AN INPUT-OUTPUT VIEW OF AGRICULTURE IN PAPUA NEW GUINEA

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Despite the dependence of the economy of Papua New Guinea upon plantation and smallholder agriculture, little has been known of the inter-relationships which exist between agriculture and the remainder of the economy, or of the changes which would follow from implementation of the official development programme. In this article, a recently completed input-output table is used to quantify these relationships in 1970 and to project changes over the period to 1978.

The input-output tables referred to in this article were constructed to meet the observed need for an analytical framework with which to identify structural changes deriving from the official development programme in Papua New Guinea. The base table, showing economic transactions in 1970, takes the form of a conventional open and static input-output model, in which transactions are identified between 46 industries, including 15 industries dealing with crop and livestock production, new land development or crop processing. The inter-industry relationships of this 1970 table form the basis of a projection model used to identify the economic structure which might emerge by 1978, given the changes initiated by the Five Year Development Programme [2] and a provisional extension of that programme as foreshadowed in an early draft of the one-year Improvement Plan [1] adopted in 1973.

Briefly, the procedures used to project from the base year 1970, to 1978, were as follows: An estimate was first made of the final demand (personal consumption, mission and public authority expenditure, investment and exports) applying in 1978. For this purpose, reference was made to both the development programme and official macro-economic projections. The levels of output required from the system of industries, in order to meet this demand, were then calculated by reference to the 1970 input-output coefficients—after first amending these coefficients to reflect the proposed import substitution and other changes in production processes during the period to 1978. By this means the original 46-industry input-output table was expanded to 51 industries in the projection model.

Full details of the 1970 input-output table and its projection to 1978 are given elsewhere [4]. For purposes of illustration, however, a highly consolidated version of the projection, in which industries have been regrouped to identify 10 major sectors of production, is shown in Table 1. A description of the agricultural activities covered in the table is given in the Appendix to this article.

The Papua New Guinea Economy 1978

Without further analysis, the format of Table 1 highlights several major characteristics of the economy which might be expected to emerge by 1978, given the official development strategy. The continuing importance of the subsistence sector is apparent from the substantial contribution (29 per cent) which non-market production makes to

TABLE 1

Input-Output Transactions, Papua New Guinea, Projected to 1978 $ Million (Purchasers' Values) (a)

Selling Sectors	Buying Sectors													Final Demand				Total Demand
	1A	1B	1C	1D	2	3	4	5	6	7	8	9	10	Pers Con-sump.	Net Current Exp.(b)	Gross Dom Cap.	Ex-ports (c)	
1 Agriculture																		
(A) Plantation		1.33				7.28								.60		.70	34.80	44.71
(B) Smallholder				.08												.80	38.00	38.88
(C) Palm Oil				.12												.10	5.60	5.82
(D) Other				.36		.58				.86		.13		16.96		4.60	1.81	25.30
2 Fishing, Forestry, Mining				.04		10.53	.05			.10				3.46		.10	209.80	224.08
3 Manufacturing	1.18	7.51	.05	.31	1.66	17.01	40.51	12.21	2.65	9.47	1.61	2.61		76.52		3.70	46.78	223.78
4 Building, Construction	.20		.16	.12	.56	.36	.61	.22	.66	16.34	1.05	.08				118.37		138.73
5 Transport, Communication	2.40	.55	.05	.91	.83	6.32	3.47	3.51	1.51	19.34	.21	11.80		16.94		.70	13.17	81.71
6 Commerce	3.48	.47	.39	2.09	3.00	25.52	7.43	4.11	.70	.64	.33	1.60		23.99		9.85	5.41	89.01
7 Education, Health, Government	.38	.06	.04	.29	.44	.22	.95	.41	1.59	.18	5.57	.35		4.70	166.95	11.60	.46	194.19
8 Other Services						.03		.15	8.31	.90		9.33		20.71	7.60		7.81	54.84
9 Business Expenses	1.10		.13	.22	4.08	6.86	7.25	2.80	13.94	2.44	4.48						3.87	47.17
10 Non-Market Production														219.00		40.10		259.10
Wages and Salaries:																		
Indigenes	11.47	1.18	.55	5.11	8.65	14.54	12.57	9.87	8.19	42.01	13.05							127.19
Non-Indigenes	2.41		.21	.72	9.90	20.66	14.78	15.82	11.69	72.53	11.11							159.83
Gross Operating Surplus (d)	17.72	26.97	3.70	12.55	154.64	53.44	13.30	17.45	36.13	2.48	15.33		259.10					612.81
Net Indirect Tax	.38	.05	.02	.10	7.22	19.79	1.85	1.46	1.19	.10	.49	1.02		13.16		3.68	2.34	52.85
Imports, cif	3.99	.76	.52	2.28	33.10	40.64	35.96	13.70	2.45	26.80	1.61	20.25		96.43		84.62	9.51	372.62
Sales by Final Buyers																—.42	.42	
Total Supply	44.71	38.88	5.82	25.30	224.08	223.78	138.73	81.71	89.01	194.19	54.84	47.17	259.10	492.47	174.55	278.50	379.78	2,752.62

(a) The entries in any row record the sales which a particular sector makes to other sectors and to final demand. Entries in any column record the components of total cost for a particular sector.
(b) Net current expenditure of public authorities, missions and financial enterprises.
(c) Including additions to stocks.
(d) Including indigenous non-market income.

total gross domestic product. The openness of the economy and the continuing inelasticity of local supplies can be seen from the extent to which imports enter into both intermediate sales and sales to final demand. The remaining dependence upon expatriate skills is apparent from the share of wage and salary income (56 per cent) ascribed to non-indigenes. In regard to commercial agriculture, the salient features are the extreme dependence of both the Plantation and Smallholder sectors upon the export market; the comparatively small scale of deliveries to domestic consumption; and the limited amount of interdependence between commercial agriculture and other domestic industries.

For the purpose of comparison between 1970 and 1978, the contribution of each sector is shown in Table 2 in terms of gross domestic product. The overall growth of 6·9 per cent during this period is more than twice as fast as the recent growth in population (2·9 per cent), implying a growth of approximately 4 per cent per annum in income per head of population. The most significant change is the expansion of the Fishing, Forestry and Mining sector, from 1 per cent of gross domestic product in 1970 to approximately 19 per cent in 1978. This expansion is due in part to the anticipated growth in tuna fishing and log exports, but reflects primarily the development of the copper mine on Bougainville. The contribution of commercial agriculture is shown to decline to about 9 per cent in 1978, at which level it would be exceeded by Manufacturing. The average annual growth in the contribution of Smallholder agriculture, at 6·4 per cent, is almost twice that of the Plantation sector.[1] The growth in Smallholder production is in

TABLE 2

Gross Domestic Product at Factor Cost, 1970 and 1978

Sector	Actual 1970		Projected 1978(a)		Average Annual Growth(b)
	$m	per cent	$m	per cent	per cent
Agriculture					
(A) Plantation	29.6	5.6	39.2	4.4	3.5
(B) Smallholder	26.4	5.0	43.4	4.8	6.4
Total Agriculture	56.0	10.6	82.6	9.2	5.0
Fishing, Forestry, Mining	5.8	1.1	173.2	19.2	52.8
Manufacturing	39.8	7.6	88.6	9.9	10.5
Building, Construction	30.9	5.9	40.7	4.5	3.5
Transport, Communication	26.1	4.9	43.1	4.8	6.5
Commerce	37.7	7.1	56.0	6.2	5.1
Education, Health, Govt.	83.8	15.8	117.0	13.0	4.3
Other Services	24.4	4.6	39.5	4.4	6.2
Non-market Production	223.9	42.4	259.1	28.8	1.8
Total	528.4	100.0	899.8	100.0	6.9

(a) In 1970 prices.
(b) The average annual growth rate does not imply a uniform rate of change during intervening years.

[1] In Table 1, the Palm Oil and 'Other' agricultural industries include production by expatriates and Papua New Guineans alike. In Tables 2 and 3 however, all commercial agricultural production has been assigned to either the Plantation or Smallholder classification.

the traditional export crops—copra, cocoa and coffee—but also in the direction of palm oil, tea, horticulture, beef, poultry and pigmeat production.

The changing structure of the monetary sector of the economy is further illustrated by the manpower projections in Table 3. The estimates here are derived from the growth in output of 51 industries projected by the model, but depend also upon specific assumptions regarding increases in productivity and achievements in localization of the workforce. Given these assumptions, the non-indigenous workforce would remain virtually unchanged, whereas the indigenous workforce (in the monetary sector) would increase to 410,000—an average annual growth of 3·1 per cent. The bulk of the indigenous monetary sector workforce (58 per cent) would still be engaged in agricultural production in 1978, but the proportion would have fallen slightly from the 1970 level of 61 per cent. Of special interest in Table 3 is the very limited growth in the indigenous workforce on plantations when compared with the growth of 3·0 per cent per annum in the workforce on smallholdings.

Measurement of the indigenous workforce engaged in commercial agriculture is extremely difficult, if only because cash crops produced by smallholders come mainly from small-scale and scattered plantings in association with subsistence gardening. In Table 3, the estimate of non-wage employment in smallholder agriculture is obtained by dividing the gross operating surplus by an estimate of the average wage paid to plantation labour. The workforce identified in this way accounts for less than 50 per cent of the number of indigenes recorded as growing tree crops in 1970, but nevertheless provides an index of the number engaged at a commercial level of output. With this proviso, it can be argued that the projected growth of 3·1 per cent per annum for indigenous employment in the monetary sector is inadequate in relation to the planned outturn from the education system and the further movement of Papua New Guineans into the cash economy. It is somewhat higher than the expected population growth of 2·7 per cent per annum, but falls well short of a recent policy recommendation that indigenous employment should expand at a rate of 5-6 per cent per annum [3]. The problem is primarily one of finding employment for school leavers and villagers seeking to enter the urban workforce, but urban unemployment would nevertheless be ameliorated by a more buoyant rural economy.

Significantly greater emphasis upon rural development is foreshadowed in the recently adopted Improvement Plan, in which one of the 'Eight Points' of policy is 'decentralization of economic activity, planning, and government spending, with emphasis on agricultural development, village industry, better internal trade, and more spending channelled to local area bodies' [1, p. 2]. Whatever the outcome of this policy, a more buoyant rural economy is now possible, if only fortuitously, as an outcome of the modified International Coffee Agreement. Under this Agreement, approved in April 1973, there will be no restrictions on world coffee sales till at least the end of 1975. For Papua New Guinea, this temporarily overcomes the rapidly emerging problem of excess production and provides an opportunity to expand coffee plantings in new areas of production with few or no economic alternatives. Under these circumstances, coffee sales may substantially exceed the earlier estimates

TABLE 3

Monetary Sector Workforce, by Sector, 1970 and 1978

Sector	Actual 1970			Projected 1978			Indig. Workforce
	Indig.	Non-Indig.	Total	Indig.	Non-Indig.	Total	Av. Annual Growth
	'000	'000	'000	'000	'000	'000	per cent
Agriculture							
(A) Plantation	53.5	0.9	54.4	56.4	0.8	57.2	0.7
(B) Smallholder	143.1	—	143.1	181.2	—	181.2	3.0
Fishing, Forestry, Mining	17.8	0.2	18.0	27.9	1.1	29.0	5.8
Manufacturing	16.0	2.8	18.8	25.9	3.3	29.2	6.2
Building, Construction	17.9	3.2	21.1	20.8	2.7	23.5	1.9
Transport, Communication	7.2	2.3	9.5	10.4	2.6	13.0	4.7
Commerce	10.9	3.7	14.6	14.6	3.7	18.3	3.7
Education, Health, Govt.	34.8	9.7	44.5	47.2	9.3	56.5	3.9
Other Services	20.0	4.4	24.4	25.3	4.4	29.7	3.0
Total	321.2	27.2	348.4	409.7	27.9	437.6	3.1
Employees	170.6	24.1	194.7	217.1	24.7	241.8	3.1
Employers, Self-Employed	150.6	3.1	153.7	192.6	3.2	195.8	3.1
Total	321.2	27.2	348.4	409.7	27.9	437.6	3.1

incorporated in the projection model, and many more Papua New Guineans may enter the cash economy at low levels of productivity.[2]

Changes in the Factor Content of Agricultural Supplies

Having sketched the broad characteristics of the economy which might emerge by 1978, it is worthwhile considering the structural changes, if any, involving the agricultural industries. This is best achieved using the standard input-output techniques to identify the total on-site plus off-site factor content of deliveries to final demand from each industry. The questions to be answered are of the type: What changes can be expected in the indigenous wage content of plantation output delivered to final demand? What is likely to be the import content of smallholder supplies in 1978?

Answers to these questions appear in Table 4 in which row 1 can be interpreted as follows: Each unit of plantation output delivered to final demand in 1970 embodied an indigenous wage content of approximately 22 per cent, non-indigenous wages of 10 per cent, a gross operating surplus of 52 per cent, and a net indirect tax content of 1 per cent. Combining these elements, the total value-added content was 85 per cent, indicating an import content of 15 per cent.

TABLE 4

Average Factor Content of Final Demand for Agriculture, 1970 and 1978[(a)]

Per Cent

Industry	Year	Wage Content		Gross Operating Surplus	Net Indirect Tax	Imports cif	Total
		Indig.	Non-Indig.				
Plantation	1970	22	10	52	1	15	100
	1978	28	9	48	1	14	100
Smallholder	1970	7	3	84	—	6	100
	1978	8	3	83	1	5	100
Palm Oil	1970	—	—	—	—	—	—
	1978	12	6	68	1	13	100
Other Agric.	1970	38	9	39	—	14	100
	1978	24	6	56	1	13	100
Total Agric.	1970	20	7	62	—	11	100
	1978	19	6	64	1	10	100

(a) Derived from input-output tables at the 46-industry (1970) or 51-industry (1978) level of aggregation.

[2] Under the revised agreement, coffee production in Papua New Guinea could exceed the earlier projection by at least 40 per cent in 1978. The expansion is likely to be confined largely to the Smallholder sector and in the early years would largely benefit growers already in the industry. Apart from its effect on the workforce, it would substantially increase indigenous disposable incomes. As a first approximation, the growth in personal consumption expenditure of indigenes in the monetary sector would increase at a rate about 1 per cent per annum faster than the estimate of 6.2 per cent incorporated in the projection model. This need not be the case, however, if the expansion in coffee has the further effect of depressing the growth in indigenous tea production.

For the agricultural industries as a whole, Table 4 shows only marginal changes in factor content between 1970 and 1978. This applies also to the Plantation and Smallholder sectors taken individually. In other words, the programmes and policies incorporated in the development plan would not significantly change the structure of commercial agriculture in terms of primary inputs over the period to 1978. The only significant changes are in 'Other Agriculture' where they can be attributed to the increasing smallholder share of cattle, poultry and vegetable production.

Of particular note in Table 4 is the high import content and high labour content of plantation output, when compared with smallholder output. The operating surplus content of the Smallholder sector is much higher, but includes the income accruing to family labour. The wage content (employed labour) of smallholder agriculture is shown to be of the order of 7-8 per cent, and the bulk of this is off-site labour engaged in industries servicing smallholders.

TABLE 5

Average Factor Content of Final Demand, All Sectors, 1970[a]
Per Cent

Sector	Wage Content		Gross Operating Surplus	Net Indirect Tax	Imports cif	Total
	Indig.	Non-Indig.				
Agriculture	20	7	62	—	11	100
Fishing, Forestry, Mining	18	14	38	2	28	100
Manufacturing	11	13	36	12	28	100
Building, Construction	12	18	21	2	47	100
Transport, Communication	15	27	29	2	27	100
Commerce	14	21	48	2	15	100
Education, Health, Govt.	22	46	8	1	23	100
Other Services	27	27	33	1	12	100
Business Expenses	8	18	16	4	54	100

(a) Derived from a 21-industry input-output table for all sectors other than Agriculture.

The overall import content of agricultural supplies, at 11 per cent, is quite low when compared with the other sectors shown in Table 5. One corollary is that agricultural exports have a substantially lower foreign exchange content than have the other export sectors—Fishing, Forestry and Mining. Other points of interest in Table 5 are differences in the indigenous and non-indigenous shares of the wage content of each sector and the exceptionally high non-indigenous wages share of the Transport and Communication and Education, Health and Government sectors. Such differences, at the 46-industry level of aggregation, throw new light on the scope for further indigenization of the workforce.

Agriculture's Contribution to Final Demand

Given the value-added content per unit of final demand deliveries from each sector (Table 4), it is possible to estimate the contribution of each sector to exports (or to consumption or investment) in terms of value-added. This procedure has been used in Table 6 to show that Agriculture's contribution to exports, when measured in terms of gross domestic product, could be expected to decline from 53 per cent in 1970 to about 19 per cent in 1978. This decline would occur despite a projected growth in agricultural exports averaging 5·2 per cent per annum. It can be attributed in part to the growth of the fishing and forestry industries, based upon an export market, but is due primarily to the growth in the contribution of mineral exports—from less than 1 per cent in 1970 to 41 per cent in 1978.

The overall import content of exports averaged 19 per cent in 1970 and this would be reduced to 18 per cent in 1978. Elsewhere [4] it is shown that the import content of total market expenditure would decline from 45 per cent to 35 per cent over this period, and the decline would be common to all categories of expenditure (personal consumption, investment, public authority and exports). In other words, activities incorporated in Papua New Guinea's development programme for the purpose of increasing import substitution, taken jointly with other activities in the programme, would have the desired effect of achieving a comparative decline in the country's dependence upon imports. The decline in the import content of exports, in Table 6, is nevertheless

TABLE 6

Exports in Terms of the Contribution to Gross Domestic Product, 1970 and 1978(a)

Industries Contributing to Exports	Value-Added Content of Exports			
	Actual 1970		Projected 1978 (b)	
	$m	Per Cent	$m	Per Cent
Agriculture				
(A) Plantation	23.1		29.7	
(B) Smallholder	23.9		35.7	
(C) Palm Oil	—		4.8	
(D) Other	0.7		1.5	
Total Agriculture	47.7	53	71.7	19
Fishing	2.0	2	11.6	3
Forestry, Timber Products	4.3	5	24.0	6
Mining	0.7	1	154.7	41
Manufact. Food(c), Drink, Tobacco	6.6	7	8.8	3
Transport, Commerce	5.2	6	13.0	3
Other Industries	5.0	5	15.6	4
Indirect Taxes(d)	1.7	2	12.6	3
Import content	17.2	19	67.4	18
Total Exports	90.4	100	379.4	100

(a) Derived from input-output tables at the 46-industry (1970) or 51-industry (1978) level of aggregation.
(b) In 1970 prices.
(c) Including copra oil and pellets.
(d) Customs duties on ships' stores and on goods consumed by visitors from abroad.

quite small in view of the substantial increase in smallholder type exports. The outcome reflects the emergence of new export industries—notably Palm Oil, Woodchip and Copper Mining—characterized by import contents which, although low, are considerably higher than that of Smallholder agriculture.

As Papua New Guinea's official policy of import substitution (incorporated in the projection model) is directed primarily towards the domestic market, it is also of interest to examine the extent to which local industries, particularly commercial agriculture, contributed towards personal consumption expenditure in 1970, and again in 1978. Local output of agricultural produce, sold for domestic consumption, amounted to some $8.1 million in 1970—being primarily an estimate of fresh fruit and vegetables sold through village and urban markets,[3] together with locally produced beef, pigmeats, poultry, eggs and milk. In terms of the value-added contribution, however, commercial agriculture accounted for $6.6 million or less than 4 per cent of personal consumption expenditure in 1970 (Table 7). The small local content was common also to the non-agricultural components of expenditure in 1970. The greatest contribution (13 per cent) in terms of value-added came from Transport and Commerce, but much of this was generated in handling imported commodities. The overall import content of personal consumption expenditure exceeded 54 per cent in 1978.[4]

The 1978 projection of the components of personal consumption expenditure, in Table 7, must be influenced *inter alia* by assumptions regarding the size of the expatriate population, the growth of consumption *per caput* in expatriate and indigenous households, and the degree of import substitution. As far as practicable, these assumptions have been drawn from the official development programme, but as many aspects of the programme have not been officially quantified, they also rely upon broad judgements as to the likely success of official policies in relation to the domestic production of rice, sugar, tobacco, pigmeats, poultry, fruit and vegetables. With this proviso, the projection in Table 7 is based upon sales of agricultural output to the domestic consumer totalling $17 million in 1978—an average annual growth approaching 10 per cent. Part of this growth is assured by the progress already made in establishing a beef cattle industry, but an overall expansion of this order would call for a considerable improvement in the production and marketing of fresh fruits and vegetables. If achieved, however, Table 7 indicates that it would lead to a position in which commercial agriculture contributed only 5 per cent of personal consumption expenditure in 1978.

The effect of import substitution is shown to be much more apparent in the case of the Manufactured Food, Drink and Tobacco sector. The contribution of this sector would rise from 6 per cent more than 11 per cent, but the sector would continue to draw primarily upon imported

[3] The estimate excludes non-marketed supplies of foodstuffs recorded in the 1970 input-output table at approximately $182 million. In Table 7, non-marketed production, including an allowance for subsistence housing, is valued at $185 million in 1970 and $219 million in 1978.

[4] The personal consumption expenditure of expatriates is calculated elsewhere [4] to have an average import content of 56 per cent. For indigenous households in the market economy, the average import content of consumption is also very high at approximately 53 per cent.

TABLE 7

Personal Consumption in Terms of the Contribution to Gross Domestic Product 1970 and 1978[a]

Market Supplies

Industries Contributing to Personal Consumption	Value-Added Content of Personal Consumption			
	Actual 1970		Projected 1978 (b)	
	$m	Per Cent	$m	Per Cent
Agriculture				
All Crops	4.9		10.4	
Livestock Products	1.7		4.5	
Total Agriculture	6.6	4	14.9	5
Fishing	1.4	1	2.4	1
Manufact. Food, Drink, Tobacco	11.1	6	31.0	11
Engineering Services	1.9	1	3.1	1
Electricity	1.6	1	2.8	1
Transport, Commerce	24.5	13	31.3	11
Dwelling Services	7.1	4	9.9	4
Other Industries, Services	10.2	6	15.9	6
Indirect Taxes(c)	18.4	10	31.9	12
Plus Import Content	98.8	54	130.3	48
Total Consumption Expenditure	181.6	100	273.5	100
Non-Market Production	185.5		219.0	
Total Personal Consumption	367.1		492.5	

(a) Derived from input-output tables at the 46-industry (1970) and 51-industry (1978) level of aggregation.
(b) In 1970 prices.
(c) Customs duties on imports entering directly into personal consumption, plus minor fees and fines.

raw materials.[5] The overall import content of personal consumption expenditure is shown to fall during this period, yet it would remain at the comparatively high level of 48 per cent in 1978, indicating the continuing potential for import substitution.

The extremely small contribution which commercial agriculture makes to personal consumption in the monetary sector is further illustrated in Table 8. Here, the input-output table has been used to show how the sales from each sector were ultimately dependent upon the various categories of final demand in 1970. The approach consolidates both the direct and indirect final demand for the output of each industry. The first entry in row 10, for example, indicates that 25 per cent of the total output of Commercial services was ultimately dependent upon the personal consumption of indigenes, although it could be shown that sales *directly* to indigenous households accounted for less than 17 per cent of the total output of Commercial services.

Both the Plantation and Smallholder sectors are shown to be highly dependent upon export markets. The much smaller Livestock and Horticulture sectors, on the other hand, rely largely upon domestic con-

[5] Locally grown sugar cane and tobacco leaf may be processed on a small scale by the Manufacturing sector in 1978, but this eventuality is not part of the projection model.

TABLE 8
Final Markets for all Sectors, 1970[a]
Market Supplies
Per Cent

Sector	Personal Consumption		Govt. & Mission	Investment	Exports	Total
	Indig.	Non-Indig.				
Agriculture						
(A) Plantation	8.1	2.8	0.6	1.7	86.8	100.0
(B) Smallholder	—	—	—	4.8	95.2	100.0
(C) Livestock	20.4	69.8	3.0	0.2	6.6	100.0
(D) Horticulture	71.9	10.7	4.8	2.2	10.4	100.0
(E) Rural Development	—	—	—	100.0	—	100.0
Fishing, Forestry, Mining	16.0	1.5	2.8	17.2	62.5	100.0
Manufacturing	24.1	13.2	10.5	30.2	22.0	100.0
Building, Construction	0.5	0.9	9.2	89.0	0.4	100.0
Transport, Communication	22.0	12.1	28.5	16.7	20.7	100.0
Commerce	25.1	24.0	4.1	31.1	15.7	100.0
Education, Health, Govt.	2.0	3.9	87.2	5.9	1.0	100.0
Other Services	13.0	42.1	21.7	9.4	13.8	100.0
Business Expenses	14.6	13.3	14.9	34.2	23.0	100.0
Total Market Supplies	11.7	10.0	28.1	31.0	19.2	100.0

(a) Derived from a 21-industry input-output table.

sumption. Of particular note is the heavy dependence of many sectors—notably Livestock, Commerce and Other Services—upon non-indigenous personal consumption expenditures. The decline at present apparent in the share of consumer spending attributed to non-indigenous households will have proportionately greatest impact upon these sectors. In regard to the Livestock sector, however, the increasing demand for livestock products on the part of Papua New Guineans, and the buffer currently provided by imported supplies, should ensure an adequate market for the projected expansion in domestic output.

Cost-Price Relationships

A feature of agriculture in Papua New Guinea is the extent to which the demand for its products is retained within agriculture and not transmitted to other sectors. In the case of Plantation agriculture, for example, the retention rate in 1970 was 79 per cent. For each additional $1 million of final demand for plantation output, the Plantation sector would expand by slightly more than $1 million, the Commercial and Other Services sectors would gain $226,000 and all other sectors (mainly Manufacturing) would gain a further $43,000.

Retention rates of the order of 80 per cent are common to agriculture in many underdeveloped economies, reflecting the small scale of mechanization, the limited industrial inputs and the comparatively simple infrastructure supporting the sector. By contrast, the retention rate for Australian agriculture is of the order of 60 per cent [5].

In the absence of significant inter-industry linkages in Papua New Guinea, interest rests upon the relationship between agriculture and its final demand, and the import content, labour content and other factor content of that demand. Many of these relationships were identified in the foregoing, but the analysis can be taken further by using the input-output table to assess the effects which a change in average wage rate (or the cost of imports) would have on sectoral product prices. Calcu-

TABLE 9

Changes in Sectoral Prices Arising from a 20 Per Cent Increase in Indigenous Wages, 1970[(a)]

Per Cent

Sector	Price Change
Agriculture	
(A) Plantation	4.6
(B) Smallholder	1.3
(C) Livestock	2.7
(D) Horticulture	1.9
(E) Rural Development	15.6
Fishing, Forestry, Mining	3.5
Manufacturing	2.4
Building, Construction	2.4
Transport, Communication	2.9
Commerce	2.8
Education, Health, Govt.	4.3
Other Services	5.3
Business Expenses	1.5

(a) Derived from a 21-industry input-output table.

lations of this type are possible because in the input-output framework the unit price of the output of any sector can be equated to the total unit cost expressed in terms of primary inputs (wages, operating surplus, indirect taxes and imports). The calculation rests on the rather restrictive assumption that all cost increases are passed on in full to consumers in the form of higher prices. This is of course not possible in the export market, but the findings are nevertheless of value in illustrating the relative sensitivity of each sector to changes in the cost of primary inputs.

In Table 9, the 1970 input-output table has been used to calculate the effects on sectoral prices of a uniform 20 per cent increase in wages paid to Papua New Guineans. This was approximately the position confronting the plantation sector following the implementation of many of the findings of the Rural Wage Inquiry completed during 1970.[6] The price effect on plantation output is shown in Table 9 to be of the order of 4·6 per cent. Those sectors registering the highest price increase (greater than 4 per cent) are Plantations, Rural Development, Education, Health and Government Services, and Other Services.

An interesting feature highlighted by the calculation is that, apart from Rural Development and Personal Services, the price rises induced by a 20 per cent increase in indigenous wages would be comparatively small and distributed fairly uniformly between sectors within the market economy. As an extension of this analysis, the findings (on a less aggregated basis) have been used to illustrate the effect which a uniform 20 per cent increase in indigenous wage rates might have upon the cost of living, defined in terms of personal consumption expenditure. The calculation shows that, given the structure of the economy in 1970, the average cost of living in the market economy would be raised by about 1·5 per cent. For indigenous households the increase would be 1·4 per cent, whereas for non-indigenous households the increase would be 1·6 per cent. These findings again emphasize the high import content and low wage content of personal consumption expenditure in Papua New Guinea.

Further Comment on the Projection

The foregoing projection depicts an economy growing at almost 7 per cent per annum. With non-market production excluded, the growth in gross domestic product, to 1978, would approach 10 per cent per annum. This falls well short of the real growth of 14 per cent per annum achieved during the period of the first Five Year Development Programme,[7] which terminated in June 1973, but is still high by international standards.

A major point of debate surrounding the Five Year Programme was the appropriate trade-off between rapid economic growth and increased

[6] Wages and rations paid to indigenes in the Plantation sector averaged $191 per man in 1970. For the purpose of the projection model referred to in this article, the average was increased to $230 per man.

[7] The official estimate of 14 per cent per annum is based upon a domestic concept—gross monetary sector product at market prices. Allowing for net factor income payable abroad, the real growth in the monetary sector, defined as gross national product at market prices, is officially estimated to have been of the order of 9 per cent per annum [1. p. 20].

participation by Papua New Guineans. This debate culminated in a UNDP sponsored report [3] recommending that emphasis in the next development plan be given to indigenous participation rather than economic growth, while recognizing that 'steady growth of product will be a necessary pre-requisite for the attainment of the other objectives which have been identified' [3, p. 14]. The planning principles outlined in the UNDP report received widespread support and in 1973 the new policy objectives of decentralization, rural improvement, equitable distribution and self reliance were given expression in the one-year Improvement Plan for 1973-74.

The slower rate of growth projected by the model for the eight years to 1978 is not inconsistent with recent policy initiatives. Indeed, the projection model draws upon information assembled in the early drafting of the Improvement Plan, and as far as practicable reflects the programmes and policies of that Plan. Not all policy changes were quantified in time for inclusion in the model, but their omission is not expected to seriously affect the outcome because the rate and direction of economic growth to 1978 will be largely determined by earlier planning decisions, modified by subsequent changes in the manpower and financial resources available.

Given the assumptions of the model, the projection implies only limited changes in the role of commercial agriculture. The growth in incomes in the Plantation sector,[8] at 3·5 per cent per annum, would be eclipsed by the much faster growth (6·4 per cent per annum) of Smallholder agriculture. Plantation employment would increase at less than 1 per cent per annum, but the Plantation sector would nevertheless account for 24 per cent of the workforce engaged in commercial agriculture in 1978. With the substantial growth projected for the Fishing, Forestry, Mining and Manufacturing sectors, commercial agriculture's contribution to gross domestic product, in the monetary sector, would decline from 10·6 per cent in 1970 to about 9·2 per cent in 1978. Commercial agriculture would nevertheless continue to account for 58 per cent of the total indigenous workforce in the monetary sector, and the proportion could be much higher if there were a marked expansion in coffee plantings.

The official development strategy has been heavily export orientated. Consequently, whereas 13 per cent of wage and salary income in 1970 was generated by export demand, it can be shown [4] that by 1978 the proportion may exceed 21 per cent. The dependence of non-wage income upon export demand is likewise expected to increase from 40 per cent to 67 per cent over this period. The agricultural sector has been the traditional source of export income in Papua New Guinea, yet the increasing dependence upon the export market is not basically attributable to the growth in agriculture. Rather it reflects the declining dependence upon government expenditure as a source of wage and salary income, and the rapid rates of growth projected for the Mining, Fishing, Timber, Tourist and some Manufacturing industries which deliver their output to the export sector.

The increasing dependence upon overseas markets can be contrasted with the official concern for import substitution and production for

[8] Including wages paid to indigenous employees.

the domestic market. The projections in Table 7 suggest that by 1978 about 48 per cent of personal consumption expenditure in the market economy will still be met from imports. The local value-added content of personal consumption expenditure can be expected to rise from 46 per cent to about 52 per cent, but the contribution from commercial agriculture is not likely to rise above 5 per cent. Any further increase in this contribution will be possible only by a marked improvement in the production and marketing of rice, fresh fruit and vegetables, or an unforeseen breakthrough in activity currently directed towards the establishment of domestic sugar, tobacco, grain and legume crops.

In the foregoing, the techniques of input-output analysis have been used to suggest likely changes emerging from a *particular* development strategy—namely that of the official development programme. However, the same techniques could be used to explore the implications of *alternative* strategies. It is perhaps inevitable that the basis of development planning in Papua New Guinea will continue to lie with the assessment of specific development projects—if only because of the dependence upon project-based foreign aid. There is nevertheless a need to quantify the wider implications of alternative development projects by their integration within the context of the total economy. The input-output approach shows promise of providing the necessary framework for this integration of specific and general policies.

APPENDIX

Agricultural Industry Classification

Table 1 has been consolidated from a 51-industry input-output table in which 8 agricultural industries are identified as predominantly 'Plantation' or 'Smallholder' in origin, and a further 5 include elements of both plantation and smallholder output. In the consolidated format of Table 1, the agricultural industries cover the following activities and commodities.

(a) *Plantation:* The plantation production, processing and marketing of copra, cocoa, coffee, rubber and tea, and the processing and marketing of 'trade' copra, cocoa and coffee purchased by planters from indigenous smallholders. Smallholder output of rubber and tea is also included, but as this would amount to less that 10 per cent of the output of each crop in 1978, the structure of the industry is predominantly plantation.

(b) *Smallholder:* The production of copra, cocoa and coffee by indigenes. Where appropriate, the costs of processing and marketing smallholder crops have been charged directly to the grower, but for 'trade' copra, cocoa and coffee these costs appear as a service purchased from the plantation sector. Using this procedure it is possible to retain the identity of smallholder output as it is sold to the final consumer, while at the same time identifying all income accruing to plantations. In the case of smallholder cocoa and coffee handled by co-operatives or private fermentaries, these processing and marketing costs are treated as services purchased from the Manufacturing sector.

(c) *Palm Oil:* The production, processing and marketing of palm oil and palm kernels. Approximately 52 per cent of the output of fresh fruit bunches would come from indigenous growers in proximity to several large estates. As there was no production of palm oil in the base year (1970), the industry has been classified apart from the Plantation and Smallholder components of the traditional export crops.

(d) *Other Agriculture:* All commercial production of rice, peanuts, vegetables, beef and other crop and livestock products, together with an imputed annual cost of planting and replanting tree crops and of maintaining immature trees for 3-7 years prior to the first harvest. In the consolidated form shown in Table 1, 67 per cent of the total output (valued at purchasers' prices) is attributed to indigenous farmers and the remainder to expatriate-controlled estates. In Tables 8 and 9, the major components of this industry are identified as 'Livestock', 'Horticulture' or 'Rural Development'.

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