connection, it would be beneficial if cattle producers, now already largely organised in producers' associations could upgrade their associations from "talking and moaning" clubs to active working organisations where topics for improvements are discussed and experts can be attracted on an ad hoc basis to look into specific problems. It would also be valuable to see where smallholders can be involved in the beef production programme. Feedlotting is not only for large enterprises; small farmers could do the same on a programme of stallfeeding steers in areas where there is a dry season free-ranging problem, but where farm roughage and industrial offal is available. Perhaps breeding enterprises could start a contract fattening system.

All improvements on the farm have to be matched by increased efficiency in the abattoirs otherwise much of the good effort will be undone. After the recent gradual decline of the general abattoir services to the point where it became little more than an artisanal slaughter operation, there has been a very definite improvement. This is very much appreciated by the producers, wholesalers and retailers alike. Nevertheless, much needs to be done to keep meat in the production line on a par with imported beef. Apart from the slaughter operation careful routines must be constantly observed to prevent bacterial contamination on all levels, coupled with the most productive way of hanging and chilling. Consideration should be given to introducing a delivery service. All these factors affect shelf-life and this is currently where locally-produced beef loses against imported beef. These factors cannot be influenced by the producers themselves. They are the responsibility of the authority administering the abattoirs. It cannot be stressed enough that if, as is the case, a government agency is responsible for the abattoirs, the service must be run professionally and efficiently.

Conclusion

The production of beef in Papua New Guinea has often been conducted without considering the actual requirements of the market. There has been little effort by producers and retailers alike to improve the rate of consumption in the local market. Producers felt protected and had no problems selling their cattle whether they were of fair or poor quality. The overall result has been that the market is still grossly under-developed. The fresh beef retail sales are in the top and lower segments only. There is hardly a market for the middle cuts. This can be explained by the general make-up of the population which is divided into the affluent sector and the low income or subsistence sector. One sector can afford the best, the other only the lower quality. The middle sector needs to be developed. This means that appropriate cooking technology needs to be passed on to the targeted consumer group. In the lower bracket of quality there is competition with cheap lamb and poultry. Low quality beef needs a longer preparation time than poultry unless it is minced or otherwise treated. This is a limitation on beef's acceptability. Very little has been done, though, to promote an acceptable quality of beef in rural areas where there must be considerable potential. One can easily see packs of lamb flaps in rural trade stores but hardly ever any minced beef or chuck steak. Yet this is where a slight shift can bring a tremendous increase of volume in the run-of-the-mill quality produced by Papua New Guinea's herds. An increase of one kilogram of beef per head of population per year would generate an extra need for some 20,000 carcasses per year. Such a volume could not possibly be supplied at present by Papua New Guinea's herd but it does indicate the growth potential of the beef industry. This points to the

increased urgency for recognising the need to consider the local production of beef as a worthwhile and desirable import substitution industry meriting government's official support.

Grading system adopted for carcass production - beef.

Type of unit		Weight range	Grade awarded
Steers	2 teeth	200/240 kg	A 1
Steers	4 teeth	220/240 kg	A 2
Steers	4 teeth	241/300+ kg	A 3
Steers	4 teeth	190/219 kg	B
Steers	6 teeth	230/320 kg	B
Steers	8 teeth	300 and over	B
Steers	6 teeth	200/229 kg	C
Steers	8 teeth	240/299 kg	C
Heifers		As for steers	
Cows	FM good	230/270+ kg	D
Steers	Culls good	160/189 kg	E
Cows	FM fair	200/229 kg	F
Bulls	FM good	260/360 kg	H
Cows & Bulls	Crackers	160/259 kg	Z

The grading to be conducted by Livestock Development Corporation abattoir staff, carcasses to be tagged.

THE CONTRIBUTION OF THE POULTRY INDUSTRY TO ECONOMIC DEVELOPMENT IN PAPUA NEW GUINEA

**B. Vernon, General Manager
Niugini Table Birds Pty. Ltd.**

Summary

The activities of the industry through forward, backward and employment linkages as well as its investment in improving the quality of human skills, all contribute significantly to meeting many of the government development objectives. While these contributions are impossible to quantify in financial terms there is no doubt that they have ensured that an increased proportion of the national income of the country is accruing to Papua New Guineans. The provision of extension services has ensured that the economic benefits of the company's broiler activities have gone significantly to smallholders. Those same smallholders have benefited in spite of economic pressures to expand the size of the individual contract growers - and the development objective of small-scale economic activity is met. While it has not come without costs, the country is now self-sufficient in poultry production and the industry's profitability has meant an increase in government revenues to meet other expenditure objectives. Finally, the fact that it employs women in the hatchery and in the processing plant, without dislocating them from their village environment, has meant that the development objective with respect to the teaching of rural skills and the participation of women also has been assisted. In all these respects the change in the industry to efficient, profitable, modern operations has contributed significantly to meeting the economic development objectives of Papua New Guinea.

.....

In both industrial and developing countries the poultry industry is characterised by increasing per capita consumption of chicken meat, not only in absolute terms but also relative to red meat consumption. This is clear from the data in Table 1. Per capita chicken consumption has almost doubled in both groups of countries since the early 1960s, and chicken's share of all meat consumed has risen. For Australia, the increasing importance of chicken has been even more dramatic, with a four-fold increase in per capita consumption and a three-fold increase in chicken's share of all meat consumed.

Papua New Guinea's meat consumption in total is currently very similar to the average for all developing countries, at around 14 kg per person per year. So was its chicken consumption in the mid-1980s, at a little under 3 kg per head. The estimate of 4.4 kgs per head of chicken meat consumption in Papua New Guinea for 1980-81 is probably an overestimate given the uncertainty surrounding the actual level of imports, particularly in 1980 and 1981. This was caused by misleading information supplied by importers.

The potential for expanding the consumption of broilers in Papua New Guinea is very substantial. Factors which will affect the rate of that expansion, apart from population growth, are per capita income growth, changes in the price of chicken relative to other meats, increasing urbanisation and any changes in taste towards less-fatty meats.

The importance of per capita cash income and urbanisation is clear from estimates of chicken consumption by region. While official data on consumption by region are not

Table 1
Per capita consumption of meat in Papua New Guinea
and other countries 1961 to 1985, (kg per capita)

	Beef & veal	Sheep meat	Pig meat	Poultry meat	Total	Poultry's share of total per cent
World						
1961-64	10.0	2.1	9.8	3.6	25.5	14
1965-69	10.5	2.0	9.9	3.7	26.1	14
1970-74	10.3	1.8	10.4	4.3	26.8	16
1975-79	10.9	1.7	10.6	5.1	28.3	18
1980-83	10.0	1.8	11.7	6.1	29.6	21
All industrial countries						
1961-64	15.6	1.7	10.1	7.5	34.9	20
1965-69	17.8	1.7	10.2	7.6	37.3	20
1970-74	18.7	1.6	11.6	8.7	40.6	21
1975-79	20.9	1.2	11.2	10.0	43.3	23
1980-83	18.6	1.2	13.0	11.9	44.7	27
All developing countries						
1961-64	4.8	1.4	4.8	1.6	12.6	13
1965-69	4.5	1.3	4.4	1.5	11.7	13
1970-74	3.9	1.2	4.1	1.5	10.7	14
1975-79	4.2	1.2	4.4	2.1	11.9	18
1980-83	4.1	1.3	5.5	2.8	13.7	20
Australia						
1961-64	57.6	48.3	10.7	4.9	121.5	4
1965-69	56.1	45.0	12.0	7.4	120.5	6
1970-74	57.5	44.7	14.6	11.7	128.5	9
1975-79	91.5	29.8	13.1	15.6	150.0	10
1980-83	70.4	30.7	15.2	19.6	135.9	14
Indonesia						
1961-64	1.7	0.4	0.6	0.4	3.1	13
1965-69	1.4	0.3	0.4	0.6	2.7	22
1970-74	1.3	0.4	0.6	0.8	3.1	26
1975-79	1.2	0.4	0.6	0.9	3.1	29
1980-83	1.1	0.4	0.6	1.3	3.4	38
Papua New Guinea						
1971-74	3.6	0.8	0.3	1.1	8.9a	13
1975-79	4.9	0.6	0.2	2.7	13.6a	20
1980-81	4.5	1.6	0.3	4.4	14.6a	30
1982-85	3.9	2.8	0.4	2.7	13.5a	20

Note: a includes imported offal and processed meats.

Source: International Economic Data Bank. Research School of Pacific Studies, ANU, Canberra and internal records of Niugini Table Birds Pty. Ltd.

available, Niugini Table Birds Pty. Ltd. have made their own estimates, reported in Table 2. The results indicate the influence of urbanisation and the associated high levels of income on per capita consumption. The Central region, which is dominated by sales in the national capital, has a per capita consumption level four times the "Other Islands". North Solomons, under the influence of the Bougainville Copper project, has even higher per capita consumption than Port Moresby. Clearly there is scope for increased consumption of poultry in the "Other Islands", although the per capita figure has remained virtually static since 1982.

Table 2
Per capita consumption of chicken in Papua New Guinea
(kg per person)

Year	Central Gulf Northern	Morobe Highlands	Madang Sepik	North Solomons	Other Islands	National average
1982	5.1	2.1	1.9	9.0	1.4	2.8
1983	5.0	2.1	1.9	6.7	1.1	2.6
1984	4.8	1.8	1.9	6.6	1.1	2.4
1985	5.2	1.8	2.1	7.1	1.0	2.5
1986	5.1	2.1	2.8	7.0	1.4	2.6

Source: Internal records of Niugini Table Birds Pty. Ltd.

The importance of income in the demand for chicken is clear also from data on monthly purchases. Much of the cash income in Papua New Guinea comes from export sales, and export earnings fluctuate because of gyrations in export prices internationally, in foreign exchange rates and in quantities exported. The distribution of annual chicken sales in the Highlands and on Bougainville reflects the fluctuations in earnings due to the seasonality of export crop yields. Sales are clearly well above average in June-July-August in the Highlands, when the coffee flush occurs.

Chicken prices

Under price control the maximum retail price of chicken in Port Moresby and Lae has not increased since October 1983. According to the Australian Bureau of Agricultural Economics Quarterly Review December 1988 and May 1986 the average retail price of frozen chicken in Australia in Australian dollars increased by 14 per cent from 1983 to 1988.

As shown in Table 3 the real price of chicken in Papua New Guinea expressed in 1977 kina values has fallen steadily and so in terms of consumer purchasing power the real price of chicken has fallen substantially.

Table 3
Chicken prices in Papua New Guinea

Year	Kina per kg POM/Lae retail prices	C.P.I.	Kina per kg real poultry prices
1977	2.36	102.8	2.30
1978	2.36	109.0	2.17
1979	2.43	117.6	2.07
1980	2.49	131.4	1.89
1981	2.67	138.7	1.93
1982	2.86	148.3	1.93
1983	3.13	160.9	1.95
1984	3.13	167.9	1.86
1985	3.13	175.2	1.79
1986	3.13	184.5	1.69
1987	3.13	190.1	1.65
1988	3.13	196.0	1.60

Notes: 1. C.P.I. from Bank of Papua New Guinea
2. Real prices to January 1977 base.

Government policy

Eight aims were articulated by the Papua New Guinea Government in 1973. These were:

- . an increased proportion of national income to Papua New Guineans;
- . greater equity in the distribution of economic benefits and the provision of services in different areas of the country;
- . decentralisation of economic activity to local area bodies;
- . an emphasis on small-scale economic activity;
- . greater self-reliance, less dependence on imports;
- . increased locally-raised revenue to meet government expenditure;
- . a rapid increase in the "equal and active" participation of women in all forms of economic and social activities;
- . government intervention and control where necessary to achieve these development goals.

The National Development Strategy of 1976 outlined the approach to be adopted in line with these national objectives. The strategy called for an emphasis on rural development aimed at increasing domestic food production, the production of export crops, the provision of infrastructure (transport, trading and other services), as well as on small-scale manufacturing.

However, the National Food and Nutrition Policy (1978) represented something of a departure from the previous emphasis on increased production and improved nutrition from the subsistence sector. The problems of feeding urban people, who had developed

dietary habits which were different from those of villagers, resulted in encouragement being given to the production of commodities - and the use of production techniques - more suited for marketed production.

With the growing population in Papua New Guinea, the draft Medium Term Development Strategy (1984) gave prominence to "the creation of productive employment opportunities". Such opportunities "could be created by increasing the productivity of village people where they live, either by increasing the efficiency of subsistence production or expanding cash crop earning opportunities". With respect to smallholder agriculture the perceived difficulties in achieving the stated objectives of development policy were lack of support services and the loss of contact with village farmers together with poor access to credit and to markets.

The Papua New Guinean labour force is estimated at 1.5 million, with 85 per cent of the population living in rural areas and engaged mainly in mixed subsistence/cash crop activities. The labour force is estimated to be growing at 40,000 per year. The attraction of urban living, assisted by the rural-urban wage differential, has produced social problems in some of the larger cities. This combination of forces should result in high priority being attached to providing employment opportunities in the village situation.

Development

In general, any sector of the economy makes a contribution to economic development of the country when it provides opportunities for other sectors to emerge and to develop, or for the economy as a whole to participate in international trade. This market contribution to development involves a number of activities, including:

- . purchasing inputs from other sectors, either in the domestic economy or from overseas; and
- . selling a product in either domestic or overseas markets.

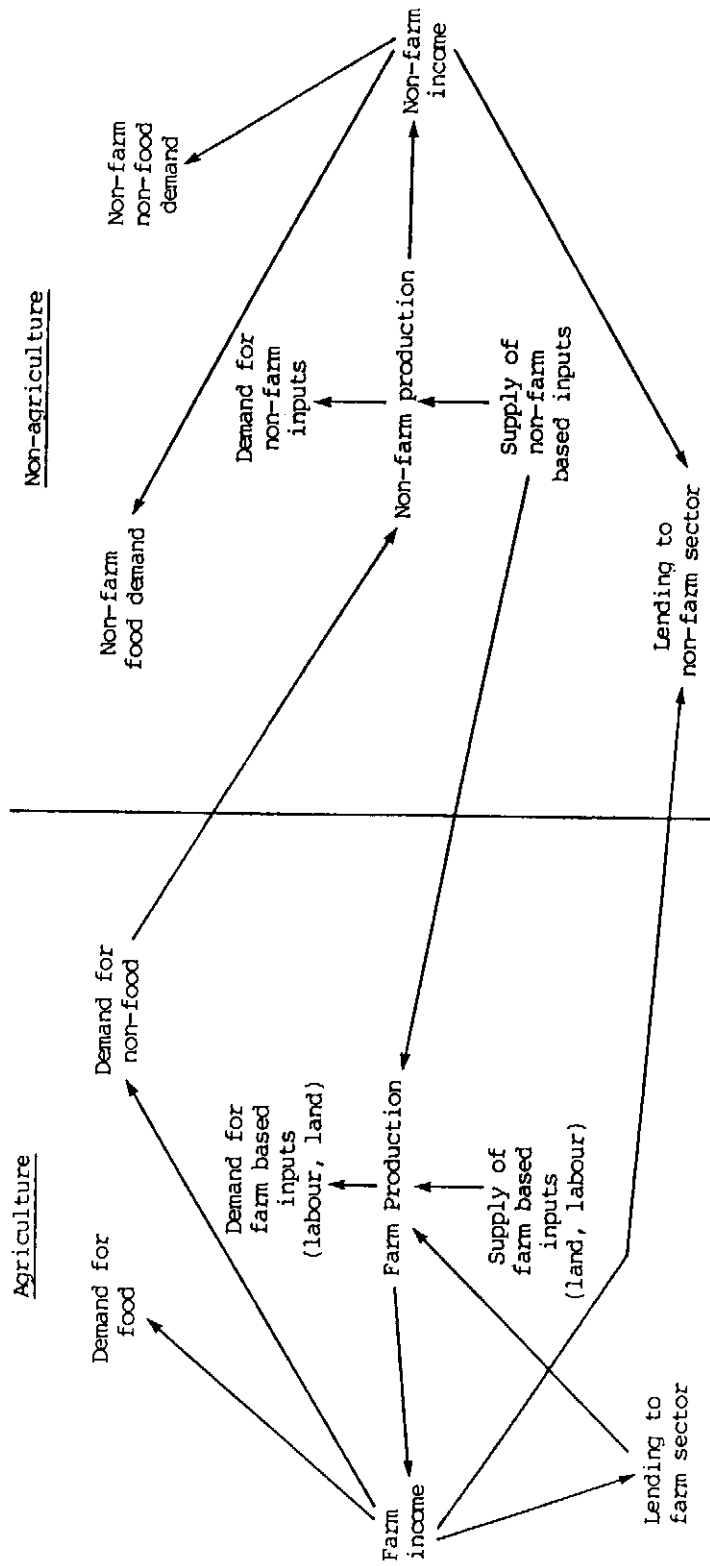
These linkages between sectors in the economy can be represented diagrammatically as in Figure 1. This figure portrays the interdependence between the farm and non-farm sectors. The essential functions of each of the sectors can be represented as a supplier of goods and services, both within the sector and to other sectors, or a demander of goods and services both from within the sector and from other sectors. Farm sector economic activities can be classified as:

- . a supplier of food and fibre;
- . a supplier of raw materials;
- . a supplier of investment funds for other economic sectors;
- . a supplier of labour;
- . a source of demand for commodities produced in the non-farm sector;
- . a source of demand for raw materials produced in the non-farm sector;
- . a source of demand for investment funds from the non-farm sector'
- . a source of demand for labour which is resident in the non-farm sector.

These linkages between the separate sectors of an economy measure the degree of sectoral interdependence. Such linkages have been regarded as important determinants of the rate of economic growth. The linkages are important in as much as the growth in one sector will induce, or will be induced by, expansion in other sectors. The linkages may be

Figure 1

Major linkages between farm and non-farm sectors of the economy



identified as forward, backward and employment linkages. A forward linkage relates to how output from one sector is distributed over other sectors, and the utilisation of that output will generate a derived supply of inputs from other sectors of the economy. Backward linkages relate to the direct use of inputs from other sectors in producing the output of the given sector. Employment linkages relate to the effect of growth in any sector on the levels of employment in that sector and in the others as well.

Subsistence agriculture, where by definition production is equal to farm consumption and where traditional factors of production are used, has very low linkage effects.

Since there is no marketable surplus generated forward linkages do not develop. Since the factors of production are typically generated within the village itself there are relatively few, if any, backward linkages to other sectors. Within the village the technology used may well be labour-intensive but given the nature of subsistence production there will be relatively little employment of labour from other sectors of the economy.

As cash cropping is introduced alongside subsistence agriculture a marketable surplus arises and forward linkages to the rest of the economy develop. As purchased inputs also tend to characterise cash cropping there are backward linkages as well. Since there is now a marketable surplus then services relating to the storage, handling and distribution of that surplus will generate employment linkages with the rest of the economy.

In the context of these linkages it is now possible to discuss the specific contribution that the broiler industry makes to Papua New Guinea's economic development. The poultry industry's output of eggs and frozen chicken is distributed to other wholesalers and to retailers. They will demand inputs from other sectors as the wholesaling-retailing function is carried out. These inputs will consist of demand for transport, storage (including freezing capacity) and fuel. As well there will be a derived demand for employment in the distribution of frozen chicken and eggs. These forward linkages, while they may be important, are not as significant in their contribution to economic growth as the backward linkages and the direct employment linkages. The industry is integrated backwards to a much greater extent than it has integrated forward. These backward linkages are significant in contributing to economic growth in Papua New Guinea.

The consensus amongst development economists is that these backward linkages, including their consequential indirect effects, are of particular significance in development because of their proven effectiveness in increasing the demand for inputs from other sectors. The employment linkages are particularly important in Papua New Guinea where one of the development objectives is improving the standard of living of the rural community and providing productive employment opportunities in the rural sector. Apart from the output of eggs and frozen chicken, the main producers also distribute day-old chicks to village growers who are not contracted smallholders. Feed is also supplied to such villagers. Both these activities contribute to the linkages mentioned above. The output of the industry makes demands on a wide variety of inputs from other sectors of the economy. In producing that output there is a requirement for transport of sawdust and feed delivered to the company or subsequently to the growers. As a by-product processing chickens produces offal which is becoming an essential feed for the expanding crocodile farming industry, with its linkages to rural employment.

Initially smallholder sheds tended to be constructed out of bush materials. The trend is now towards purchased inputs from the building and construction sector as shed sizes, even for smallholders, are becoming larger and more permanent materials involving cement, corrugated iron and timber replace bush materials. Since the industry also provides housing for some staff, these linkages with the building and construction sector are strengthened. Feed constitutes one of the largest single components of all the inputs used by Niugini Table Birds and the construction of its own feed mill has also had consequential effects on the building and construction and transport sectors as well as on those sectors providing raw materials to supply the feed mill itself. The existence of the feed mill creates the opportunity to develop a grain-growing industry in Papua New Guinea.

The Agriculture Bank of Papua New Guinea has played a significant role in the provision of credit to develop the broiler industry in Papua New Guinea and Niugini Table Birds has provided the management of such loans without fee. The operations are now profitable and the flow of profits to the Agriculture Bank facilitates further lending by the Bank. As well the smallholder growers are introduced to the need for management skills, particularly financial management skills, in an agriculture which is commercialised. In that same context, Niugini Table Birds's unique extension service has provided a significant educational input into the on-farm education of smallholders in both animal husbandry practices, as well as into the development of a more broadly-based educational capacity to manage their own affairs.

The employment linkages generated by the operations are both direct and indirect. In terms of direct benefits the companies employ substantial numbers of people (see Table 4). In addition to these direct employment linkages, several companies provide a source of income for over 250 Papua New Guinea contract poultry farmers and other subcontractors. At the same time, the distribution of profits of Niugini Table Birds means that approximately 40,000 Morobe citizen shareholders derive income from the operations of Niugini Table Birds, through the parent company Mainland Holdings.

Given the specific development objective that there be "equal and active" participation by women in the economic development of Papua New Guinea it is important to point out that the majority of the staff employed in hatcheries and in the processing plants are women from nearby rural villages. This provides a wage-related employment opportunity which does not dislocate the women from their village base.

While the linkages mentioned above are important determinants of economic growth, they are not an exhaustive set. Apart from the possession of natural resources which can be exploited, one other significant factor in economic development has been the growth of skills in the labour force. This investment in human capital, as it has been called by some development economists, can be a significant contributor to economic growth. As the local population becomes increasingly skilled, more of the income that is generated in the country will accrue to Papua New Guineans. While Papua New Guinea has a formal educational structure which is aimed at improving the skills level in the population, the industry has actively pursued a training programme which has meant that skills level of both its own employees as well as that of the contract growers has materially increased. Many of the skills taught have wider use in the village situation.

Apart from the linkages and the direct investment in improving the quality of the national labour force in Papua New Guinea the industry also performs a number of other activities

which are difficult to classify but nevertheless make a significant contribution to the economic development of Papua New Guinea. In particular, the relative freedom of the Papua New Guinea poultry industry from exotic diseases is, in no small part, due to the exercise of control over imported chickens through the management of the government's quarantine station, the National Poultry Hatchery. The same control ensures the distribution of disease-free birds to villagers and smallholders in Papua New Guinea. Similarly support of charities, clubs, youth groups and sports teams all assist in an improvement in the quality of life of many citizens, even though the direct benefits of such activities may be difficult to quantify.

Table 5
Poultry industry employment levels

A. Direct employees

	Fulltime	Casual	Sub-contractors and smallholders	Total
Niugini Table Birds	450	20	170	640
Ilimo	330	50	20	400
MRP	35	4	63	102
Gouna	70	-	-	70
Zenag	180	-	-	180
Rhado	12	-	-	12
CLTC	30	-	-	30
N. Solomons Agri.	20	-	-	20
Salvation Army	10	-	-	10
Madang Enterprises	12	-	-	12
Total	1149	74	253	1476

B. Independent operators

Estimate of small business and smallholder operators in town and rural areas purchasing day-old meat chickens for sale in markets (live) or day-old layer for egg production.

North Solomons	250
CLTC	100
Ilimo	30
Gouna	10
Zenag	100
Niugini Table Birds	200
Others	50
Total	740

C. Industry total

Allowing for employees in business substantially dependent on the poultry industry the total is estimated at 2500.

Source: Poultry Industry Association (March 1989).

FINANCING FOR NEW AGRICULTURAL DEVELOPMENTS AND EXTENSION

**R. Hoyle, Representative
Commonwealth Development Corporation**

Firstly, I thought some very brief background information on the Commonwealth Development Corporation (CDC) would be appropriate. Despite the name Commonwealth Development Corporation, we are not a multi-national corporation. We are a British statutory body, which started business in 1948, funded principally by the British Government and from our own self-generated funds. Our stated purpose is to assist in the development of the economies of developing countries and the British Government imposes on us a duty to secure that revenues are not less than sufficient to meet revenue outgoings, taking one year with another. Investment is restricted to areas of basic development, for the main part, and includes renewable natural resource projects - agriculture, aquaculture, ranching, forestry; also utilities (power, water, communications, transport), industry, mining, housing, development finance, mortgage finance and the like.

In Papua New Guinea, which is a natural tree-crop country, we have focused on nucleus estate-plantations development, principally in two main tree crops - oil palm and cocoa, and also in sugar in the Ramu Valley. We were first invited by the Papua New Guinea Government in the mid 1970s to examine and develop the Higaturu project near Popondetta. This was followed by an investment in Ramu Sugar and in the 1980s we followed this with investments in the Milne Bay Estates, Poliamba estates in New Ireland and latterly New Guinea Plantations. Of these five investments, two are straightforward investments and loans and for three (Higaturu, Milne Bay and Poliamba) we provide management services as well as equity and long-term loans. Four of the five investments include also substantial government-funded smallholder sectors.

The State partners us in the three managed ventures, along with the provincial government in the case of Poliamba. State's participation stems from a policy in the 1970s of encouraging these large-scale nucleus estate developments, exemplified by the State initially taking 50 per cent equity stakes in the first three major oil palm projects in the country (New Britain Palm Oil, Hargi and Higaturu). This policy has been modified over time and effective state participation in Milne Bay Estates and Poliamba is 40 per cent.

This is a very brief background to CDC in Papua New Guinea and covers the essentials for this seminar.

There are a number of advantages in these nucleus-estate developments. They are major, cost-effective creators of employment. They provide processing facilities for smallholders and encourage village growing. They halt urban drift and provide an economic wealth-creating base from which the nearby towns (Alotau, Popondetta, Kavieng et al) can take advantage and so themselves develop. We cannot push this but the opportunities are created. The investments bring health, education, roads and other forms of benefits and support the macroeconomic policy of the country. Agricultural and management skills are imparted to national staff, extension services are expanded. Land, which often otherwise is not put to productive use, becomes highly productive.

The nucleus estates also have a catalytic role in stimulating research - essential to our continued competitiveness - and play any number of support service roles for the smallholder sector. There are many areas in Papua New Guinea where a new nucleus estate would provide the motivation for village developments and in CDC generally I am not happy at promoting any new ventures unless I can see openings for such complementary developments.

There are naturally downside aspects: tree-crop commodities are fairly limited in number principally tea, rubber, coffee, cocoa, oil palm, copra. Such commodities, these days, are part of a very competitive business, the competition coming from other producing countries. Efficient producers will however make a fair and adequate return on their investment and the overall benefits, I suspect, outweigh perceived disadvantages.

The total investment in the five projects in which CDC has invested is around K160 million providing employment for 9,000 persons which approximates to K18,000 investment per person employed - not an unreasonable price to pay, and, in the interests of job creation and macroeconomic benefits, an area of development that I suggest, warrants continued government support.

Generally developments of this type are dynamic by nature and once having achieved their original objectives, they will seek fresh opportunities and so expand. Extensions often form excellent and highly economic developments, attaching as they do to the physical and management infrastructure already in place for the first development.

For this seminar I was asked in particular to comment on future funding for new, similar developments and extensions.

Funding for these projects is needed in three broad forms:

1. State funds for infrastructure items
2. Long term loans - nucleus estate
 - smallholder sector
3. Equity capital - nucleus estate.

Regarding item (1), infrastructure, many of these projects are situated in relatively remote locations, where roading, schools, health services, wharf facilities, etc. - whilst perhaps in existence - are quite inadequate to service the needs of the proposed development and the concentration of people. The infrastructure needed is seen as a state obligation, readily accepted by the state. It is not within the province of these notes to comment on this aspect of funding, but suffice to say that if sufficient notice is given to the government of infrastructural needs related to a new project, then government will respond and feed the requirements into its planning system and will try to respond in time to meet the project's needs. Often, in these projects one can signal the requirements some two to three years ahead; such projects rarely get started in under a two-year lead time.

Regarding item (2) of the main types of funding needed, long-term loans are probably in adequate supply, although it needs to be stated that these are frequently in a mix of hard offshore currencies not necessarily matched by the currency earnings of the project, thus exposing the nucleus project to exchange variations. However, given that we have a viable project, then usually it is possible to procure the necessary long-term loan funding

needed from offshore. By long-term one is looking for funds of say twelve years' duration, often with a moratorium on actual debt repayments of between five and seven years after start-up of the project. In Papua New Guinea, traditional sources to date have been the World Bank, European Investment Bank and DEG (the German Development Bank). All three of these major international organisations have been prepared either to lend direct to the projects, or to the projects via government and all have been prepared to acknowledge the long-term nature of the project. Terms are generally concessional, (but not "soft") but, as noted above, carry a major exchange risk - all too often, in the case of these projects, materialising in significant realised exchange losses, on repayment of the debts. Similar funding is generally available to assist with the smallholder schemes, and it is not normally a major problem to fund the schemes.

An alternative for the nucleus project, although not normally available in sufficient amounts and not generally of adequate duration, would be to borrow offshore through commercial banks. Generally, however, we do not find this form of funding appropriate to the proposed project and it will remain a source of last resort unless loan duration can be improved and the debt repayment schedule acknowledges the hazards of tree-crop and other forms of nucleus estate-type agriculture and the long-term nature of these renewable resource projects.

Onshore, commercial bank long-term funding is presently virtually not available. Funds generally are tight in the commercial banking sector and the banks find it difficult to contemplate lendings of the magnitudes required to the nucleus estate sector. Other sources are potentially available via the various Funds in Port Moresby (some very large and some less so) and whilst some of these Funds have been very supportive in certain instances, regarding equity investments, as far as I know little has been done regarding long-term kina loans. The indications are, however, that at least one of the Funds would agree to consider long-term lending to nucleus estate agriculture.

Long-term loans themselves are not the only form of finance needed; equity capital is needed and this is the scarcest of all commodities. No development of this nature can be undertaken solely on borrowed funds. Some form of permanent capital is essential.

These projects are demanding in their needs for equity funding and, typically, in view of the long-term nature of their development, one seeks a debt:equity ratio of between 60:40 and 50:50. This is very important. Too-high-gearing can cripple these projects once loan repayments become due. Government has taken substantial stakes and so encouraged the creation of the developments which today exist. CDC in turn has matched or improved upon the government equity contribution and so ensured that an appropriate debt:equity structure can be achieved. Whilst CDC generally has been able and prepared to meet between half and 60 per cent of the equity requirement (as well as a substantial part of the long-term loan requirements) we have not been able to raise the balance other than from the state or from sources emanating from or sponsored by the state. In recent times attempts have been made to galvanise the private sector into putting equity into such developments and public floats have been made in order to try to promote new sources of equity and also broaden the shareholder base of the companies concerned. Neither effort has been wholly successful and at the present time it is very doubtful that funds of any magnitude could be raised in these ways. Investors perceive perhaps quicker returns from other forms of investment coupled to the fact that the low agricultural commodity prices currently obtaining necessarily lead to there being less funds available within the country.

The government's own policy of support in relation to CDC has in reality been consistent, although there is a desire to leave the investment side to the "private sector" or to other institutions. The foreign earnings and job creation elements of these projects are, I would suggest, essential to the country's continued progress and without continued government support, I can only see that it will be very much harder and sometimes not possible to promote these developments. Kina funds do exist in Papua New Guinea, sufficient to meet the needs of this form of project, but in view of the long-term nature of the development, the long lead time prior to profitability and dividend payouts is generally incompatible with the requirements of the major funds in Papua New Guinea and their financial obligations and policies.

Currently within my own office in Port Moresby I have five new proposals at various stages of promotion - and am probably looking at an investment upwards of K200 million over a four year period. The number of projects could probably be geared up to eight or nine. There are a number of constraints to doing this but the main one would be that of equity funding.

There is nothing sacrosanct about nucleus estate-type developments. They are hard work, demanding of high management skills and the rewards are long term. However, I would suggest that they will continue to have a role to play essentially as wealth creators and one of the most effective forms currently available of creating employment and in developing an increasingly effective smallholder sector.

FINANCING THE PUBLIC INVESTMENT PROGRAMME IN AGRICULTURE

G. Paru

**Principal Programmes Officer, Bilateral Programmes Branch
Department of Finance and Planning**

The Public Investment Programme (PIP) presents a full five year programme of investment activities. It is therefore possible for departments to concentrate on the implementation of an established set of projects rather than devising new projects each year. The PIP groups together small projects into large programmes. This simplifies project design and implementation, produces projects which are sufficiently significant in financial terms to attract major donors and makes the overall programmes much more comprehensible and manageable.

The PIP only includes projects which:

- . are once-off expenditures that have a finite lifetime even if they have recurrent cost implications;
- . yield permanent and productive assets, either physical or human.

Preparation of the PIP is done in close consultation with line departments and provinces who will be responsible for its implementation and focuses upon:

- the more precise definition of each project's rationale, objectives and components;
- the accurate estimation of technical assistance requirements; and
- the phasing of expenditures.

The size of the PIP programme is determined by the growth in the availability of both domestic and external resources as well as by the proportion of government expenditure that is allocated to investment. The government's investment strategy over the lifetime of the PIP aims to meet the following objectives:

- to increase the proportion of GDP which is allocated to investment and increase its impact on economic growth and rural employment, by promoting investment in the non-mining private sector;
- to increase government investment by use of aid finance and technical assistance and by resource transfers from non-essential recurrent activities only; and
- to concentrate public resources on improvement of health, education and law and order, the development of infrastructure and the promotion of smallholder-related activities, which the private sector cannot adequately undertake.

The present government has sought to achieve a more careful balance: between economic growth and social development, between private and public sector investment and between recurrent and investment activities. There is considerable scope for extending private sector activities into government areas such as agricultural extension or business development where there are wide opportunities for cost recovery on government services.

In a recent high-level consultation between Papua New Guinea and the Asian Development Bank (ADB), the bank has agreed at the request of Papua New Guinea to take a lead agency role in the development of the various sectors including agriculture and livestock, and fisheries and marine resources among others. It was agreed with the bank that the lead agency role in the various sectors will require provision of:

- assistance in sector policy development;
- support to institutional development;
- technical assistance and programme and project financing; and
- assistance in mobilising and coordinating additional funds (grant aid and concessional loan finance from multilateral and bilateral sources).

The ADB advised that Papua New Guinea is eligible for programme loans and agreed to assist in formulating a Programme Loan to be disbursed over 1989 and 1990 which would be aimed at the development of the agricultural sector including agro-processing, and would focus especially on private sector incentives and institutional development. Financing of new projects also depends on the satisfactory implementation of ongoing projects in the same sector.

To facilitate the theme of my address I would like to briefly outline basic procedures for submission of projects and programmes for inclusion under the PIP for possible funding.

Presentation of project proposals and programmes for consideration for possible inclusion in the PIP is done in close consultation between the Department of Finance and Planning and the proposing departments and agencies concerned. In the past there was very little central direction given to line departments over the project ideas which they should

develop. In 1988, the departments were provided with a much clearer statement of government priorities and this is reflected in the sectoral allocations in the PIP.

To assist determine realistic allocations for each proposal initiating departments are required to provide project cost estimates, cash flows and justifications as to why their proposal should be funded and justification for the level of funding required. This standard approach is applied across the board including the agriculture sector.

One major constraint which affects effectiveness of project implementation has been project planning and implementation capacity and the lack of technical expertise. The poor performance of the World Bank funded Agriculture Support Services project and the slow fund utilisation rate by the Agriculture Bank of Papua New Guinea have been

caused basically by the aforesaid reasons coupled with a host of other reasons.

The underlying principle of funding agriculture sector projects is to increase the proportion of GDP which is allocated to investment and increase its impact on economic growth and rural employment. Programmes and projects funded are specifically output oriented and designed to meet particular criteria such as increasing employment, improving lifestyle and standards, etc. etc. Project selection for PIP is based closely on both national and sectoral objectives. For departments to prepare initiatives compatible with the main thrust of the national government efforts provides a guarantee for long-term continuity.

Agriculture has been the backbone of the Papua New Guinea economy. Programmes and projects in this sector have been diverse. PIP serves as a vehicle for coordinating these varying projects and programmes with the view to achieving the common goals and targets set by the national government. Programmes and projects that get the nod for inclusion in the PIP are considered to have objectives and aims which support national objectives and aims. Projects and programmes outside this formula may create unnecessary strain on the already very tight departmental resources and energies.

TAX INCENTIVES - RELATIVE SECTIONS OF THE INCOME TAX ACT

**J. Lohberger
Commissioner of Internal Revenue**

In general, the income derived by a primary producer is assessed and taxable on a normal accounting basis. There are, however, a number of special provisions in the Income Tax Act dealing with primary production which are outlined below:

Section 4(1) - Definitions

Primary production - includes cultivation of plants, cultivation of animals or poultry and fishing operations;

Fishing operations - includes fishing for fish, turtles, oysters, etc. and pearling operations.

Pearling operations - includes culturing or taking of pearls, pearl shell, trochus, beche-de-mer and green snails;

Livestock - does not include beasts of burden or working beasts used in an industry other than primary production e.g. race horses, etc.

Sections 45I to 45M - Ten Year Rural Development Tax Holiday

A ten year tax holiday is allowed for agricultural enterprises set up in one of the 41 least developed districts of Papua New Guinea (referred to as rural development areas and listed in Regulation 6AA).

Sections 54 to 56 - Valuation of Livestock

An agricultural producer can opt to value his livestock either at cost or at market value. However, once he has exercised the option he must in future years consistently use the same basis of valuation.

For the purposes of establishing cost values for natural increases, the agricultural producer can use the tax values set out in Regulation 8, which are 40 toea for sheep, 50 toea for pigs and K2 for cattle and horses or he can opt to use his own cost basis, which may not be less than the above tax values.

The low cost figures allowed for natural increases under the tax act have the effect of delaying, for tax purposes, the tax assessment of income from natural increases until they are sold.

Section 57 - Disposal of Livestock because of Natural Disasters

Where livestock has to be disposed of because of the resumption of land by the government, the loss or destruction of pasture because of fire, flood or drought or expropriation of a lease for the eradication of cattle tick, the income from the sale of that livestock may, at the option of the producer, be taken into account for tax purposes over five years, at the rate of 1/5th each year.

Section 57A - Compensation for Death of Livestock

Where livestock dies or is destroyed by reason of a disease for which the law of Papua New Guinea provides compulsory destruction, the income from any compensation paid for that death or destruction may, at the option of the producer, be taken into account for tax purposes over five years, at the rate of 1/5th each year.

Primary producers are allowed to write off, in the year of acquisition, the capital costs of acquiring plant or articles used directly for agricultural production. This includes also fishing boats used in the fishing industry, but not exceeding 7 metres in length.

Pursuant to section 73(3) an accelerated depreciation deduction of 20 per cent in the year of acquisition is allowed for agricultural plant not qualifying under the preceding provision i.e. plant not used directly in agricultural production, such as buildings, office equipment, etc.

Section 97 - Deductions

Primary producers are allowed an outright deduction against income of a variety of capital expenditures as follows:

- (a) eradicating animal or vegetable pests;
- (b) destructing or removing timber, scrub or undergrowth;

- (c) destruction of weeds or other detrimental plants;
- (d) preparation of land for agriculture;
- (e) ploughing and grassing land for grazing;
- (f) draining of swamp or low-lying land;
- (g) prevention of soil erosion;
- (h) construction of dams, earth tanks, irrigation, bores, etc.;
- (i) construction of levee banks for the same purpose;
- (j) construction of roads, bridges, culverts, etc.;
- (k) planting of the land with trees, including purchase of seedlings, etc.;
- (l) construction of fences to prevent entry of animal pests;
- (m) construction of labour quarters, other than managers' residences.

Section 97A - Transfer of deduction for Primary Production Development Expenditure to Shareholders of Companies

A primary production company which has incurred primary production development expenses may elect, within two months of the end of the year in which it was incurred, to transfer the right to a tax deduction for that expenditure to its shareholders.

A shareholder may opt out from this provision if, for any reason, he does not wish the right to deduct the expenditure.

The deduction allowed cannot exceed the issue price of the shareholders' shares.

Section 101A - Losses incurred in carrying on Primary Production

Losses incurred in primary production can be carried forward indefinitely, unlike losses incurred in other business activities which must be recouped within seven years and are lost if not recouped within that period.

SOME COMMENTS ON AGRICULTURE FROM THE COMMERCIAL BANKERS' ASSOCIATION OF PAPUA NEW GUINEA

Rural incomes. As a general rule, the presence of stabilisation schemes is favoured by financiers. While quick and temporary boosts to rural incomes could be necessary in some sectors to keep existing producers afloat, emphasis should be placed, when framing government policy, on increasing rural incomes gradually and permanently, regardless of crop concerned.

The implied "quick fix" through forest harvesting would seem to have little effective and lasting benefit to Papua New Guinea. Any massive boost to rural incomes in Papua New Guinea through forest harvesting would in the main require external financing and provision of equipment by companies who have other revenue sources to cover their commitments. Logging in Papua New Guinea affords a high credit risk due in particular to the fact that permits can be withdrawn for a multitude of reasons by the authorities.

Although it has been stated that available information on land use potential is not being fully utilised by government and industry, this may in some cases be because information provided by the government is not felt to be sufficiently accurate, or that it is too dated.

It may be argued that even when the information is considered to be accurate, the government is too slow to act, and even when it does, the action is seen as either inappropriate or ineffective.

We are aware of five papers published in the 1980s by the Institute of National Affairs which have bearing on land use potential. How much influence these papers have had on framing government policy is not readily discernible.

A common observation is the wide variance in production yields in the non-plantation sector. In this regard the extent and quality of extension services provided appear to considerably reduce the value of production that could be taken off land currently under some form of production. Government policy towards extension services may be sound but actual delivery of services cannot be similarly described.

Mode of production. Getting expanded and more effective production through a whole village-based system in theory has merit but the organisational requirements would seem a major obstacle and beyond administrative capacity. It could be said that the only true adherents of the Plantation Redistribution Scheme to date are those who claim to be the traditional landowners.

The logistics of getting smallholder production to market and in saleable condition irrespective of production mode, is very relevant.

An expansion of the plantation mode, whether citizen or foreign-owned in whole or in part, under the management of skilled and technically proficient people, would appear to present the best opportunity to meaningfully expand economic rural production in Papua New Guinea.

The plantation mode and land tenures. It is highly questionable whether the land evaluation and demarcation (LEAD) project can or will be effective. If every province were to enact legislation along the lines of East Sepik Province, administration from a lending viewpoint would prove very difficult. It is usually found where difficulty abounds, nothing tangible emanates.

Land, whether national government leasehold or otherwise, especially in remote areas or near settlements, can frequently be adjudged useless as security for borrowing. If the lender had to foreclose, in practical terms it becomes almost impossible for a mortgagor in possession or a new mortgagor to work the land. Consequently, additional security will regularly be sought where borrowings are substantial, management ability is not proven and past track record is questionable or non-existent.

The government has tried to overcome this problem to some extent with provision of a form of "insurance" through the Credit Guarantee Scheme. This scheme has not proved completely successful and government is in the throes of modifying aspects which will result in an elevation of the criteria for eligibility and subsequent approval.

Savings. Generally, savings in the village or smallholder sectors tends to be minimal within the overall aggregates of the financial system. Banks are told that there are millions of kilobucks lying idle "out there in the villages". If such funds do exist, national and provincial leaders could positively assist by openly supporting the saving ethic to strengthen the formal financial system.

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What is generally not understood by the population is that there is need to save (obtain equity) before one borrows from a bank or finance company. A government-backed education programme might prove very beneficial.

Other factors involved here are work ethic (i.e. only work when money is needed) and the lure to dispose of all income on consumption rather than a proportion on production-based expenditure. These are social aspects in which the national and provincial governments could take a strong lead.

Law and order. Any increase in lawlessness reduces a credit agency's preparedness to risk adventure into any particular area, especially those which are remote and difficult to get to. Banks will not provide services where it is felt their staff could be placed in jeopardy, irrespective of cost.

National-provincial relations - Extension services. The apparent fuzziness in role responsibility by provincial/national governments is not something that is restricted to agriculture. The system itself, as well as constant changes of ministers and senior bureaucrats, contribute significantly to inefficiency.

In a recent view of the Credit Guarantee Scheme by the banks and Department of Finance and Planning, it was generally agreed that more borrowers in the rural sector would have a chance of survival (success) if reasonable extension services had been provided. It certainly would seem more sensible for extension services to be dispensed on a national policy basis.

LAW AND ORDER, RURAL DEVELOPMENT AND THE POLICE IN PAPUA NEW GUINEA

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This paper will consider the development of the police service into the rural areas of Papua New Guinea since c. 1974, consider the constraints to extension and outline an approach for future development strategies.

The development of policing in rural areas is taken as the theme of this paper from which the question of the policing of agricultural communities may be addressed. The paper will argue that any extension of the service whether on a permanent or semi-permanent basis is constrained by the adequate provision of resources, (manpower and capital equipment) and stress the necessity for any economic analysis of development projects in rural areas to take into account more fully the provision for law and order maintenance.

The economics of law and order

The importance of a stable law and order situation to economic growth is well documented (Goodman *et al* 1985: Clifford *et al* 1984), the basic argument being that development

through foreign investment is hampered by an adverse law and order situation. It is axiomatic that two factors in economic growth are the political and public order situations in that investors will take the level of both into account in their investment decisions. Exploitation of natural resources does have a price it seems but possibly only when it is to take place abroad. Although impossible to quantify satisfactorily one can judge that the level of dissatisfaction with economic enterprise, measured through industrial disputes, and with the law and order situation, measured by the rate of capital crime (murder, assault, robbery, rape, etc.) is no worse in Papua New Guinea than in any state of Australia.

Investment will be jeopardised by public disorder, industrial dispute or crime, moreso in the Third World than the First. But who is to pay to maintain law and order. The host government or the foreign investor? More important, who should pay?

Policing rural areas

The development of policing in rural areas equates roughly with the development of the host country at the macro-economic level. Constraints to state provision in the areas of health, education and services (roads, water, electricity, etc.) also apply to policing.

There are three means to deliver the policing service to areas where it does not exist -

- . by extending the patrolling area from an already established police station or post (extended-patrol in rural areas);
- . by setting up a police post to be manned on particular occasions (semi-permanent policing) and;
- . by establishing a permanently manned police post/station.

A fourth, short-term way of providing policing to an area is to deploy a mobile squad. A prerequisite however is an uncontrollable law and order situation (Bougainville 1989); a potential breakdown (Ok Tedi 1988) or a long-standing crime situation (Lo-Met 1988). This, however, is very expensive and can be counter-productive to police-public relations (Wewak 1988).

There may be no particular reason for establishing a police presence in an area, either on a permanent or semi-permanent basis, other than a natural growth in the indigenous population resulting in an escalation of the crime situation (Nissan Island). Or it may be that an industrial venture is planned or has started leading to the importation of labour by the company (Ok Tedi) or people have migrated into the area to exploit the newly discovered natural resource (Mount Kare).

Data from twelve commercial operations (see Reference 1) planned and started or planned and not started since the early 1970s indicates that within the provision of essential resources to facilitate the extension of police presence into an area where a commercial venture is planned lay structural constraints which are relatively constant. The resources are capital equipment (buildings), infrastructure (roads, services) and manpower. The constraints are finance and the negotiations between the parties to an agreement, the government, the company and the police.

That negotiation can be a constraint is evidenced by one venture, the Vanimo Timber Development, where the original scope of exploitation of the resource, planned in 1972, has never materialised due to unsatisfactory negotiation and partly due to the cost of services, including that of the law and order provision.

Uncertainty pervades negotiations not only at the conceptual level and on the supporting framework but also on funding the necessary infrastructure and services. In the case of Vanimo in its two development proposals (c. 1974 and c. 1980) uncertainty concerning the scope of the proposed projects led to uncertainty as to the size of police deployment and therefore either a potentially inappropriate proposal on the size of the police operation was drafted or no proposal drafted at all as decision-makers called for more information - information that could not be supplied.

As the size of the venture increases (beyond what was originally proposed) and/or industrial disputes multiply or the crime problem escalates, so do demands from both the company the local police commander for more men, equipment and housing (see Reference 2).

Constabulary planners are therefore left in an invidious situation. The industrial or crime situation may warrant a special operation (Bougainville) or deployment of a mobile squad (Ok Tedi) but this can only be a short-term solution, is one which stretches the Constabulary's resources, is very expensive and not cost effective.

A further and far greater drain of the Constabulary's resources is a permanent increase in manpower. Even though the extra manpower may be funded through the Public Investment Programme (PIP formerly NPEP) budget it is not certain that a proposal will be approved in full (Items 1 to 10) or that the additional expenditure will be transferred in the second year from PIP to recurrent expenditure. In any event cost alone is not the only factor. Administrative back-up for the operational area can be measured in financial terms but it is also important to evaluate the quality of service, given current administrative systems. The analogy is that of the electrical system which overloads as additional appliances are connected. Efficiency of operation decreases until there is complete breakdown. Given current administrative systems in the public service based upon time-consuming processes, bordering on the inefficient, overload is never far away.

This latter point has been the subject of much research and debate as the police organisation has, since the early 1980s, come under the scrutiny of a nervous public's gaze in the light of a perceived growing law and order problem.

Organisational analysis

Three external consultancies on law and order in the eighties (Morgan 1983; Clifford *et al* 1984; Coopers & Lybrand 1986) cast a gaze in varying degrees of intensity upon the Constabulary. All pointed to major structural deficiencies in the organisation and the latest, Coopers & Lybrand, made detailed recommendations, perhaps reflecting the view of the others, whose aims were to rectify the problems. A major point of reference for these studies is the "way it is" in other police forces (in the main Australian) and thus the "way it should be" in Papua New Guinea is based upon a consolidated model of the best way to achieve law and order management and the means by which this is achieved elsewhere.

The receiving Commissioner of these reports, David Tasion, was enthusiastically instrumental in facilitating the appointment of the AIDAB Team to put into practice the good advice received. Under the current Commissioner therefore, the process of restructuring the Constabulary's management systems and operational facility within the Royal Papua New Guinea Constabulary's Five Year Development Plan, is being undertaken.

The strength of the government's commitment to the project can perhaps be measured in terms of the money and resources being put into the plan.

In total K12.2 million is being committed to the project (3/4 Australian aid, 1/4 Papua New Guinea's contribution). Twenty-six adviser-consultants will be employed on the project spending a total of 48 man-years. The areas being evaluated with a view to change are: administration, operations, personnel, management, forensic science, computing and training. In addition 18 Papua New Guinea police members will spend time on work attachments with Australian police forces: K1 million aid donation will be spent on transport and radio equipment and K2.8 million on the provision of 150 kit houses for police personnel (see Reference 3).

We can perhaps summarise those areas which consultancy reports saw as problematic and which are the subject of assessment, review and change within the Five Year Development Plan:

- . organisational rules and guidelines
- . career planning
- . manpower management
- . training
- . force planning and policing philosophy
- . manpower resource - provisions.

Deficiencies in these six areas have led to internal dissent, evidenced by low morale, a high number of discipline charges, organisational apathy and inadequate management of the law and order situation, and resulting in a growing lawlessness. An underlying assumption of these reports is that the police are partly to blame for the increasingly adverse law and order situation, not at source but in the lack of control of it.

Bearing in mind the problems inherent in too much "good" advice the following is a summary of how the Constabulary has and is tackling these problem areas:

Organisational rules and guidelines. Following the Clifford Report which pointed out that the Constabulary's Administrative Manual and Standing Orders were last written in the mid-1970s, a Standardisation Task Force was set up (1985-1986) to research and publish new organisational rules, regulations and guidelines. Contained in three manuals (legislation, procedure and administration), the aim is to standardise the delivery of the policing service throughout the country. A publication branch has been set up to update and publish reviews of the content.

A structural problem in standardisation of service is geographical diversity of policing units, as indeed it is an overall command problem in both administrative and operational areas. It is difficult to reinforce rules from the centre given the locational diversity of units and thus to ensure that they are being followed. However, an inspectorial directorate has been set up to maintain standards.

Career planning. Clifford *et al* pointed out the management and morale drawbacks to too many postings of senior officers, the consequent limited time in any one job and the high cost of transfers. In their view the junior ranks were transferred less frequently (pp 207-211). Coopers & Lybrand did more in-depth work in their review and made a series of recommendations which took into account the adverse effect on morale of too many transfers (pp 18-21).

Recent research supports these recommendations. The average time in post of a provincial police commander is one year and three months and the average time in post of a police station commander is two years and two months.

A major problem in career planning and transfer policy has been a lack of data on manpower; a rank to job analysis; the definition and identification "key" jobs and knowing which jobs each policeman was performing.

Work on these areas has now been completed and a transfer panel convened. In future, therefore, the rate of transfer of senior officers will decrease and any member will be considered for transfer after five years in post.

Manpower management. The needs of the organisation and the wishes of its actors are not often in accord, often in conflict (Silverman:40). Both Clifford (pp 211-215) and Coopers & Lybrand (pp 18-21; 37-43) considered promotion and discipline within the Constabulary and the latter (pp 22-27) at performance and potential assessment. The story in these areas is not a happy one.

The rate of disciplinary charges rose from 21.7 per cent in 1969 to 28.7 per cent in 1984 (Clifford p.213) and although at 565 serious charges (59 per cent of the 1983 figure) and 324 minor charges (95 per cent of the 1983 figure) there has been a slight fall in 1988, there is still obvious cause for concern.

The promotion system has not been delivering the most able candidates based as it was upon seniority and not competence. Data on members upon which management should base its manpower resource decisions is woefully incorrect, inadequate and out of date.

Following Coopers & Lybrand (pp 26-27) a new staff appraisal form and system have been devised and is in the final stages of testing and again following their recommendation (pp 40-41) a new promotion system has been devised, necessitating legislative changes based on the principle of promotion to vacancy not promotion to rank. The newly constituted selection board will have summarised accurate and current data on promotion candidates and promotion decisions will be based more on relative ability and potential to perform in the post than on seniority without consideration of the post to be occupied.

The Police Gazette (Coopers & Lybrand pp 42-43) is being redesigned and will be published weekly.

Training. Although the basic training of policemen is considered adequate (Coopers & Lybrand p.30) concern has been expressed about the training of prosecutors and investigators (Coopers & Lybrand p. 30; Clifford *et al* pp.188-199). A complete overhaul of the course material at Bomana has recently been undertaken as a part of the AIDAB initiative but the results have yet to be evaluated.

Resource provision in the specialist areas of investigation and forensic science has not correlated with the task in hand (Clifford pp.194,193). The Fraud Squad has recently been given direct government finance to re-equip and the forensic science provision will benefit from better training of members (two constables are currently undergoing a 12 month on-the-job work attachment in Australia), new premises and analytical equipment.

Force planning and policing philosophy. A lack of long-term planning leads to crisis management (Clifford *et al* p.215) which can degenerate into a series of short-term "hard" policing operations which does nothing to ease the problem in the long run, indeed may

compound it, and more often than not has a negative effect upon police-public relations. Work in the community relations field since 1985 has diverted a degree of resources into proactive police strategies which includes neighbourhood watch schemes, crime prevention initiatives, an increase in reserve police manpower and the provision of police housing in the community. Public order disturbances (Port Moresby March 1989, Bougainville March 1989) however, tend to reinforce the "iron fist", reactive policing philosophy within the Department as the police don their para-military cloak, which pervades down into police force policy and planning.

Shortly a new department within the Force, corporate planning, will be set up to fashion a long-term planning facility based upon the management technique of "policing objectives". A prerequisite of this philosophy is a community-oriented policing strategy.

Manpower resource - provisions. Problems in the working environment (equipment, training, transfers, office accommodation, promotions) are compounded by unsatisfactory living conditions (Clifford et al p. 212). Demonstrations by police wives in early 1988 served to reinforce the point of many factors contributing to low morale (Coopers & Lybrand p. 78). It has to be said of course that living conditions for policemen, although in the main atrocious, are probably no worse than for the majority of government workers and infinitely better than for the majority of the urban squatter population. Nevertheless, if policemen are to do their important jobs properly they must be properly housed and funding for upgrading police barracks has been allocated; as well the housing maintenance programme continues and plans are in hand for the supply of 150 kit houses under an AIDAB scheme.

The Organisation's Centre therefore has been researched, assessed and subjected to a plethora of recommendations. Changes have been and will continue to be made but mainly within the confines of a budget which does not rise according to need, certainly in respect of expenditure on capital resources. Many of the changes made and planned can be achieved within current budget particularly those within the fields of manpower management, organisational rules, career planning and force planning. Additional "one-off" funding of projects should be received with gratitude but unless there is a concomitant increase in annual budget and regular assessments of the organisation's performance in maintaining standards and necessary adjustments made, the additional resources can become a burden on the existing budget and administration as the organisation spreads itself too thinly in order to assimilate new initiatives.

Conclusion:

The economic analogy to the thesis being presented here is that of the Centre's status and strength with regard to its peripheral interests, being dependent upon the strength of its relationship with the metropole. The stronger the link between the centre and the metropole, the stronger the link between the centre and its peripheral interest (Amarshi et al 1979).

Ideologically, the government will always express concern about law and order, being in its interests to do so vis-a-vis its relationship with the electorate and in a developing economy, to give confidence to current and potential investors. Not that current investors are necessarily put off by a "breakdown" in law and order. Recent pronouncements by the senior management of Bougainville Copper Limited (BCL) that they are determined to stay in the country despite the current problems in Bougainville, are no doubt to an extent promoted by their profit margin - being in 1988 K108.6 million (Post-Courier 13 April 1988).

It is, however, one thing to express concern about law and order, another to adequately resource the Centre and evaluate its performance to service the operational arm rather than just extend the periphery on an ad hoc basis.

Peripheral growth of the policing service does not reinforce the centre, it weakens it unless expenditure is increased proportionally to fund internal infrastructure i.e. training, recruitment, transfers, equipment (both domestic and for the work place) and administrative costs.

The development of the policing service in Papua New Guinea has moved since Independence from the expedient to the implementation of strategic objectives derived from a corporate plan in the 1990s, and has mirrored the development of the country as a whole.

Consolidation of the organisation is an important prerequisite before expansion. This holds true for any organisation but is a particularly difficult path to follow in a police force in a developing country where demands for expansion are frequently made and not always achieved with success.

Notes:

1. The relevant projects are:
 Kennecott Ok Tedi
 Purari River Hydro Scheme
 Gogol Timber Scheme
 Open Bay Timber Area
 Frieda River Project
 Vanimbo Timber Development
 Central New Ireland Timber Development
 Kapiura Timber Development
 Kamusi Timber Development
 Popondetta Oil Palm Project
 Umboi Timber Development Project
 Bialla Oil Palm Project.
2. An example being a request for an increase in police manpower at Ok Tedi. It is the case that the local police commander will invariably support, even instigate, the request.
3. This information was supplied by Barry Todd, Project Manager of the Five Year Development Plan which is being managed by Price Waterhouse Urwick.

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PALM OIL EMPLOYMENT

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The introduction of oil palm industry in Papua New Guinea in 1967 resulted in rapid development and expansion in various fields. The infra-structure of this development brought in smallholder farmers who produce oil palm fruit and sell it to the company and brought workers from around the country to work in the plantations. The industry provides livelihood for many thousands of families both directly and indirectly.

In the initial stage of the development of New Britain Palm Oil Development Limited in Hoskins, workers were recruited from outside the province and were repatriated after completion of their terms. Nowadays, only a small portion of the workers are recruited outside the province whilst the large portion of the workers are recruited locally. Kapiura Plantations Pty. Ltd., a new development, had given employment priority to local villagers in order to achieve harmonious relations with the local communities and acting in accordance with local political demand. However, this has been unsuccessful as the villagers prefer the village style of life to the plantation rhythm of work and wage employment. With political understanding of this trend and the recent acquisition of an Employment Agents Licence, Kapiura Plantations Pty. Ltd. is now vigorously recruiting workers from other provinces. In the light of the current turmoil in Bougainville, some politicians oppose recruitment in their provinces whilst others demand assurances and better working conditions for their people.

Recruitment is quite an expensive exercise as turnover is high. However, experience has shown that local recruitment of workers who came to seek employment here and others who were brought in by other employers to some extent does even out cost. Labour turnover varies from month to month for such reasons as: to visit loved ones at home

during Christmas, attend to customary obligations, location of the plantations, ethnic composition of the labour force, resignation or termination of a key figure, to name only a few.

To give you a fair idea of the labour turnover, Table 1 shows the lowest, highest and average figures in percentages for 1988 for the two estates mentioned above.

The oil palm industry, like any other plantation is labour-intensive. The bulk of the workforce has little or no education and is unskilled. However, once employed, they are trained in a number of skills such as harvesting, weeding, etc. and actually become productive. Piece rate formula for payment of wages is favoured by skilled and experienced workers in such work as harvesting, as it greatly increases their take-home pay. Some harvesters earn twice the basic minimum rate of pay per fortnight. Unskilled workers doing general duties are paid the basic minimum rural wage. Overtime is paid when applicable.

At all management levels we emphasise the need to explain explicitly and honestly to the workers their terms and conditions of employment, employer-employee relationships, responsibilities, liabilities and obligations on engagement and the maintenance of standards and discipline as these lay the foundation for harmonious industrial relations.

In the early years of this development we experienced frequent industrial strikes, mainly due to lack of constant water supply (caused by break-down of machinery), limited medical provisions, never ending demand for wage increments, lack of effective communication, and misunderstanding and delayed workers' compensation settlements. Improved financial situation and technological know-how has remedied the former causes whilst drastic improvements have been made on the latter issues. These have reduced the occurrence of industrial disputes over the years. The main causes of disputes currently encountered are demands for an increase in the unit of payment for piece rate workers, bonus for hardships and sympathy strike (when a tribesman or a fellow workers dies). Minor industrial complaints pertaining to legal entitlements together with major disputes are attended to by the company personnel. However, when settlements are not reached the matters are referred to the Department of Labour and Employment.

Labour in any situation is not easy to deal with, whether employees are educated or not. People are difficult to deal with. With the aid of the relevant legislation, awards, management practices, accepted industrial practices and experience, maximum efforts are made to prevent and minimise industrial unrest.

The company offers non-wage benefits such as electricity, housing, reticulated drinking water, sanitary services, medical care, schools, transport for high school children and recreational facilities (sports grounds, equipment, church building, community hall, and films). Land is provided on the fringe of the estate for employees to grow subsistence crops to supplement their wages. All of these are provided free of charge; therefore, with minimum expenditure on non-essential commodities such as beer, cigarettes and betelnut, the workers are far better off than their counterparts in other companies and their relatives at home.

In an establishment such as this, where people from nearly all over the country with diversified customary backgrounds work and live together, one cannot expect to find a

Utopian society. Occasional conflicts occur which normally stem from drunken brawls, marriages, accidents involving injuries or deaths, traditional rivalry (in the case of Highlanders). Welfare cases and misdemeanours such as gossips, use of abusive language, assault, etc. occur regularly and are attended to by company personnel. Compromise is the mode of the settlement of the above grievances. Matters that require further counselling or legal attention are referred to the appropriate authorities. Nevertheless, despite all of these, since all workers work for one company, live together and share a lot of things there is a greater feeling of oneness. More things unite them than divide them. This helps to foster the feeling of nationalism.

Table 1
Annual labour turnover
(per cent)

	Lowest	Highest	Average
New Britain Palm Oil Development Ltd.			
Bebere Plantations	0.00	20.40	7.24
Kumbango Plantations	6.40	23.60	10.39
Togulo Plantations	3.60	32.40	14.18
Navarai Plantations	5.50	67.10	26.26
Malilimi Plantations	2.00	64.00	18.42
Dami Plantations	0.00	29.73	8.60
Kapiura Plantations Pty. Ltd.			
Kapiura Plantations	1.00	67.00	20.00
Biloma Plantations	16.00	51.00	36.92

A CASE STUDY OF RURAL EMPLOYMENT IN PAPUA NEW GUINEA RAMU SUGAR LIMITED

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Company background

Ramu Sugar is rurally located close to the Ramu River and dissected by the Madang highway some 180 km from Lae, 160 km from Madang and 120 km from Goroka. The company holds the leasehold of some 26,000 ha of government land of which approximately 7,500 ha are assigned for sugar operations and the balance devoted to cattle ranching. Of the land allocated for sugar use, 6,500 ha are actually utilised for cane production. Ramu Sugar is the country's only sugar and ethanol producer as well as its largest beef cattle producer.

Sugar production in 1988 exceeded 50,000 tonnes of which 7,852 metric tonnes were exported to the U.S.A. and New Zealand. Ethanol (used in Papua New Guinea as an additive to petrol) is principally used in the Morobe, Eastern Highlands and Chimbu provinces but has also recently been exported to the EEC. The cattle herd numbers 15,000 and provides over 20 per cent of the domestic market.

The company inherited an established cattle enterprise but development of the sugar and ethanol component took place between 1979 and 1983. Sugar is therefore a comparative newcomer to the country's economy. Consolidation of production capacity was proceeding as planned with production in excess of 30,000 tonnes of sugar being achieved in 1984 and a production capacity of 40,000 tonnes firmly within sight the following year. There followed a unique and catastrophic production sequence caused by a virulent pathogen which almost wiped out one harvest at a critical juncture in the company's fortunes. The company is painfully but successfully recovering from this internal crisis with the knowledge that it cannot totally emerge "from the shadows" until it can sustain very high production levels for several years to come and thus repay major loans which have been rescheduled.

The venture has involved local investment to date of K100 million comprising K35 million subscribed by shareholders and K65 million from off-shore lenders. Whilst the government is the largest single shareholder it does not hold the majority of ordinary shares and Ramu is a private sector company.

The sugar and associated ethanol components of the business currently contribute 97 per cent towards the revenue generated by the company while beef contributes 3 per cent. While the latter is therefore important, it is sugar and its by-products which are the preponderant feature of the company at present.

The general characteristics of the cane sugar and beef cattle industries in conjunction with the specific circumstances of these two primary products within Papua New Guinea are key determinants of the size and composition of the labour force. Certain features of the labour force are well-nigh universal regardless of the location; others may well vary dependent on the particular situation ruling within the company and the regional or

national environment in which the business operates. This paper will now address the distinctive features and determinants of the labour force in the sugar industry.

The sugar industry environment

The industry's "front-end" and mainstream is agriculture comprising a conventional land preparation, planting, cultivation and harvesting sequence of operations. It is usually a seasonal industry especially in a rain-fed rather than irrigated environment. The agricultural component does not, by definition, require production within a large-scale plantation though this often helps to achieve economies of operating expenses. It is, however, well-nigh essential to ensure that the cane production is in proximity to the initial processing into cane sugar; otherwise a disproportionate increase in cane transportation expenses and attendant quality control problems may well render the outlying areas of cane production uneconomic. Quality control is supremely important involving plant pathology, entomology and optimising sugar content by constant monitoring of plant formation.

The processing dimension involves a "heavy engineering" milling facility and a sophisticated processing cooperation where chemical and food technology process control are critical at all stages. The initial capital investment needed at Ramu for the sugar factory and distillery was in excess of K27.5 million comprising 40 per cent of the total investment to the point of commencing operations. Vital features of the manufacturing operation include

- Sensitive and continuous inter-action between the agricultural and manufacturing operations so that cane supply is in equilibrium with the capacity of the mill and process house and that cane quality does not generate undue manufacturing problems.
- Consistent and responsive quality control procedures. As a major food, consumers have a right to expect a healthy product.
- The need to maintain production with the minimum disruption during the harvesting season. Twenty-four hour operation is essential for at least six days a week and ideally for seven. Any significant unscheduled break in production can often have a major adverse impact on operating costs.

The industry is therefore, in its modern form, complex and fast-moving. It follows that management of the industry must be of high calibre and the pressures and demands on managers can be severe. A very substantial proportion of the labour force must be skilled and their skills frequently need up-dating in response to technological change. These industry characteristics are complemented by distinctive factors germane to this country and to the location chosen for establishing the industry.

The development area chosen and its hinterland was very thinly populated. To a considerable extent this may have derived from the prevalence of a virulent malaria (the area attracted the soubriquet "Death Valley" among the indigenous peoples). The absence of more than a handful of clan groups in the locality presented two major development options; on the one hand to concentrate agricultural development in a centrally-managed nucleus estate with supporting outgrower development of small holdings utilising to the maximum extent the existing local population and fostering their interest in sugar cane.

The alternative option would have involved perhaps a smaller nucleus estate and a larger out-grower component involving immigrant workers from neighbouring provinces. The former option was chosen.

By virtue of the low population and lack of established sources of employment on any scale, the existing infrastructure within the project area of roads, other communications, schools, medical facilities, housing and related services was virtually non-existent.

Paradoxically, although Papua New Guinea is the original source of a considerable proportion of the cane sugar strains leading to commercial varieties throughout the world, it has been one of the most recent tropical countries to have developed its own industry. Inevitably therefore, when Ramu Sugar was formed, it could not draw for its labour requirements from any indigenous "pool" of established skills in any aspect of sugar cultivation or process technology.

A well-established feature of any "green field" sugar production facility in a developing economy is its capacity to generate a major boost to economic and social development. Ramu Sugar is in the mainstream of such evolution and in addition to its crucial role in generating direct export earnings and substitution of local production in place of imports has been characterised from a very early stage by -

- . large-scale development of employment opportunities;
- . a major contribution to the development of the stock of skilled labour;
- . significant commercial growth within the local traditional farming community;
- . the setting up of associated enterprises as a spin-off to service the industry's varied commercial requirements;
- . the development of a modern economic and social infrastructure.

The remainder of this paper will describe in outline the nature of the company's labour force and how it has evolved.

Functional deployment of the labour force

Table 1 below sets out the details of employment by department and by section (excluding ranching). In summary, as regards the permanent work force, 42 per cent are employed in agriculture, 33 per cent in the factory and distillery, 10 per cent in finance, sales, stores and purchasing and 15 per cent in personnel and community services. Of the seasonal work force the bulk are employed in agriculture.

Table 2 sets out the broad occupational classification of the permanent workforce.

Manifestly, the company's skill requirements are considerable and in many respects very distinctive. Thus while it is helpful to have a sound background elsewhere in Papua New Guinea in areas such as commercial agriculture or process technology these have to be matched by intensive knowledge and understanding of the quite different requirements of the sugar industry. To meet this challenge, the company initially employed some 86 expatriates whilst undertaking a parallel crash training programme to ensure that localisation proceeded effectively and at the earliest possible juncture. This policy has achieved a substantial measure of success in that current expatriate numbers have fallen to 29 within a six year period with no detrimental effects on efficiency. Further

localisation will progressively occur; the remaining expatriate positions are almost exclusively at section manager and head of department level and for key specialists.

Table 1
Employment by function - Ramu Sugar Ltd.

Department/section	Total permanent	Total seasonals
Agriculture		
. administration	6	-
. agronomy	36	13
. cultivation	120	856
. engineering	81	33
. harvesting	33	716
. workshop	119	9
Factory		
. administration	37	-
. process	79	26
. engineering	132	53
. packaging	38	103
. distillery	20	14
Finance		
. administration	36	-
. stores and purchasing	38	9
. sales administration	8	-
. sales sugar store	15	43
Personnel		
. administration	21	-
. housing	5	-
. building	41	21
. comm. & recreation services	45	17
. security	26	-
Total	936	1,913

Table 2
Employment by broad occupational classification
Ramu Sugar Ltd.

Permanent employees	Total	
Managers	56	(28)*
Supervisors	83	(1)*
Skilled trades group	151	
Semi-skilled	326	
Skilled clerks	47	
Semi-skilled clerks	63	
General labourers	165	
Management trainees	15	
Apprentices	30	
Total	936	

Note: * Figures in parenthesis indicate current expatriates.

Training is not perceived exclusively in terms of facilitating localisation. Principally nowadays it is focused on improving the effectiveness of management and supervision and the training of artisans and operators. Expenditure on training comprises almost 2 per cent of total operating costs and the company employs a training manager, two trade instructors and supporting staff. The company has 42 apprentice motor vehicle mechanics, electricians and auto-electricians, fitter machinists and welders. So far the company has been able to offer ongoing employment to the majority of apprentices completing their indentures. With a more stable labour force emerging and a more modest growth rate, it is likely in the medium term that larger numbers of apprentices will need to seek outside employment on completing their training. With the substantial increase in demand for artisans throughout the country, Ramu-trained artisans surplus to the company's own requirements should find little difficulty obtaining suitable alternative employment.

A substantial ongoing training task is skills improvement and a variety of approaches are adopted. A number of special in-house training assignments have been undertaken covering, for example, agricultural engineering, process engineering and instrumentation and process technology. These have involved overseas specialists sponsored by Australian and EEC aid agencies. The company runs a number of skills improvement courses for established tradesmen and as far as practicable these are linked to a trade testing system which determines promotion.

One very distinctive feature of the industry is the multi-skilling of many of the permanent sugar production operatives. In their mainstream skill areas they can only productively be employed during the harvesting period. This can leave anything between 4-6 months of potentially unproductive employment. Since the staff in question have unique skills, it would be very unsatisfactory to consider lay-off as an option. Many are therefore employed in semi-skilled maintenance activities during the off-crop period. This practice is widespread throughout the cane sugar industry world-wide wherever the harvest period is quite short.

Seasonal labour requirements

There are two overlapping seasonal labour requirements. The first (entirely agricultural) is to meet peak cultivation requirements during the growing season. A major component is the need for intensive weeding to ensure that young cane is not choked by rapid weed growth. The labour requirements involved may emerge rapidly and not always predictably but in normal circumstances would be expected to peak during November to January possibly exceeding 1,000 personnel. A substantial proportion of the labour needed is female, consisting of the wives of existing employees or local villagers.

The second requirement is associated with the harvesting period usually between May and September or longer. The principal requirement is for cane cutters. Some 52 per cent of the annual cane output is cut mechanically. Company policy has been to maintain a significant hand cutting harvest operation which is labour intensive (some 360 cutters and 100 gleaners are currently employed). Cane cutters are paid on completion of a task, the actual task is carefully measured to take account of all the relevant circumstances e.g. whether cane is cut burnt or "green", cane variety and characteristics etc. A normative task would be four tonnes burnt or three tonnes green cane per man day. Significantly higher tonnages are in fact achieved by a proportion of the labour force with appropriate enhancements of remuneration.

The other principal seasonal labour requirements are as follows:

Tractor and harvesting trailer operators. With cane being transported from the fields by trailer at the rate of up to 20 per hour continuously throughout the harvest season 120 extra operators are required.

Engineering, packaging & sugar storage - usually some 80-100 low-skill operators and other staff are employed "in crop".

The recruitment, transportation, contracting, housing and (for new employees) training of such large numbers of temporary employees presents a formidable challenge to management. Fortunately, the majority of such employees have by now become familiar with the industry's requirements and welcome the opportunity for extended temporary work. Unforeseen loss of a significant proportion of such seasonals during the course of the crop can prove particularly disruptive and to minimise this risk since the inception of operations in 1982, it has been the practice to pay a terminal bonus to such employees who complete an entire crop.

Outgrower production

A great deal of effort has been maintained to foster cane supply from local villagers. To this end the company provides a range of extension services to meet the varying needs of particular village groups. At one extreme villagers might prepare, plant, cultivate and perform all agricultural operations other than harvesting. Conversely, they might seek a contract which involves minimum inputs e.g. weeding. In all cases the company will seek to monitor all phases of production and help villagers to optimise their output and therefore their income.

Villagers are well informed, at all stages, of production prices which are agreed between the company and the Departments of Finance and Planning and Agriculture and Livestock in accordance with negotiated formulae.

Income generated will obviously vary considerably dependent on the area planted, agricultural conditions and the inputs and efforts of villagers. Conservatively, annual income exceeding K34,000 for each of 12 clan groups in the cane area is being achieved.

Prior to the advent of Ramu Sugar, local villagers had no realistic opportunity for breaking out of the subsistence cycle. Clearly, this is no longer the case and at present some 10 per cent of total company cane production comes from local villagers. This proportion is roughly double the quantity to which the company is contractually committed under the terms of the Master Agreement between the company and the national government. Unfortunately, given the low level of population of neighbouring traditional villages and their location it is unlikely that a dramatic enhancement to the output of local village groups can readily be achieved within the immediate future on a cost-effective basis.

Origins of the labour force

Table 3 below indicates the source by province of the permanent work force.

Table 3
Analysis of Ramu Sugar's permanent workforce by province
of origin (excluding management)

Province	Workforce from the province as a percentage of the total
Western	0.3
Gulf	1.0
Central	2.5
Milne Bay	1.0
Oro	0.3
Morobe	18.0
Madang	14.0
East Sepik	7.0
West Sepik	1.8
Southern Highlands	3.0
Enga	9.0
Western Highlands	7.0
Chimbu	17.0
Eastern Highlands	16.0
Manus	1.0
New Ireland	0.5
East New Britain	1.0
West New Britain	0.3
North Solomons	0.3
Total =	100.0

The company's overall policy on engagement is to maximise recruitment from the immediate locality and neighbouring provinces whilst ensuring that for skilled and managerial positions the most suitable national applicants are considered regardless of geographical or ethnic origin. The company is well aware of the pitfalls of excessive wantokism in the field of placement and seeks to guard against any incipient tendencies in this direction by a number of means including ethnic monitoring, opting for centralised recruitment through the personnel function and by ensuring that all managers and supervisors are cognizant of company policy. The company's principal centre of operations is located in Madang Province but notwithstanding numerous past efforts to encourage a higher proportion of work opportunities being filled from this quarter, in practice success has been limited. For skilled and many semi-skilled position the work force is very diverse. For unskilled seasonal position, the great majority are filled by personnel from the Highlands Region with Eastern Highlands, Chimbu and Engan staff being the main sources.

Family status of the workforce

A key element in employment policy from the beginning has been construction and maintenance of adequate housing of a high standard for the permanent labour force to enable the majority to be provided with family housing.

The company's current stock of permanent housing is summarised in Table 4 below.

Table 4
Current stock of permanent housing

Type	No. of units	
High covenant		
Detached houses (3 bedroom)	54	
Flats (2 bedroom)	3	
Intermediate category		
Detached houses (3 bedroom)	45	
Detached houses (2 bedroom)	199	
Low covenant		
Semi-detached (2 bedroom duplex)	432	(x 2)
Flats (bachelor quarters)	44	(x 2)
Total	777	(1253)

At present in excess of 95 per cent of the permanent workforce are housed with their families. Married staff awaiting suitable housing allocation number at present 27. Seasonal staff are currently housed on a bachelor status basis sharing either three or four to a duplex or two per room in single bedroom units. The company has an active policy to promote the continual improvement of the housing stock both in quantity and quality and a long-term strategy to this end is regularly updated. A further one high covenant and seven intermediate houses are to be constructed within the next year. Construction of these houses, by freeing houses already occupied will ultimately also benefit workers in lower grades.

Company employment policy

Earlier comment has alluded to recruitment and housing policies. The fundamental aim of the company is to establish a stable well-trained and motivated workforce appropriately remunerated, housed and provided with amenities and services to cater for the normal needs of a community numbering in excess of 6,000 inhabitants. The various elements which comprise the policy are inter-related and experience suggests that undue concentration on one and neglect of others will be counter-productive. It is undoubtedly the case that serious lack of essential community services is probably more important than more immediate employee benefits. Higher pay and benefits do not offset the absence of such services and amenities. It is therefore appropriate that any resume of company employment policy will initially focus on community environment.

Housing

Construction (already described) is only part of the equation. Proper administration ensuring equitable allocation, prompt attention to repairs, planned preventative maintenance and a positive programme addressing the need to encourage tenants to improve their home environment are all vital features. There is reasonable evidence to suggest that the high profile given to maintaining a pleasant material home and neighbourhood environment is amply repaid in terms of employee perception of the company. It would be idle to suggest that all major problems have been resolved. Such mundane but vital aspects as water supply, sewerage, rubbish collection regularly present challenges to keep abreast or ahead of requirements. In the past three years virtually the entire septic tank system comprising over 200 units has been rehabilitated and expanded. Similarly the water supply reticulation has been almost completely refurbished and a major new reservoir of 700,000 litres capacity installed. There is a perennial problem of maintaining a tidy environment in the neighbourhood of houses and for many residents until they are educated to identify themselves with higher standards it will prove difficult to sustain the improvement necessary.

Most residents attach considerable importance to having an adequate garden with a primary purpose in many cases of providing a supplementary food supply. Gardens are therefore in most cases of a reasonable size to achieve this. The really keen gardeners can however also obtain allotments from the company to this end. A further spin-off from such development is the ability of those wives who are unable or unused to obtaining paid employment to maintain their traditional activities.

Security

A peaceful and stable community environment would feature as a high priority in most people's index. The company employs its own security force of some 37. While the major preoccupation of this body is to safeguard company assets, by virtue of the limited complement of the Papua New Guinea Constabulary at Ramu (currently some 15 men) the company security force is frequently called upon to assist the constabulary in its normal community functions. A system of village court magistrates utilising elected Ramu Sugar residents was instituted in 1987. This at the time was a unique experiment in applying the principles of the village court process to the much larger and modern environment of Ramu. The preliminary indications are that this system has ameliorated the scale of community problems which would otherwise generate criminal behaviour. In addition there is a district court building where cases are heard sessionally. Currently this is with a visiting magistrate from Madang though it is hoped before long to have a resident magistrate.

A perennial problem in Papua New Guinea is the scale of long-term unauthorised residence due to the influence of the wantok system. Ramu Sugar has its share of the problems as well as the benefits inherent to the social customs prevailing and it cannot be claimed that we have found a simplistic formula for resolving them. However, it remains our view that however imperfect the action taken, sustained effort within the law to contain unauthorised residence is worthwhile and generally speaking the evidence strongly indicates such moves are welcomed by our staff.

Other community needs

The company has initiated and sustained a major contribution towards social services, recreational needs and the supply of goods and services. Comment on each of these follows:

Education. A large primary school (St. Lukes) was established in 1981 jointly funded by the madang Provincial Government, the Catholic Church and the company. It now has over 600 students from Grade 1 to 6 educated non-denominationally and achieves impressive results provincially and nationally. A vocational school emphasising trades of value in a rural environment will shortly be established by the Madang Provincial Government (MPG) with material assistance in the form of land, services and equipment from the company.

Health. The company provides a full occupational health service for all its employees in a purpose-built clinic staffed by a full-time medical officer, nursing sisters, auxiliaries, a laboratory technician and a malaria control supervisor.

There is also a rural health centre managed by the MPG staffed by a health extension officer, nursing sisters and auxiliaries catering for the medical, environmental health and health education needs of employees and other residents in the area. Again, the company has made a major contribution towards the capital development of this centre; the medical officer and staff provide continuous support and help and malaria control activity by the company extends to neighbouring villages.

Recreation, entertainment and other community activities. The age profile of the company's labour force is heavily concentrated in the group 18 to 40. Good sporting facilities are therefore an extremely important component of Ramu life and those which have been developed (especially outdoors) are acknowledged to be among the finest available in mainland Papua New Guinea. The emphasis is on self-help but with the company providing the basic amenity and with some "pump priming" by way of equipment to help launch a new activity. Television, video and (periodically) live entertainment is available. The company has been extremely cautious in the allowable scope for bars and taverns while recognising that this policy will need to be kept under continuous review. However, the limited experiments which have been conducted in this field suggest that in the particular cultural environment of Ramu continued caution will be needed. A substantial new staff club is currently under construction.

Ramu is the home of several churches and it is probably quite unusual that these are physically located in close proximity to each other. Amicable relations between the churches are the norm and there are several resident pastors. Several of the churches undertake a variety of community activities.

Retail outlets and markets. In the early years of development, the company had to establish the initial shops and market facilities. The latter remains a company activity but progressively, substantial retail and wholesale outlets have been established using their own purpose-built premises. Employees are understandably concerned to ensure that the costs of purchases are not unduly inflated by the relatively remote location and limited competition. A citizens "watchdog" committee seeks to monitor prices to ensure that on basic goods they are compatible with those of Lae with a transport supplement. Fresh traditional foodstuffs are available in the market and this is a magnet for many villagers from the adjacent Rai Coast area to sell their produce.

Other services. All company houses are provided individually with electricity, water, sanitary conveniences and rubbish collection without charge. These services are a major cost to the company and equally constitute a very valuable fringe benefit for staff. Regular bus and PMV services have operated for some years now between Lae and Madang calling at Ramu. PMV services to and from the Eastern Highlands are also regularly available. Two bank agencies and a post office are well established. The "greening" of Ramu has involved planting of thousands of ornamental, shade and fruit trees which have greatly enhanced the appearance of the project.

Salaries and other benefits. Most categories of skilled and some semi-skilled staff are at a premium within Papua New Guinea and it has proved essential to maintain a sound and competitive pay structure. For an organisation of this size, it is essential to have a well-structured grading system, where the duties and activities required are well-defined both to ensure appropriate comparisons externally and also to foster career development and progression internally.

As a rural employer, the company is bound by the Minimum Wages Board determination for rural areas. In the competitive environment which operates however, due regard is paid to urban wage levels for skilled workers abated to some extent to take cognizance of the provision of free housing and services. For all except unskilled staff there is a merit salary range to reward high performance. Opportunity to provide merit pay is for skilled workers linked to a full performance review system operating annually. Other terms of service for the general staff would be those commonly provided by employers and are usually based on statutory provisions of the Employment Act marginally enhanced in some cases. The strong links most staff retain with their home areas have resulted in some improvements in leave provisions geared to length of service and similarly the provision of paid passages at intervals to and from their home area. Shift work is a feature of this industry to which employees are by now accustomed. Shift allowances are paid and premium overtime rates apply for Sunday, public holiday or rostered rest day work.

Employee relations. Given the large and complex scale of operations the management of industrial relations is not easy. The company chose to promote at an early stage the evolution of a responsible industry-based trade union and this was achieved in 1984 with the registration of the Ramu Sugar National Employees Union and in the same year by the development of a Supervisory Staff Association. It is a natural feature of most industrial relations situations that progress is uneven and initial friction developed into overt conflict in 1986. This led to a major overhaul of company strategy, a higher profile in terms of company resources devoted to industrial relations and the development of a close-knit system of inter-locking approaches consisting of the following:

1. A management-staff two way formal briefing session with a regular monthly briefing from senior management through to the shop floor using a tok save as a focal point for management communication down the line and subsequent management feedback on shop floor opinion. It would be naive to claim that the system fully resolves the potential for conflict but there is little doubt that with the appropriate commitment from top management and the necessary logistic support and effort further down the line, the system can prove a powerful aid to improved employee relations.
2. A weekly informal dialogue between senior union officials and company personnel staff to exchange views in a non-confrontational setting. These are **not** negotiating sessions but can act to clear the air, remove misconceptions as between fact and fiction and monitor the industrial relations "temperature". There are dangers in this process and skill is required to maximise its benefits.
3. At two or three month intervals a Joint Staff Consultative Committee meets formally between elected shop floor union representatives and senior company managers to consider major issues, developments and opportunities.
4. Finally, there is opportunity for negotiations in accordance with formal procedures. Recently a long-term pay and benefits agreement was reached covering a two and half year period ending on 31st December 1990.

We lay no special claims for perfection in this vital area of management activity. We do however, believe that we potentially have an approach which applies the best of modern practice in a context relevant to conditions in this country. It will of course take continued goodwill and understanding on both sides to maintain a sound industrial relations structure. This is perhaps particularly difficult for the employees' representatives. Naturally members expect appropriate benefits for their subscriptions and expectations tend to run high generally in the country. With the company still struggling for the next four years at least to pay off its very substantial debts to overseas lenders, continued restraint in unnecessary expenditure will remain vital on the company's part for several years yet. The challenge to management is to seek continued understanding on the part of employees of these underlying factors and striving to continue productive improvement while attempting slowly to continue the process of material improvement to conditions at Ramu.

Concluding comments

The general thrust of company employment policy is hopefully clear. Some success has attended its efforts so far. The labour force is more stable; turnover is currently running now under 10 per cent compared with 20 per cent four years or more ago. Management is increasingly in the hands of national staff with no discernible drop in efficiency. Production last year was at an all-time high of 50,000 tonnes with only a fractional increase in permanent staff, a reasonable indication of substantially higher output per man. Staff increasingly appear to be creating a dynamic and stable community with Ramu as their home.

To maintain this progress will not prove easy as almost inevitably, the special efforts which have been made by staff in recent years to recover from the disastrous crop of 1986 cannot reasonably be sustained in future at quite the level of the recent past. It is to be earnestly hoped that further progress will not be jeopardised by any abnormal inflation of wage costs through ill-judged move to place Ramu Sugar or other rural employers into a different wage classification under the Minimum Wages Board.

MACROECONOMIC POLICY ISSUES AND OPTIONS FOR AGRICULTURAL DEVELOPMENT

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Introduction

Papua New Guinea is a small open economy and as such is susceptible and vulnerable to the vagaries of international market forces. It is open in the sense that it is heavily involved in free trade (both domestic and international) and free enterprise typified by heavy involvement in the international exchange of goods, services and capital. It is small because the degree of domestic and international activities is limited in comparison with other world economies.

With a view to reducing external dependence on international trade and aid and moving towards economic self-sufficiency in the medium to longer term, the national goals and directive principles have directly addressed the issue of self-reliance and self-sufficiency. We have seen successive governments, given resource and budget constraints, thus direct resources (manpower and capital) and investment to the most productive and economic sectors of the economy, like mining and agriculture, to bring about meaningful economic growth and development.

However, economic growth has been sadly lacking and slow due to institutional and structural problems to growth and development, which sectoral policies have not been able to adequately address. These problems include the inaccessible terrain, land ownership system, weak infrastructure, paucity of local skills, weak capital and financial markets, high costs (especially transport and electricity) diseconomies of small-scale production, and small domestic and fragmented market. There is also an urban crime problem and worrying ethnic tensions together with an unstable political climate.

Like most other developing economies, Papua New Guinea is a primary resource exporting country, with a fairly high degree of concentration in exports which thus renders the economy highly vulnerable to cyclical external price fluctuations.

Given these characteristics of the economy the government's macro-economic policy focused on economic stability. Although now abandoned, it was achieved through the hard kina policy. The main thrust of this policy was intended to insulate the economy from these fluctuations which give rise to irregular variations in aggregate demand, instability in government revenue and instability in foreign exchange.

Two basic aims of stabilisation policies were to:

- . maintain a steady level or rate of growth of economic activity in the modern sector and in wage employment; and
- . restrict the rate of growth of prices.

Agriculture, as an economic sector, is by far the biggest sector. No doubt it is considered the major force for economic growth. Industrial countries which were once agricultural nations are evidence of this fact (for example China, South Korea). The sector, including fisheries and forestry, contributes about one-third of total output (GDP), employs over 80 per cent of the population, and contributes about a third of export earnings. Evidently a sector of such relative size will not only have a considerable influence on macroeconomic variables such as GDP, employment and foreign exchange, but will also be affected greatly by macroeconomic policy-making and implementation.

In this paper I will try to define the theory and practice of macroeconomic policy-making in Papua New Guinea since independence and assess what impact it has had on the agricultural sector. Implications for the agriculture sector will also be analysed and several consequences of policy harmful to the sector will be identified and solutions suggested within the context of current policy tools. The macroeconomic policies covered include the exchange rate policy, wages policy and stabilisation policy. Fiscal and monetary policy will be covered in brief. This set of policies has been aimed at achieving internal and external balance together with an efficient allocation of resources. These two conditions are considered necessary but not sufficient; other sectoral policies must be pursued and implemented to promote economic growth and development.

In addition, in view of current low commodity prices and the subsequent likely stagnation of the agricultural sector opportunities, positive policy measures will be suggested. The common objective for the agriculture sector of stimulation of growth and employment opportunities will be the focus of discussions.

Let us now discuss the macroeconomic policies separately.

Exchange rate policy. Perhaps it is useful to present the historical perspective of exchange rate policy evolution since independence basically to evaluate the consequences and impact it has had on the agricultural sector. Essentially this calls for discussion of the "hard kina" policy which was the core of macroeconomic policy after independence. This included the exchange rate policy, monetary and fiscal policy and wages policy. The "hard kina" policy was seen as a policy of real wage and inflation containment. It was designed to maintain a strong balance of payments with manageable levels of foreign debt through restraint on real levels of domestic expenditure and wages rather than through exchange controls while at least maintaining the foreign exchange value of the freely convertible kina against major world currencies (Goodman *et al*: 1985:53).

The hard kina policy was introduced on 19 April 1975 to coincide with the new currency and new exchange rate policy. Essentially the hard kina policy went through three periods:

- From 1975-1979 there was active pursuit of the policy and the kina was revalued several times.
- From 1980-1983 there was a passive pursuit of the policy. The then Minister for Finance, Mr. Kaputin, in August 1980 declared that there would be no further revaluation of the kina.
- From 1983 onwards saw the relaxation of the policy in which there was devaluation on 8 March 1983.

Admittedly, although very little data exists that specifically ties macroeconomic policy to agricultural sector performance and development, we can nevertheless observe some trends which affected the agricultural sector. Several points need to be made about

specific effects on the agriculture sector. In particular, revaluation of the kina has had several consequences.

It led to disincentives for local producers. For exporters it led to a decline in the kina price of exports, consequently reducing income of exporters and ultimately having an adverse effect on foreign exchange reserves, taxation, government expenditure and overall growth. Although it can be argued that the hard kina policy maintained the free convertibility of the kina and kept inflation rates low, the cost of maintaining a hard currency (through revaluations) caused the number of kina per dollar of exports to be lower with the subsequent effect of hindering the growth of some existing and potential exports, especially of agricultural commodities produced by smallholders who employ little or no paid labour and are therefore relatively unaffected by the level of wages.

Revaluation of the kina also encouraged the purchase of imported commodities and thus discouraged the local production of goods competing with imports. This is because the strategy meant that the number of kina paid out per dollar was lower. Thus for importers and import substitution industries the strategy led to increased competition.

It is interesting to note that there are some who argue that the effects of revaluation of the kina on the agriculture sector are neutral. For example Garnaut and Baxter (1983) argue that exchange rates are neutral, with harder rates protecting consumers from "inflation tax" effects on real incomes, thus cancelling out lower prices received by lower consumer item prices, particularly imported inflation. They also argue that although they accepted that revaluation reduced exporters incomes in kina terms, this has been compensated more by the exporters paying less tax i.e., absence of "inflation tax".

Dahanayake (1984) gives a startling and quite a contrary argument to these commonly held views. He argues that the hard kina strategy's legitimate concern should be the maintenance of the free convertibility of the kina and not that of lowering imported kina prices and the internal rate of inflation. He argues that the policy of revaluation which was pursued between 1976-79 had the immediate effect of raising real wages, particularly of expatriate workers and that relative prices in Papua New Guinea may be affected through revaluations because the prices of purely domestic goods may not move in line with prices of imports. He argues that a cut in real wages now talked about is easier through devaluation.

Generally, whilst the hard kina policy has created price stability (from imported inflation) and fiscal responsibility (confidence in the kina installed), it has had some dampening and adverse effects on the agriculture sector. In fact Dennis Young branded it a "cheap import" policy. Imports were cheap and local production was discouraged. Income distribution became uneven in that high income earners (both expatriate and national) gained from import consumption.

Ward and Carrad (1984) give more weight to these views by arguing that the impact on domestic food producers has been negative and thus internal balance has not been maintained. They say that the imported component of export crop production has increased, benefiting the users of capital (plantations) rather than the users of labour. Whilst this has been a net gain in terms of productivity it has encouraged large rather than small-scale plantations.

What have been the consequences of devaluation? Devaluation of the kina led to an increase in the kina price of exports thus increasing producer incomes, foreign exchange reserves, taxation and government expenditures through promotion or encouragement of import-substitution and export-promotion industries. Devaluation has also meant that the number of kina paid out per dollar was higher. This may led to imported inflation and without other controls could translate into a partial rise in wages through the minimum wages mechanism. It should be noted that in the past when full indexation of wages to the Consumer Price Index (CPI) was operational, imported inflation would have led to proportional rises in wages. However, currently there is partial indexation leading to partial rises in wages.

Wages policy. Wages policy is one of the central policies that affects the total economy including the agriculture sector. It has impact on employment, migration, rural development, standard of living, wage costs and incomes, production and investment. Within the overall macroeconomic policy framework, it has an important role to play in bringing about stability and creating an economic environment that is conducive to economic growth and productive employment.

Papua New Guinea has a highly institutionalised wage setting and adjustment system. A triennial Minimum Wages Board (MWB) determines not only the minimum wage for level 1 and 2 urban centres but also a junior wage, an apprenticeship and various skilled and semi-skilled wages. The MWB's wage adjustment has always been based on movements in the CPI, a "minimum needs" concept and "capacity of plantations to pay" for the case of plantations or some mixture of these.

Papua New Guinea has a tradition of government intervention in the labour market (principally through MWBs) which distinguishes it from other countries. Basically the current wages structure was determined by MWBs between 1972 and 1975.

There have been concerns raised in various reports (Goodman *et al* 1985, Colclough and Daniel 1982) that real wages in Papua New Guinea are too high in relation to productivity, basic needs of the workers, and countries at the same comparable level of income (see Tables 1 and 2) and as such a reduction of wages is advocated. It is argued that since wages are so much higher relative to productivity it is difficult for Papua New Guinea to even get started in the simplest manufacturing industries. High wages also discourage investment in manufacturing both for export and import substitution and also discourage plantation activity. They also intensify the search for labour substituting techniques of production in both urban and rural areas. This is because, theoretically a firm will employ labour where the value of marginal product is equal to the wage rate. If the value of marginal product of labour is lower than the wage rate (which is currently the case in Papua New Guinea), the producer will be forced to employ capital-intensive techniques of production.

Dahanayake (1987) argues that the effects of high wages means that Papua New Guinea loses its international competitiveness in relation to other developing countries. He makes the point that developing countries compete to attract foreign investors who prefer to go to the most profitable places. Since profitability depends on costs and costs depend on factors such as wages, rents and interests, if these are too high relative to those of other developing countries, then our ability to compete with them and sell our products weakens. Thus there is less production, less employment, less incomes and less profit.

Table 1
Minimum wages rates in selected developing countries, 1978
(US dollars a day)

Country	Manufacturing	Agriculture
Papua New Guinea	7.00	2.60
Malaysia	3.85	1.90
Western Samoa	3.40	2.70
Philippines	1.85	1.55
Thailand	1.70	1.25
Sri Lanka	0.90	0.65
Indonesia	0.60	n.a.

Source: Goodman et al 1985 : 61.

With regard to wages costs in the agriculture sector, direct labour costs which are influenced mainly by rural wage determinations, are a relatively high proportion of costs, especially in commercial agriculture (Colclough and Daniel 1982:129). Agricultural activities are also highly vulnerable to indirect wage costs and thus to changes in urban wages.

Table 2
Average non-agricultural wage rates in selected lower-middle
income developing countries, 1980
(US dollars a week)

Country	Wage rate
Papua New Guinea	62.07
Honduras	35.93
El Salvador	29.14
Western Samoa	26.41
Nigeria	21.98
Philippines	10.50

Source: Goodman et al 1985 : 62.

Wages costs are extremely important in plantation agriculture but there is evidence that rural real wages have changed very little. Prior to independence real urban wages more than doubled while real minimum wages in the rural sector remained more or less constant at 1972 levels (see Tables 3, 4 and 5).

This led to a gradual widening of the urban:rural wage gap which by 1976 reached a ratio of 3:10. Although there has been a very slight bridging of the urban-rural wage gap from 2.9:1 in July 1975 to only 2.7:1 in January 1987 (Dahanayake 1987) the disparity between urban and rural wages is still very substantial. Thus it can be argued that this huge wage differential has encouraged urban migration and possibly reduced employment in rural areas and hence reduced output from the agricultural sector, although producers can increase output by using capital-intensive technology.

Table 3
Minimum wages

	Urban minimum wages (urban labour level 1)	Unskilled rural workers
1980	34.84	13.00
1981	37.56	14.01
1982	39.28	14.65
1983	41.51	15.48
1984	43.59	16.25
1985	45.51	16.97
1986	47.57	17.70
1987	49.84	18.58
1988	51.33	19.14

Source: Bank of Papua New Guinea, Quarterly Economic Bulletins - various issues.

Table 4
Index of nominal labour costs
(1980 = 100)

	100
1980	
1981	115.4
1982	120.6
1983	127.5
1984	133.9
1985	139.8
1986	145.8
1987	152.9
1988	157.7

Source: Bank of Papua New Guinea Quarterly Economic Bulletins - various issues.

Table 5
Minimum wages July 1975 - January 1987

	CPI 1977-100	Annual rate of inflation per cent	Urban wage labourers (Level 1)		Rural minimum wage	
			Nominal K/W	Real K/W	Nominal K/W	Real K/W
1975 July	88.6		25.80	29.12	8.90	10.05
1976 Jan.	95.1		27.18	28.58	9.43	9.92
1977 March	97.9	3.6	28.08	28.68	9.90	10.11
1977 Sept.	100.8	5.0	28.46	28.23	10.23	10.15
1978 March	103.6	5.8	29.71	28.68	10.73	10.36
1978 Sept.	106.4	5.6	29.71	27.92	10.97	10.31
1979 March	108.3	4.5	30.82	28.46	11.45	10.57
1979 Sept.	112.2	5.5	30.96	27.59	11.73	10.45
1980 March	121.0	11.7	33.25	27.48	12.40	10.25
1980 Sept.	126.1	12.4	34.84	27.63	13.00	10.30
1981 March	134.3	11.0	36.78	27.39	13.75	10.24
1981 Sept.	135.0	7.1	37.56	27.82	13.82	10.23
1982 March	140.6	4.7	38.54	27.41	14.39	10.23
1982 Sept.	143.0	5.9	39.28	27.49	14.65	10.24
1983 March	150.4	7.0	41.51	27.60	15.48	10.29
1983 Sept.	154.6	8.1	41.51	26.29	15.48	9.34
1984 Jan.	165.8	7.5	43.59	26.29	16.25	9.80
1985 Jan.	171.9	3.7	45.51	26.47	16.97	9.87
1986 Jan.	181.3	5.5	47.47	26.18	17.70	9.76
1987 Jan.	187.3	3.3	49.99	26.69	18.64	9.95

Source: Dahanayake, P.A.S., 1987 Wages Policy in Papua New Guinea, Institute of Applied Social & Economic Research.

Notes: 1. In Table 1 data were used on a quarterly basis in order to examine periodic changes at regular intervals, whereas in Table 2 data were used as per first effective month for minimum wages, since these occurred at regular intervals.

2. Rural minimum wage prior to 1980 relates to primary industry. In 1980 and thereafter rural minimum wage was unified.

3. For years 1984 and after, annual CPI increases were used since minimum wage increases took place annually since 1984.

Ward and Carrad (1984) argue that problems exist with wages policy in both intra-sector and inter-sector contexts. They state that the large disparity or differential between urban and rural minima is a result of the use of two different criteria for the determination of increases namely: the "capacity to pay" of primary industries and the "basic needs" of urban

workers. The "basic needs" criteria risks separating the minimum wage from the economic reality of Papua New Guinea while the "capacity to pay" risks misjudging the secular trends in commodity prices and hence what the plantation sector can afford to pay and yet not impair investment. They therefore argue that the consequence of such a separation are a rise in the urban:rural minimum income differential and lower total employment, lower agricultural rural development, as well as higher migration to urban areas.

The extent to which private industry would create more jobs depends not just upon relative international competitiveness but upon overall profitability and this is a function of both the average cost of labour and other inputs, and average prices received for the product. Thus, if product wage is determined, which corresponds inversely with changes in employment, any reduction in product wage will lead to increases in employment (Ward and Carrad 1984).

It seems that wages are high, not only because of the minimum wage fixation system but also because of internal and institutional factors such as high cost of living, high transport costs, fragmented market, high rents and high price mark-ups due to low turnover and high overhead costs incurred in initial stages of production. Thus any reduction in wages with the view to narrowing urban:rural wage differential will occur only if these factors that contribute to the high cost structure of the economy are eliminated or at best minimised.

While reduction in wages seems justified from the cost and productivity point of view, it is not so from the income or welfare point of view as it is argued that the current minimum wage is still not sufficient to meet the basic need of an average family (man, wife and two children). It covers only 75 per cent of the needs.

Nevertheless, the orthodox view to reducing wages is based on two propositions. They are that it is possible to cut wages by either a pay policy, devaluation or both and that reducing real wages will have a beneficial impact on at least one of the following: investment, output, employment, production and growth.

Story and Vickerman (1984:153-162) critically examine this orthodox position on wages and try to show why it is irrelevant to the issues of employment and income creation. For example, in the case of agriculture they say that the wages issue is irrelevant to the most dynamic sector, the smallholders. They argue that the only result of current wage policy would be to cut real wages and living conditions of those on minimum wages without in any way improving the state of the economy, which is faced with structural and demand constraints to growth.

When talking about productivity, it should be observed that it is being argued that wages are in excess of labour supply price as determined by the average product of labour in agriculture. By lowering wages to labour supply price, it is argued that rural-urban inequalities would be reduced, urban unemployment would be eliminated and there would be an increase in employment and economic growth.

There is also the recognition of the need to avoid gearing wage levels to the commodity price cycle. Wage increases in terms of high commodity prices will lead to an unstable economy with a resultant hike in costs and loss of investment confidence. Conversely it is extremely difficult to reduce wages dramatically when commodity prices are low. Because of these reasons the government has always recognised the need for gearing wage levels to the capacity of the economy to pay.

Fiscal and monetary policies. Essentially the policy of fiscal or budgetary restraint has been pursued since independence, with a view to maintaining Papua New Guinea's external balance within the context of fluctuating revenues from mining and primary industry sources. The national budget which was brought down in November 1984 proposed real growth in government expenditure on goods and services of only 0.5 per cent a year from 1986 to 1990 (Goodman *et al*: 1985:65).

What have been the implications of governments' policy of budgetary restraint on the agriculture sector? Perhaps the most obvious is the decrease in goods and services to rural areas and also a decline in investment in rural infrastructure (e.g. roads, bridge, marketing and processing facilities, extension services and government subsidies to farmers).

These institutional and structural requirements are essential pre-requisites to growth and expansion of the sector. It can be argued that negligence by the government and maybe the private sector in not adequately developing these basic requirements has led to hindering growth of the agricultural sector.

With a view to encouraging import-substitution and export-promotion industries, the government could extensively use the other fiscal policy tool at its disposal, namely, taxation. For example, the import levy should be increased not only to raise more internal revenue, but also to protect local industries. An exception should be given to imported inputs used in producing exports and government must ensure that any increase in the prices of imported goods resulting from the levy is not automatically translated into wages rises.

It should, however, be cautioned that the general import duty, the "ad valorem" export taxes, high taxes on fuel and power have raised transport and other related costs in the sector and the economy, leading to adverse effects in agricultural development and growth.

With a view to alleviating high costs, Papua New Guinea offers some financial incentives to promote investment in the agriculture sector. They include accelerated depreciation where 20 per cent of the capital cost may be deducted in the initial year and a 200 per cent tax deduction for wages paid to apprentices (Ward and Carrad 1984:10). These incentives should continue.

The aim of monetary policy has been to influence the broad money supply to ensure the availability of sufficient credit to finance economic activities consistent with maintaining a balance of payments position and suppressing domestic inflationary pressures (Ward and Carrad 1984:11).

Generally, agriculture has been affected by monetary policy through the effects of interest rate changes on the supply and cost of credit. High interest rates on capital goods coupled with lack of mobilisation of savings, especially by the majority of farmers who lack basic education, has probably led to very low investment in the agriculture sector, especially in the subsistence sub-sector.

Lack of education and the very stringent requirements by the Agriculture Bank and commercial banks for farmers to even get started with small-scale agricultural projects, have been disincentives and impediments to growth of the agriculture sector. Thus, this calls for relaxation of awesome loan procedures and increase in more rural credit lending.

It can be argued that the agricultural sector had more impact on monetary policy rather than the reverse, through changing volumes, prices and values of commodity output and stabilisation fund balances, all of which have significantly determined the level of money supply in the economy.

The current government's monetary and credit policy takes a medium-term perspective aimed at providing sufficient liquidity and credit to finance non-mining private sector development within the important constraint of meeting balance of payments objectives. The Bank of Papua New Guinea's board in December 1988 adopted the 1989 monetary policy. Based on the economic goals announced in the 1989 budget and balance of payment considerations, the monetary policy stance adopted is a target of 9-11 per cent growth in private sector credit in 1989.

This certainly should see increased investment in the agriculture sector. Although there is no empirical evidence, it can be argued that the overall effects of monetary and fiscal policy on the agricultural sector have been minimal.

Commodity price stabilisation policy. Commodity stabilisation has been in existence in Papua New Guinea in one form or another for about the past forty years since the inception of the first scheme for copra in 1946. The objective of the scheme was to provide income support in times of low prices by levying producers in times of high prices. The other three schemes namely coffee, cocoa and palm oil were established on the same lines.

Perhaps it should be stated from the outset that a price stabilisation scheme was considered desirable to help achieve macroeconomic stability. Thus commodity stabilisation schemes were set up to reduce effects of price fluctuations of the commodities and stabilise income to the producers. This is done by collecting levies during boom periods and paying out bounties when prices are depressed.

Initially the objective of the schemes was that of income stabilisation based upon an industry cost of production rather than price stabilisation. However, price stabilisation was adopted in favour of income stabilisation after a major review by Wheeler and Wyatt in 1978. The main and inherent objective of price stabilisation is to stabilise prices that producers receive for their agricultural commodities, which in turn fulfills an income stabilisation objective via the bounty and levy mechanism.

It should be conceded that a number of external factors have threatened the strict adherence to the stipulated objectives of the schemes. For example, there have been suggestions notably by politicians, to use the funds to finance activities within the respective industries and to finance direct pest and disease control of crops. Essentially this has switched the emphasis from price stability to maintenance of income (Kiele 1987).

As of December 1988 the commodity stabilisation funds deposits with the Bank of Papua New Guinea were at one of their lowest levels ever (see Table 6). Consequently deposits with the commercial banks also declined, while "other investments" and investments in government securities (see Table 7) remained stable.

The declines in deposits and investments of the funds were a result of low international prices received for our major agricultural commodities. Thus the respective commodity boards have had to pay out bounties in order to stabilise prices and thus incomes received by producers. There is a danger that if current depressed commodity prices persist this could lead to fast depletion of the funds deposits. Thus alternatives need to be found to maintain a balance in deposits i.e. the need for compensatory financing.

Table 6
Commodity industry boards and stabilisation funds : deposits
(K Million)

Period	Coffee	Cocoa	Copra Board	Fund	Palm Oil
1975	3.8	0.4	1.3	5.1	-
1976	6.8	4.4	1.3	1.2	-
1977	46.4	32.0	1.8	2.3	-
1978	63.6	48.9	0.9	2.5	-
1979	83.8	60.2	4.3	9.5	-
1980	94.9	61.9	-	7.5	-
1981	90.3	53.7	-	1.7	-
1982	92.1	44.7	0.1	-	-
1983	85.3	44.9	0.4	0.3	-
1984	82.1	46.0	23.2	7.9	-
1985	83.5	47.1	0.2	23.4	11.6
1986	116.4	40.5	0.2	4.9	8.7
1987	79.9	29.6	-	-	6.3
1988	24.3	10.8	0.9	42	6.3

Source: 1. Bank of Papua New Guinea Quarterly Economic Bulletins - various issues.
2. Goodman *et al* 1985, Table A30:247.

Note: Totals up to and including 1982 are inclusive of palm oil funds. However, as of 1983, totals do not include palm oil funds. It is obvious that deposits for all three schemes have been lowered due to payment of bounties.

Basically the mechanisms by which the commodity stabilisation schemes operate are similar although each one is governed by a formula agreed upon by the respective boards, growers and the government. The copra stabilisation fund operates slightly differently to the other three funds, although its basic purpose is the same. While the cocoa, coffee and two palm oil schemes take in and pay out money with reference to a long-term moving average f.o.b. price¹ which is changed annually, payments into the copra funds are fixed in accordance with a schedule which is based on the plantation cost of production, whose floor or support price would be the cost of production such that bounties would be paid if prices

¹. This strategy disregards cost of production as the basis in determination of a floor price. Instead levies and bounties are based upon a long-term average of prices. Levies would be collected if prevailing prices were above the long-term average prices and bounties paid when prevailing prices fell below the long-term average.

fell below this survival price and levies collected when prevailing prices rose above the cost of production. Essentially this is referred to as the "survival price strategy". There have been suggestions that the copra scheme should adopt the long-term average price strategy adopted by other schemes.

Table 7
Commodity industry boards and stabilisation funds : investments
(K million)

Period	Deposits		Government securities	Other investments	Total
	Commercial banks	Bank of PNG			
			6.3	-	10.5
1975	4.2	-	10.3	-	13.6
1976	3.0	0.3	11.6	0.4	82.5
1977	21.4	49.5	10.0	0.3	115.9
1978	37.2	68.4	9.7	0.3	157.8
1979	51.5	96.3	7.9	0.3	164.3
1980	53.7	102.3	8.2	0.3	145.7
1981	46.2	91.0	6.1	0.3	136.8
1982	39.7	90.7	5.3	-	130.9
1983	42.2	83.3	5.3	-	160.2
1984	74.6	80.2	5.3	-	165.9
1985	9.8	80.7	5.3	-	170.8
1986	76.3	89.2	5.0	0.3	115.8
1987	45.4	65.2	5.0	0.3	46.5
1988	28.3	12.9			

Source: Bank of Papua New Guinea Quarterly Economic Bulletins - various issues.

Notes: 1. Totals as of 1980 include investments from palm oil.

2. Deposits with the Bank of Papua New Guinea are higher than with the commercial banks because of a legal agreement to deposit 60 per cent of funds with the Bank of Papua New Guinea, where they are sterilised. The deposits with the Bank of Papua New Guinea are likely to increase as of 1989 because the respective boards have now agreed to have 75 per cent of their asset deposited with the Bank.

3. The respective commodity boards have opted and argued strongly to deposit most of their funds with the commercial banks because of higher interest rate offered, than with the Bank of Papua New Guinea.

Wheeler and Wyatt (1978:5) argue strongly in favour of the "moving long-term average price strategy" which in their view affords true price stabilisation and implies some form of equalisation about the long-term trend. When world prices are high, levies siphon off the peaks so that the prices which growers receive are lower, but still above the long-term

average price. Conversely, when world prices are low then bounties are paid to growers to increase the price they receive, up towards the long-term average price. Hence, the peaks and troughs of world price fluctuations are substantially removed. They further argued that the "survival price strategy" and also the "cost plus strategy"² essentially stabilise incomes rather than prices. For example, the "survival price" strategy would allow prices to continually fall to the cost of production; only then would bounties be paid.

Having adopted the "long-term moving average" a historical moving average was adopted as projection of future prices was considered unreliable to ensure smooth operation of the fund. Although an average of the past does introduce a considerable lag and its relevance to current prices is questioned, it is considered the most reliable. Each year's prices are also adjusted for inflation, thereby expressing them in constant terms of the most recent year, although the inclusion of inflation in the current formula has to be questioned. It was also decided to halve the rate of fluctuation about the historical moving average. Thus if the price was above the average, 50 per cent of the difference between the actual price and the average would be deducted as levy. Conversely, when the price was below the long-term average bounties equal to 50 per cent of the difference between the actual price and the average would be paid out.

Probably the biggest question surrounding the price stabilisation schemes is whether they have been effective or not in stabilising prices received by producers and thus incomes. Since the inception of the schemes there has been a lot of controversy and debate among professionals in government, academic and political arenas to this effect. There are those who argue that the schemes have been successful to a certain extent and therefore advocate their continuity. The most notable are Goodman *et al* (1985), Shaw (1985), Lam (1978) and Guest (1987). The respective commodity boards share this view, although they admit some technical and methodological problems that need rectification as regards the fund size, the funds multiple role (for the case of coffee), the ways in which levies and bounties are determined, the limit to income or outgoings, the use of inflation in calculating the threshold prices and the need for compensatory finance (in situations where funds are depleted).

Guest (1987:21) did some empirical work to analyse the effectiveness of the schemes and their ability in reducing the variability of f.o.b. export prices. He did this by calculating the "incremental bounty", which is the change in the bounty or levy from month to month against the corresponding monthly change in the f.o.b. export prices. He concluded that an analysis of the effectiveness of the cocoa, coffee and copra funds in reducing f.o.b. export price fluctuations over the period since independence reveals that the cocoa scheme has been the most successful of the three, reducing the degree of instability in f.o.b. cocoa prices by 46 per cent. This is closely followed by the copra scheme which has reduced its own measure of f.o.b. export price instability by 43 per cent. The coffee scheme came a distant third, reducing the degree of instability in f.o.b. coffee prices by 32 per cent. The palm oil scheme was not analysed due to its recent inception (in 1983).

He further stated that the success of the schemes depends on two things:

². The floor price in this case was the cost of production plus some margin. When prices fell below this "cost plus" floor price then bounties were paid and levies paid if it was above.

1. the extent to which the levies and support payments actually dampen the fluctuations in export prices (that is, determined by the rate of levy and bounty applied to price disturbances); and
2. the extent to which the monetary effects of accumulated fund balances can be kept out of domestic circulation (that is, sterilised).

The schemes have also received favourable comments from various visiting teams from leading financial institutions such as the World Bank and the International Monetary Fund (IMF). It has often been said that the schemes have been successful in achieving the objectives of easing the burdens of price fluctuations upon farmers as well as contributing to the macroeconomic management of the economy.

There has been concern raised by the respective commodity boards that the bounties and levies do not reach the producer in full due to manipulation by the exporters (for the case of coffee and cocoa) where exporters are involved.

Guest (1987) carried out regression analysis using the ordinary least squares method from the available data series called "producer prices" for cocoa and copra, and "factory door prices" for coffee to try to examine the extent to which stabilisation bounties and levies applied at the point of export are passed through the domestic marketing chain. The results indicated that bounties and levies in the cocoa and copra industries are passed in full to the DIS level. Available data for the coffee industry indicated that as much as 30 per cent of bounties and levies never reach the factory door buying prices. This issue is obviously of considerable importance to the individual commodity price stabilisation schemes whose basic philosophy is that the funds belong to the growers.

The adjusted price, after deducting levies and adding back bounties, is the price that is transmitted into aggregate domestic economic activity and in a very narrow sense that, and the sterilisation of accumulated fund balance, is all that macroeconomic stabilisation policy is concerned with. However, the stabilisation schemes do have stated objectives with regard to stability of prices received by growers. The funds are supposed to represent the savings of the growers, and the price that the growers receive "at the farm gate" is supposed to reflect in full the amount of levy or bounty that has been netted out of the f.o.b. export price at the end of the domestic marketing chain.

An examination of the possible implications of the schemes suggests that there are benefits and costs generated, although the costs outweigh the benefits. The potential consequences, which appear to involve both macro and microeconomic elements, are:

Benefits: The macroeconomic benefits arise because a significant proportion of gross domestic production is exported and subject to the vagaries of international price movements. Variations in world prices can thus have a significant impact on both export earnings and the level of foreign exchange reserves. These reserves are a major means by which developments in the international markets are absorbed by the economy. Without such cushioning, the current macroeconomic problems of relatively high unemployment and low economic growth could be exacerbated. The commodity price stabilisation schemes ensure that some of the large foreign exchange earnings accrued during periods of high commodity prices are retained, since the extra income is not passed on to producers and thus does not flow to increased imports (Beck and Dalton 1987).

(Shaw 1985:150) clarifies the point on why such retention of foreign exchange earnings accrued during periods of high commodity prices is necessary. He argues that the siphoning off of money into stabilisation funds at times of high prices reduces internal demand and therefore inflation which is another form of tax. In his view, farmers are therefore probably better off with the current stabilisation schemes.

Commodity stabilisation funds have a contributory role toward management of aggregate demand for domestic and imported tradeable goods and services in order to complement the normal fiscal and monetary instruments practised by the government to control such macroeconomic variables as inflation, foreign exchange flows, interest rates and domestic liquidity. The greater the degree of domestic macroeconomic stability that is achieved by automatic instruments such as the commodity stabilisation schemes, the less is the need for macroeconomic policy instruments such as monetary and fiscal policies.

The Bank of Papua New Guinea maintains that in times of high commodity prices the extra income available to producers may lead to demand-induced inflation in the economy. In such events, the government has instituted the stabilisation framework of "taxing" producers in the form of levies during high commodity prices and paying out bounties in times of low prices.

The commodity stabilisation funds are mainly invested with the Bank of Papua New Guinea (60 per cent) while the remainder is invested with other commercial banks. The Bank of Papua New Guinea argues that all, if not most of the funds, should be invested with them. However, the boards argue that the interest rates offered, compared to the commercial banks, is lower.

The Cocoa and Coffee Industry Boards have had investment agreements with the Bank of Papua New Guinea since 1978. Guest (1987) argues that to the extent that the funds are held on deposit at the Bank of Papua New Guinea they have a counterpart in the Bank's holdings of foreign exchange reserves where disturbances can be absorbed without adverse consequences for domestic stability. In his analysis, he found that at the present time, the maximum marginal rate of bounty and levy in the cocoa and coffee industries is 50 per cent and only 60 per cent of that is sterilised by the investment agreements, while none of the copra fund's deposits is sterilised (kept out of domestic circulation). Together these imply a maximum reduction in macroeconomic instability arising out of export price fluctuations of only 30 per cent. He argues that if the marginal rate of bounty and levy was raised to 75 per cent and if 75 per cent was sterilised in the central bank deposits (the boards have now agreed to reach this target by 1989), there would be more than 55 per cent reduction in macroeconomic instability, a substantial gain over present arrangements and close to a level one could reasonably call effective.

The accumulated balances of the stabilisation funds together in 1987 comprised on average about 11.6 per cent of the total money supply. It is apparent that without the funds, Papua New Guinea would be consuming a much higher proportion of the GDP.

Wheeler and Wyatt (1978) argue that in times of high prices, effective domestic and imported demand emanating from growers substantially increases. Hence there is pressure placed on domestic resources and inflation and also increased imports and an outflow of foreign exchange. In times of low prices the opposite occurs; effective demand falls and the economy can be thrown into recession.

The stabilisation scheme based on long-term moving average prices evens out these fluctuations, by syphoning off money in levies in times of high produce prices and paying this back in bounties in time of low produce prices. Demand is therefore regulated to some extent and the losses in foreign exchange being spent on imports are reduced.

Moreover, as the boards invest the majority of their funds (currently 60 per cent) with the central bank then rapid increases in money supply are averted because they are sterilised or kept out of domestic circulation.

The investment of the stabilisation funds does have a role in influencing interest rates because of their size, relative to the total money supply. As the availability of money also determines its price (the price of money is interest rate), the management of commodity stabilisation funds affects interest rates. High interest rates or wide fluctuations in interest rates affect investments and can destabilise the economy. If all or most of the funds were invested in the commercial banks it could result in banks overlending during periods of high export prices and may also have a similar effect (Kiele 1987). There seems justification therefore for the Bank of Papua New Guinea to maintain control of the money supply through the stabilisation funds held as deposits and investments.

It has been argued, notably by Goodman *et al* (1985:53), that while the government (since independence) has maintained a strong exchange rate in insulating the economy from imported inflation, it has not encouraged the export sector but in fact has encouraged imports. As smallholders, who are responsible for some 60 per cent of total earnings from export crops, have a high marginal propensity to consume out of income, it is obvious that import demand is highly sensitive to export prices. Contributions to the stabilisation funds therefore serve to dampen demand for imports and contribute to the maintenance of balance of payments equilibrium. Note that the government in part has used the exchange rate to control the demand for imports.

Commodity stabilisation funds can indirectly affect the balance of payments (BOP). Given the high marginal propensity to consume, if stabilisation funds were non-existent, there would be considerable consumption of imported goods as prices of exports rise, hence creating balance of payment problems. The stabilisation schemes have limited imports by charging levies on producers when prices are high.

The microeconomic implications should be considered from both smallholder and plantation perspectives. The major potential benefit is seen to be associated with the increased certainty regarding the future minimum level of prices. It is argued that the scheme has been successful in stabilising prices and incomes of producers through the bounty-levy mechanism. However, as already argued, to date there is no empirical evidence to prove that factory door prices reflect producer prices.

Nevertheless, certainty regarding the future minimum level of prices brings confidence to growers and investors, at least as far as planning of income for investment and reinvestment is concerned and whether they will produce more or less of the crop.

There is also the argument that stabilisation schemes affect government revenue. This is important because a stable revenue base is essential for planning and forecasting.

Costs. It has been argued, notably by Shaw (1985:150), that the stabilisation fund monies held for each crop represent forced savings for rural producers. If the interest on the money after deduction of administration expenses is less than the return available to the producers if they invested it themselves, then they are effectively paying an additional tax. Furthermore, he argues that without research on the supply response to growers, it is not possible to say whether the stabilisation policy has meant higher supply in times of low prices or lower supply in times of high prices.

It has been advocated (notably by community leaders) that stabilisation funds be used to finance rural credit, especially in agriculture. The problem with this is that investments in agriculture, by nature, are long-term and so do not yield immediate returns to the investor. Besides, it would conflict with the current objectives of price stabilisation. However, there probably is justification in this argument because it may appear unreasonable to farmers who are forced to save and yet do not have easy access to the funds, whereas it is relatively easy for speculative investors to obtain bank loans to finance, for example, real estate development.

The microeconomic implications considered from smallholder and plantation perspectives show that the major costs arise from the potential resource misallocation by encouraging excess production when prices are low (due to receipt of bounties) and discouraging production when prices are high, due to payment of levies. Obviously this argument would refute Shaw's argument that such is not the case (if the empirical evidence were available : Editor).

Since the introduction of these schemes, there have been a number of modifications to the mechanics of their operations. These changes reflect changing objectives as well as concern over the economic efficiency of the arrangements; for example, there have been numerous criticisms of the existing formula.

Guest (1987:36) argues that there are a number of fundamental methodological problems associated with the determination of the threshold price in the current bounty-levy formula, which in his view, inhibit the effectiveness of the stabilisation schemes. It appears that the problems are bound up with attempts to derive a reliable measure for the threshold price. He notes, however, that a commodity price stabilisation formula does not have to specify a threshold price at all. The current stabilisation formula can be written as follows:

$$B(t) = b^* \times [TP - FOB(t)]$$

where B denotes the bounty in kina per tonne;
 TP denotes the threshold price in kina per tonne;
 FOB denotes the f.o.b. export price in kina per tonne;
 b* denotes the rate of bounty (currently $b^* = 0.5$); and
 t denotes the time period (that is, each month).

When the current f.o.b. price is below the threshold, the term $[TP - FOB]$ is positive and the bounty payment to growers is a positive fraction (b^*) of the difference between the threshold and the f.o.b. export price. Conversely, when the current f.o.b. export price is above the threshold, $[TP - FOB(t)]$ is negative. Hence there is a "negative bounty" and a levy is deducted from the growers, equal to a positive fraction (b^*) of the price difference.

An alternative formula suggested by Guest (1987:44) focuses directly on the monthly price fluctuations we want to reduce as follows:

$$B(t) = B(t-1) - b^* \times [FOB(t-1) - FOB(t-2)]$$

where $FOB(t-1)$ denotes the average f.o.b. export price in the month immediately preceding the current month (t); and

$FOB(t-2)$ denotes the average f.o.b. export price two months ago.

He argues that the lag of one month is necessary to allow for the recording of the average monthly f.o.b. export price, and in the long run a lag of one month is of no consequence. The suggested alternative formula implies that the current month's bounty $[B(t)]$ will be equal to the previous month's bounty $[B(t-1)]$ if there is no change in the (lagged) f.o.b. export price; that is, if $[FOB(t-1) - FOB(t-2)] = 0$.

When the price is rising, $[FOB(t-1) - FOB(t-2)]$ is positive, and the stabilisation bounty $[B(t)]$ will fall (levy will rise) by a positive fraction (b^*) of the change in price from one month to the next. Conversely when the price is falling, $[FOB(t-1) - FOB(t-2)]$ is negative, and the stabilisation bounty $[B(t)]$ will rise (levy will fall) by the same positive fraction (b^*) of the change in price.

The alternative formula has some advantages over the current formula. There is no attempt in the alternative formula to pre-judge what the long run trend of either real or nominal f.o.b. export prices will be, nor is there any presumption that some moving average of past prices in either real or nominal terms will approximate the long-term price trend. Under the alternative formula, the adjusted prices, after deducting levies and adding back bounties, will fluctuate around the trend in nominal f.o.b. export prices. The size of the fluctuations will depend on the marginal bounty-levy rate (b^*) and thus the trend in the adjusted price, by construction, will be equal to the trend in the f.o.b. export prices. Furthermore, because the alternative formula guarantees that the adjusted price will be equal to the f.o.b. price in the long term, and because the uncertainty associated with estimates of the threshold price is removed, it should provide the commodity boards with added confidence to raise the marginal rate of bounty-levy above 50 per cent.

There has also been a lot of debate as to what the size of the funds for the respective commodity stabilisation schemes should be. The existing formula does not incorporate any provision for coping with a fund that becomes too large or is in danger of running down. From the modelling which has been carried out by the Australian Centre for International Agricultural Research (ACIAR), it has been found that as fund size increases, its efficiency in reducing price variation does not increase commensurately.

There is some evidence from the modelling work which has been carried out to specify a maximum fund size, beyond which levies will not be collected. Once the fund is at its maximum then the interest should be returned to the growers through the bounty mechanism. The preliminary analysis by ACIAR has shown that a maximum fund size equal to the value of the previous year's exports is most efficient at reducing price variability, although this level is likely to be reached only on rare occasions. Other possibilities include the setting of a maximum fund size at which levies are reduced and

the setting of a maximum payout which could relate to the existing fund size. Alternatively, a shorter moving average would allow the threshold price to move more in line with f.o.b. prices thus reducing the size of the levies and bounties. The chances of the fund becoming too large or running down would be reduced. A similar effect could be achieved by a different type of moving average where the weights attached to past prices decline over time. Under this system, the current threshold price is more influenced by what has happened in the recent past than by previous prices.

The respective boards have argued that inflation bears no relation to the supply or demand of any particular primary commodity, and therefore no relation to its price either. The only reason for including an inflation adjustment is to gain an idea of the purchasing power a producer has this year, relative to any other. Since the idea of using the funds to protect a particular cost of production has been dismissed as impractical and irrelevant to smallholders, the usefulness of the inflation adjustment must be seriously questioned. Inflation adjustments create a trend factor in the threshold price over time, but since any real trend will be picked up in the moving average, by definition there can be little to gain by counting it again. Clearly the implication of dropping the inflation adjustment would be to increase levy payments in the short term, when prices are high, and to increase the longevity of the fund in a slump. However, this may make it impossible to run it down. The inclusion of inflation in the formula tends to increase the threshold price relative to the export price. This has the effect over a number of years, of reducing levies and increasing bounties and may lead to the quick run down of funds.

Anomalies in the operations of the funds can also arise when the bounties and levies are not determined on a consistent basis. This is a problem in the coffee industry because of the time lag between the price movements which determine whether a bounty should be paid and the date of payment. The time lag is so long (up to a year) that a levy situation may then prevail leading to the anomalous situation of bounties and levies applying at the same time. Levy payments are determined by the current price compared to the moving average. However, in order to simplify calculations, bounty payments for the current year are at present determined by comparing last year's average price with the current moving average (ten year). This obviously requires a change in procedures.

The multiple role of funds applies to coffee only. The fund's multiple functions of price stabilisation, equalisation and stockholding has come under criticism. There have been suggestions to separate these functions because a multiple role obscures how much money is available for any one purpose. The modelling done by ACIAR has shown that a maximum fund equal to the value of the previous year's exports is helpful for optimising price stabilisation. Clearly using some of the fund for stockholding reduces that available for stabilising prices and reduces the fund's efficiency in that direction.

There has also been concern raised regarding limitations to income (levy) and outgoings (bounty) as preliminary simulation models done by ACIAR show that the funds work more efficiently when there is constraint on the amount by which the funds can grow or shrink in any one year.

In the light of discussions focusing on the common objective for the agricultural sector of stimulation of growth and employment opportunities the following are suggested if the government is to see the expansion of the agricultural sector:

1. It has been identified that Papua New Guinea is a high-cost economy vis-a-vis the three modes of transport, electricity, wage rates, high interest rates on capital and investment goods, high land rates, unskilled and less productive labour and fragmented market. These internal institutional and structural constraints to growth and expansion of the agricultural sector and the economy need to be given special attention. Once these factors that contribute to high costs are minimised there can be increased investment, employment and growth of the sector. Import-substitution and export industries should also be boosted as a result.
2. Since the agricultural sector supplies the industrial sector with raw materials, growth in the latter will ultimately depend on the former. This will only come about once (1) is properly addressed.
3. Since the policy of budgetary restraint has been pursued with a view to maintaining external balance, investment in the agriculture sector has declined, especially in rural infrastructure (roads, marketing and processing facilities), there is a need for more investment both domestically and also from off-shore. Thus a good investment climate needs to be created. The private sector also needs to invest more.
4. In order to encourage import-substitution and export industries and help increase incomes received by producers, there should be gradual devaluation of the kina, although there could be inflationary pressures.
5. In order to reduce real minimum wages and thus narrow the large urban:rural wage differential, remedies need to be found to the factors that contribute to the high cost structure of the economy. They include high cost of living, fragmented market, high transport costs, high dependence on imports, high operational costs (high rents and high price mark-ups). Reduction in wages is necessary in order to increase investment to the agricultural sector and thus growth. This could be achieved through devaluation and not a direct reduction of wages in order to avoid industrial or union unrest.
6. Stabilisation schemes should continue to operate as they have been able to stabilise producer prices and thus producer incomes, although modifications to the mechanics of operations of the schemes are necessary with regard to the fund size, the fund's multiple role (in the case of coffee), the ways in which levies and bounties are determined, the limit to incomes and outgoings, the use of inflation in calculating the threshold prices and the need for compensatory finance.
7. Labour productivity needs to be increased through more training and increased extension services.

Conclusion

Macroeconomic policy will no doubt continue to impact greatly on the agricultural sector due to its prominence and could possibly determine the parameters within which sectoral and microeconomic policies should be set. In order for the agricultural sector to expand and thus contribute more to the development of the economy by way of increasing employment opportunities, GDP and foreign reserves, it is imperative that macroeconomic policies work in harmony with other sectoral policies and strategies to minimise internal and external institutional and structural constraints to growth and development.

Every effort must be made by both the government and the private sector to create an economic and investment environment that is conducive to the growth and expansion of the agricultural sector and also the economy as a whole.

Although no empirical evidence exists to specifically analyse the effects of macroeconomic policy on the agricultural sector, trends observed nevertheless suggest that macroeconomic policy has and does influence the sector, and that linkage effects to other sectors of the economy are significant.

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AN ASSESSMENT OF THE IMPACT OF FOREIGN EXCHANGE MOVEMENTS ON A COFFEE PLANTATION

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Background

In recent years there has been substantial volatility in the foreign exchange markets which, although growers may not have known it, has had a substantial impact on the prices of primary products. Such volatility affects all goods and services which are imported or exported. Coffee as the most important export crop, in value and employment terms, is the focus of this paper.

The plantation and block development sectors are the highest-cost parts of the coffee industry and therefore most influenced by price and exchange rate levels. This is also the sector about which most is known in terms of costs and returns. As the principal source of good quality, high-value coffee it is of concern to the Board that this sector is currently threatened with substantial losses which endanger its future.

This paper looks at the cost structure of a plantation and attempts to assess the impact of a kina devaluation on both costs and revenues. The likely result of continuing with present exchange rate policy is outlined and a re-evaluation of that policy is recommended.

Methodology

The Papua New Guinea Coffee Industry Board (CIB) carried out in mid-1988 a study in the Eastern Highlands Province (Bodman 1988) to estimate plantation coffee cost of production. As the most up-to-date study available on the industry and, in particular, on the sector which is most affected by changes in exchange rates, it is this which forms the basis for the analysis.

From the main cost components which were identified in the study are derived the foreign exchange component inherent in each. The way in which these have moved over the last nine years is shown graphically. An attempt is made to estimate the likely effect of a 20 per cent devaluation of the kina on both revenues and costs. The effect of no change in exchange rates is outlined and the advantages of a devaluation are explored against other ways of increasing the viability of the high-cost coffee producers.

Costs

Overleaf is a break-down of the fixed and variable operating costs of a typical plantation in 1988 (Table 1). Also given is the foreign exchange component of each item and the currency in which the item is most frequently traded. From this information it is possible to derive an idea of the currencies against which the fluctuation of the kina is most important, in terms of affecting the cost of production of coffee.

For comparative purposes details are also given of a similar study conducted in 1985. It may be of interest to note the increased expenditure on crop protection as a result of coffee leaf rust. The increase in the depreciation and fuel elements relate to differing assumptions on the part of the participants in the surveys.

On the basis of Table 1 and the relative importance of each cost item in overall costs it can be seen that the US dollar is the most significant currency in imported inputs.

There are various secondary effects from exchange rate movements which are not always apparent and which are difficult to quantify. One of these is the value of kina salaries for overseas personnel relative to those elsewhere, be it in their own countries or overseas. Were kina salaries to become relatively less attractive for Australian accountants for example and firms preferred to hire such people for whatever reason then it may be necessary for those salaries to rise to attract suitable people. If that were to happen the cost of accountancy services would also have to rise.

A further important result of currency movements is the effect on the price of imported food items, in particular rice and tinned fish which form a large part of the staple diet. There is a fear that a rise in the cost of such staples will be reflected in calls for increased wages. This relationship between the price of staple foods and wage rates and the degree to which one determines the other will affect the extent to which a devaluation achieves the desired aims. From the table it can be seen that 24.11 per cent of all costs in 1988 are likely to be directly affected by the movement of foreign currencies relative to the kina. Of that the largest proportion is for inputs quoted principally in US dollars.

Currencies in coffee trade

While Papua New Guinea coffee is sold to many countries in virtually all cases the currency in which the price is fixed is the US dollar. A price is normally fixed relative to the New York C contract terminal market and then payment is made in US dollars by the buyer. For example although the bulk of Papua New Guinea coffee is sold to West Germany (44 per cent) and Australia (25 per cent) it is traded at prices fixed relative to the New York market.

Exporters are daily traders on the market and endeavour to get foreign exchange cover on the same day as contract commitments are made. For a typical sale to West Germany the price will be fixed in US dollars at the New York C contract price of (say) 132 USc/lb less 4 USc discount for August delivery. Payment, although from a West German buyer, will be made in US dollars and the exporter will therefore take exchange cover in that currency. The buyer will also obviously take exchange cover from deutschemarks to US dollars to allow for the currencies in which he receives and pays funds. The same procedure applies for almost all sales to whatever destination with the result that the US dollars : kina exchange rate plays a pivotal role in the price achieved by exporters and paid to growers.

Other exchange rates such as the deutschemarks, Australian dollar and yen will be important only in so far as their level against the US dollar will determine the cost of coffee imports. A strong yen against the US dollar will make coffee imports from any origin cheaper than they would otherwise be and so help to boost consumption. Conversely a weak currency against the US dollar will make coffee imports relatively more expensive and therefore serve to depress consumption.

Table 1
Financial data relating to a representative 50 ha.
plantation, Goroka area, Eastern Highlands Province

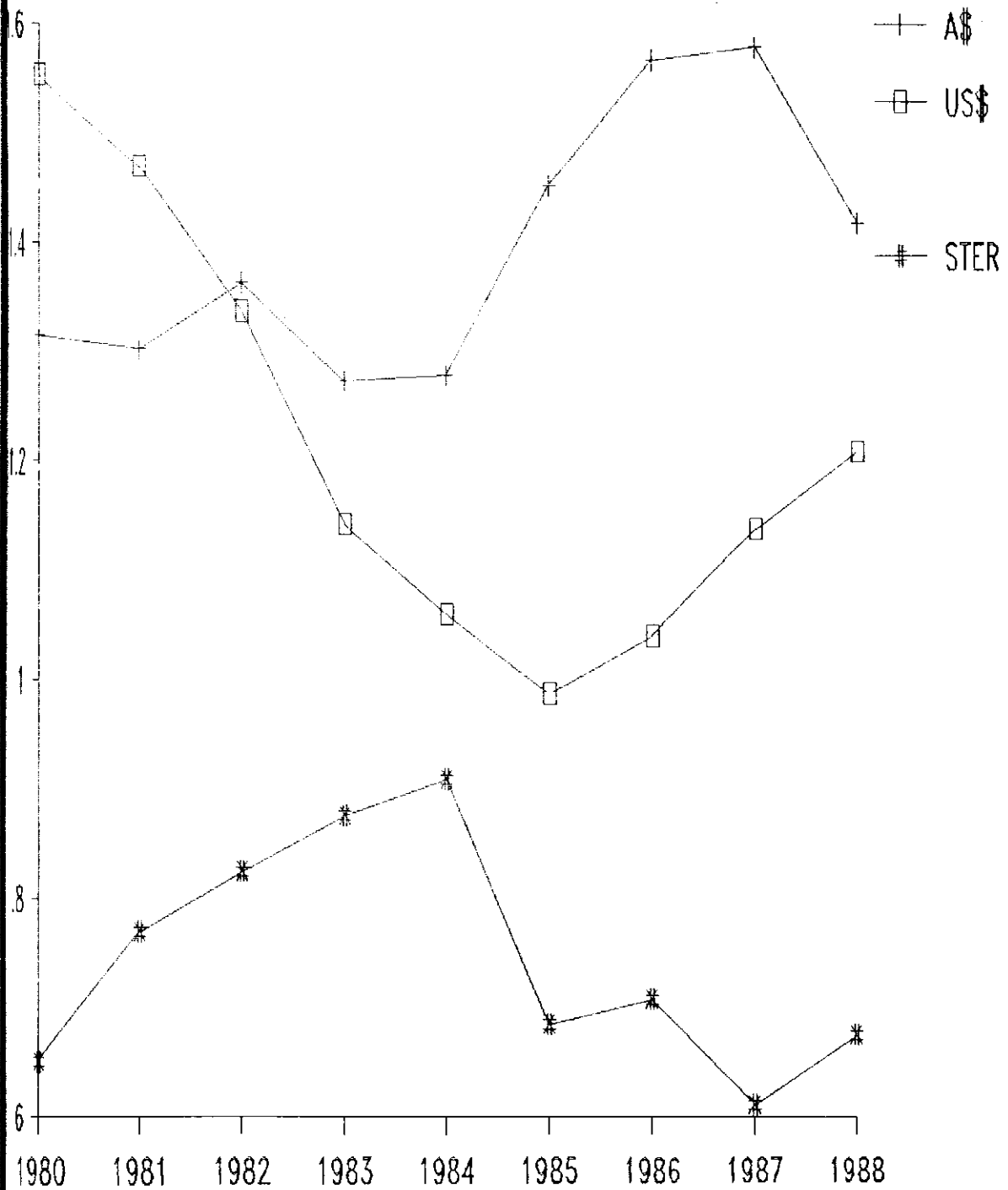
Item	1988		1985	Main currency
Fixed costs	kina	per cent	kina	
Management	20,250	10.77	16,000	-
Wages	3,330	1.77	--	-
Professional services	3,750	1.99	7,000	-
Insurance	4,300	2.29	3,320	-
Office expenses	1,400	0.74	425	-
Interest	1,950	1.04	4,575	-
Depreciation	24,500	13.03	9,125	-
Sub-total	59,480	31.62	40,435	-
Variable costs				
Wages - maintenance	19,100	10.16	18,000	K
- harvest	33,600	17.86	31,550	K
- other	300	0.16	250	K
Fertiliser	20,200	10.74	23,550	US\$ A\$
Herbicide	4,000	2.13	2,150	US\$
Crop protection	8,450	4.49	2,250	US\$
Tools	1,250	0.66	1,850	Yen Stg
Repairs & Maintenance	6,650	3.54	3,600	K
Fuel & oil	11,450	6.09	4,750	US\$
Electricity	6,000	3.19	--	K
Miscellaneous	2,600	1.38	3,250	
Sub-total	113,600	60.40	91,200	
Processing (Dry)	15,000	7.98	Not av.	
Processing (Wet)	36,000		35,500	
Total	188,080 (dry)		131,635	(excl. proc.)

Source: Bodman P.M., PNGCIB Coffee Discussion Paper No. 1, 1988, PNGCIB/QDPI
Largeholder Coffee Study 1987

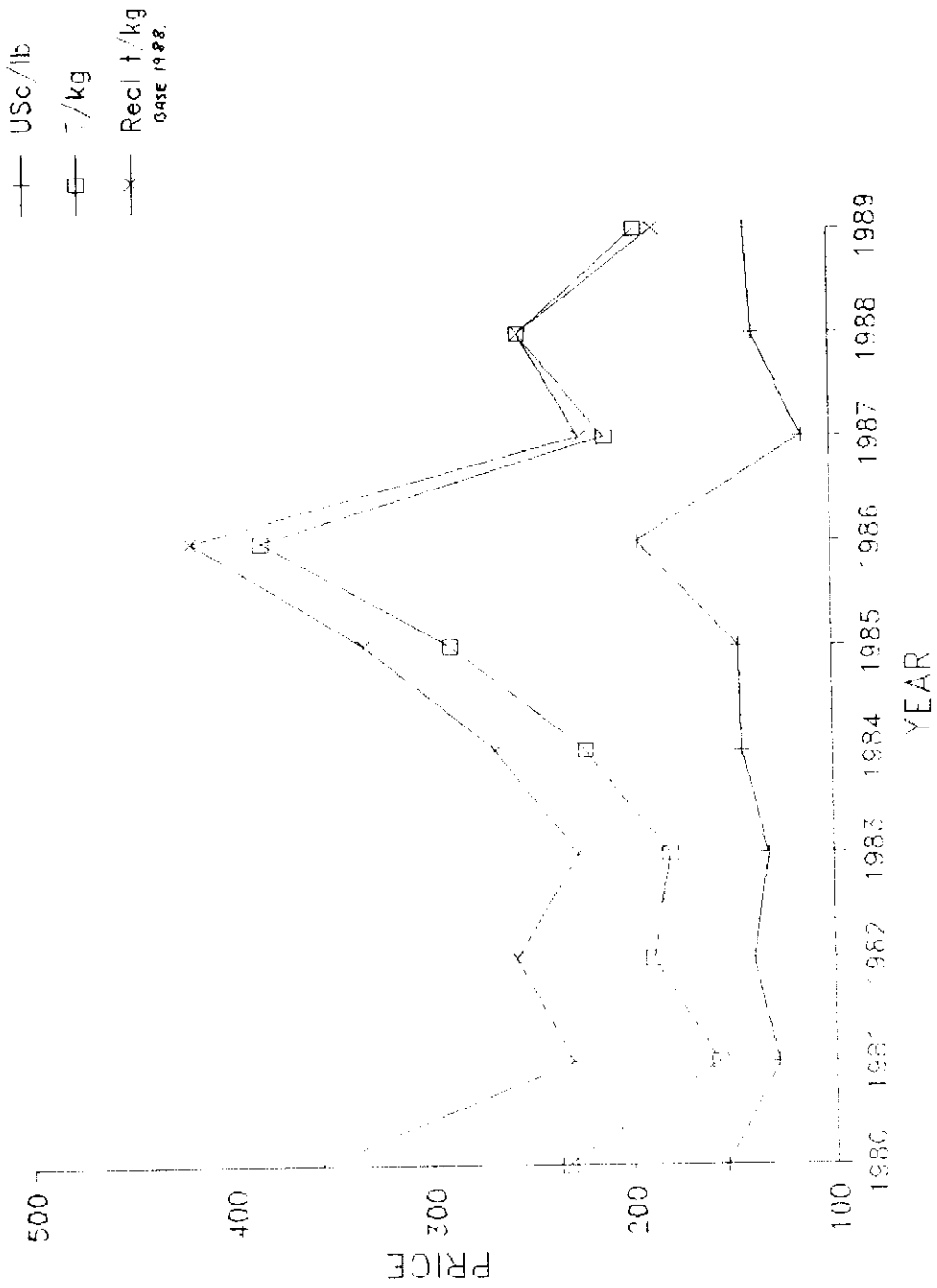
Recent exchange rate movements

Graph 1 shows the movement of exchange rates against the kina in the last nine years. From the graph it is apparent that there has been a marked decline in the US dollar against the kina over the last three years of the period. Graph 2 shows how this period has coincided with a decline in international coffee prices, which has been accentuated when expressed in kina terms. The decline in real (1988) terms is even more marked and it is this which is of most concern to the growers. It is important to note that the

Graph 1
Exchange rates - Foreign currency units per kina



Graph 1
Papua New Guinea FOB & 0. Mild International Coffee Organisation Indicator Price, 1980 - 1989



Source: Papua New Guinea Coffee Industry Board

exchange rates shown are mid-point buying/selling rates as set by the Bank of Papua New Guinea, however, exporters will only get the buying rate which will be somewhat less attractive than the rate shown by the graph. Importers will be somewhat better off than the graph indicates.

It is notable over the period that coffee prices while improving somewhat since 1980 have in real terms showed a steady decline. It is this decline in world prices which accentuates the impact of a deterioration in the exchange rate. A 15 per cent decline in the kina price received is of much greater importance if the business is only breaking-even than if it is making a reasonable profit.

As can be seen from the graph the average price of exports for the whole year is expected to fall to 190 t/kg, virtually the same in cash terms as prices in 1982 (189.32 t/kg). In real terms that would be approximately 140 t/kg in 1982 values! The volatility of the kina price of coffee appears to have been accentuated by the movement in the value of the US dollar, although this has not been tested.

Other currency movements have helped sustain consumption during the period. The increasing strength of the Japanese yen and the German deutschemark against the US dollar have made coffee relatively cheaper in those countries and so helped consumption. In particular, it has allowed these countries to maintain their preference for good quality washed mild arabica coffee, the market for Papua New Guinea coffee.

Results

From what has been outlined above it appears that there is a limited response to a relative weakening of the kina. Direct inputs of 18 per cent of total costs could be expected to rise by the full amount of the devaluation while wages (forming 33 per cent of total costs) could be expected to rise by one-fifth of the devaluation, given the importance of imported foods in the diet of those on minimum rural wages.

On the benefit side the improvement in coffee prices received by exporters would be expected to feed through almost uninterrupted to the plantation sector, because of the competitive nature of the exporting and processing sectors when exports are unrestricted as they are in 1989. Evidence from the smallholder sector indicates that there is less competition at the coffee buyer level and that therefore less of the price increase derived from a devaluation may feed through.

To take an example of a 20 per cent devaluation of the kina against the US dollar, for the typical plantation studied the revenue earned would increase by 20 per cent from K170,000 to K204,000 as the price per tonne of green bean rises from K1,700 to K2,040.

Costs at the same time could be expected to increase by the same 20 per cent for the 24 per cent of imported inputs denominated in US dollars, that is by $K45,350 \times 0.2 = K9,070$.

Wage rates could also be expected to increase, the amount being dependent on the imported component in the workers expenditure pattern. An FAO study (Rice development policy; an analysis of the options, 1986) quoted estimates of rural tinned fish consumption of 7.8 kgs/head/year and of 500 gms rice per head per week. Taking current prices of 90 toea/425 gms tin of fish and 70 toea/kg of rice this amounts to

expenditure of K1.00 per head per week, or some K6 per week for a family of six. With the present rural wage of approximately K19 per week this would amount to 32 per cent of income being spent on imported food. Given that the FAO estimates are for all rural people it may be fair to assume that plantation wage earners with consumption of meat as well may spend up to 50 per cent of their wage on imported items. As regards the currency for tinned fish and rice; the former is quoted in US dollars whether from Japan or Chile, and the latter is quoted in Australian dollars (mostly) or US dollars. It could be estimated therefore that a 20 per cent devaluation would lead to a 20 per cent increase in cost of 50 per cent of expenditure. Such a cost increase could be compensated for by a 10 per cent pay increase, so pushing the wages bill from K56,330 to K61,963.

On balance therefore the result would be for revenues to grow by K34,000 and for costs to rise by K14,703, an increase in net profits of K19,300. For a plantation with a cost of production of K1,880 per tonne this makes a substantial difference, the difference between losing K180 per tonne and possibly making a small K13 per tonne profit on operating costs.

Higher management costs would arise if expatriates were employed and this could reduce the beneficial impact of the devaluation. It would be necessary to counter this by increased localisation so that management costs were reduced. Where this seems hard to attain improved training of junior managers seems the only solution, a necessary move whether there is a devaluation or not at present prices.

With regard to timing, the benefits of better prices obtained by exporters would be available almost immediately and would be passed on quickly. Higher prices for imported goods, be they fertilisers or rice, would take longer to filter through to the industry because of shipping times and the time taken for purchases to be made. There would also be a lag before the higher cost of living would filter through to the CPI index and be reflected in a rise in the minimum wage rate, therefore, the benefit would be felt sooner than the cost increase.

Alternative ways of improving returns

Coffee plantations are faced with a cost of production of some K1,800 to K1,900 per tonne and with a price for the output, mostly Y grade, of K1,700 per tonne including bounty (K350 per tonne). As such they need to explore ways of cutting costs and increasing returns, such as improved quality, reduced costs or increased yields. However, because even if the output were all able to be sold as A grade the price would still only be K1,850 per tonne, relative to a production cost of K1,880 per tonne, improved quality alone does not appear to hold the solution to the plantations' problem.

It could be asked whether a higher output could be obtained from the existing area, especially where yields are only 2 tonnes per hectare at present. An increase of 10 per cent in output may be attainable for an additional 5 per cent of fertiliser. The cost of fertiliser (K1,600), picking (K3,000), transport (K400) and processing (K3,600) give a total cost of K7,600 for output worth K17,000, a marginal cost of production of K760 per tonne. Obviously there are limits to such marginal changes as declining returns set in so the overall impact on the average cost of production must be limited. It seems unlikely that any plantations will be able to reduce their average cost of production much below K1,700 per tonne.

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Alternative ways of improving returns

Coffee plantations are faced with a cost of production of some K1,800 to K1,900 per tonne and with a price for the output, mostly Y grade, of K1,700 per tonne including bounty (K350 per tonne). As such they need to explore ways of cutting costs and increasing returns, such as improved quality, reduced costs or increased yields. However, because even if the output were all able to be sold as A grade the price would still only be K1,850 per tonne, relative to a production cost of K1,880 per tonne, improved quality alone does not appear to hold the solution to the plantations' problem.

It could be asked whether a higher output could be obtained from the existing area, especially where yields are only 2 tonnes per hectare at present. An increase of 10 per cent in output may be attainable for an additional 5 per cent of fertiliser. The cost of fertiliser (K1,600), picking (K3,000), transport (K400) and processing (K3,600) give a total cost of K7,600 for output worth K17,000, a marginal cost of production of K760 per tonne. Obviously there are limits to such marginal changes as declining returns set in so the overall impact on the average cost of production must be limited. It seems unlikely that any plantations will be able to reduce their average cost of production much below K1,700 per tonne.

Replanting with semi-dwarf varieties would also help to reduce unit costs through increasing the yield and keeping many overheads constant, however, given the fact that variable costs amount to 68 per cent of total costs the scope for reduction in average costs below K1,600 or K1,700 per tonne seems very limited. That would assume the fixed costs were spread over 50 per cent higher output and variable costs per unit of output remain the same.

It should be noted that such increases in efficiency are made considerably more attractive when combined with a more attractive exchange rate. In addition the exchange rate improvement benefits all producers be they large or smallholders, efficient or inefficient. A worsening of the exchange rate position would hasten the demise of the plantation sector.

Policy implications

From the simple analysis which has been carried out there is little doubt that the initial impact of a weakening of the kina against the US dollar (and other currencies) would be to improve the viability of the plantation and block sector of the coffee industry. Plantations and blocks are the highest cost sectors of the industry but they also produce the best quality coffee which gives Papua New Guinea its good reputation. With no change in exchange rates and even if improvements in efficiency are made it is likely that operating losses in 1989 will average K200 per tonne for the sector, or K3.4 million. In addition there will be little or no scope for repayment of any long-term debt. On this basis the marked improvement in viability under a more favourable exchange rate must be worth further study.

The debt question? It has been suggested that a relative decline in the value of the kina against other currencies would be to increase debt repayments. This is undoubtedly true of US dollar denominated debt but if there are no exports then Papua New Guinea will be unable to service the debt anyway. Remote arabica coffee and all robusta areas are now faced with very low prices, 30 to 40 t/kg green bean. The anticipated decline in coffee prices in 1989 may well force these smallholders out of coffee production, while the prices paid in the main Highland areas of K1,700 per tonne may well prove insufficient to keep many plantations in business. The result of this may be a decline in exports of up to 10,000 tonnes (K19 million), even without declines attributable to coffee leaf rust. Such a loss of export revenue is not going to help service the debt.

By ignoring the plight of agriculture during a mineral boom there is every prospect of following in the path of countries such as Nigeria. Nigerian experience with a strong currency to keep import prices down and increased dependence on imports was to cause the neglect of agriculture with a resultant decline in agricultural export revenue which is now making the debt burden virtually unsustainable. The renewable nature of agriculture compared to the essentially non-renewable nature of mineral exploitation indicates that close attention should be paid to the policies affecting agriculture if the country's debt is to be serviced.

In summary therefore it should be repeated that the countries which have had greatest economic growth in the last twenty or thirty years are those which have followed export promoting policies (Hong Kong, Singapore, Korea, Taiwan, Thailand). Papua New Guinea would be well advised to consider this in the context of the present difficulties with the export tree crops and their vulnerability at present exchange rates. Needless to say the viability of any export-orientated industry will be enhanced by a weaker kina, be it wood-

products, minerals, sugar, etc. In a world where Papua New Guinea is faced with competition from countries with much lower unit costs of production such as Brazil and Colombia (coffee) and Australia (sugar) and Thailand (rice) the role of exchange rates in influencing our international competitiveness cannot be ignored (see Bhagwati J.N., World Bank Research Observer Vol. 3 No. 1, January 1988 and others).

Can it be done? The level of the kina is determined by a basket of currencies, based on the pattern of trade. It can reasonably be argued that if there has been a past policy to keep imports cheap, as appears to be the case, then the pattern of trade will reflect that, so any trade-based basket of currencies used to set the rate for the kina today or in the future will, by definition, be pro-import and anti-export. Hence, it is time for a real attempt to encourage exports through a lower kina to be made.

Naturally the kina cannot be devalued against one currency alone but only against all currencies. There is obvious validity in this and the US dollar has been highlighted here because of its importance to coffee. The argument advanced is not negated by this comment since the objective is to make a conscious shift from being pro-import and anti-export in exchange rate policy to the reverse, whereby agriculture is made more competitive. A decline in the rural standard of living is certain from present policies while a new approach as suggested holds the possibility of a revitalised agriculture. Even the danger of importing inflation as indexation of costs occurs can be avoided with appropriate monetary and wage policies, together forming a package which would reduce Papua New Guinea costs relative to those of other producers. Such a package needs careful discussion and prompt attention to address the plight of cash crops.

It is believed that many of the points made here with reference to coffee are also true of cocoa and copra although there has not been any opportunity to confirm this. Some response or views on the points raised would be opportune to indicate to government the position of these major export industries. There can be little doubt that a failure to act on exchange rates will ensure a continued stream of requests for millions of kina of government assistance to export industries over the coming years which will make those already made seem paltry.

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THE COFFEE INDUSTRY AND ITS FUTURE

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Introduction

The coffee industry in Papua New Guinea has grown to become the largest agricultural pursuit in the country in terms of its contribution to national revenue and to the general welfare of a sizable proportion of the national population. Export earnings from coffee exports rose substantially over the years to a stage where it now ranks third only to gold and copper. In fact in 1986 alone coffee earned the country a total f.o.b. value of K208 million in export earnings which comprised 20 per cent of total export earnings, making it the second largest after gold in that year. Statistics from the 1980 Census showed that about 260,000 families depend on coffee growing as a source of income. This figure times an estimated average family size in Papua New Guinea of six (4 children plus husband and one wife) gives a total population of about one and a half million people, which is about 45 per cent of the total national population. Coffee is also an important source of revenue for the government collected in the form of export, personal income and company taxes.

Overview of history and structure

Coffee was reportedly introduced into the country in the late 19th century under the German administration where it was first grown experimentally on mission and agricultural stations. The first reported coffee exports was from British Papua worth 915 pounds in 1905/06 with a reported land area under coffee of 180 acres by the year 1908/09. On the New Guinea side the first documented exports were in the years 1938/39 with 38 tons, 1939/40 with 63 tons and 1940/41 with 74 tons. Planting of coffee was originally dominated by expatriates until the early fifties when local involvement was encouraged, especially in the Highlands as part of the government's development strategy to raise standards of living of the local people and to raise finance to fund public social expenditure. By 1955 there was a reported area of 516 acres under coffee owned by locals compared to 1,807 owned by expatriates. Today the industry is almost localised in terms of ownership and employment. In fact 95 per cent of production is owned by nationals.

Although coffee is grown in about fifteen provinces throughout the country about 90 per cent is produced in the five Highlands provinces. In 1986/87 Western Highlands accounted for 47 per cent of national production, Eastern Highlands 31 per cent, Chimbu 5 per cent, Morobe 5 per cent, East Sepik 4 per cent, Enga 3 per cent and the other 5 per cent shared by Southern Highlands, Oro, West Sepik, Madang, Milne Bay and Gulf provinces. Arabica coffee makes up about 95 per cent of total Papua New Guinea exports. The remaining balance is made up of Robusta coffee grown in the lowland coastal provinces, the bulk of it grown in the East Sepik Province. Arabica coffee is grown mainly in the five Highlands provinces and the high altitude areas of coastal provinces like Morobe, Central, Gulf, Oro, Madang and West Sepik provinces. The type of Arabica grown in Papua New Guinea is the mild Arabica type which is of a high quality and is demanded highly on the world market.

About 70 per cent of coffee produced in Papua New Guinea is grown by smallholder growers on small village plots averaging 0.5 hectares. The other 30 per cent is grown on

plantations totalling almost 400 and ranging in size from 5 to 1,956 hectares. The latest survey on plantations carried out by the Board gave a total of 13,100 hectares already under coffee with a potential to expand to 21,700 hectares. Papua New Guinea's production is expected to double by the end of the century once all estates use up all potential areas. Production which averaged about 800,000 bags over the five years between 1980/81 and 1985/86 jumped to a record 1,070,000 bags at the end of 1986/87. This performance improved by a further 6 per cent when production increased to 1,147,630 bags the following year. Production for this year is forecast at 1,200,000 bags.

The coffee industry is being served by about 80 coffee processing factories located mainly in the Eastern and Western Highlands provinces. Fifty-four of these are registered factories that are authorised to buy and process smallholder coffee. The rest process coffee from their own plantations only.

Marketing of coffee

The system used to market coffee both internally and externally is a carbon copy of the free market system where competition is encouraged to give the best prices to producers. On the domestic scene coffee is being bought by middlemen buyers, some of whom do not plant coffee at all. Some of these are either village entrepreneurs or buyers contracted by the big factories. Some factories provide some assistance to some buyers in the form of a truck or cash advance to buy coffee on the condition that the coffee purchased is sold back to the factory in which profit is deducted to meet the cost of the truck or cash advance.

The export of coffee (although a Board function) under the Coffee Industry Act of 1976 is being undertaken by ten licensed exporters. The Board considers the numbers of exporters currently licensed as adequate for the time being to ensure competition which in turn ensures fair prices for the growers.

Papua New Guinea has been able to export to a wide range of countries which is indicative of a quality conscious export sector that has been able to sell Papua New Guinea coffee even in the most difficult times. In 1986/87 Papua New Guinea export performance was boosted to a total of 1,136,508 bags. This is a record performance compared to an average export performance of 800,000 bags over the last five years. West Germany is the largest importer of Papua New Guinea coffee as demonstrated by 1986/87 statistics which showed that that country took in 54 per cent of exports compared to 22 per cent by Australia, 6 per cent by United Kingdom, 5 per cent U.S.A., 3 per cent by Singapore and Netherlands and 2 percent by South Korea. The other 5 per cent went to countries like Fiji, France, Ireland, Japan and Italy.

The Coffee Industry Board (CIB)

The Coffee Industry Act 1976 has empowered the CIB to manage the affairs of the industry on behalf of the government. The current Board is made up of nine grower representatives, from the main coffee-growing provinces and one official member who is the Secretary of the Department of Agriculture and Livestock. There is mounting pressure from all sectors of the industry for the Board to be truly representative. Steps are now being taken to propose amendments to the Act to accommodate all sectors of the industry.

Under the Act the Board is responsible for the overall administration of the industry's affairs ranging from planting, processing and marketing of coffee. The Board has left

most of these tasks to the private sector and is concentrating on its regulatory functions like quality inspections and licensing of factories and exporters. The Board was instrumental in setting up two autonomous institutions to assist it in looking after the affairs of the industry. The Coffee Research Institute was set up in 1985 to undertake research into all aspects of coffee growing and proper husbandry methods, fertiliser usage and high-yielding and disease-resistant varieties. The Coffee Development Agency was set up in 1986 in response to the outbreak of the coffee leaf rust disease. Its function is mainly that of extension focused on educating farmers on proper husbandry methods like drainage, pruning, shading and fencing. Both institutions together with the Coffee Industry Board get their funding from an 8 toea levy imposed on every kilogram of coffee exported out of the country.¹

The Board is also empowered under the Act to maintain a stabilisation fund collected from levies imposed on coffee exports. The purpose of the fund is to support prices when prices are low through bounty payments and stock holding. Bounty payments are paid to top up producer prices when they fall below a certain threshold price calculated from a ten year moving average. The stock holding function of the fund was put in to use last year when a portion of the fund was used to finance exporter stocks in order to meet our target for the International Coffee Organisation (ICO) stock count that took place at the beginning of April this year.

Coffee prices

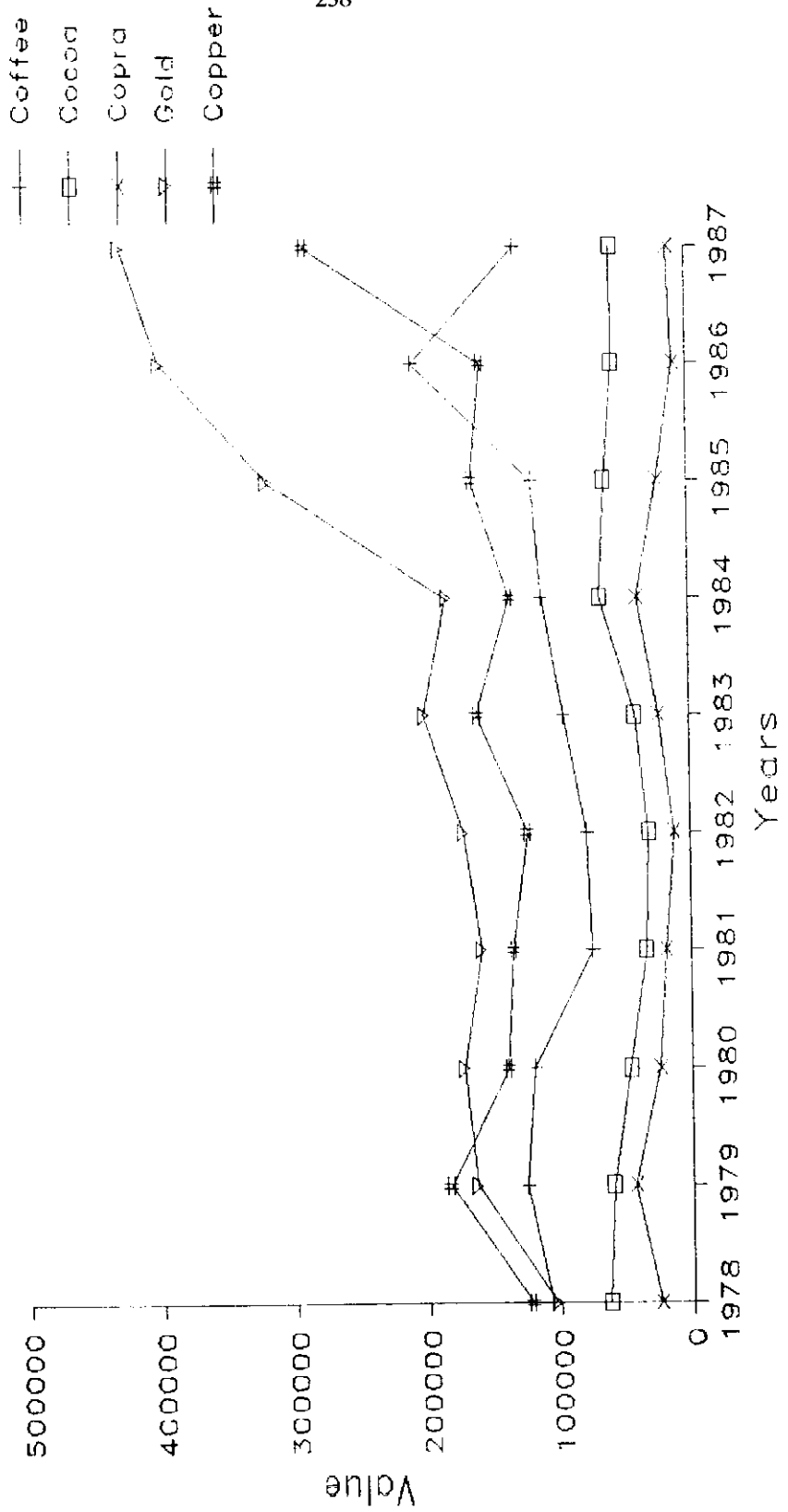
Coffee prices are very important in so far as they determine the revenues received by the producers and government in the form of taxes. The fact that almost 100 per cent of the country's production is exported and this production amounts to about one per cent of global production means that the prices received by the industry depends to a large extent on the prevailing world market conditions. This is demonstrated in Graph 1 which shows Arabica f.o.b. prices rise by almost 60 per cent between November 1985 level of K2.87 and April 1986 peak level of K4.90 per kilogram. Since then prices maintained a downward trend until October 1987 when prices started to pick up in the face of ICO quotas imposed that year. Presently, Arabica export prices continue to hover above K2 per kilogram with the help of ICO quotas re-introduced again in October 1988. Domestic or factory door parchment prices have moved in line with export prices. From a record peak of K2.55 in April 1986, it has fallen to current level of near K1 per kilogram.

The current world coffee market is regulated by ICO quotas introduced in October 1987 and re-introduced again in October 1988. This follows from a brief suspension in February 1986 after being imposed for more than five years from the time quotas were imposed on 1 October 1980. The current quota agreement for the current year allows for an initial global quota of 58 million bags with outer limits of 53 to 63 million bags after cuts and increases. The aim of quotas is to maintain prices between 120 US cents per pound and 140 US cents per pound. The 15 day moving average of the ICO composite price is now back to its level when quotas were first introduced in October 1987 at 112.00 US cents a pound after peaking at 132.00 US cents a pound in January this year.

Papua New Guinea's quota for this year is 1.17 per cent or 633,175 bags of total global quota of 58 million bags. This was an improvement on last year's quota of 1.15 per cent or 622,351 bags. Despite a quota share of 622,351 bags Papua New Guinea was only able

¹. This levy has subsequently been reduced to 4 toea.

Graph 1
Value of major export commodities
(K'000 f.o.b.)



to export 547,659 of these to member countries after the cuts imposed by the ICO at the end of the year 1987/88. Papua New Guinea was able to export 94,700 bags to non-member countries for the same year with accumulated stocks of 582,000 bags. Although there has been suggestions that Papua New Guinea would be better off without the ICO in terms of its ability to sell all of its production, there is no doubt that prices would fall considerably in the absence of an ICO. This view is being confirmed by current World Bank projections that world coffee prices would be 30 per cent lower in 1990 and 10-20 per cent lower for the following three to four years if quotas were to be suspended. Negotiations are underway in London for the fifth International Coffee Agreement to succeed the current one which expires at the end of September this year. The insistence by the United States for the next agreement to address the issues of a two-tier market and shortages of high-quality coffee has been a major obstacle to an early agreement.²

The general outlook for the world coffee economy is for production to rise faster than consumption and this trend is forecast to continue late into the century. As shown on Graph 2 total production had risen by 17 per cent from 74 million to 87 million in the ten year period between 1979 and 1988. In the same period gross opening stocks by member countries rose by 100 per cent. The World Bank has projected supply by Brazil to grow by 2 per cent per year until the end of the century compared to that of Colombia at 1.9 per cent. On the other hand world demand for coffee has been projected at 1.7 per cent per year until the year 2000. As this trend is expected to continue coffee prices are likely to remain depressed for an indefinite period.

Prospects for the future

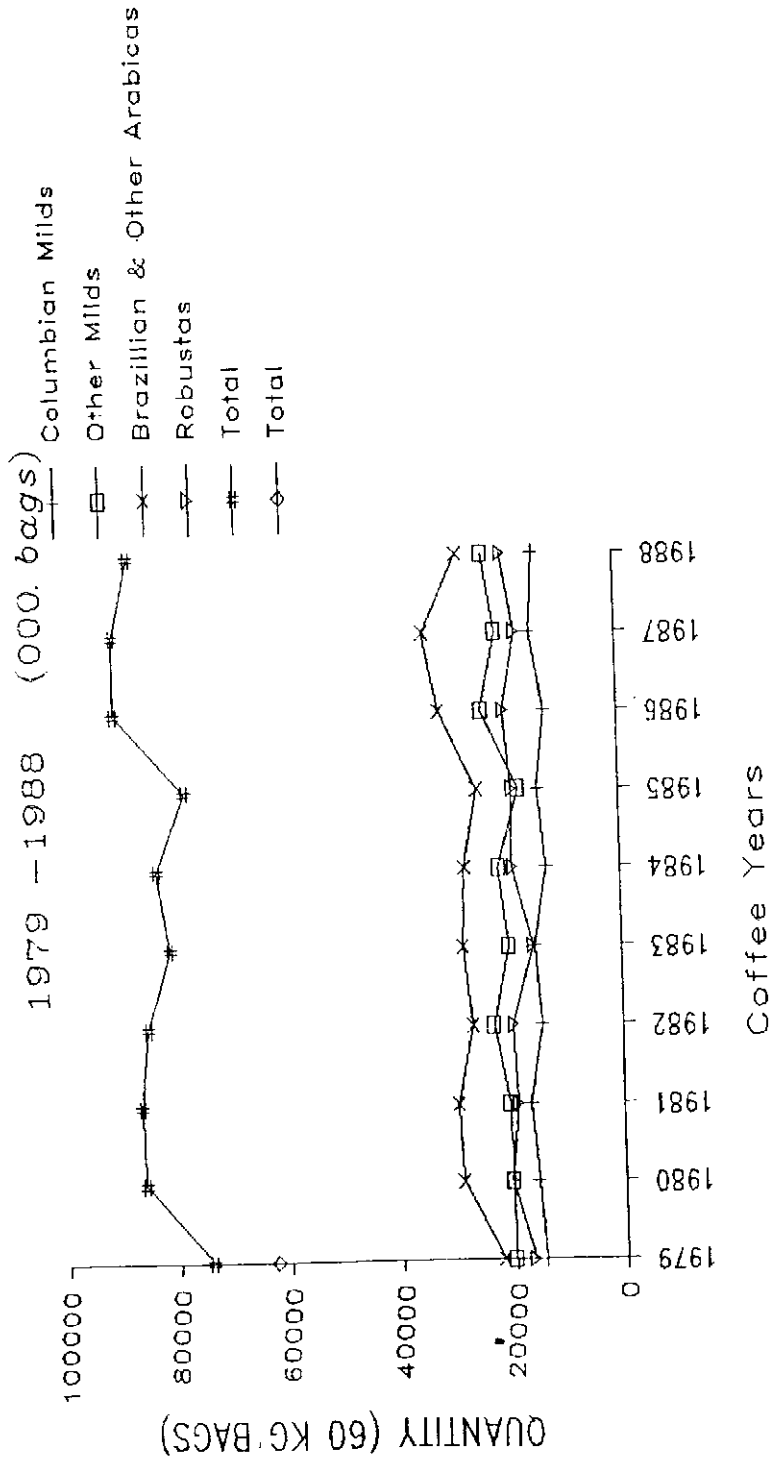
In view of the current world market situation and its influence on the domestic market the CIB who is responsible for the affairs of the industry has to act responsibly to ensure industry confidence is maintained. Last year the Board engaged a group of consultants with the assistance of DAL to draw up a Five Year Coffee Development Plan that will set the framework for the future, bearing in mind our position in the world coffee economy. The draft report has outlined some measures which are in line with the current Board thinking as outlined below.

Quality

Firstly, it is reasonable to assume with orthodox economic theory that in a world where quantity is high, consumers will want to choose a product on the basis of quality. At a time when there is overproduction of coffee, this has particular relevance to the coffee market. One of the arguments put forward by the U.S. is for the issue of shortage of high-quality coffee in quota markets to be taken into account in the new agreement. Recent surveys have shown that U.S. consumers prefer quality coffee at a time when consumption in that country is declining. Papua New Guinea's production has increased dramatically over the years and has the capacity to double by the turn of the century. Should the current world market situation continue, Papua New Guinea will have to put up an image in order for us to maintain our current hold on the market and further increase demand for our coffee. If we are to keep up with the times we have to incorporate quality into our marketing strategy. For the first time, the Board has set up a liquoring section with a view to standardising current quality standards used by exporters in grading our coffee. An expatriate liquorer will be recruited soon to train and oversee counterpart national staff for this very important work. The consultant's report has

². The current agreement has been extended for two years and quotas were suspended on 4 July 1989.

Graph 2
Total production by member countries



also mentioned setting-up community pulpers to address the quality problem that is inherent with village producers. The setting up of central buying depots is an option being considered in this strategy where quality control will be centralised and controlled. It is expected that these measures once in place will improve the quality of our coffee in the long term.

Efficiency

A broad second measure proposed by the report is routed in the belief that only efficient individuals or firms should be allowed to produce and market coffee. The report highlighted the removal of the current system that subsidises inefficient operators in the industry. It has been mentioned that the current bounty system provides a form of subsidy to producers of low quality coffee, especially Robusta producers. It is proposed that assistance should be given to the inefficient producers who choose to exit and not those who choose to stay.

The export sector has been singled out as another area where the current system protects those who are inefficient. There are 10 exporters currently licensed by the Board. These exporters are allocated export quotas based on past performance to export markets over the past 36 months. It was suggested that the current three year moving average favours the established exporters even though they may be inefficient and that the formula be dropped in favour of one where exports for the forthcoming year is based on past year's performance. It has been further suggested that ten per cent of quotas be auctioned to allow entry of new exporters into the market. The Board has made a decision that as from 1 October 1989, 15 per cent of quota will be based on value of exports for the preceding 36 months. Presently there is a moratorium on the number of export licences until the end of this year. Any decision to decrease or increase the number of export licences will only be done after careful study of the pros and cons.

Cost of production

Still on the topic of efficiency, one of the major problems that would affect the future viability of the industry is rising cost of production, especially at a time when coffee prices are falling. Although the consultant's report recommended that inefficient producers be allowed to exit from the industry and that the Board focus on quality rather than expansion, the exit of producers must not be allowed to the extent that our production is decreased to threaten future supplies to our customers. The onset of the rust disease in early 1986 has raised costs especially for the plantation sector to the extent that some plantations are reported to be operating at barely break-even. The consultant's report has singled out this sector as being the most efficient in relation to the campaign for better quality and should therefore be encouraged. As shown in Table 1 this sector has experienced a rise in costs by 31.5 per cent in the three year period between 1985-1988. It also shows the wage component on maintenance and harvesting accounting for 30 per cent of total costs. If management and fixed wages are included then the total component on wages amount to a staggering 44 per cent. It must be stressed that current government wage policy has important implications on cost of production and productivity which are very important in determining our competitiveness in relation to other producer countries.

About 70 per cent of coffee produced in Papua New Guinea is grown by smallholder or village producers. This sector has been described as one of "low input, low output" and quite efficient in ensuring high returns in respect to costs. It is our view that this sector has the potential to expand production if given the right type of training in better husbandry methods and some assistance to acquire fertiliser and other farm chemicals.

The coffee industry has been the first in this country to set up and fund its own extension agency in the form of the Coffee Development Agency (CDA). Although the Agency was set up initially to combat the effect of rust, we attach very great importance to the ability of CDA to develop the potential of this sector and to encourage production. The recent decision by the government to cut its contribution to this organisation is a sorry state of affairs as it will serve only to bring back the extension work to where it was before.

The implications of the current government exchange rate policy on coffee and other agricultural industries is being dealt with in another paper presented at this seminar by our senior economist but I will briefly mention a few things. Since independence the government has pursued a hard currency policy which ensured that the value of the kina was kept high in relation to other currencies. It could be estimated correctly that this country has lost millions of kina over the years due to the high exchange rate policy. Although the government has pegged the currency to a basket of currencies and hinted lately it will allow the kina to depreciate over time, current movements are of insignificant impact on producer margins and productivity.

Table 1
Financial data relating to a representative 50 ha. plantation
Goroka area, Eastern Highlands Province
(average costs in kina)

Item	1988		1985	
Fixed costs				
Management	20,250	11.70	16,000	12.16
Wages	3,330	1.92	-	-
Professional services	3,750	2.17	7,000	5.32
Insurance	4,300	2.48	3,320	2.52
Office expenses	1,400	0.81	425	0.32
Interest	1,950	1.13	4,575	3.48
Depreciation	24,500	14.16	9,125	6.93
Sub-total	59,480	34.37	40,435	30.72
Variable costs				
Wages - maintenance	19,100	11.03	18,000	13.67
- harvest	33,600	19.41	31,550	23.97
- other	300	0.17	250	0.19
Fertiliser	20,200	11.67	23,550	17.89
Herbicide	4,000	2.31	2,150	1.63
Crop protection	8,450	4.88	2,250	1.71
Tools	1,250	0.72	1,850	1.40
Repairs & maintenance	6,650	3.84	3,600	2.74
Fuel & oil	11,450	6.62	4,750	3.61
Electricity	6,000	3.47	-	-
Miscellaneous	2,600	1.50	3,250	2.47
Sub-total	113,600	65.63	91,200	69.28
TOTAL	173,080	100.00	131,635	100.00

Conclusion

In conclusion it must be reiterated that the coffee industry, being as large as it is, is very complex to administer. The current world market situation together with the discovery of the rust disease has ushered in a new era where some hard decisions have to be made if the industry is to move into the future. The industry has reached a stage where we can no longer afford to be complacent if we are to compete effectively as equals in the world market.

The Board realises it has a formidable task ahead to chart the future of the industry and although we at the Board consider it a challenge to run the industry, we would like to appeal for the cooperation and assistance of other government bodies to help implement some of the measures already discussed. Although we were disappointed at the Department of Finance and Planning's reluctance to lift the export tax on coffee exports we are encouraged by the fact that discussions are underway to work out a proper formula on which to determine when the export tax on coffee can be suspended.³

The government must be seen to place emphasis on the agricultural sector where the bulk of the population is located and focus its economic policies towards that sector. Since the government is responsible for setting the environment in which the industry operates, the ability of the industry to implement changes can be hindered by government inaction.

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³. The export tax on coffee was suspended effective 31 May 1989.

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