

ECONOMIC INTERACTIONS IN GHANA:  
A STUDY OF SECTORAL INTERDEPENDENCE AND LINKAGES

by

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D E C L A R A T I O N

Except where otherwise indicated, this sub-thesis is my own work.

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## A C K N O W L E D G E M E N T S

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## A B S T R A C T

This thesis examines the background to development planning in Ghana, and the interactions between sectors of the economy, with special reference to the primary sectors. It makes use of the official input-output (I-O) table to identify the type of interactions that existed within the Ghanaian economy in 1968. Input-output analyses have been in use for development planning and research for a long time, but very little use has been made of the Ghanaian I-O table since it was published in October, 1973.

The findings of this paper are not to be regarded as final, but as providing a basis for looking at major problems of the economy (e.g. low incomes, high unemployment and growth as a whole) on a national basis rather than from the viewpoint of industrial projects. As pointed out by Chenery and Raduchel (1971), "to the extent that production requires inputs in fairly fixed proportions, growth is likely to be impeded by shortage of specific factors rather than by a general scarcity of resources." "Planning models", they continued, "in developing countries have concentrated mainly on avoiding bottlenecks in production by making better use of scarce resources of capital and foreign exchange. Possibilities for increasing total welfare through varying the composition of consumer demand or through making greater use of surplus labour have been considered only in the context of partial analyses of individual projects. The problem of unemployment has acquired an increasing urgency in many developing countries because of the neglect of labour absorption in most development plans."

The first chapter is essentially an introduction dealing with the measurement of economic performance and the various approaches to economic development.

Chapter two deals with the historical background to economic development planning in Ghana. It briefly compares aspects of the Ghanaian economy with those of some other developing countries.

Chapter three introduces theoretical aspects of input-output analysis. It briefly discusses the official Ghanaian I-O table, how it was compiled, and some of its deficiencies.

Chapter four makes use of the I-O approach to identify various linkage effects in the economy in 1968.

Chapter five is a concluding section which also incorporates suggestions for improving the current Ghanaian I-O table for use in development planning.

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## CHAPTER ONE

### INTRODUCTION

Concern with economic development, whether in its theoretical or its practical implications, is not new in less developed countries (LDCs), a term which has defied any suitable definition even though the majority of the world's population live in these areas. Different authors have diagnosed the characteristics of underdevelopment according to one or more features common to most LDCs. These are the ratio of population to productive land area (Viner, 1953), scarcity of capital, a low capital output ratio, a low ratio of industrial output or industrial labour force to total output or to total population, a low standard of living (defined in various ways) and low per capita income. None of these features alone defines underdevelopment appropriately. According to Viner (1953):

What is considered material in this respect is the ratio of population to productive land. It is noted that there are certain underdeveloped countries where the ratio of population to such land is very high, for example, India and Bangladesh, while in certain developed countries the ratio of population to land is very low.

The above quotation illustrates one of the flaws in such simple definitions. If low ratio of population to productive land is a main feature in economic development, then Sudan would qualify as a developed country (DC) since Sudan has a very low population to land ratio compared to most DCs. It is important to point out that a low population, scattered over a very large area, equally constitutes a problem of considerable magnitude in economic development. It places a strain on the resources of the economy if social services such as schools and hospitals are to be provided for every member of the society. Instead of building just one school, for instance, to

serve many people, a school will have to be built in each of many small communities.

The simplistic nature of the diagnosis of underdevelopment in the past has resulted in equally simplistic prescriptions or approaches to solving the problem. This "faulty" diagnosis and the desire of the peoples in LDCs to raise their standard of living, has contributed to the importation of economists and technicians from the advanced countries for guidance. In many instances, their experience in applying their training to the situation in LDCs has not been rewarding. As Herkovits (1964) points out:

The economic principles and their mathematical models developed in Europe and America were found to be inadequate when applied to economies in the process of rapid change, for here the economies involved deep historical and cultural roots as opposed to those of pecuniary industrialised countries of Europe and America. And despite the introduction of money and machines, despite the development of urban centres where industry could be sited and also despite growth of large scale mechanised agriculture, assumptions whose validity had gained general acceptance, were found not always to hold.

He continued:

The concepts of value, allocation of wealth, motivations in both the production and distributive aspects of the economies differed from those of Europe and America - factors having to do with traditional institutions, kinship and prestige hold dominance. This is why for example it is much easier to study the economic growth of South Africa than in Sudan.

This means that we must revise the conventional approaches to economic development and the theories on which they were based, to suit the economic structure of the LDCs else these imported concepts will be applicable only to the degree to which the economic and social settings found in the LDCs are identical to those of the western technologically advanced countries.

#### Approaches to economic development

Some of the approaches to economic development adopted in the past in the LDCs are discussed below.

### Introspective generalisation and immanent empiricism

Introspective generalisation was inspired by the theory of evolution and growth of DCs exclusively. It involves examining data of DCs and trying to evolve a simple and abstract theoretical framework for application to all countries, including LDCs, regardless of the differences in the problems of DCs and LDCs. It is obvious that this approach is at best a theoretical empty box or at worst naive. Immanent empiricism, which is almost opposite to introspective generalisation, involves assigning infinite weights to the deviations from the "special case" of the DCs and looking at data hard and long enough until some "general principles" become clear, more by insight than formal logic (Bronfenbrenner, 1966). These two approaches do not contribute any operational theories in relation to economics of development, only dogmas, each of which look at only one aspect of development, while ignoring interdependence and trade-offs during the process of economic development. These interdependencies and the trade-offs (the main purpose of this thesis) will be discussed later on.

### Capital fundamentalism

The model used in the framework of capital fundamentalism makes the rate of growth of the economy the result of the internal savings rate and of the capital output ratio. Another aspect of capital fundamentalism is the view that capital serves as a vehicle of growth. This approach has led to such policies as tax exemptions and granting of monopoly concessions to encourage individuals or firms to save and invest (Lewis, 1955). Alternatively, prices have been distorted to favour investment goods relative to mass consumption goods (imported or exported) (Chenery, 1953). As a consequence of underpricing of capital, it is substituted for labour, thereby resulting in unemployment. In certain circumstances capital is

so underpriced that it is underutilised (UN Commission to Latin America, 1966; UNIDO, 1967; Winston, 1971). The main implication of distorting prices in favour of imported western capital is that it may inhibit the domestic manufacture of capital goods and thereby limit the possibilities of creating a technology which takes account of domestic factor endowments.

### Industrial and agricultural fundamentalism

The claim of industrial fundamentalists is that industrialisation can lead to modernisation of agriculture. It relies upon the positive relationship between the size of the industrial sector and the level of per capita income. Planners in most LDCs accepted industrial fundamentalism not only as a panacea for economic ailments but also as a step further in their desire to achieve economic independence after political independence. They looked back to the period of their political domination by industrial powers such as Britain and France with bitterness, a period during which they were suppliers of raw materials while providing a market for manufactured goods from industrial powers without any conscientious effort on the part of these powers to encourage development within the LDC. They were concerned to escape from such outright exploitation. Industrial fundamentalism has led to the establishment of industries dependent on foreign technology, capital and at times management, but without regular supplies of raw materials (domestically produced or imported) or foreign exchange to keep them going. An example of this kind of industry is the cement factory in Tema (Ghana).

Agricultural fundamentalism considers increased productivity in the agricultural sector, where the vast majority of population in LDCs live, as a prerequisite to increased standards of living and industrialisation. This type of fundamentalism has resulted in what may be termed growth

without development and in distribution of income skewed in favour of the landed aristocracy, for example in certain Latin American countries. In some other cases, it has led to the establishment by the public sector of "ever loss making" large-scale farms, for example the state farms established by the Kwame Nkrumah regime in Ghana in the 1960s.

Too often, fundamentalist thinking ignores or does not emphasise the complementarity of agriculture and industry.

### Import substitution fundamentalism

The notion here is that development or industrialisation can be initiated by producing those commodities for which domestic demand already exists. The call for import substitution was usually implemented through tariff protection and imposition of quotas (Plebisch, 1959). This drive for import substitution has led to the establishment of industries like razor blade and light bulb industries.

On the credit side of this approach are conservation of scarce foreign exchange reserves and the promotion of self-sufficiency which decreases dependence on the terms of trade and on uncertain foreign markets. These benefits which are claimed to accrue to import substitution are not costless, but the costs can go unnoticed for a long time. On the debit side of the import substitution approach is the fact that import substitution for final goods results in the build-up of over-capacity at the final stages of production and very little capacity at the intermediate stages which have the most significant linkages and which are the stages that lead to the development of indigenous technology.

### Planning fundamentalism

A further major approach to economic development is planning fundamentalism. The gospel here is that any planning is better than no planning at all, more planning is better than less planning. It is often justified by the invalid assumption that development can be achieved without any loss in terms of scarce resources - simply by utilizing unused resources.

Clearly, governments should have a plan incorporating their intentions whilst in power, but the shortcomings of this approach become clear from a cursory look at the political history of most governments in most LDCs. Considering the amount of skilled man-hours put into drafting these plans and the fact that often governments in LDCs may be toppled before the plan can be implemented, one cannot help having misgivings about this approach. In addition, the programs contained in the plan commonly are not followed because of the breakdown of the fundamentalist assumptions of the superiority of planning activities over market activities or the existence of surplus resources from which other scarce resources can be created. An example from Ghana will throw more light on these points. Out of the four economic plans so far formulated only one was carried to full term. The first was a ten-year plan intended for the period 1920 to 1930, but it ceased to be effective in 1927 after the departure from Ghana of the then Governor Gordon Guggisberg. There was another plan from 1951 to 1957. This lasted the full term. From 1959 another development plan was launched - initially a five-year plan which was to last until 1964, but was superseded in 1963 by the Seven Year Development Plan. The latter plan lasted three years being discontinued in 1966 by a military government which seized power in that year. After 1966 most of the production targets set by the successive military regimes were not based on any discernible economic grounds - but were more or less plucked from the air.

The above discussion on approaches to development planning dealt with only free enterprise economies where the government or the planning agency recognises the private sector. They are not the kind of approach one would expect in any socialist or communist economy such as USSR or China.

### Measurement of economic progress

On the basis of past mistakes, it is now being slowly recognised that economic development is a complex process which defies an easy prescription. This realisation has made development planners reticent to adopt any doctrinaire approach to planning. For the most part, they no longer pronounce dogmatic statements about contributions of industrial or agricultural expansion towards development. It is recognised that there is a need to engage in careful analysis to locate the areas of comparative advantage of each economy. In the task of development the main enemy is the poverty of the masses, caused by massive unemployment, though disguised, and growing income inequality. This condition, mainly in the rural areas, gives rise to a vicious circle of ignorance, high birthrates, more unemployment and more poverty.

One of the main measures of economic development is growth in GNP, a measurement which pays no attention to how the benefits of this growth are distributed. The United Nations is not free from blame in this respect. In the 1960s the United Nations General Assembly Resolution 1710 (xvi) declared a "Development Decade". The objective was to achieve a minimum annual growth of aggregate national income of 5 per cent in all, or at least most, LDCs.

The hope implicit in this approach is that somehow the benefits from such growth would trickle down to the poor. But instead of this result there has been a backwash effect by which income inequality has worsened.



Apart from the danger in the equation of changes in per capita national product and changes in average well-being there is the conflict between economic and social goals. The approach tends to foster an indifference to inequality or growing inequality. It also encourages indifference to the pattern of investment. Because a high value of output per worker is considered to be good, car assembly plants may be favoured ahead of traditional light consumer goods. It is my contention that this conflict of objectives would not arise if priority were given to a program which assured a better standard of living for, say, the poorest half of the population in terms of basic necessities of food, clothing, housing and education through the creation of additional job opportunities with sufficiently remunerative income, the provision of certain services by the State, and the strict enforcement of progressive income taxes. This would shift the emphasis to employment and narrow existing differences in income distribution.

A danger in using GNP as a measure of welfare is that "crazy" expenditures authorised by politicians to further their own political objectives do not benefit the average man but are included in the GNP calculations. Another danger in the use of GNP as a measure of welfare is displayed by international comparisons. Often the GNP of LDCs are compared with those of DCs to show how backward the former countries are. In the first place these international comparisons are affected by changes in exchange rates. Secondly, in temperate countries much expenditure on heating homes is included in the per capita GNP calculations without any offset being made in comparison with countries where such expenditures are not required. Thirdly, as pointed out by Raymond Frost (1961):

Equal per capita growth rates conceal a rather grim statistical trick . . . an equal  $1\frac{1}{2}$  per cent rate of growth would mean \$33 per annum for Americans compared with about 90 cents for Indians . . . the absolute difference between the wealth of the two nations becomes inexorably wider.

The per capita method of measuring growth gives misleading results in economies with a lot of non-monetary economic activity. Moreover if high GNP per capita can be equated to a high level of development, then the Arab oil-producing countries must be among the most developed countries.

It is now evident that other more suitable measures of economic growth like income distribution, education and health standards, and consumption per capita should be used either to supplement or replace the GNP measure. In this light, and since the main problems of Ghana are those of unemployment, poverty and inequality in income distribution the use of GNP as a measure of economic performance in Ghana must be considered to be highly unsatisfactory.

LDCs seem to ignore or rather try to forget the importance of equitable distribution of incomes. Gross inequality is deplored on one hand by people who believe in the concept of social justice, and defended by others as encouraging saving. It is true that much of the saving in the LDC is done by the rich, but it is also true that in these countries inequality in income leads to a great deal of inequality in consumption. This very often leads to a distortion of resource use. The effective demand of the rich leads to the import (or investment in local assembly) of consumer goods such as cars, while agriculture is paid lip-service and stagnates. It is not difficult to see how this affects the economy. If a large proportion of the population is unemployed or economically underprivileged and if only a small proportion can exert a really effective demand for goods, then the market for manufactured goods (which all LDCs want to produce) is much smaller than will appear.

It is not implied that the inequality in income distribution in LDCs is due solely to an intentional attempt by the rich to cheat the poor. Much of this inequality can also be explained by misplaced policies by the

government of these countries. For example, in the last 30 years most governments of LDCs have embarked upon unnecessary industrialisation, in the belief that it will be a panacea for all their problems of inadequate production, distribution and unemployment. A lot of foreign aid and/or foreign earnings of these countries was used to import foreign machinery. That was the era of industrial fundamentalism. The author maintains that if prosperity in these countries depends on the adequate production and distribution of goods with intensive mechanisation, then clearly prosperity and full employment are contradictory in the circumstances of LDCs. It may be argued that the LDCs could use simple labour-intensive techniques. But the problem is (with the exception of a few larger LDCs like India and Brazil) much of the equipment used in the LDCs is imported from developed countries. Consequently the range of technological choice is, to a large extent, limited by technical specification of the imported equipment designed to be labour-saving. The possibility of choosing labour-intensive techniques is reduced by the fact that old labour-intensive techniques are no longer in use (and are therefore no longer produced) or are limited in supply and expensive to maintain.

As long as LDCs have no control over the direction and speed of technological change, the goals of industrial growth with significant labour absorption will be difficult to realise. As long as their demand for capital goods is insignificant they will have a negligible impact on both current production decisions about the type of machine to be produced and the direction factor-saving bias will take in the future. Unless LDCs have their own capital goods industry to produce labour-using equipment, industrialisation and absorption of the surplus labour will be hard to meet.

## CHAPTER TWO

### HISTORICAL BACKGROUND

Ghana is a small country by size and population; its area being 93,400 square miles. The country has the Gulf of Guinea as its southern boundary, Upper Volta in the north, Ivory Coast in the west and the Republic of Togo in the east. The latest figures put the population at 9.1 million with a rate of growth between 2.1 and 2.5 per cent per annum. The people of Ghana belong to various tribes, but tribal considerations take second place to overall national interest.

The economy and pace of economic growth in Ghana are based mainly upon agricultural production and the production of gold. By 1970 the GNP was estimated at ₦G470 million giving a per capita GNP of ₦G70. Between 1955 and 1962, GNP increased by 40 per cent in total, that is an average annual compound rate of growth of 4.8 per cent.

Table 1 shows that Ghana has the second highest per capita income in West Africa. It also shows that the per capita income in Ghana is not growing as fast as that in such countries as Nigeria (5.4 per cent), Ivory Coast (4.1 per cent), Liberia (4 per cent), compared to Ghana's 1 per cent. However, it has to be pointed out again that the level of per capita income and its rate of growth does not necessarily reflect an increase in the welfare of the majority of the people in a country.

Data on household consumption in Ghana reveals a relatively small degree of subsistence production. Consumption of own-produce by producers in Ghana represents about 20 per cent of household consumption (1960). This figure is not too high considering that over two-thirds of the population is engaged in farming. Subsistence consumption in urban areas was estimated at 7 per cent and in the rural area at 31 per cent.

TABLE 1  
GNP, GNP PER CAPITA, AND GROWTH RATES OF SOME WEST AFRICAN COUNTRIES

| Country       | GNP<br>(million<br>\$US) | GNP<br>per capita <sup>a</sup><br>(\$US) | Growth rate of<br>GNP per capita <sup>b</sup><br>(per cent) |
|---------------|--------------------------|--|---|
| Dahomey       | 300                      | 110                                      | 1.7   |
| Gambia        | 50                       | 140                                      | 1.4   |
| Ghana         | 2,700                    | 300                                      | 1.0   |
| Guinea        | 440                      | 90                                       | -0.3  |
| Guinea Bissau | 130                      | 230                                      | 3.4   |
| Ivory Coast   | 1,840                    | 340                                      | 4.1   |
| Liberia       | 410                      | 250                                      | 4.0   |
| Mali          | 400                      | 80                                       | 1.3   |
| Mauritania    | 210                      | 180                                      | 2.0   |
| Niger         | 400                      | 90                                       | -5.1  |
| Nigeria       | 9,350                    | 130                                      | 5.4   |
| Senegal       | 1,050                    | 260                                      | -0.7  |
| Sierra Leone  | 520                      | 190                                      | 1.8   |
| Togo          | 330                      | 160                                      | 3.3   |
| Upper Volta   | 400                      | 70                                       | 0.6   |

Source: World Bank Atlas (1974).

a. For 1972.

b. Between 1965 and 1972.

Ghana rural households enjoy a high standard of living compared with other LDCs. In West Africa this is reflected by the flow of migrant labour into Ghana (certain special factors may also have contributed to this). Migrants come from Nigeria, Upper Volta, Togo, Liberia, Niger and Dahomey. This is shown in Table 2.

If the labour force engaged in industry is an indication of the degree of development, then Ghana may be grouped among the more developed LDCs. According to Table 3, about 42 per cent of the labour force in Ghana is engaged in industry and services leaving 58 per cent on the farm.

Data on the calorie value of diets also show that Ghana is better off than many other countries. These figures (shown in Table 4) should be treated with care since they are now somewhat out-dated.

As pointed out earlier, none of these economic indicators alone is an adequate measure of welfare. One should look at a range of indicators (GNP, GNP per capita, calories consumed per capita per day, etc.) before drawing conclusions.

#### Economic development planning in Ghana

Economic development planning in Ghana dates back to the 1920s when Sir Gordon Guggisberg put forward a ten-year plan to cover the period 1920-30. A total of £G24 million was to be spent on such items as a railway system, development of harbours, water supplies and roads, and social services. The breakdown of expenditure in the priority areas was as shown in Table 5.<sup>1</sup>

1. This is an example of a typical colonial plan where transportation is of the greatest priority - to ease and/or increase the flow of raw materials to the colonial countries whilst little or no attention is paid to welfare or educational projects.

TABLE 2

FOREIGN AFRICANS IN GHANA BY ORIGIN 1921-1960 (Census Years)  
('000)

| Country             | 1921 | 1931  | 1948               | 1960  |
|---------------------|------|-------|--------------------|-------|
| Dahomey             | -    | -     | -                  | 31.6  |
| Ivory Coast         | -    | -     | -                  | 54.4  |
| Liberia             | 12.6 | 6.8   | -                  | 8.7   |
| Mali                | -    | -     | -                  | 19.4  |
| Niger               | -    | -     | -                  | 24.9  |
| Nigeria             | 21.2 | 67.7  | -                  | 190.8 |
| Togo                | -    | -     | -                  | 280.6 |
| Upper Volta         | -    | -     | -                  | 194.6 |
| Other West Africans | 14.5 | 199.1 | -                  | 6.0   |
| Other Africans      | -    | 15.6  | -                  | 0.7   |
| Total               | 48.6 | 289.2 | 174.1 <sup>a</sup> | 811.7 |

Source: Ghana Statistical Year Book, 1962.

- a. A partial explanation why the 1948 total is lower than 1931 is a difference in enumeration technique. In 1931 the child of foreign nationals who was born in Ghana was considered a foreigner; in 1948, foreigners were defined as those born outside Ghana.

TABLE 3

## LABOUR FORCE UTILISATION IN WEST AFRICAN COUNTRIES

| State         | Population<br>(millions) | Labour<br>force<br>(thousands) | Labour force           |                               |
|---------------|--------------------------|--------------------------------|------------------------|-------------------------------|
|               |                          |                                | %<br>in<br>agriculture | % in<br>industry,<br>services |
| Dahomey       | 2.4                      | 1318                           | 52                     | 48                            |
| Gambia        | 0.4                      | 168                            | 78                     | 22                            |
| Ghana         | 9.1                      | 3492                           | 58                     | 42                            |
| Guinea        | 5.1                      | 1870                           | 83                     | 17                            |
| Guinea Bissau | 0.5                      | 2172                           | 89                     | 11                            |
| Ivory Coast   | 5.4                      | 2302                           | 81                     | 19                            |
| Liberia       | 1.6                      | 478                            | 74                     | 26                            |
| Mali          | 5.3                      | 2848                           | 91                     | 9                             |
| Mauritania    | 1.2                      | 366                            | 85                     | 15                            |
| Niger         | 4.3                      | 1217                           | 91                     | 9                             |
| Nigeria       | 69.5                     | 22534                          | 67                     | 23                            |
| Senegal       | 4.0                      | 1739                           | 76                     | 24                            |
| Sierra Leone  | 2.7                      | 1054                           | 74                     | 26                            |
| Togo          | 2.0                      | 800                            | 75                     | 25                            |
| Upper Volta   | 8.6                      | 2997                           | 89                     | 11                            |

Source: Africa Magazine No.52, December 1975, p.69.



TABLE 4  
CALORIE VALUE OF DIETS

| Country                                      | Calories<br>per capita<br>per day |
|--|-----------------------------------|
| Former French West Africa (excluding Guinea) | 2,450                             |
| Angola                                       | 2,215                             |
| Tanganyika                                   | 2,175                             |
| Guinea                                       | 2,400                             |
| Liberia                                      | 2,540                             |
| Ceylon                                       | 2,060                             |
| Togo   | 2,645                             |
| Former French Equatorial Africa              | 2,575                             |
| India  | 2,050                             |
| Congo and Ruanda Urundi                      | 2,650                             |
| Kenya  | 2,240                             |
| Haiti  | 1,875                             |
| Tunisia                                      | 2,170                             |
| Guatemala                                    | 2,175                             |
| Pakistan                                     | 2,030                             |
| Honduras                                     | 2,190                             |
| Cameroun                                     | 2,470                             |
| Libya  | 2,180                             |
| El Salvador                                  | 1,975                             |
| Federation of Rhodesia and Nyasaland         | 2,500                             |
| Nigeria and the British Cameroons            | 2,680                             |
| Ecuador                                      | 1,935                             |
| South Korea                                  | 2,040                             |
| Ethiopia                                     | 2,295                             |
| Indonesia                                    | 2,125                             |
| Ghana  | 2,605                             |
| Egypt  | 2,340                             |
| Dominican Republic                           | 1,950                             |
| Burma  | 2,150                             |
| Syria  | 2,225                             |
| Bolivia                                      | 1,880                             |

Source: Clark, C.G., Haswell, M.R., The Economics of Subsistence Agriculture, (1964), p.59.

TABLE 5

## BREAKDOWN OF EXPENDITURE IN PRIORITY AREAS

| Area of expenditure | £Gm  |
|---------------------|------|
| Railways            | 14.6 |
| Harbours            | 2.0  |
| Water supplies      | 1.8  |
| Road development    | 1.0  |
| Total               | 19.4 |

Source: Birmingham, W., et al., p.440.

By 1927, expenditure on the projects earmarked in the plan totalled £G12.4 million.<sup>2</sup>

The 1951 development plan

It was explained by the planners that the 1951 plan "provides an outline of what it is hoped will be achieved in all fields of development during the ten-year period beginning April 1, 1950". It was also made clear that the ten-year period was "merely one phase in the development of the country which has been going on steadily for many years and will continue beyond the decade with which the plan is concerned."<sup>3</sup>

Even though the colonial authorities recognised that a development plan should encourage a balanced development of the whole country, rather than a series of unco-ordinated projects, they adopted the "shopping list"

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2. Under the colonial currency system operating at the time in Ghana, the domestic currency was backed 100 per cent by the Sterling and therefore there was no difference between the Ghana pound (£G) and the pound Sterling.

3. The 1951 Development Plan.

method of planning which could not have enabled a balanced growth in the economy. Estimates were assembled (from all government departments) of all the projects which departments desired to see implemented during the planning period. The available financial resources were then compared with the total estimate. The shortcomings of this method are clear. First, it fails to take account of the close interrelationship between the various sectors of the economy. Second, the financial resources available often fall short of the total proposed by departments. This leads to certain projects being modified or abandoned.

The "shopping list" approach to planning is illustrated by the following excerpt from a circular letter sent to government departments in connection with the preparation of a new development plan in 1957:<sup>4</sup>

The first step to be taken in the planning for the Second Development Plan is to obtain from all departments, through their Ministries, a list of projects which they desire should be considered for inclusion in the plan and which departments consider they will be able to undertake during the five years commencing June 1959. In the past, it has been the custom to issue a financial allocation to each Ministry; on this occasion allocations will not be made but Ministries are asked to bear in mind that overall planning is based on a total of between £80 million and £100 million over the five-year period.

The ten-year plan launched in 1951 had economic and productive services as its top priority, but attention was also to be given to other spheres of the economy like communications, social services and common services and general administration. Strangely enough, the priority given to economic and productive services was not borne out by the percentage allocation of the planned investment.

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4. Circular No.SCR 10100/Vol.IV, dated December 31, 1957, issued by the Development Commission.

TABLE 6

## BREAKDOWN OF THE FINANCIAL ALLOCATION IN THE 1951 TEN-YEAR PLAN

| Project                                    | £G         | Percentage |
|--|------------|------------|
| Economic and productive services           | 12,444,000 | 16.9       |
| Communications                             | 26,110,000 | 35.3       |
| Social services                            | 24,542,000 | 33.1       |
| Common services and general administration | 10,896,000 | 14.8       |
| Planned total investment                   | 73,992,000 |            |

Source: Birmingham W., et al., p.442.

Of the total amount of almost £G74 million required by the plan, £G26 million was to be obtained through loans and grants - the Colonial Development and Welfare Fund was to contribute £G3 million and £G23 million was to be raised by way of loan.

In 1951, shortly after launching the ten-year plan, Dr Kwame Nkrumah came into power and his government decided that the ten-year plan be implemented in five years. Though considerable additions were made to the plan, its basic structure remained the same. Under this new five year plan, the government was to direct attention towards farming. The plan envisaged the establishment of agricultural stations for research; experimentation and training was to be speeded up; solutions to the problem of agricultural credit were to be found through the formation of an agricultural loans board; and the cocoa industry was to be put on its feet within seven years. The sources of finance for this five-year plan were to be those shown in Table 7.

TABLE 7  
SOURCES OF FINANCE FOR THE FIVE-YEAR PLAN  
(£G million)

| Source of finance  | £G<br>(million) |
|--|-----------------|
| Amount to be financed from existing assets                   | 7.5             |
| Refund by UK Government of loan made for duration of the war | 0.8             |
| Additional cocoa duty  | 26.5            |
| Recurrent budget surpluses                                   | 13.1            |
| Grants from Colonial Development and Welfare Fund of the UK  | 3.0             |
| Loans from all other sources                                 | 23.0            |

Source: Birmingham, W., et al., p.443.

The plan was also to promote industries such as textiles, shoes, breweries, tobacco, canning, building materials, cement, bricks and tiles and timber, but by 1960 few of these industries had been established. The communications network was to be improved. Social services were allocated £G24,542,000, i.e. 33 per cent of the planned total investment. Free primary school education was to be introduced, secondary schools expanded, construction of the then University of the Gold Coast to be undertaken, and £G1.2 million was set aside for the establishment of a medical school.

The outcome of the 1951 development plan is not easily assessed. However, the plan contributed in no small way to the fairly high rate of growth in the national income between 1950 and 1957.

The second five-year development plan

The two years immediately following the end of the first five-year plan in 1957 were designated "a period of consolidation". The period saw the preparation of another five-year plan which was launched on 4 March 1959. The approach was again mainly the "shopping list" technique. Capital investment initially proposed under the plan was about ₦G350 million. This was inclusive of the ₦G100 million earmarked for the Volta River hydro-electric project. Because the government realised that it was impossible to implement a plan costed at ₦G350 million, it decided to divide the plan into two programs - one based on a realistic appraisal of the country's resources and potential and involving an expenditure of ₦132 million, and the other involving an expenditure of ₦G250 million. The latter program was deferred for implementation later on. The proposed capital expenditure of the plan as a whole is shown in Table 8.

The plan was intended to be financed largely from the country's own resources: ₦G15 million from general revenue; ₦G50 million from the government's free reserves which were in the form of Sterling securities; and the Cocoa Marketing Board was to provide ₦G50 million from its reserves.

Under agriculture, priority was given to the following objectives:

- (1) to raise the yields of the cocoa industry;
- (2) to establish large acreages in rubber and bananas in the wet south-west;
- (3) to establish the foundations of a cattle industry;
- (4) to raise yield of cereals in the northern region;
- (5) to bring the Volta flood plain under irrigation;
- (6) to study and promote the use of fertilizers;
- (7) to increase research, extension and education programs in agriculture.

TABLE 8

PROPOSED CAPITAL EXPENDITURE IN THE SECOND FIVE-YEAR DEVELOPMENT PLAN  
(£G thousand)

| Sector                                | For immediate<br>implementation | Total<br>allocation |
|---------------------------------------|---------------------------------|---------------------|
| Agriculture and natural resources     | 10,425                          | 24,668              |
| Industry and trade                    | 15,418                          | 25,331              |
| Electricity                           | 7,000                           | 8,765               |
| Communications                        | 28,679                          | 53,010              |
| Local and regional governments        | 9,220                           | 18,852              |
| Education                             | 14,150                          | 27,852              |
| Information and broadcasting          | 1,693                           | 2,677               |
| Housing                               | 7,093                           | 17,000              |
| Health, sanitation and water supplies | 19,675                          | 43,650              |
| Police and prisons                    | 4,786                           | 7,677               |
| Miscellaneous                         | 7,718                           | 13,684              |
| Contingencies                         | 6,143                           | 6,834               |
| Total                                 | 132,000                         | 250,000             |

Source: Adapted from Birmingham, W., et al., p.447

During the plan period, it was intended to establish not less than 600 factories of varying size, producing over 100 different products. This, it was thought, would provide jobs for primary school leavers and satisfy the growing demand for manufactured goods. It was also thought that industrialisation would help diversify the economy. It soon became clear that establishment of 600 factories was too ambitious. By mid 1964, less than 150 of the factories proposed under the plan had been erected and were in production.

### The seven year development plan

The government decided to abandon the second five-year development plan less than two years after its launching. It was to be succeeded by a seven-year plan. No official explanation was given. One important feature of the seven-year plan was that unlike the previous plans, it did not use the "shopping list" approach but rather it took the inter-relationships of sectors into account. In the plan, the socialist stand of the government was clearly spelt out. It was indicated that first the economy must be developed at a fast rate; second, national product was to be utilised for "socially purposeful ends"; and finally, private affluence would not be allowed to co-exist with public want in Ghana.

Apart from the socialist objectives, it was also hoped that this plan and subsequent ones would help eradicate unemployment and transform the structure of the economy from that based mainly on export of primary products. This was to lead to the processing of raw materials domestically. The final objective was to ensure that the country would be able to play a full part in a Pan-African economic community.

The seven-year plan had a target growth of GNP of  $5\frac{1}{2}$  per cent per year, which when adjusted for  $2\frac{1}{2}$  per cent growth in population at the time



was expected to lead to an annual growth of 3 per cent in per capita income, about ₦G75 in 1972. If the target growth rate were achieved by 1970, per capita national income would be about ₦G95 in terms of 1964 prices.

Total investment under the Plan in both the government and the private sectors together was estimated at ₦G1016 million. This meant an average annual gross investment of ₦G130 million. Total planned government investment was to be ₦G476 and the remaining ₦G540 million was to come from private investment. The success of the plan would depend upon the ability of the country to raise the estimated ₦G1016, especially the foreign capital component. The estimated ₦G476 million of government investment was to be financed as follows:

TABLE 9  
ESTIMATED GOVERNMENT INVESTMENT IN THE  
SEVEN-YEAR DEVELOPMENT PLAN  
(₦G million)

| Type of investment                                       | ₦G<br>million |
|--|---------------|
| Recurrent budget surpluses                               | 100           |
| Profits of state corporations                            | 23            |
| Small savings  | 12            |
| Foreign loans and grants (including Volta River Project) | 240           |
| Long-term domestic borrowings                            | 14            |
| Short-term borrowing (deficit financing)                 | 87            |
| Total  | 476           |

Source: Seven-year Development Plan, p.270.

The estimated ₦540 million private investment expenditure was to be obtained as follows:

|  | <u>₦G million</u> |
|--|-------------------|
| "Direct labour" investment               | 100               |
| Residents' net private savings           | 340               |
| New foreign capital - Valco <sup>5</sup> | 60                |
| - Other                                  | 40                |
| Total . . .                              | <u>540</u>        |

Of the total investment under the plan, about ₦340 million was estimated to be new capital flowing into the country. Unfortunately the greater part of available foreign funds at the time consisted of short term credit facilities at relatively high interest rates. Soft loans were very scarce. The Seven-Year Plan did not see its full term because of a military coup in 1966.

Though it would be unfair to claim that Ghana has not derived any benefits from her development plans, it can be said that the plans were not successful in providing the country and the government with programs determining the future pace and pattern of economic development. Too often ad hoc decisions made during the plan period, departed so far from the original proposals that these decisions cannot be attributed to the need for flexibility and modification alone. This may be explained by a variety of reasons. The first was the obsession of the government for very rapid economic growth to allow the country to catch up with more developed countries. The objective of rapid growth of the government was constantly in conflict with the principles of choosing between alternatives.

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5. Volta Aluminium Company.

TABLE 10  
 PLANNED AND PROJECTED STRUCTURE OF INVESTMENT  
 1963-4 TO 1969-70

| (a) <u>By investor:</u>                      |       | <u>£G million</u> |
|--|-------|-------------------|
| 1. Planned Investment (state sector)         | 333.3 |                   |
| Housing                                      |       | 20.0              |
| Infrastructure (excluding transport)         |       | 75.7              |
| Volta River project                          |       | 33.7              |
| Social services                              |       | 127.9             |
| Mining                                       |       | 10.2              |
| Agriculture                                  |       | 65.8              |
| 2. Projected Investment (private sector)     | 273.7 |                   |
| Mining: bauxite and alumina                  |       | 16.4              |
| gold   |       | 10.3              |
| other  |       | 4.8               |
| Agriculture, direct and recorded             |       | 110.8             |
| Housing: urban                               |       | 24.5              |
| Other  |       | 75.2              |
| 3. Industrial Investment (state and private) | 269.3 |                   |
| Aluminium smelter                            |       | 43.6              |
| Basic industrial enterprises                 |       | 79.3              |
| Other industry                               |       | 43.5              |
| Industry for post-1970 period                |       | 30.0              |
| Transport                                    |       | 62.9              |
| 4. Depreciation                              |       | 140.2             |
| Total investment . . .                       |       | <u>1,016.5</u>    |
| <br>(b) <u>By economic sector:</u>           |       |                   |
| Agriculture                                  |       | 176.6             |
| Industry                                     |       | 206.4             |
| Mining                                       |       | 41.7              |
| Transport                                    |       | 62.9              |
| Housing                                      |       | 76.2              |
| Infrastructure                               |       | 109.4             |
| Social services                              |       | 127.9             |
| Other  |       | 75.2              |
| Depreciation                                 |       | 140.2             |
| Total . . .                                  |       | <u>1,016.5</u>    |

Source: Seven-Year Development Plan, p.271.

A good reason for the government's inability to keep to development plans lay in the fact that in Ghana, at the time, all important projects were initiated by politicians who on many occasions took decisions which committed the nation before the planners and technicians were consulted.

Another factor was the absence of a clear distinction between the functions of the cabinet and the responsibility of the planning agencies. The cabinet at times took decisions which had economic and financial implications and which were not properly assessed in terms of existing plans.

### *An alternative technique for planning*

Throughout this chapter it has been noted that successive economic plans for the development of Ghana (except the Seven-Year Development Plan) have given virtually no recognition to the interactions which exist between major sectors of the economy, nor to the scope for changing these relationships. This approach is in contrast to the system advocated and applied by Seers (1966) as a framework for economic planning in Zambia. In recommending the use of a modified input-output system for planning in developing countries, Seers commented that:

Some degree of disaggregation is essential for any economy of this type because the prime movers consist of a few leading export sectors (often only one). To understand such an economy one needs to see the relations between these leading sectors and the remainder; a development plan consists essentially of changing the economic structure and developing new sectors. Aggregative accounting systems are thus of only limited use, and we must look towards Leontief rather than Keynes for our tools of analysis. (Seers, 1966).

An input-output table showing transactions in Ghana during 1968 was released by the Central Bureau of Statistics in October 1973. This table appears to have received very little use as a tool in economic planning.

The following chapters of this report make use of the official I-O table to derive a range of new statistical series and to identify economic linkages considered to be of relevance in the planning process.

## CHAPTER THREE

## INPUT-OUTPUT ANALYSIS WITH RESPECT TO GHANA

Input-output analysis was developed by W.W. Leontief as a method of identifying interdependence among various sectors of the economy. In contrast to most programming analyses, which predict what ought to be, given specified objectives and means, I-O mainly describes conditions as they existed at a particular point in time. The conditions are explained largely in terms of interdependence coefficients which identify relationships between the various sectors. However at times these coefficients are used to predict output and employment in the economy under different conditions of demand.

The relationships identified between inputs and outputs in an I-O table are linear. This may be a major disadvantage, especially if the model is used as a predictive device.

There are generally two procedures for aggregation of data for input-output models: these set out to define sectors in such a way as to minimise intra-sector transactions; and to maintain the highest possible degree of similarity of input structures among the products of any sector.

The output of each economic sector is defined as the sum of sales by the sector to all other sectors, including sales for export, to government and to individuals. Sectors whose demand for goods arises out of their own decisions to produce are termed "intermediate" or "producing" sectors. Sectors whose demand for goods results from other reasons, such as political decisions or individual or consumer preferences, are usually called "autonomous". They represent final demand or the "final bill of goods".

Government outlays, foreign trade and households are usually placed in the "final demand" category although various other arrangements can be adopted.

In the usual input-output formulation, the flows between intermediate sectors consist of goods which are still to undergo some stage of processing. Only goods ready for final consumption or consumption outside the system enter final demand sectors. This classification raises problems at times, for example, many farm-produced foods might be consigned either to a processing or a consuming sector, since they undergo relatively minor processing. Choice of the direction of flow for each product is often guided partly by the objectives of the study and partly by the availability of data.

#### Valuation of transactions

The transactions identified by an input-output table can be recorded using any of the following:

- (i) Basic values: Indirect taxes are excluded from the value of the outputs and the inputs;
- (ii) Approximate basic values: In this case the value of output excludes indirect taxes but the inputs include indirect taxes;
- (iii) Producers' values: Under this system the valuation of both outputs and inputs includes indirect taxes;
- (iv) Purchasers' values: Transactions are valued to include trade and transport margins in addition to indirect taxes.

The basic value method has many advantages but very few countries have the statistical resources to make use of this method of valuation.

Most LDCs have not been able to use even the approximate basic values approach since data on commodity taxes are not usually tabulated at commodity level by type of user in these countries. The stability of the coefficients varies with the method of valuation - being greatest where basic values are used and least stable where it is necessary to record transactions at purchasers' values.

### Calculations

Having defined the sectors, their outputs can be designated as  $X_1, X_2, \dots, X_n$ , where  $n$  is the number of sectors, and  $X_1$  is the total output of the first sector. A matrix with  $n$  rows and  $n$  columns can now be formed. This is termed the transactions matrix. The producing sectors are represented by the rows and the purchasing sectors by columns.

The  $n^2$  cells of the matrix record (normally in value terms) the transactions between sectors. In any one row, the entries record the sales from a particular sector to all other sectors. Where a purchasing sector does not receive any input from a producing sector, the relevant cell contains zero.

These intersector flows may be designated as  $x_{ij}$ , representing the amount of output of the  $i^{\text{th}}$  sector moving to the  $j^{\text{th}}$  sector. This is illustrated in the following table where  $x_{21}$  is the value of output of sector 2 which is used by sector 1.

This table has two additional columns: (1) a Final Demand column depicting goods and services which do not move between producing sectors but which go directly into consumption; and (2) the column headed Total Output which represents the sum of all output of the respective producing sectors (that is the amount of product going to other producing sectors plus the amount going to final demand).



|   | Consuming Sectors |          |          |          |          | Final Demand | Total Output |
|---|-------------------|----------|----------|----------|----------|--------------|--------------|
|   | 1                 | 2        | 3        | ...      | j        |              |              |
| 1 | $x_{11}$          | $x_{12}$ | $x_{13}$ | $x_{1j}$ | $x_{1n}$ | $y_1$        | $x_1$        |
| 2 | $x_{21}$          | $x_{22}$ |          | $x_{2j}$ | $x_{2n}$ | $y_2$        | $x_2$        |
| 3 | $x_{31}$          | $x_{32}$ |          | $x_{3j}$ | $x_{3n}$ | $y_3$        | $x_3$        |
| . |                   |          |          |          |          | $y_i$        | $x_i$        |
| i | $x_{i1}$          | $x_{i2}$ |          | $x_{ij}$ | $x_{in}$ | $y_i$        | $x_i$        |
| . |                   |          |          |          |          | $y_n$        | $x_n$        |
| n | $x_{n1}$          | $x_{n2}$ |          | $x_{nj}$ | $x_{nn}$ | $y_n$        | $x_n$        |

Producing Sectors

Total output  $X_i$  may be defined on a net or gross basis, depending on whether the model records intra-sector flows. The entries across the main diagonal (where  $i=j$ ) are zero if intra-sector flows are not recorded. For example where  $i$  indicates the maize industry,  $X_i$  may represent total maize output minus maize used as seed.

### Input-output coefficients

An input-output coefficient  $a_{ij}$  shows the amount of output from the  $i^{\text{th}}$  sector required per unit of output of sector  $j$ . If sectors could be defined in sufficient detail to describe a single homogeneous product from each industry, flows of goods and services and input-output coefficients could be expressed in physical quantities. However, as the number of possible sectors is too great for such detailed stratification, several products must be aggregated to represent the output of each sector. Rather than define an agricultural sector which uses maize, it may be necessary to define the feed grain sector which includes maize, millet, sorghum, etc. The aggregation problem is even more complex in service industries such as retailing. A single retailing activity such as a grocery store may service a wide range of products.

For this reason intersector flows and input-output coefficients are measured in value terms. Input-output coefficients can therefore be redefined as the value of output from the  $i^{\text{th}}$  sector needed to produce a dollar's worth of output from sector  $j$ . That is:

$$a_{ij} = \frac{x_{ij}}{X_j} \quad \dots (1)$$

where  $a_{ij}$  is the input-output coefficient.

It then follows from the proportionality assumption <sup>1</sup> that total output from sector  $i$  is -

$$X_i = \sum_{j=1}^n a_{ij} X_j + Y_i \quad \dots\dots (2)$$

where  $X_i$  is the total output of sector  $i$ ,

$Y_i$  is the output entering into final demand, and

$X_j$  is the total output of sector  $j$ .

Conversely the total output of any industry can be equated to the value of inputs from other industries plus value added in production, that is -

$$X_i = \sum_j a_{ij} X_j + V_j$$

where  $V_j$  is the values added in industry  $j$ .

The total output of sector  $i$  can also be written as:

$$X_i = x_{i1} + x_{i2} + \dots + x_{ij} + \dots + x_{in} + Y_i$$

hence the total output for all sectors in the economy can be written as -

$$X_1 = x_{11} + x_{12} + \dots + x_{1j} + \dots + x_{1n} + Y_1$$

$$X_2 = x_{21} + x_{22} + \dots + x_{2j} + \dots + x_{2n} + Y_2$$

$$\dots\dots\dots (3)$$

$$X_i = x_{i1} + x_{i2} + \dots + x_{ij} + \dots + x_{in} + Y_i$$

$$X_n = x_{n1} + x_{n2} + \dots + x_{nj} + \dots + x_{nn} + Y_n$$

1. The proportionality assumption asserts that the inputs absorbed by each sector are determined entirely by the level of output of that sector. It specifies a production function in which inputs of a particular sector vary proportionately with its output.

The balance equation above means that the total output of a sector (say sector  $i$ )  $X_i$  equals the sum of the intermediate demand for the sector's output and the quantity of the  $i^{\text{th}}$  sector output going into final demand.

Using the relation in equation (1), equation (3) can be rewritten as -

$$\begin{aligned}
 X_1 &= a_{11}X_1 + a_{12}X_2 + \dots + a_{1j}X_j + \dots + a_{1n}X_n + Y_1 \\
 X_2 &= a_{21}X_1 + a_{22}X_2 + \dots + a_{2j}X_j + \dots + a_{2n}X_n + Y_2 \\
 &\cdot \\
 &\cdot \\
 &\cdot \\
 X_i &= a_{i1}X_1 + a_{i2}X_2 + \dots + a_{ij}X_j + \dots + a_{in}X_n + Y_i \\
 X_n &= a_{n1}X_1 + a_{n2}X_2 + \dots + a_{nj}X_j + \dots + a_{nn}X_n + Y_n \dots (4)
 \end{aligned}$$

Denoting (1)  $a_{11}X_1 + \dots + a_{ij}X_j + a_{in}X_n$  as  $\sum a_{ij}X_j$

and (2) the column vectors of

$$\begin{bmatrix} X_1 \\ X_2 \\ \cdot \\ \cdot \\ \cdot \\ X_n \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} Y_1 \\ Y_2 \\ \cdot \\ \cdot \\ \cdot \\ Y_n \end{bmatrix}$$

respectively as  $X_i$  and  $Y_i$

Equation (4) can be rewritten as  $X_i = \sum a_{ij}X_j + Y_i$  ..... (5)

The balance equation can then be expressed as -

$$X_i - \sum_j^n a_{ij}X_j = Y_i \quad \text{..... (6)}$$

In matrix notation this system of  $n$  equations can be expressed as

$$X - AX = Y \quad \text{..... (7)}$$

where

$X$  and  $Y$  are the column vectors of industry outputs and industry final

demand deliveries, respectively, and A is the matrix of input-output coefficients.

### Interdependence coefficients

Input-output coefficients show only part of the interactions between industries. They measure only the first round effects; the contribution that intermediate inputs from other sectors make to the total value of production of sector  $j$ . Apart from these direct contributions there are also important second, third, etc., round effects. An increase in  $j^{\text{th}}$  sector output will require not only an increase in output of the sectors producing its inputs, but also increases in the outputs of sectors producing inputs for these sectors as well. These direct and indirect effects may be defined as the total inter-industry linkage arising from an increase in final demand.

To derive the total linkage effect, equation (7) can be solved by matrix inversion. The resulting equation is:

$$X = (I - A)^{-1}Y$$

where I denotes an identity matrix.

In this form, elements  $(b_{ij})$  of the matrix  $(I-A)^{-1}$  represent the total effect which a unit increase in final demand (measured in value terms) for the product of any given sector will have on the total output of this and every other sector.

Calculations of this type form the basis of this paper.

The input-output table for Ghana

The input-output table used in this paper was compiled by the Central Bureau of Statistics to show transactions in Ghana in 1968. In preparing the table, the concept of gross sector output was adopted (hence the diagonal elements in the table are not empty) and all transactions are valued at producers' value, i.e. output as well as inputs include indirect taxes.

Imports were regarded as an addition to the production of each domestic producing sector and hence no distinction was made between sales of goods of domestic or foreign origin. Conceptually, it would have been better if imports were separately identified and transactions involving imports were distinguished from those involving domestically produced goods. This procedure was not possible in Ghana at the time because of lack of data relating to intermediate consumption, disaggregated into locally produced and imported components, in respect of the various establishments in each industry group. Many of the industrial establishments found it difficult at that time to distinguish in their records between imported and domestically produced raw materials.

Treatment of imports as an addition to local production helps to stabilize coefficients in the I-O table. This can be an advantage for a developing country such as Ghana as some goods currently provided by imports can be substituted by locally produced goods with the passage of time. For example, clinker, an important raw material for cement manufacturing which is available at present from imports will be produced in due course from local mines.

Provision was made for non-monetary transactions, in the preparation of the table, even though separate estimates could not be recorded for such transactions. For example, in the case of agriculture the production

of a crop by peasant farmers was estimated by multiplying the area under crop and yield per acre. The total out-turn of the crop thus estimated was evaluated at producers' price irrespective of whether it was mainly consumed by the farmer or whether it was mainly sold in the market. In Ghana, the economy is highly monetized and there is no sector which can be termed "non-monetary" in a strict sense.

The official input-output table for the Ghanaian economy in 1968 has 37 producing sectors, five final demand columns and one sector identifying imports classified by the comparable Ghanaian sector of production. For the purposes of this paper the official I-O table was condensed to 11 producing sectors, and four final demand columns. Imports were treated as a row rather than a column. By this means it was possible to incorporate imports within the body of the I-O table and to charge imports to consuming industries through domestic industries producing a somewhat similar product. Thus imports of agricultural products were treated as a sale first to the domestic agricultural sector, for subsequent sale to other industries and to final demand along with output of domestic agriculture. In constructing the consolidated I-O table, the standard methodology was followed. First the total output of each sector was distinguished and then allocated to using industries and to final demand categories. In this process the cost structure of the consolidated industrial sectors was distinguished.

#### The sectors of the economy

The official input-output table compiled for Ghana has 37 producing sectors, but for the purposes of this paper these were condensed to the following 11 sectors:

### Agriculture:

This sector excludes the production of cocoa. It includes two broad categories of primary production. The first includes such activities as -

- (i) growing of field crops, fruits, nuts and vegetables;
- (ii) coffee, rubber and oil palm plantations;
- (iii) raising of livestock and poultry;
- (iv) agricultural and animal husbandry and horticultural services on a fee or contract basis such as harvesting, shelling, spraying, etc.;
- (v) hunting, trapping and game propagation.

The second category includes -

- (i) commercial fishing in ocean, coastal and off-shore waters;
- (ii) catching, taking and gathering of fresh water fish from rivers, lakes, dams, etc.;
- (iii) subsistence fishing and angling by people other than professional fishermen; and
- (iv) gathering of seaweeds, sea shells, pearls, sponges and other ocean and coastal products.

For the agricultural sector, the official I-O table relied upon statistics assembled by the Economics and Marketing Division of the Ministry of Agriculture with supplementary information from some farms. Information on fishing was collected by the Fisheries Office of the Ministry of Agriculture, the Volta River Authority and by analysing the annual income and expenditure of several fishing companies.

### Cocoa:

This industry involves activities such as plantation, picking, grading and marketing of cocoa. In preparing the official I-O table, information on this industry was obtained mainly from the Cocoa Marketing



Board (CMB) which is the only institution legally dealing in this commodity. Supplementary information regarding the cost of cultivation of cocoa was drawn from a survey conducted in Ashanti Region. The production of cocoa during the year was estimated on the basis of sales to the CMB with due adjustments for changes in stocks of cocoa beans held by farmers.

#### Forestry and Logging:

Enterprises considered under this sector are the felling and rough cutting of trees, hewing and rough shaping of poles, blocks and other wood materials, transportation of logs to permanent lines of transportation from where they can be transported by rail or road; gathering of uncultivated materials such as gum and resins, wild rubber, saps, barks, wild fruits, charcoal burning, etc. Main sources of information were the Forestry Division of the Ministry of Agriculture, and export statistics compiled by the Central Bureau of Statistics (CBS). Data relating to items of intermediate consumption were obtained by a survey in Ashanti region.

#### Mining and Quarrying:

The sector covers underground and surface mines and quarries and all supplementary operations such as breaking, milling, washing, cleaning and grading of ores. Constituents of this industry in Ghana are gold, diamonds, manganese, bauxite, salt and stone quarrying.

Information for this sector came from quarterly and annual censuses of industrial establishments by the CBS with additional information from the office of the chief inspector of mines. Minerals were valued at pit head prices.

### Manufacturing:

The manufacturing sector involves activities concerned with the mechanical or chemical transformation of inorganic or organic substance into new products. In deriving the official I-O table, this sector was divided into three categories, namely:

- (i) large scale establishments;
- (ii) medium scale establishments;
- (iii) small scale establishments.

Data on large scale establishments came from an annual and quarterly industrial census of the CBS. Information on medium and small establishments came from a sample survey, carried out in 1963, and projections of labour force engaged in such establishments. Industries listed under the manufacturing sector are:

- (i) food manufacturing (excluding establishments engaged in the manufacture of cocoa products);
- (ii) cocoa products: manufacture of cocoa butter, cocoa liquor, cocoa paste, cocoa cake and other confectionery cocoa products;
- (iii) establishments involved in manufacturing beverages, tobacco products, textiles (excluding wearing apparel or jute mill), leather and footwear, clothing, timber and furniture, paper products and printing, chemicals and chemical products, cement, cement blocks, tiles, bricks and other structural clay products. Other establishments under this sector manufacture glass products, packing material of jute and polythene, basic iron and steel and fabricated metal products, machinery and equipment, aluminium, other non-ferrous metal

products, electrical engineering goods, boats (including repairs). Also included in this category are motor vehicle assembly and repair and spare parts, and other manufacturing establishments (e.g. establishments producing jewellery, musical instruments, toys, sporting goods, watches and photographic goods).

#### Electricity:

This sector covers the generation, transmission and distribution of electric energy for sale to households, industrial and commercial users. It excludes the electricity generated for own use for which data cannot be separated from the parent enterprise.

#### Construction:

This industry covers the construction, repair, alteration and demolition of buildings, highways, streets, bridges, roads, sewers, railway road-beds, harbours, airports, dams, drainage, communication systems, land drainage and reclamation. There was no adequate information on land reclamation by private bodies and hence it was not included. The total availability of construction materials was estimated by a commodity flow approach in connection with the 1968 national income price series.

#### Petroleum:

This involves refining imported crude mineral oil. Information about this industry was available from the Ghana Supply Commission and the sole refinery.

### Transport and Communication:

The transport component of this sector includes such activities as:

- (a) land transport, freight transport by road and services supporting land transport;
- (b) water and air transport and their supporting services;
- (c) services allied to transport such as forwarding, packing and crating and operation of storage and warehousing facilities.

The other component of this sector covers communications services rendered by post and wire. It excludes radio and television broadcasting studios which are included in the "Services" sector.

### Services:

This includes banking and insurance, real estate, distributive trades, hotels and restaurants and miscellaneous services.

The real estate industry comprises:

- (i) letting and operating real estate;
- (ii) imputed rent of owner-occupied buildings other than government office buildings. The output of this industry was estimated on the basis of -
  - (a) estimated average value per house by type of construction materials;
  - (b) frequency distribution of the houses by type of construction materials;
  - (c) bank rate on immovable property, and the bank deposit rate;
  - (d) average economic life of a house by type.

Distributive trade consists of wholesale and retail trade in new and used goods sold to retailers, industrial, or other wholesale users. Estimates for this industry were arrived at by decomposing the purchases of the various industries at purchasers' values into:

- (a) value at producers' price,
- (b) trade margins; and
- (c) transport margins.

Hotels and restaurants cover the operation of restaurants, cafes and eating and drinking places such as "chop" bars, hotels and other lodging places. Information on hotels and restaurants was collected by CBS on a census basis, but that on "chop" bars on a sample basis. Miscellaneous services includes legal services, accounting and auditing services, engineering services and machinery rental, social, recreational and related services such as private educational services, personal and household services such as domestic servants, barbers and hairdressers, photographers and other miscellaneous services nowhere else classified. Output and input of this industry was estimated from National Income Estimates.

#### Government Services:

Government services cover non-profit making activities of public authorities such as the Ministries, government departments, defence, promotion of economic growth, social security arrangements, health, education and other government activities at sale prices which do not fully cover their cost of production.

Data on central government was collected from the Auditor-General's Department. Information on local government was collected (on the basis of local councils, city and urban councils) from the Ministry of

Local Government. Sources of data on public non-profit institutions were the Auditor-General's Department and the institutions themselves.

#### Final Demand:

For the purpose of this study, the four components of final demand identified in the official I-O table were retained. These components were private expenditure on consumption (derived as a residual after estimating the entries in all other columns); government consumption expenditure; exports (valued f.o.b.) and gross capital formation.

#### Value Added:

The gross value added row in the official input-output table was not broken down into wages, depreciation, operating surplus, etc., but for the purposes of this paper some estimate of the wages component was considered to be essential. In order to separate the wage component from the other components of value added, reference was made to A Study of Contemporary Ghana (p.78), which gave an estimate of returns to labour as a percentage of gross value added in each sector of the economy in 1960. On the assumption that factor shares did not change significantly in 1968, these percentages were applied to the appropriate sectors. The estimated returns to labour, as a percentage of gross value added, in each sector are shown in Table 11.

#### Reading the inter-industry table

The adjusted and consolidated version of the official I-O table prepared for the purposes of the study is shown in Table 12. The entries in any row of this table record sales which a particular industry makes to other industries or to final demand. For example, in row 5, sales of manufactures are shown to total c663.6 million. Part of these sales are

TABLE 11

## ESTIMATED RETURNS TO LABOUR BY SECTOR, 1960

| Sector                                     | Returns to labour<br>as a percentage<br>of gross value added |
|--|--|
| Agriculture                                | 89   |
| Forestry                                   | 44   |
| Cocoa                                      | 62   |
| Mining and Quarrying                       | 34   |
| Manufacturing                              | 61   |
| Electricity                                | 45   |
| Construction                               | 55   |
| * Petroleum                                | 3  |
| * Transport and Communications             |  |
| * Services                                 | 51   |
| * Government Services (public consumption) | 94   |

Source: A Study of Contemporary Ghana, Vol. 1 p.78.

\* Adjustments had to be made in some sectors (Fuel, Public Utilities, Services and Public Consumption) where the classification was not identical with that used for the consolidated sectors in this paper.

TABLE 12  
A CONSOLIDATED INPUT-OUTPUT TABLE FOR GHANA 1968  
(at producers' prices: c million)<sup>1</sup>

|   | Final Demand |       |          |                      |             |             |              |           |                             |          |                     | TOTAL SALES |            |         |           |         |
|---|--------------|-------|----------|----------------------|-------------|-------------|--------------|-----------|-----------------------------|----------|---------------------|-------------|------------|---------|-----------|---------|
|   | Agriculture  | Cocoa | Forestry | Mining and Quarrying | Manufacture | Electricity | Construction | Petroleum | Transport and Communication | Services | Government Services |             |            | Exports |           |         |
|   |              |       |          |                      |             |             |              |           |                             |          | Consumption         |             | Government |         | Formation | Capital |
| 1. Agriculture  | 4.4          | -     | -        | -                    | 22.3        | -           | -            | -         | -                           | 20.4     | -                   | 464.1       | 5.3        | -2.2    | 3.9       | 518.2   |
| 2. Cocoa  | -            | -     | -        | -                    | 24.6        | -           | -            | -         | -                           | -        | -                   | -           | -          | -19.2   | 185.6     | 191.0   |
| 3. Forestry   | -            | -     | -        | 0.1                  | 8.0         | -           | 2.3          | -         | -                           | 0.4      | -                   | 38.8        | -          | -       | 16.4      | 66.0    |
| 4. Mining & Quarrying   | -            | -     | -        | -                    | 4.1         | -           | 1.7          | 13.6      | 0.4                         | 0.1      | -                   | 2.0         | -          | -3.4    | 55.3      | 73.9    |
| 5. Manufacture  | 17.6         | 5.4   | 1.1      | 7.3                  | 96.3        | 1.1         | 39.7         | 0.4       | 16.0                        | 16.1     | -                   | 235.3       | 27.1       | 96.1    | 104.0     | 663.6   |
| 6. Electricity  | 0.2          | -     | -        | 1.2                  | 7.7         | -           | -            | -         | 0.7                         | 1.8      | -                   | 4.6         | 3.0        | -       | -         | 19.2    |
| 7. Construction   | -            | 0.5   | -        | 0.3                  | 1.2         | -           | -            | 0.1       | 0.1                         | 11.0     | -                   | -           | 10.3       | 109.4   | -         | 132.7   |
| 8. Petroleum  | 1.0          | 0.2   | 0.7      | 1.2                  | 8.2         | 0.5         | 0.3          | 0.2       | 20.1                        | 1.4      | -                   | 3.2         | 8.8        | 0.2     | 1.7       | 47.8    |
| 9. Transport & Communication  | 1.3          | 5.7   | 0.1      | -                    | 4.7         | -           | 6.6          | -         | 14.3                        | 43.7     | -                   | 66.7        | 5.9        | -       | 20.4      | 169.4   |
| 10. Services  | 7.3          | 2.2   | 0.6      | 3.7                  | 22.1        | 0.8         | 9.4          | 0.5       | 21.4                        | 39.9     | -                   | 393.0       | 31.2       | -       | 8.8       | 540.7   |
| 11. Government Services   | -            | -     | -        | -                    | 0.3         | -           | -            | 0.1       | 0.5                         | 0.5      | -                   | 5.3         | 193.7      | -       | -         | 200.4   |
| Total Intermediate Inputs   | 32.8         | 14.0  | 2.5      | 13.8                 | 198.5       | 2.4         | 60.0         | 14.9      | 73.6                        | 135.3    | -                   | -           | -          | -       | -         | -       |
| Gross value added   | 462.4        | 177.0 | 63.5     | 42.2                 | 195.9       | 16.8        | 72.9         | 25.6      | 66.7                        | 383.2    | 200.4               | -           | -          | -       | -         | -       |
| Wages   | 411.5        | 109.7 | 27.9     | 14.3                 | 119.4       | 7.5         | 40.1         | 0.8       | 42.7                        | 195.4    | 188.4               | -           | -          | -       | -         | -       |
| Other value added   | 50.9         | 67.3  | 35.6     | 27.9                 | 76.5        | 9.3         | 32.8         | 24.8      | 24.0                        | 187.5    | 12.0                | -           | -          | -       | -         | -       |
| Imports   | 23.0         | -     | -        | 17.8                 | 269.2       | -           | -            | 7.3       | 29.1                        | 22.1     | -                   | -           | -          | -       | -         | -       |
| Total sales   | 518.2        | 191.0 | 66.0     | 73.9                 | 663.6       | 19.2        | 132.9        | 47.8      | 169.4                       | 540.7    | 200.4               | 1213.0      | 285.3      | 180.9   | 396.1     | 2622.8  |
| 1. cl = \$US1.16 (1966). Attempts to get the 1968 exchange rates proved unsuccessful. |              |       |          |                      |             |             |              |           |                             |          |                     |             |            |         |           |         |

1. c1 = \$US1.16 (1966). Attempts to get the 1968 exchange rates proved unsuccessful.



to other industries (¢17.6 million to Agriculture; ¢5.4 million to the Cocoa industry; ¢96.3 million to the manufacturing sector itself; etc.). The remaining sales are to final demand (capital formation, exports, government and private consumption).

In order to produce total sales of ¢663.6 million, the manufacturing sector required ¢198.5 million of intermediate inputs and ¢465.1 million primary factor inputs (¢119.4 million wages; ¢76.5 million operating surplus, depreciation, etc.; and ¢269.2 million imports). These various intermediate inputs to the manufacturing sector are indicated as entries in column 5. As can be seen from Table 12, the total supply must equal total demand for the output of each industry. The sum of the intermediate purchases of an industry is not necessarily equal to the sum of its intermediate sales even though aggregate intermediate purchases must equal the sum of aggregate intermediate sales and the sum of primary inputs (factor incomes, net indirect taxes, etc.) must equal the sum of all deliveries to final demand. The equalities are presented in Table 13.

TABLE 13

## AGGREGATE INTER-INDUSTRY FLOWS, 1968

|   | <u>¢ million</u> | <u>¢ million</u>                        |
|---|------------------|---|
| Intermediate purchases                      | 547.8            | Intermediate sales 547.8                |
| Primary inputs:                             |                  | Final demand:                           |
| Wages                                       | 1157.7           | Personal consumption 1213.0             |
| Depreciation,<br>Operating surplus,<br>etc. | 548.9            | Current government<br>expenditure 285.2 |
| Imports                                     | 368.5            | Gross capital formation 180.9           |
|   |                  | Exports 396.0                           |
| Total supply <sup>a</sup> . . .             | 2622.9           | Total demand <sup>a</sup> . . 2622.9    |

a. The minor difference between the totals in this table and the total in Table 12, is due to rounding.

## CHAPTER FOUR

## INPUT-OUTPUT COEFFICIENTS: GHANA, 1968

The I-O table used in this paper was prepared in Ghana by the Central Bureau of Statistics.

It was the first attempt to prepare a detailed I-O table in Ghana and it was envisaged as an aid to economic planners and others concerned with the Ghanaian economy. In a Preface to the document, the Deputy Chief Statistician stated:

It is my hope that this publication will be found useful by economic planners and individual scholars engaged in analytical studies of the Ghanaian economy.

Notwithstanding the purpose of the document, there has been no official attempt to invert the matrix or to use the table for analytical purposes.

As outlined in the previous chapter, it was desirable for the purposes of this paper to amend and consolidate the official I-O table. The 37 sectors were consolidated into a table with 11 sectors; imports were incorporated within the body of the table by treating them as sales first to domestic industries producing a somewhat similar product, for subsequent sale to consuming industries along with any domestic output; finally, the treatment of "value added" was also different. As it was presented in the official I-O table, "value added" was not separated into its components of wages, salaries, depreciation, operating surplus, etc. For analysis of income generation linkage effects, however, an estimate of wages was required. The wage component of value added was therefore separated from the other components by referring to Omaboe, Neustadt and Birmingham, Vol. II (1966).

Having amended and consolidated the official table in this way, the first task was to calculate the direct inter-industry coefficients from which backward and forward linkage effects could be derived. The next step was to calculate the (I-A) matrix and to invert it in order to examine the:

- (a) total inter-industry linkage effect;
- (b) employment linkage effect;
- (c) income generation linkage effect;
- (d) import content of total sales;
- (e) final markets for each sector;
- (f) cost-price effects.

These calculations are the subject of the remainder of this chapter.

### Inter-industry linkage effects

An inter-industry table can be viewed as a disaggregation of the national income and expenditure accounts. Apart from describing the economy at a point in time it also can be put to other important uses. Firstly, it provides a means for deriving a range of new statistics on structural aspects of the economy. Secondly, because of the inter-relationships identified between industries within the framework of the table, it can be used to show how a policy change affecting one industry has implications elsewhere in the economy. Finally, because of its disaggregation and internal consistency, an inter-industry table provides a useful macro-economic frame for forward planning.

A feature of the inter-industry structure of Ghana presented in Table 12 is the significant value added and import content. Value added is particularly high in four sectors - Agriculture, Cocoa, Forestry and Services. This can be explained by the fact that in Ghana, these sectors are based mainly on the inputs of labour, natural resources and own capital.

Another feature of the Ghanaian production matrix is the limited reliance upon local inputs. There are only limited transactions between local industries at the intermediate stage.

A further structural feature, not directly apparent from the input-output table, is the heterogeneity in technology and methods of organization in certain industries. In sectors such as construction, the transactions are those of large scale construction and building firms which employ modern technology; and those of small-scale operators, employing perhaps one or two masons, but who depend mainly on their own labour. This leads to an increase in on-site value added within the sector. The coefficients in the input-output table are therefore influenced by production techniques and particularly the extent of small-scale operations.

Other aspects of the Ghanaian economy can be identified from information incorporated in the input-output table. On the supply side it is possible to determine the direct dependence of each productive sector on all other productive sectors, for its intermediate inputs. On the demand side, the table identifies the dependence of each sector on all other sectors for the disposition of its output.

The inter-industry table can also help answer questions of the type: What was the wage content of one unit of industrial output delivered to final demand? What was the multiplier effect of output in the forestry sector?

As a first step in answering these questions the cost structure of each sector is calculated in terms of a common unit - input per unit of output. This gives the direct input-output coefficients (Table 14) which can be used to derive various linkage effects.

TABLE 14

INPUT-OUTPUT COEFFICIENT: GHANA, 1968

| Sector                         | Agri-<br>culture | Cocoa  | Forestry | Mining<br>& Quar-<br>rying | Manu-<br>facture | Elec-<br>tricity | Con-<br>struc-<br>tion | Petro-<br>leum | Transport<br>& Communi-<br>cation | Servi-<br>ces | Govern-<br>ment<br>Services |
|--------------------------------|------------------|--------|----------|----------------------------|------------------|------------------|------------------------|----------------|-----------------------------------|---------------|-----------------------------|
| Agriculture                    | 0.0085           | 0.0000 | 0.0000   | 0.0000                     | 0.0336           | 0.0000           | 0.0000                 | 0.0000         | 0.0000                            | 0.0377        | 0.0000                      |
| Cocoa                          | 0.0000           | 0.0000 | 0.0000   | 0.0000                     | 0.0371           | 0.0000           | 0.0000                 | 0.0000         | 0.0000                            | 0.0000        | 0.0000                      |
| Forestry                       | 0.0000           | 0.0000 | 0.0000   | 0.0014                     | 0.0121           | 0.0000           | 0.0173                 | 0.0000         | 0.0000                            | 0.0007        | 0.0000                      |
| Mining and Quarrying           | 0.0000           | 0.0000 | 0.0000   | 0.0000                     | 0.0062           | 0.0000           | 0.0128                 | 0.2845         | 0.0024                            | 0.0002        | 0.0000                      |
| Manufacture                    | 0.0340           | 0.0283 | 0.0167   | 0.0988                     | 0.1451           | 0.0573           | 0.2987                 | 0.0084         | 0.0945                            | 0.0298        | 0.0000                      |
| Electricity                    | 0.0004           | 0.0000 | 0.0000   | 0.0162                     | 0.0116           | 0.0000           | 0.0000                 | 0.0000         | 0.0041                            | 0.0033        | 0.0000                      |
| Construction                   | 0.0000           | 0.0026 | 0.0000   | 0.0041                     | 0.0018           | 0.0000           | 0.0000                 | 0.0021         | 0.0006                            | 0.0203        | 0.0000                      |
| Petroleum                      | 0.0019           | 0.0010 | 0.0106   | 0.0162                     | 0.0124           | 0.0260           | 0.0023                 | 0.0042         | 0.1192                            | 0.0026        | 0.0000                      |
| Transport and<br>Communication | 0.0025           | 0.0298 | 0.0015   | 0.0000                     | 0.0071           | 0.0000           | 0.0497                 | 0.0000         | 0.0844                            | 0.0808        | 0.0000                      |
| Services                       | 0.0141           | 0.0115 | 0.0091   | 0.0501                     | 0.0333           | 0.0417           | 0.0707                 | 0.0105         | 0.1263                            | 0.0738        | 0.0000                      |
| Government Services            | 0.0000           | 0.0000 | 0.0000   | 0.0000                     | 0.0005           | 0.0000           | 0.0000                 | 0.0021         | 0.0030                            | 0.0009        | 0.0000                      |

Backward linkage ( $L_{Bj}$ ) measures the ratio of total intermediate inputs to the total supply from each sector. Mathematically  $L_{Bj}$  can be represented as follows:

$$L_{Bj} = \frac{\sum_i x_{ij}}{X_j} \quad \text{..... (8)}$$

where  $\sum_i x_{ij}$  = the sum of sector  $j$ 's intermediate inputs

$X_j$  = total output of the  $j^{\text{th}}$  sector

i.e.  $L_{Bj} = \sum_i a_{ij}$  (from equation (1))

Forward linkage ( $L_{Fi}$ ) measures the ratio of any one sector's intermediate sales (to other sectors) to its total output.  $L_{Fi}$  is expressed as:

$$L_{Fi} = \frac{\sum_j x_{ij}}{X_i} \quad \text{..... (9)}$$

where  $\sum_j x_{ij}$  = total intermediate sales of the  $i^{\text{th}}$  sector

i.e.  $L_{Fi} = \sum_j a_{ij}$  ..... (10)

These measures of direct interdependence were computed for each sector in Ghana and are shown in Table 15, together with the ranking of sectors according to the magnitude of each of these two indices.

The interactions between agriculture and non-agriculture can be expected to change considerably over time during the process of development. In the early stages of development, agriculture is of extreme importance as the employer of between half and three-quarters of the labour force and as a source of over half the GNP. Considering the extent of rural-urban migration and urban unemployment in Ghana, an understanding of the interactions between the agricultural and the non-agricultural sectors is of tremendous importance in formulating economic development policy.

TABLE 15

DIRECT INTER-INDUSTRY LINKAGE INDICES AND THEIR RANKINGS: GHANA, 1968  
(rankings in brackets)

| Sector                         | $L_{Bj}$    | $L_{Fi}$    |
|--------------------------------|-------------|-------------|
| 1. Agriculture                 | 0.0614 (9)  | 0.0909 (10) |
| 2. Cocoa                       | 0.0732 (8)  | 0.1288 (8)  |
| 3. Forestry                    | 0.0379 (10) | 0.1636 (7)  |
| 4. Mining and Quarrying        | 0.1894 (6)  | 0.2730 (5)  |
| 5. Manufacture                 | 0.3008 (4)  | 0.3031 (4)  |
| 6. Electricity                 | 0.1250 (7)  | 0.6042 (2)  |
| 7. Construction                | 0.4515 (1)  | 0.0995 (9)  |
| 8. Petroleum                   | 0.3118 (3)  | 0.7092 (1)  |
| 9. Transport and Communication | 0.4345 (2)  | 0.4510 (3)  |
| 10. Services                   | 0.2501 (5)  | 0.1996 (6)  |
| 11. Government Services        | 0.0000 (11) | 0.0070 (11) |



It seems that the government of Ghana, rather than formulate an adequate policy for the development of primary industries, has treated agriculture only as a source of cocoa for export. Nevertheless, it is likely that agriculture in Ghana could be made to play a more important role in the economy than merely the supply of exports. In the present situation, apart from a levy on cocoa there is very little scope for an investable agricultural surplus to be transferred and utilised for development in the non-agricultural sector. This transfer could be strengthened and could take the form of an outflow of capital from agriculture, via the outflow of labour, or through agricultural taxation, or through the terms of trade changing against agriculture<sup>1</sup> (Nicholls, 1963).

The agricultural sector, if adequately developed, would not only increase its demand for intermediate inputs such as fertilisers, machinery and insecticides that are produced by the industrial sector, but would also provide employment for agricultural workers. As incomes in the agricultural sector rose, the demand for consumer goods produced by the non-agricultural sector would increase. The availability of such goods often acts as an incentive to greater work effort, savings and productivity in the agricultural sector.

Even if greater efforts were made to promote improvements in the agricultural sector, as development proceeded, a decline in the importance of agriculture relative to industry could be expected. This decline could be explained by a number of factors, the most important being the role of changes in composition of demand. Income elasticity of demand

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1. The family farming system, through an intersectoral profit transfer of technological progress, delivers to the non-farm sector progressively increasing supplies of food at progressively lower prices.

for food is generally less than one and decreases as incomes grow, whilst income elasticity of demand for industrial goods is generally greater than one and increases as incomes increase.

Another factor is that of input and output substitution during the process of economic development. Certain agricultural outputs are substituted for by industrial outputs whilst others undergo further processing, the "value added" of which is reflected in the output of the non-agricultural sector. Industrial inputs replace farm inputs - tractors replace labour and farm animals.

Finally, during the course of economic development, as the size of the market in the country grows, both as a result of population increases and increasing per capita income, changes in factor cost tip the balance in favour of manufacturing.

The findings in Table 15 imply that any expansion or contraction in the agricultural, cocoa or forestry sectors would have little direct repercussions on the economy as a whole. Even though these are only direct dependence coefficients, this situation is disturbing since above 50 per cent of the Ghanaian labour force is involved in the agricultural sector. Instead of establishing industries which make use of local raw materials, reliance appears to have been placed upon industries which use a lot of imported raw materials. In preference to agro-based industries which could be expected to take advantage of the very substantial agricultural potential and better the lot of the majority of the population, activities such as razor blade and light bulb production (industries which depend on imported raw materials and deliver all their output to final demand) have been established. It is the view of the writer that more attention should be paid to industries using local raw materials, thereby lessening the country's serious foreign exchange

problem. Attention should also be paid to industries which are characterised by their interactions with other sectors.

The direct coefficients do not tell all the story since they identify only the direct relationships between sectors - how the output of an intermediate input-supplying sector is influenced by a unit increase in demand of an input-demanding sector. There are indirect effects too. A unit increase in demand for the output of a given sector would require an increase in the output of sectors supplying its intermediate inputs. These sectors in turn would require more inputs from other sectors in order to meet the increased demand. These direct and indirect effects generate a series of additional demands for intermediate inputs. As outlined in the previous chapter it is possible to identify all these effects by means of matrix inversion. The interdependence coefficients derived by this means are presented in Table 16.

Individual elements in the inverted matrix record the output required (directly and indirectly) from the corresponding productive sectors to sustain a unit increase in the final demand of a given sector.

The relationship between the I-O table presented in Table 12 and the inverted coefficients (the interdependence coefficients) presented in Table 16 may be clarified by reference to the entry at the intersection of column 7 and row 10 in Table 12. This entry shows that ¢9.4 million of the Service sector's output was required for the Construction sector to produce an output of ¢132.9 million. That is, each ¢1 million of Construction had an on-site service industry content of ¢.0707 million. However, the Construction industry also required inputs from other sectors listed in column 7 and these, in turn, required, directly and indirectly, output of the Service sector for their production. Hence, the amount of Service sector output required directly and indirectly for ¢1 million of

TABLE 16

## INTERDEPENDENCE COEFFICIENTS: GHANA, 1968

| Sector                         | Agri-<br>culture | Cocoa  | Forestry | Mining<br>& Quar-<br>rying | Manu-<br>facture | Elec-<br>tricity | Con-<br>struc-<br>tion | Petro-<br>leum | Transport<br>& Communi-<br>cation | Servi-<br>ces | Govern-<br>ment<br>Services |
|--------------------------------|------------------|--------|----------|----------------------------|------------------|------------------|------------------------|----------------|-----------------------------------|---------------|-----------------------------|
| Agriculture                    | 1.0107           | 0.0021 | 0.0011   | 0.0065                     | 0.0418           | 0.0043           | 0.0162                 | 0.0027         | 0.0108                            | 0.0438        | 0.0000                      |
| Cocoa                          | 0.0015           | 1.0015 | 0.0008   | 0.0046                     | 0.0437           | 0.0026           | 0.0136                 | 0.0017         | 0.0051                            | 0.0022        | 0.0000                      |
| Forestry                       | 0.0005           | 0.0005 | 1.0003   | 0.0030                     | 0.0143           | 0.0009           | 0.0219                 | 0.0010         | 0.0019                            | 0.0019        | 0.0000                      |
| Mining and Quarrying           | 0.0012           | 0.0020 | 0.0034   | 1.0064                     | 0.0123           | 0.0084           | 0.0198                 | 0.2877         | 0.0422                            | 0.0056        | 0.0000                      |
| Manufacture                    | 0.0417           | 0.0392 | 0.0209   | 0.1230                     | 1.1802           | 0.0713           | 0.3656                 | 0.0465         | 0.1370                            | 0.0601        | 0.0000                      |
| Electricity                    | 0.0010           | 0.0007 | 0.0003   | 0.0180                     | 0.0141           | 1.0012           | 0.0052                 | 0.0053         | 0.0074                            | 0.0049        | 0.0000                      |
| Construction                   | 0.0005           | 0.0031 | 0.0003   | 0.0056                     | 0.0033           | 0.0012           | 1.0029                 | 0.0040         | 0.0046                            | 0.0226        | 0.0000                      |
| Petroleum                      | 0.0031           | 0.0058 | 0.0114   | 0.0194                     | 0.0174           | 0.0280           | 0.0158                 | 1.0101         | 0.1357                            | 0.0158        | 0.0000                      |
| Transport and<br>Communication | 0.0047           | 0.0348 | 0.0029   | 0.0068                     | 0.0151           | 0.0051           | 0.0667                 | 0.0033         | 1.1079                            | 0.0988        | 0.0000                      |
| Services                       | 0.0177           | 0.0191 | 0.0113   | 0.0614                     | 0.0476           | 0.0493           | 0.1009                 | 0.0298         | 0.1608                            | 1.0985        | 0.0000                      |
| Government<br>Services         | 0.0001           | 0.0002 | 0.0001   | 0.0002                     | 0.0007           | 0.0002           | 0.0005                 | 0.0022         | 0.0038                            | 0.0014        | 1.0000                      |

output for the Construction sector to be delivered to final demand was more than  $\text{¢}0.0707$  million. The amount is shown in Table 16 to be  $\text{¢}0.1009$  million, indicating an indirect or off-site content of  $\text{¢}0.0301$ . The importance of Table 16 can be illustrated further by reference to entries in column 5. These show that sales to final demand of  $\text{¢}1$  million from the Manufacturing sector required an increase of  $\text{¢}1.1802$  of sales from the Manufacturing sector itself,  $\text{¢}0.0418$  million from the Agricultural sector,  $\text{¢}0.0143$  million from Forestry,  $\text{¢}0.0033$  million from Construction,  $\text{¢}0.0476$  million from the Service sector and  $\text{¢}0.0007$  million of Government services. The column totals give the total (direct and indirect) interdependence between the sectors of the economy.

Total interdependence coefficients (total linkage effects) are presented for each sector in Table 17:

TABLE 17  
TOTAL INTER-INDUSTRY LINKAGE ( $L_{Tj}$ ) INDICES AND  
THEIR RANKING: GHANA, 1968

| Sector                      | $L_{Tj}$ |
|-----------------------------|----------|
| Agriculture                 | 1.0828   |
| Cocoa                       | 1.1089   |
| Forestry                    | 1.0528   |
| Mining and Quarrying        | 1.2585   |
| Manufacture                 | 1.3908   |
| Electricity                 | 1.1725   |
| Construction                | 1.6292   |
| Petroleum                   | 1.3952   |
| Transport and Communication | 1.6172   |
| Services                    | 1.3556   |
| Government Services         | 1.0000   |

The total inter-industry effect can be illustrated by reference to the entry for Transport and Communication. This entry (1.6172) indicates that in order for the Transport and Communication sector to deliver one unit of output to final demand, the output of all sectors including Transport and Communication must be jointly increased by 1.6172 units.

It must be recognised that policy inferences drawn from these linkage effects depend on the country in question. Care should be taken in interpreting some of the findings because at times certain interdependencies between the sectors, such as economies of scale, are not reflected in the linkage calculations. As Westpal (1971) puts it:

The development literature has repeatedly questioned the market mechanism's efficiency as an instrument for allocating investment. Interdependencies between sectors that are not reflected in the structure of existing prices gives rise to such questions . . . . To date these models have successfully incorporated only a limited set of interdependencies between sectors - those arising from I-O relations, competition for scarce resources and changes in relative factor scarcities. Economies of scale in interdependent sectors constitute an empirically important case in which market signals are inefficient instruments of investment planning.

Employment linkage effects (discussed below) should be of special interest in formulation development plans for Ghana, if employment creation is the main policy goal. But if income distribution, or increasing the incomes of the majority of the population, are important objectives then sectors with high income generation linkage effects should command special interest. These income generation effects for Ghana are also examined below.

If special emphasis is to be given to sectors with high income generation linkages, it must be recognised that this effect is consistent with a high marginal propensity to consume, which may result in low saving rates and a slow rate of growth of the economy.

Finally it must be remembered that the linkage effects do not take into consideration supply constraints that might exist in the economy. If supply shortages are more chronic than deficiencies in demand, then policies which favour high income generation linkages may lead to excess demand which ultimately will lead to inflationary pressures in the economy unless adequate measures are taken to prevent undesirable side effects.

The economy of Ghana is subject to high unemployment; a high rate of rural-urban migration; a high rate of population growth; and low per capita incomes. Tables 18 and 19 show some of these features of the Ghanaian population. In these circumstances, policies which create employment for the majority of the people, help check the rural-urban drift and increase incomes are the most welcome.

TABLE 18  
RURAL-URBAN MIGRATION: 1921-1960  
(in thousands)

|   | <u>1921</u> | <u>1948</u> | <u>1960</u> |
|---|-------------|-------------|-------------|
| Urban population                        | 181         | 538         | 1,551       |
| Total population                        | 2,296       | 4,118       | 6,727       |
| Percentage of population in urban areas | 7.9         | 13.0        | 23.1        |

Source: 1960 Population Census.

TABLE 19  
RATE OF GROWTH OF URBAN AND RURAL POPULATION

|  | <u>1921-48</u><br>% | <u>1948-60</u><br>% |
|--|---------------------|---------------------|
| Average annual rate of growth:                               |                     |                     |
| Urban population   | 4.1                 | 9.2                 |
| Rural population   | 0.7                 | 3.1                 |
| Proportion absorbed of total<br>population growth in period: |                     |                     |
| Urban population   | 37                  | 39                  |
| Rural population   | 63                  | 61                  |

Source: 1960 Population Census

TABLE 20  
PERCENTAGE OF WORKFORCE EMPLOYED IN DIFFERENT INDUSTRIES, 1960

| <sup>a</sup><br>Sector                              | %  |
|---|----|
| Agriculture (including Cocoa, Forestry and Fishing) | 62 |
| Mining and Quarrying                                | 2  |
| Manufacturing                                       | 9  |
| Construction and Electricity                        | 4  |
| Commerce  | 14 |
| Transport and Communication                         | 3  |
| Services  | 6  |

Source: 1960 Population Census.

- a. The classification of sectors differs slightly from that presented in the I-O table in this paper.



As shown in Table 20, even with the high rate of rural-urban migration about 62 per cent of the workforce is in rural employment. Figures on unemployment are not presented in this paper. These would not be meaningful in Ghana: firstly, because there are no unemployment benefits and therefore no incentive to register as unemployed; second, the conventional methods of measuring unemployment are not adequate to record all the unemployed since they ignore people who are not looking for jobs (but would accept work if it were available) because of their previous failure to find work or because they are merely under-employed in their present jobs.

In circumstances like these, a realistic policy for developing the rural industries - Agriculture, Cocoa, Fishing and Forestry - is needed.

#### Employment linkage

The employment creating aspect can be studied by calculating the employment linkage effect, the computation of which involves as a first step, expressing each sector's utilisation of labour relative to its respective total output. This gives a set of labour coefficients, that is, the amount of labour in value terms required per unit of each sector's output. Multiplying the labour coefficients by the elements of the inverted inter-industry matrix and summing over columns gives the total employment linkage effect.

Mathematically, the labour coefficient ( $L_j$ ) can be expressed as:

$$L_j = \frac{L_j}{X_j} \quad \text{..... (11)}$$

where  $L_j$  is the labour coefficient of sector j

$L_j$  is the labour utilised (in value terms) in sector j

$X_j$  is the total output of sector j

and the employment linkage effect ( $E_j$ ) with respect to sector j can be

represented as:

$$E_j = \sum_i L_j A_{ij}^*$$

$$\text{where } A_{ij}^* = (I - A_{ij})^{-1} \quad \dots (12)$$

The employment linkage effect has the same interpretation as the total inter-industry linkage effect; each coefficient expresses the total effect which a particular element in final demand has upon employment. The employment linkage effects and their rankings for Ghana are presented in Table 21.

TABLE 21  
EMPLOYMENT LINKAGE BY SECTOR

| Sector                      | Employment<br>Linkage |
|-----------------------------|-----------------------|
| Agriculture                 | 0.8203 (2)            |
| Cocoa                       | 0.6021 (3)            |
| Forestry                    | 0.4344 (6)            |
| Mining and Quarrying        | 0.2631 (10)           |
| Manufacture                 | 0.3087 (9)            |
| Electricity                 | 0.4314 (7)            |
| Construction                | 0.4582 (5)            |
| Petroleum                   | 0.0988 (11)           |
| Transport and Communication | 0.3921 (8)            |
| Services                    | 0.4807 (4)            |
| Government Services         | 0.8997 (1)            |

The first coefficient in Table 21 can be interpreted as indicating that each ₦1 million of agricultural output delivered to final demand embodies employment (in value terms) equivalent to ₦.82 million. Apart from Government Services - which ranks highest - Agriculture, Cocoa and the Service and Construction sectors occupy an important position from the viewpoint of employment linkage effects.

The employment linkage effect is important in understanding the employment-creation ability of a sector, but it does not take the level of income into consideration. The analysis ignores the level of income on the assumption that income is independent of the structure of production.

#### Income generation linkage

Since the employment level is determined partly by the inter-industry structure, wage payments cannot be treated as independent of the structure of production. Furthermore, given the household's marginal propensity to consume different commodities, the structure of final demand is also affected by the level of income. Changes in income, in turn, lead to a chain of interactions between the sectors, stimulating increases in the demand for intermediate products and for labour, with the indirect effects again reflected on the level of household incomes.

To take account of the way in which the level of household income affects the model, we define a new linkage effect - income generation linkage. The conventional way of calculating this new set of coefficients is to "close" the I-O model with respect to households. This involves the enlargement of the I-O matrix by one row and one column. The implicit assumption is that increased income is spent by income earners in the same proportion and on the same items as implied in the original matrix, that

is on the assumption that the marginal propensity to consume equals the average propensity to consume.

One method of "closing" the I-O table with respect to households is to include a household row and column in the intermediate sector. For simplicity, the household sector can be defined as wages and salaries (the row) and personal consumption (the column). Other components of primary inputs are sometimes included (e.g., part of profits) if it is considered that they accrue to households and are not repatriated overseas, etc. As for all sectors, the row total for households must equal the column total for households. In the case of Ghana, the appropriate total would be the sum of all wages and salaries together with any part of non-wage income which was considered for inclusion for household income. The column for households would have the same entries as those appearing in final demand under "personal consumption", but these entries would be reduced in scale so that in total they added to the total for household income. In this particular I-O table, the total household wage and salary income was ₵1157 million and total household consumption was ₵1213 million. Each entry in the household column was therefore reduced by the proportion 1157 to 1213.

After this operation (of adding a row and a column to represent the household sector), we have a 12 x 12 matrix in which the last column denotes the marginal (equal to average) propensity to consume of industry. Household demand therefore becomes an induced component of demand whilst government, investment and export demands remain autonomous.

Direct input coefficients can be calculated from this new 12 x 12 matrix in the usual manner. If the resulting coefficient matrix is denoted by  $D_{ij}$ , the total (both direct and indirect) income generation linkage effect is calculated by inverting the  $(I-D)$  matrix to derive  $(I-D)^{-1}$ .

The entries along the  $(n+1)^{th}$  row in the  $(I-D)^{-1}$  indicates the income multiplier for each industry and represents the income generation linkage ( $YL_j$ ). The income generation linkage effects for Ghana in 1968 and their rankings are presented in Table 22:

TABLE 22  
INCOME GENERATION LINKAGE EFFECTS

| Sector                      | Income<br>generation<br>linkage |
|-----------------------------|---------------------------------|
| Agriculture                 | 1.9105 (2)                      |
| Cocoa                       | 1.4013 (3)                      |
| Forestry                    | 1.0114 (6)                      |
| Mining and Quarrying        | 0.6038 (10)                     |
| Manufacture                 | 0.7169 (9)                      |
| Electricity                 | 1.0045 (7)                      |
| Construction                | 1.0680 (5)                      |
| Petroleum                   | 0.2363 (11)                     |
| Transport and Communication | 0.9150 (8)                      |
| Services                    | 1.1210 (4)                      |
| Government Services         | 2.1914 (1)                      |

From the table, it is clear that one unit (in value terms) of expenditure in the Agricultural sector has the highest (apart from Government Services) income multiplier effect. Forestry, Cocoa, the Service and Construction sectors also have high multiplier effects.

### Imports

Another important analysis involving the I-O table, especially in LDCs where foreign exchange is usually limited, is the determination of the total (direct and indirect) import content of the final output delivered by each sector. In LDCs, the government may wish to maximise the returns from foreign exchange in terms of particular policy objectives - employment creation and/or increasing levels of income. To determine the import content of each sector, the imports (in value terms) entering a sector are first expressed relative to the total output of that sector.<sup>2</sup> This calculation for all the sectors gives a row vector of import coefficients. Multiplying these import coefficients by entries of each column of the inverse matrix and summing the results for each column gives the total (on-site and off-site) imports required by each sector in order to deliver a unit of sales to final demand. These results for the Ghanaian economy in 1968 are presented in Table 23.

The ranking of sectors with regard to their total import content differs from that in preceding tables. This is because in Table 23 priority is being given to sectors that use less imports per unit of final output. As an illustration, Manufacturing is ranked below Agriculture because it requires ₵0.49 of imports in order to deliver one unit of final output whilst Agriculture requires only ₵0.06.

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2. The method used to incorporate imports into the I-O table was described in Chapter 3. Using this method, the import content derived in this section identifies imports embodied (directly and indirectly) in a unit of sales (rather than domestic output) delivered to final demand.

TABLE 23

## TOTAL IMPORT CONTENT PER UNIT OF DELIVERIES TO FINAL DEMAND

| Sector                      | Import Content |          |             |
|-----------------------------|----------------|----------|-------------|
|                             | Direct         | Indirect | Total       |
| Agriculture                 | 0.0444         | 0.0197   | 0.0641 (5)  |
| Cocoa                       | 0.0000         | 0.0242   | 0.0242 (3)  |
| Forestry                    | 0.0000         | 0.0120   | 0.0120 (2)  |
| Mining and Quarrying        | 0.2409         | 0.0592   | 0.3001 (10) |
| Manufacture                 | 0.4057         | 0.0851   | 0.4908 (11) |
| Electricity                 | 0.0000         | 0.0383   | 0.0383 (4)  |
| Construction                | 0.0000         | 0.1718   | 0.1718 (7)  |
| Petroleum                   | 0.1527         | 0.0918   | 0.2445 (8)  |
| Transport and Communication | 0.1718         | 0.1121   | 0.2839 (9)  |
| Services                    | 0.0409         | 0.0509   | 0.0918 (6)  |
| Government Services         | 0.0000         | 0.0000   | 0.0000 (1)  |

### Market analysis

The I-0 table can also be used to determine the extent to which the output of each of the sectors ultimately depends on the output of all other sales to final demand. Each sector has a direct and indirect market for its output - the direct market is represented by its sales to final demand and the indirect market by the ultimate destination of its intermediate sales as they are embodied in the final output of other sectors.

The individual elements in any one column of the inverse matrix measure the output required (directly and indirectly) from each productive sector to sustain a unit increase in deliveries to final demand from the nominated sector (column). Consequently, multiplying each element along a row by the appropriate final demand gives the total output of the sector designated by that row, required directly and indirectly in 1968 for deliveries from each sector to final demand.

As an example, each entry in row 5 of Table 16 records the amount of manufactured output required directly and indirectly by the sector listed above to deliver a unit of sales to final demand. Multiplying each entry in this row by the appropriate final demand gives the total (direct and indirect) amount of the manufacturing industry's sales required by each sector in meeting its final demand deliveries.

The above statement can be interpreted mathematically as follows:

$$X_i = \sum_j b_{ij} x_{jD} \quad (i=1 \dots 11) \quad \dots (13)$$

where  $X_i$  = total output of the  $i^{\text{th}}$  sector

$x_{jD}$  = output of the  $j^{\text{th}}$  sector delivered to personal consumption  
or to some other component of final demand

$b_{ij}$  = interdependence coefficients in the matrix  $(I-A)^{-1}$



The results for Ghana are presented in Tables 24, 25 and 26 in terms of the final markets for Manufactures, Electricity and Agriculture, respectively. Table 24 can be interpreted as follows: from column 1, it can be seen that personal consumption constituted 49.9 per cent or ₵331.22 million of the total market for the manufacturing sector in 1968. It can also be seen from row 5 that ₵227.607 million or (34.3 per cent) of this market is attributable to sales made directly from the manufacturing sector. The remainder entered personal consumption indirectly by way of sectors which purchased intermediate manufactured goods and subsequently sold their output, directly or indirectly to households. The remaining three columns in Table 24 illustrate the extent to which the manufacturing sector relied upon the final demand from government, capital formation (investment) and export markets for the sale of its final output.

The same procedure was used in Table 25 to identify the markets for electricity in 1968. Of interest here is the part exports played in the sale of electricity. Even though exports did not contribute any direct market (intersection of row 6 and column 4) for electricity, they indirectly contributed 14.6 per cent (₵2.83 million) of the market for electricity through other sectors using electricity in the production of their goods, some of which were exported. The part the export market plays in the sale of electricity has become more vital since 1968 as electricity is now exported directly to neighbouring countries of Togo and Dahomey.

Table 26 shows the same sort of calculation for the identification of final markets for the agricultural sector. Personal consumption constitutes the dominant market for agriculture. It accounted for 95.9 per cent (₵496.94 million) of the market for agricultural products.

TABLE 24  
FINAL MARKETS FOR MANUFACTURES, 1968  
(¢ million)

| Sector                         | (1)<br>Personal<br>Consumption | (2)<br>Govern-<br>ment | (3)<br>Capital<br>Formation | (4)<br>Exports | (5)<br>Total |
|--------------------------------|--------------------------------|------------------------|-----------------------------|----------------|--------------|
| 1. Agriculture                 | 19.353                         | .221                   | -.092                       | .163           | 19.645       |
| 2. Cocoa                       | -                              | -                      | -.751                       | 7.257          | 6.506        |
| 3. Forestry                    | .811                           | -                      | -                           | .343           | 1.154        |
| 4. Mining and Quarrying        | .249                           | -                      | -.424                       | 6.896          | 6.721        |
| 5. Manufacture                 | 277.607                        | 31.973                 | 113.379                     | 122.699        | 545.658      |
| 6. Electricity                 | .328                           | .214                   | -                           | -              | .542         |
| 7. Construction                | -                              | 3.765                  | 39.986                      | -              | 43.750       |
| 8. Petroleum                   | .150                           | .413                   | .009                        | .080           | .652         |
| 9. Transport and Communication | 9.138                          | .808                   | -                           | 2.795          | 12.741       |
| 10. Services                   | 23.580                         | 1.872                  | -                           | .528           | 25.980       |
| 11. Government Services        | -                              | -                      | -                           | -              | -            |
| ¢ million                      | 331.22                         | 39.27                  | 152.11                      | 140.7          | 663.35       |
| per cent                       | 49.9                           | 5.9                    | 22.9                        | 21.2           | 100          |

TABLE 25  
FINAL MARKETS FOR ELECTRICITY, 1968  
(ç million)

| Sector                         | (1)<br>Personal<br>Consumption | (2)<br>Govern-<br>ment | (3)<br>Capital<br>Formation | (4)<br>Exports | (5)<br>Total |
|--------------------------------|--------------------------------|------------------------|-----------------------------|----------------|--------------|
| 1. Agriculture                 | .464                           | .005                   | -.002                       | .004           | .471         |
| 2. Cocoa                       | -                              | -                      | -.013                       | .130           | .117         |
| 3. Forestry                    | .012                           | -                      | -                           | .005           | .017         |
| 4. Mining and Quarrying        | .037                           | -                      | .062                        | 1.012          | 1.111        |
| 5. Manufacture                 | 3.341                          | .385                   | 1.365                       | 1.477          | 6.568        |
| 6. Electricity                 | 4.606                          | 3.004                  | -                           | -              | 7.609        |
| 7. Construction                | -                              | .054                   | .569                        | -              | .623         |
| 8. Petroleum                   | .017                           | .048                   | .001                        | .009           | .075         |
| 9. Transport and Communication | .494                           | .044                   | -                           | .151           | .688         |
| 10. Services                   | 1.926                          | .153                   | -                           | .043           | 2.122        |
| 11. Government Services        | -                              | -                      | -                           | -              | -            |
| ç million                      | 10.90                          | 3.69                   | 1.98                        | 2.83           | 19.39        |
| per cent                       | 56.2                           | 19.0                   | 10.2                        | 14.6           | 100          |

TABLE 26

FINAL MARKETS FOR AGRICULTURE, 1968  
(¢ million)

| Sector                         | (1)<br>Personal<br>Consumption | (2)<br>Govern-<br>ment | (3)<br>Capital<br>Formation | (4)<br>Exports | (5)<br>Total |
|--------------------------------|--------------------------------|------------------------|-----------------------------|----------------|--------------|
| 1. Agriculture                 | 469.006                        | 5.357                  | -2.224                      | 3.942          | 476.141      |
| 2. Cocoa                       | -                              | -                      | -.040                       | .390           | .350         |
| 3. Forestry                    | .043                           | -                      | -                           | .018           | .061         |
| 4. Mining and Quarrying        | .013                           | -                      | -.022                       | .365           | .356         |
| 5. Manufacture                 | 9.859                          | 1.136                  | 4.027                       | 4.358          | 19.379       |
| 6. Electricity                 | .020                           | .013                   | -                           | -              | .033         |
| 7. Construction                | -                              | .169                   | 1.783                       | -              | 1.951        |
| 8. Petroleum                   | .009                           | .024                   | .001                        | .005           | .038         |
| 9. Transport and Communication | .720                           | .064                   | -                           | .220           | 1.004        |
| 10. Services                   | 17.213                         | 1.367                  | -                           | .385           | 18.965       |
| 11. Government Services        | -                              | -                      | -                           | -              | -            |
| ¢ million                      | 496.94                         | 8.13                   | 3.52                        | 9.68           | 518.28       |
| Total<br>per cent              | 95.9                           | 1.6                    | .7                          | 1.87           | 100          |

TABLE 26  
FINAL MARKETS FOR ALL SECTORS, 1968  
(per cent)

| Sector                         | (1)<br>Personal<br>Consumption | (2)<br>Govern-<br>ment | (3)<br>Capital<br>Formation | (4)<br>Exports | (5)<br>Total |
|--------------------------------|--------------------------------|------------------------|-----------------------------|----------------|--------------|
| 1. Agriculture                 | 95.9                           | 1.6                    | 0.7                         | 1.87           | 100          |
| 2. Cocoa                       | 6.4                            | .8                     | -7.1                        | 99.8           | 100          |
| 3. Forestry                    | 65.6                           | 1.1                    | 5.7                         | 27.6           | 100          |
| 4. Mining and Quarrying        | 15.7                           | 4.8                    | -1.1                        | 79.6           | 100          |
| 5. Manufacture                 | 49.6                           | 5.9                    | 22.9                        | 21.2           | 100          |
| 6. Electricity                 | 56.2                           | 19.0                   | 10.2                        | 14.6           | 100          |
| 7. Construction                | 7.7                            | 8.4                    | 82.7                        | 1.2            | 100          |
| 8. Petroleum                   | 51.6                           | 22.8                   | 7.2                         | 18.4           | 100          |
| 9. Transport and Communication | 70.0                           | 6.4                    | 4.7                         | 18.9           | 100          |
| 10. Services                   | 85.6                           | 7.0                    | 2.8                         | 4.7            | 100          |
| 11. Government Services        | 3.2                            | 96.6                   | .1                          | .1             | 100          |

The procedure used to derive Tables 24, 25 and 26 was used to identify final markets for all the eleven sectors of the economy in 1968. For convenience only the column totals have been recorded. From Table 27 it can be seen that apart from Cocoa and the Mining and Quarrying sectors, the other sectors rely heavily upon personal consumption. It follows that any decline in the share of GNP going to households would have proportionately greater impact on these sectors.

### Cost-price analysis

In the inter-industry model, total production cost is made up of the intermediate and primary inputs, the latter comprising wages, operating surplus, net indirect taxes, depreciation and imports. It is possible to calculate the total unit cost expressed in terms of primary units. This calculation helps in assessing the effects which a uniform change in average wages or the cost of imports would have on product prices. This is possible because in the inter-industry framework the unit price of the output of any sector can be equated with total unit cost expressed in terms of primary inputs. Even though this type of calculation rests on the rather restrictive assumption that all cost increases are passed on in full to the consumers in the form of higher prices, the results are helpful in illustrating the relative sensitivity of each sector to changes in the cost of primary inputs.

The analysis requires the following steps:

1. Transpose the matrix of interdependence coefficients.
2. The first entry of each row is then multiplied by the F value related to sector 1, i.e., the coefficient which shows the amount of primary inputs required for a unit of total sales of sector 1. Similarly the second entry

- is multiplied by the F value related to sector 2,  
and so on.
3. The above results are now added across the row. If the calculations are correct they should add to 1.0 (i.e., unity), indicating that the price per unit of output of each industry is equal to the cost of the primary inputs incorporated in its output.
  4. Instead of using the original values of F (as in step 2) it is possible to repeat the calculation assuming the F value for each sector is uniformly increased by, say, 10 per cent. The outcome will then be a figure slightly higher than unity. The difference between this figure and unity shows the extent to which prices of the output of each sector will be affected by the 10 per cent change in primary cost. Alternatively the F value can be increased by the amount which would follow from, say, a 10 per cent increase in the wage component alone (or the import component alone).

Mathematically the cost-price relationship can be derived from:

$$P_j = \sum_i b_{ji} P_i + F_j \quad \text{..... (14)}$$

This is the same as:

$$P_j = \sum_i b_{ji} P_i = F_j \quad \text{..... (15)}$$

Where  $P_j$  is the price per unit of output of sector j, and

$b_{ji}$  are the elements of the transpose of the direct input-output coefficient matrix, and

$F_j$  is the sum of primary inputs absorbed directly by sector j.

In matrix notation equation (15) may be expressed as:

$$P - BP = F \quad \text{..... (16)}$$

Where P and F are vectors of sector unit prices and unit primary inputs respectively.

Equation 16 can be solved to obtain the relationship between prices and primary inputs. The solution is obtained in the same way as that used to derive the general input-output solution, i.e.:

$$P(I-B) = F \text{ therefore} \quad \text{..... (17)}$$

$$P = (I-B)^{-1}F \quad \text{..... (18)}$$

Where I is the identity matrix.

If the elements of the transpose of the inverse matrix  $(I-B)^{-1}$  are termed  $r_{ji}$  then

$$P_j = \sum_j r_{ji} F_j \quad \text{..... (19)}$$

The 11-sector inter-industry table has been used to calculate the effects of a uniform 20 per cent increase in wages on prices of each sector's output. The results are presented in Table 28.

These results show that apart from Agriculture, Cocoa and Government Services, where the price effects are in excess of 12 per cent, a 20 per cent rise in wages would induce price increases between 2.1 per cent (for petroleum) and 9.6 per cent (for Services).

The entries in Table 28 can be used to show the effect which a uniform 20 per cent increase in wages might have on the cost of living. This calculation involves multiplying the entries in Table 28 by the proportion of total consumption expenditure contributed by the respective sectors.



TABLE 28

CHANGES IN SECTORAL PRICES ARISING FROM A 20 PER CENT  
INCREASE IN WAGES: 1968

| Sector                      | per cent |
|-----------------------------|----------|
| Agriculture                 | 16.4     |
| Cocoa                       | 12.1     |
| Forestry                    | 8.7      |
| Mining and Quarrying        | 5.2      |
| Manufacture                 | 6.1      |
| Electricity                 | 8.6      |
| Construction                | 9.3      |
| Petroleum                   | 2.1      |
| Transport and Communication | 7.9      |
| Services                    | 9.6      |
| Government Services         | 18.82    |

The results indicate the increases in consumption expenditure from each sector. These are summed and calculated as a percentage of the original total consumption expenditure. The calculation shows that given the structure of the Ghanaian economy in 1968, a uniform 20 per cent increase in wages would raise the cost of living by 11.4 per cent.

## CHAPTER FIVE

## CONCLUSION AND SUMMARY

Previous chapters of this paper discussed some of the disadvantages and advantages of the conventional measurements and approaches used in development planning. They have also illustrated how an input-output table (or a modified version)<sup>1</sup> and associated techniques can be used in a variety of ways in economic planning. But in interpreting the results of I-O analysis for a developing country it must be borne in mind that the growth process involves three specific characteristics that are not treated satisfactorily using the normal I-O procedures.

First, there are changes in the I-O coefficients over time, part of which may be stochastic while another part may be induced by planned investment. In such a case, a net change in final demand can induce two different responses from the supply side: one, a change in the gross output vector with a constant structure of I-O coefficients and the other a change in the coefficient structure itself with a constant vector of gross output. Conventional I-O techniques neglect the second aspect.

Second, I-O coefficients in a developed economic framework may be interpreted as indicators of a previous optimal adjustment of the process mix, on the side of production, in response to changes in final demand. This may not hold true in the short run in developing economies, particularly for the agricultural sector. Apart from capacity restrictions within each short period, there are other structural constraints on growth

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1. Dudley Seers (1966).

relating to institutional and behavioural responses. For a large part of the agricultural sector, I-O ratios are to be taken as allocation coefficients - a change in supply is assumed to predetermine demand in such cases rather than the other way round, whereas for the industrial sector, having a more elastic production structure, the interpretation of I-O ratios as production coefficients would be appropriate. In other words, final demand acts more as a binding constraint on the industrial sector whereas gross supply in the agricultural sector, subject to chance variation over time, predetermines the changes or adjustments in final demand.

The Ghanaian input-output table has all the restrictions discussed above (plus certain structural imperfections) but, if improved, could offer a worthwhile tool for development planning. First, the treatment of imports (the current table incorporates all imports as an addition to domestic production) could be improved. It would be desirable for imports to be broken down into competitive and supplementary. The supplementary imports could then be charged directly as inputs into domestic industries or as sales to final demand, leaving competitive imports to be allocated along with locally produced supplies. Alternatively, for some purposes, there would be value in an I-O table in which the intermediate transactions identify only those goods and services produced locally.

Another improvement warranted in any updated I-O table for Ghana is the further dissection of value-added into its various components. Although made difficult by the lack of data, this procedure would help in formulating better taxation, price, income and employment policies.

A further useful amendment is on the final demand side, where clear distinction should be made between the inventory demand, consumption and investment, and an attempt made to distinguish between the imputed and monetized components.

Despite imperfections in the official Ghanaian I-O table, the coefficients have been used elsewhere to predict, retroactively, the value of imports and non-factor goods for the periods 1955-1959 and 1961-1962. The results (shown in Table 29) indicate that the coefficients are fairly accurate, as a means of prediction. Table 29 shows that over the six years examined, the predictions would have overstated import requirements by 4.5 per cent.

This paper does not examine implications of any alternative development strategy. It provides the inter-industry linkages which are of value to planners in pursuing policies which affect each sector of the economy, rather than planning which ignores the inter-dependencies between sectors (shoplist approach to planning).

Within the limitations of the official input-output table, this paper has set out to establish some of the relationships between agriculture and the remainder of the economy of Ghana. The approach has assumed that agricultural development planning should not be carried out in isolation, but conducted within the country's general strategy of economic development. Ideally, the approach requires an explicit statement of national objectives in terms of the growth and distribution of incomes, employment, sectoral growth, balance of payments, etc. The input-output model could then offer a means of examining the relationships between targets and means - distinction being drawn between major sectors of the economy.

TABLE 29

PREDICTED AND ACTUAL IMPORTS OF GOODS AND NON-FACTOR SERVICES,  
1955-1959, 1961-1962, AT 1960 PRICES  
(£G million)

| Year  | Predicted | Actual |
|-------|-----------|--------|
| 1955  | 110       | 106    |
| 1956  | 112       | 104    |
| 1957  | 116       | 109    |
| 1958  | 112       | 97     |
| 1959  | 113       | 126    |
| 1961  | 154       | 163    |
| 1962  | 146       | 140    |
| Total | 883       | 845    |

Source: A Study of Contemporary Ghana, Vol. I, p.88.

By this means it should be possible both to identify likely growth sectors and to project the outcome of particular development strategies. Examples of the use of input-output tables in this way may be found in Seers (1966) and Parker (1973).

In the absence of adequate information for Ghana, the analysis in this paper has been restricted to inter-sectoral relationships as they existed in 1968. The analysis has involved modification and consolidation of the official input-output table and inversion of the resulting matrix of input-output coefficients. The interdependence coefficients derived in this way were then used to identify the following new statistical series for Ghana:

- employment linkage effects
- income generation linkage effects
- market analysis
- cost-price effects

As an aid in developing and implementing policies which require a long range view of future patterns of economic growth in Ghana, however, projections beyond the official input-output model are warranted. The framework of the present model, and the absence of a consistent set of official programs and policies, provided an inadequate base for such projection.

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\* Economic Community of West African States.

\*\* United Nations Economic Commission for Latin America.

\*\*\* United Nations Industrial Development Organization.