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PAPER I

THE ECONOMIC SIGNIFICANCE AND CONTRIBUTION OF INDUSTRIES BASED ON RENEWABLE NATURAL RESOURCES AND THE POLICIES AND INSTITUTIONS REQUIRED FOR THEIR DEVELOPMENT

The FAO Contribution to this Symposium includes in addition to the one mentioned above six other papers entitled:

II: Some Essential Requisites for Industrial Development of Renewable Natural Resources.

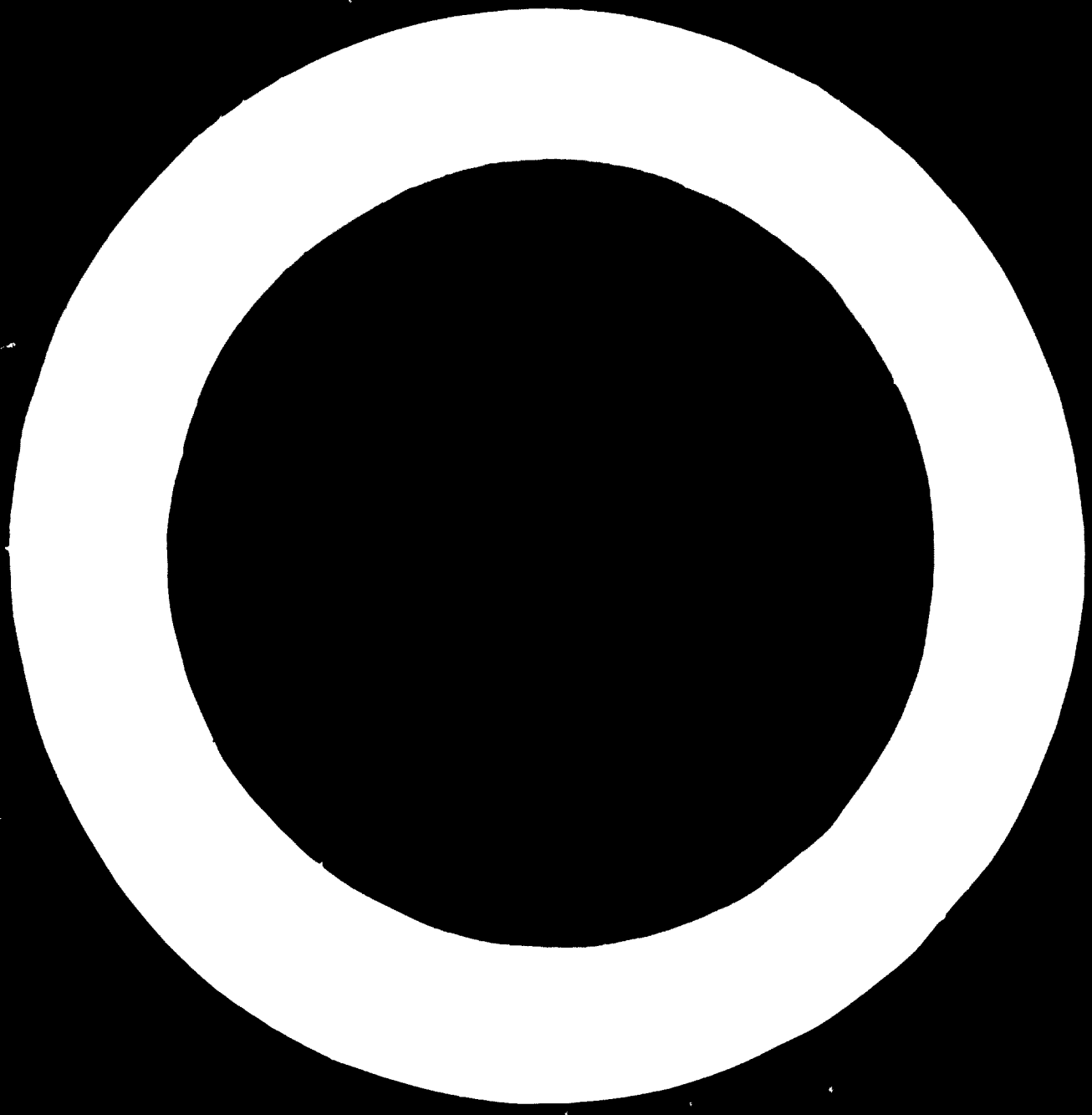
III: Food and Food Products Industries.

IV: Industries Processing Agricultural Products other than Food.

V. Development of Forest Industries.

VI: Fisheries Industries.

VII: FAO's Relations with Industry through the Freedom from Hunger Campaign.



THE ECONOMIC SIGNIFICANCE AND CONTRIBUTION OF INDUSTRIES BASED ON RENEWABLE NATURAL RESOURCES AND THE POLICIES AND INSTITUTIONS REQUIRED FOR THEIR DEVELOPMENT

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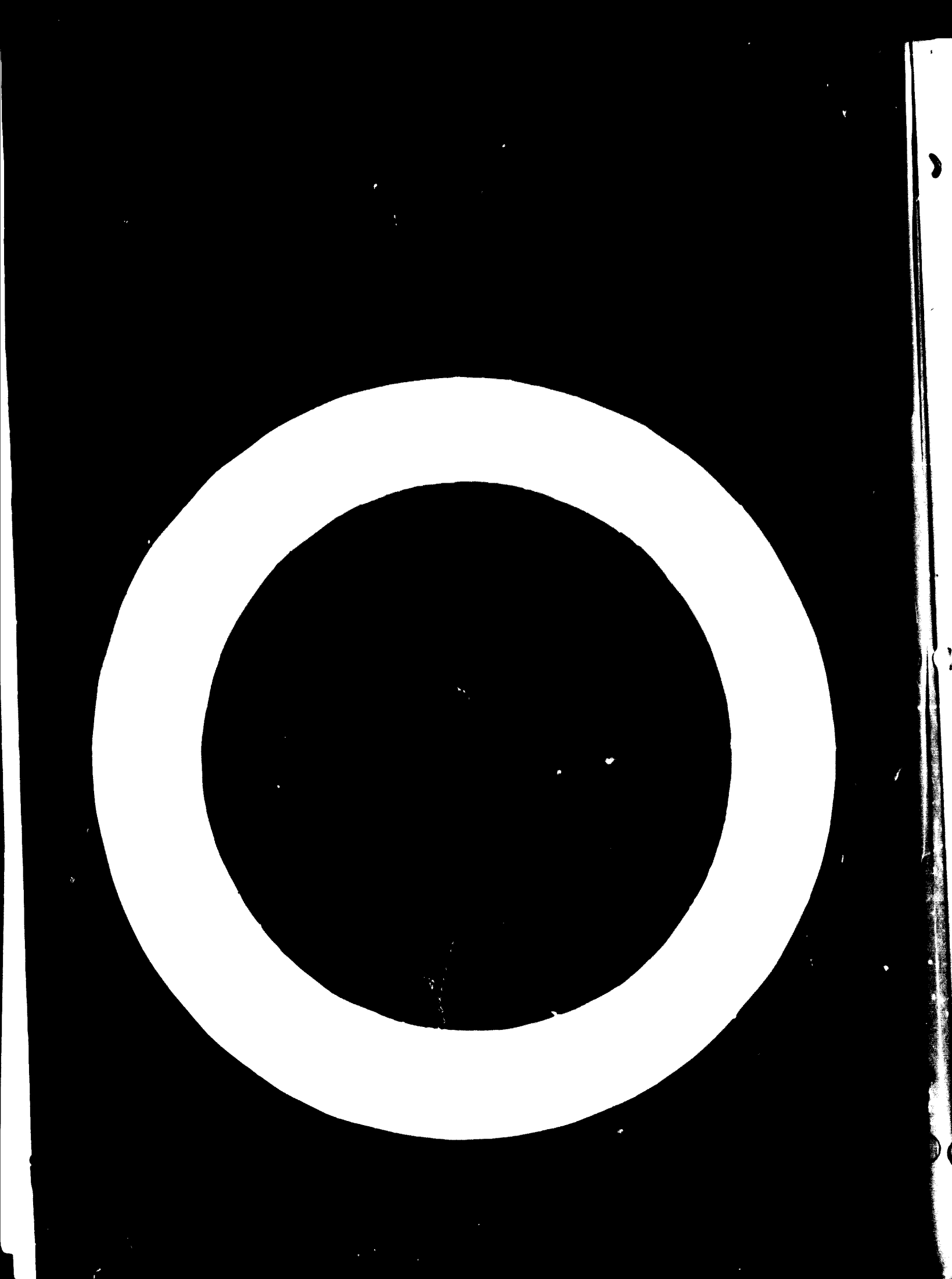


THE ECONOMIC SIGNIFICANCE AND CONTRIBUTION OF INDUSTRIES BASED ON RENEWABLE NATURAL RESOURCES AND THE POLICIES AND INSTITUTIONS REQUIRED FOR THEIR DEVELOPMENT

1. Agriculture* and Industrialization

1. There is now increasing recognition in the developing countries that the acceleration of the rate of industrialization and of general economic development necessitates a concurrent and parallel development of agriculture. The ability to support an ambitious program of industrialization is, in the final analysis, partially determined by the ability to secure enough food to meet the consumption requirements of the expanding non-agricultural population. Since the rate of urbanization (see Table 1 below) usually far exceeds the rate of population increase and the availability of productive job opportunities in the non-agricultural sector, the marketed surplus of food has to increase at a much faster rate than that of total food production and total population, if food prices relative to wages are not to rise and retard the process of development.

2. The reduction of waste and losses is one method of increasing available food supplies, particularly in urban areas. This is discussed in Appendix 1.

Table 1. Rates of increase of urban and total population in selected countries

Country	Period	Urban pop. rate	Total pop. rate
Mexico	1940/50	4.7	2.8
Venezuela	1941/50	6.7	3.0
Ceylon	1953/56	8.2 (estimated)	3.5
Algeria	1948/60	5.1	2.0
Iran	1950/56	8.0	2.4
Jordan	1952/60	6.1	3.1
U.A.R.	1947/60	4.2	2.4
Philippines	1948/56	6.4	3.0

Source: UN Demographic Yearbook, 1960.

3. Shortfalls in domestic food production could be counterbalanced by increased food imports but, unless there is a simultaneous increase in foreign exchange earnings, this would merely transfer the pressure from the domestic price level to the balance of payments. (Even concessional food imports contain a small foreign exchange element for shipping, insurance and other services). There are, in addition, some other considerations which do favour a policy of increasing domestic food production. Industrialization almost invariably involves higher imports of capital equipment and intermediate goods as well as increased supplies of imported consumer (industrial)

* Agriculture here and in the rest of this paper is used in the broad sense and includes animal husbandry, forestry and fisheries.

goods for the newly-employed labour force, and these essential imports would tend to place an even greater strain on the already unfavourable balance of payments of the developing countries. The high opportunity cost of foreign exchange means that the domestic production of goods with a relatively low import content would have high priority in the general development strategy. This criterion would favour domestic agriculture since several programs needed to stimulate agriculture in these countries are of an organizational or institutional nature with a minimal foreign exchange component, e.g. land reform and rural credit programs, improvements in the marketing network and extension services, etc. Moreover, much of the physical capital required by the sector could be provided through utilizing unemployed or under-employed rural labour on a labour intensive rural works program, as many developing countries are now doing. There are also many simple technical measures which could increase production rapidly and which would require only small amounts of scarce resources. Production inputs, however, such as fertilizers, pesticides, tractors and other farm implements, pumps, harvesting and other pre-processing and processing equipment, are a major exception as nearly all of them are currently imported by developing countries. Since there is likely to be a steadily rising demand for these inputs, countries should consider either local manufacture for the simpler requisites, or where appropriate the establishment of an assembly plant as a first step towards this. (See also Paper No. II: "Some Essential Requisites for Industrial Development of Renewable Natural Resources").

4. Since import requirements tend to rise with industrialization, another element of planning strategy is that the developing countries should do their utmost to increase their foreign exchange earnings. But earnings from the traditional primary agricultural exports which provide most of the foreign exchange earnings of the developing countries, and is therefore one of the main contributions of agriculture to economic growth, are rising only very gradually. In general the volume of such exports has expanded but only at the expense of a widespread and, for some commodities, a severe fall in price. While there is little reason to hope for a sustained reversal of this trend, a more promising feature has been the relative success of the developing countries in increasing earnings through exporting processed or semi-processed agricultural products. Thus, between 1953-55 and 1959-61, while earnings of the developing countries from unprocessed agricultural commodities rose by only 3 percent, those from the major processed products* increased by almost 50 percent. Although the contribution to the balance of payments of these industries, which process raw materials from farms, forests and the sea (renewable resources), is still small relative to the traditional exports, they provide a starting point for industrialization and have wider repercussions on the economy as a whole, as will be shown in this paper.

5. There are several other ways in which agriculture and industry are linked. In several developing countries, the agricultural sector is the main source of finance for the development of the rest of the economy. In the early stages of growth the agricultural population provides a market, frequently the principal one, for the products of the nascent industrial sector while, conversely, an expanding industrial sector creates effective demand for agricultural commodities and also absorbs the surplus agricultural population. In view of these interrelationships, it is essential that development programs for each should be drawn up on the framework of a

*Canned meat and fish, fish meal and oil; processed fruit; vegetable oils, oil cake and meal; manufacture of jute, cotton and wool; rubber manufactures; processed wood, pulp and paper; leather and leather manufactures.

comprehensive and consistent overall development plan. This would ensure that the various intersectoral relationships are taken fully into account and also that the program for each sector will support and promote the growth of the other. As part of this planning process, all the stages of the raw material and food processing industries, ranging from the growing to the manufacturing, marketing and ultimate consumption, should be planned jointly and implemented as part of an overall program.

6. The interrelationships between agriculture and the other sectors and the principal structural changes associated with development will also be systematically investigated by the World Indicative Plan for Agricultural Development which the FAO is now engaged in formulating. In the foreword to The State of Food and Agriculture 1965, the Director-General states that: "The task of establishing such a world plan for agricultural development, which would chart in a broad way the goals and objectives which governments might reasonably set themselves in their fight against malnutrition and for economic betterment, should be regarded as the first step in this critical phase of our history. This would bring out (as national or even regional plans could not) the interactions between agricultural developments in different regions, and the interrelationships between agricultural and general economic development. It would not confine itself to mapping goals, but would also attemtp to indicate the means and measures by which these goals might be realised."* In view of their increasing importance in the economies of the developing countries for the promotion of both agriculture and industrialization, the role and contribution to agricultural and general economic development of industries connected with agricultural production and food distribution will be specially identified in the Indicative World Plan.

II. Some Characteristics and Economic Consequences of Agricultural Products Processing Industries

7. A significant portion of total agricultural output has to be processed in some form or another before final use. The table below tries to measure this by showing, first, the distribution of total agricultural output between final demand (final consumption, gross capital formation and exports) and intermediate demand for some countries, and second, the proportion of output going into intermediate demand which is absorbed by the domestic food and processing industries in the same countries.

Table 2. Distribution of agricultural output between final and intermediate demand in selected countries

	India	Japan	Malaysia	New Zealand	Philippines
Proportion of agricultural output going into	.....Percentage.....				
a) Final demand	73	20	28	32	67
b) Intermediate demand	27	80	72	68	33
of which used by food and other processing industries	40	53	86	57	78

Source: Calculated from tables in ECAFE Growth Studies No. 2 - Economic Development and the Role of the Agricultural Sector.

* Page 3 of Foreword, State of Food and Agriculture, 1965 - FAO.

8. While there is substantial variation among the countries in the proportion of output flowing into intermediate uses, in all countries the food and other products processing industries absorb the bulk of these supplies. This is most marked in the case of Malaysia where, owing to the importance of the rubber industry, 86 percent of the agricultural output flowing into intermediate demand is utilized by these industries.

9. Another indication of the importance of these industries in the economic structure of the developing countries is obtained by setting them in the context of the organised manufacturing sector, as done in Table 3. Since censuses and surveys of manufacturing industries frequently tend to omit the smaller establishments processing agricultural materials, their importance in the economy is likely to be under-stated in the table.

Table 3. The place of agro-industries in the manufacturing sector

Agro-industries as percent of all organized industries

Country and year	No. of establishments	Total productive capacity	Fixed capital	Employment	Value added
	.....	.....	Percentage	.....	.....
India 1958	57.1	55.9	49.3	72.8	60.2
1960	57.6	38.2	33.8	59.9	51.6
Pakistan 1959/60	42.3	76.7	67.1	71.3	68.0
Philippines 1960	69.8	....	61.8	69.9	64.7
Japan 1957	33.1	23.4	28.9	30.1	31.7
1962	30.6	17.3	20.3	23.7	20.2

Source: ECAFE Growth Studies No. 2 - Economic Development and the Role of the Agricultural Sector.

10. Except for Japan, which in any case is at a higher stage of development than the others, agro-industries account for the major portion of employment and value added by industries. Judging from the experience of India and Japan, it would seem that the relative importance of these industries tend to diminish as industrialization proceeds. This would also indicate that these industries are the pioneer ones to be established in developing countries.

Raw Material Availability and Transport Costs

11. A major reason for starting with these agricultural products processing industries is the ready availability of the raw material locally and the fact that over a range of these industries, especially in the initial forms of processing, the principal cost element is that of the basic raw material input.

Table 4. Basic raw material costs as percentage of total manufacturing costs

Commodity	Percentage
Sugar manufacture	70-80
Vegetable oil extraction	75-85
Starch manufacture	50-60
Saw milling	50-70
Pulp and paper	30-50
Plywood	30-50
Canned fish	40-60
Fish meal	40-60
Leather manufacture	60-70

Source: FAO

12. Although processing and manufacturing industries have been set up in a few countries without an indigenous raw material base, e.g. Hongkong, jute in post-partition India, the availability of the raw material is a definite incentive to further processing and its availability at reasonable cost could go far towards offsetting any disadvantage represented by higher capital costs or poorly developed infrastructure.

13. This factor, combined with transport and technological considerations, can be of decisive significance in determining the location of a processing industry in the primary producing country. It is thus relatively more economic to establish processing industries near the source of the raw material for commodities like some forest products which are lighter and easier to transport than the original logwood, meat where processing reduces weight and volume and finally for products like fish or similar food products which are so perishable that they can be transported only in processed form. Another example is the cassava processing industry. The roots of this plant contain around 20 - 25 percent starch in weight and the processing industry has to be set up in the production area to avoid high transport costs as well as for technological reasons. The same applies to the sugar industry and also the initial processing of vegetable fibres, such as the ginning of cotton, decortication of sisal, jute, abaca, etc., must be carried out in the area of production of the raw material. However, in other commodities transport costs may be of a less decisive character. In the case of some grains, shipment of the raw product in bulk is frequently cheaper and easier to handle while with oilseeds and their processed forms of oil and cake or meal, they can all be stored or shipped quite satisfactorily and because their weight and bulk is approximately the same in both processed or unprocessed forms, there is technical freedom of choice as to the location of processing. However, seeds from the oil palm and fruits from olives being of a perishable nature require rapid processing and hence establishment of processing facilities in the producing area.

Economies of Scale and the Size of the Market

14. Valid generalizations about agricultural processing industries as a group are difficult to make owing to the wide variety of industries in this category. One of the principal economic considerations, for example, in the operation of an efficient and competitive industry are economies of scale. There are several industries such as the manufacture of cordage or sacks from hard fibre, and cotton textiles where the economies of scale are negligible or cease to be significant beyond a certain stage. Another such industry is rice milling where, as in the Far East, a large number of mills, usually of small capacity, have been set up in each country. The absence of significant economies of scale in rice-milling has led in some countries to the installation of excess capacity, and some governments, e.g. Korea, Madagascar, are now seeking to rationalise the industry. (This emphasises the necessity for careful Government planning and assistance to avoid the wasteful use of scarce resources). On the other hand, most of the wheat mills set up recently, especially in the non-wheat producing developing countries, are automatic and capital intensive and the capital outlay and operating costs of such mills decline as they grow larger in size and scale of operation. For example, the capital cost of buildings, land and equipment per metric ton of flour is nearly twice as high in relatively small mills in Colombia, El Salvador, and Costa Rica than in the large mills in Sudan. An interesting instance is provided by the forest industries where in some manufacturing processes such as saw milling, economies of scale are not pronounced while in other branches such as newsprint, kraft pulp and paper, such economies are considerable.

Table 5. Influence of type and size of pulp and paper mills on fixed investment

Mill type	Daily capacity, metric tons			
	25	50	100	200
	Fixed investment in $1000 per daily ton			
Non-integrated				
Unbleached chemical pulp	235	175	135	105
Bleached chemical pulp	325	240	190	150
Integrated				
Unbleached paper	300	230	180	140
Bleached paper	390	295	235	185

Source: Pulp and Paper Development Prospects in Asia and the Far East, Bangkok, 1962.

15. Given the high impact of capital charges on production costs, a small mill must enjoy compensating advantages to compete successfully with a larger rival.

16. The size of the market is clearly of vital importance in the choice of industries in which economies of scale are or are not significant. Those industries in which relatively small-scale operations can be efficient and economic have particular relevance to situations where local markets are limited and where a policy of import-substitution is being pursued. On the other hand, significant economies of scale necessitate large markets - far

larger, in several cases, than the purely domestic market which single developing countries can offer to the products of their processing industries. The coordination of development plans and regional cooperation between developing countries is one way of increasing the size of the market.

17. In several instances, however, the really significant market would lie in the developed countries but there these products have frequently to compete not only with the already established industries in these countries, but also with their import policies which discriminate against processing in the primary-producing country, and is thus a tax on value added. Examples are discriminatory import duties favouring the raw against the processed product in the case of oilseeds, husked rice and coffee. Other such instruments are quantitative import controls, internal consumption taxes and support measures for domestic high cost industry. The developing countries under such circumstances, may not only lose potential foreign exchange but also the chance of establishing processing industries on a scale large enough to make them competitive. Indeed, in cases where it would be possible to establish a large-scale industry for the domestic market, provided that a certain minimum of exports can also be counted upon, the obstacles to export may prevent a developing country from establishing an industry designed primarily to replace imports.

Capital and Labour Intensities

18. The typical situation in developing countries is that in terms of factor availabilities agricultural raw materials and unskilled labour are plentiful while capital, foreign exchange and managerial ability are in short supply. Any new industries established should therefore aim at maximizing returns to the scarce factors in combination with as much as possible of the abundant resources. Industries based on agricultural products as a group provide favourable opportunities for doing so.

Table 6. Input-output relations in agro-industries

Country c/	Output-Total cap. ratio a/			Employment-Total cap. ratio a/			Output-Employment ratio b/		
	Agro-ind.	Other ind.	Total	Agro-ind.	Other ind.	All ind.	Agro-ind.	Other ind.	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
India									
1958	43	36	40	195	92	150	2228	3937	2691
1960	58	34	43	227	94	145	2586	3589	2977
Japan									
1952	72	56	60	2168	2084	2109	330	268	286
1957	83	55	62	1702	1207	1323	489	455	465
1962	61	50	50	975	656	712	623	764	731
Pakistan									
1959/60	43	66	48	131	173	141	3272	3837	3434

a/ Persons per million Rs. for India and Pakistan; per 1000 yen for Japan
b/ Rs. for India and Pakistan; 1000 yen for Japan
c/ Statistics for the two years for India are not comparable

Source: ECAFE, Growth Studies No. 2, Page 90.

19. It will be seen from the above table (columns 1-3) that in both India and Japan, though not in Pakistan, investment in agro-industries generates a larger annual output per unit than in other industries, and though net value added per unit of capital would be more conclusive, it may be assumed that these industries are relatively efficient users of capital. Similarly, columns 4-6 indicate that once again in India and Japan, a given amount of capital creates more employment in these industries than in other manufacturing industries. (Pakistan is once again the exception). Since the reciprocal of the employment-capital ratio shows capital-intensity, these industries have a lower capital intensity too. Agro-industries in Japan and India thus satisfy two criteria for the selection of investment programs and projects in developing countries: a given amount of capital provides a larger flow of output and a greater volume of employment than other industries. It must be emphasised, however, that a similar conclusion does not necessarily hold for all countries, especially in view of the figures for Pakistan, nor for all industries based on renewable natural resources. Obviously, the comparative efficiency of capital and labour intensity between agro-industries and other industries in different countries will depend, inter alia, on the type and composition of the various industries, the scale and technology chosen, and so on.

20. There are some other factors which, from the point of view of capital requirements, employment and labour utilization favour these industries. In several of them, and this is of importance in capital-scarce economies, the fixed capital required per establishment is lower than in other industries. In addition, the production techniques used are relatively simple and do not require highly skilled labour which is so scarce in developing countries. The required technical skills can moreover be built up without prolonged and expensive education and training programs while they also provide the foundation for the more complex industrial skills needed when the simpler forms of agricultural processing are subsequently replaced by more modern industries. In fact, the technology in several processing industries utilizing renewable natural resources is relatively flexible, so that when labour becomes scarcer or more skilled, a greater degree of mechanization can be introduced in certain phases of the manufacturing process without a radical redesigning of the plant. Saw milling, spinning and weaving, starch processing, and vegetable oil processing are all cases in point.

21. As was mentioned earlier, certain agricultural products processing industries or at least some of the initial stages of processing must necessarily be set up near the source of the raw material. This locational rigidity may be caused by the perishability of the product, e.g. several food crops, to minimize transport costs as in the case of sugar mills or primary forest industries for technological reasons or for a combination of them as in the case of several plantation crops where the processing facilities are more suitably located in the plantation itself. The economic consequences of establishing these industries in rural areas are many. In the first place, it provides employment opportunities to under-employed, or un-employed rural labour, and the generally lower level of wages and other costs in rural areas could represent a substantial incentive to the establishment of labour-intensive industries, and sometimes, as has happened in Japan, these differentials encourage urban manufacturers to sub-contract work to small and medium-sized rural enterprises. This locational inflexibility, by providing greater and more diversified employment opportunities, would also assist in restricting the premature outflow of labour from rural to urban areas, which is a problem that many developing countries are facing. Large urban concentrations of population tend to create social tensions as well as influence the pattern of investment away from directly productive sectors to the provision of

frequently uneconomic social infrastructure, e.g. low cost, subsidized urban housing and food subsidiaries. As the Director-General of FAO has stated recently, "most processing industries are best located in, or closely adjacent to, rural areas and the same is true for the manufacture of farm machinery and other agricultural inputs. These industries are capable of providing vitally needed employment and incomes to rural people and act as a brake on the exodus to urban slums." 1/

Some Economic Consequences of Industries Based on Renewable Natural Resources

(a) Value added and foreign exchange earnings from agricultural processing industries 2/

22. In general, the greater the degree of processing or manufacture of the primary product, the greater the value added which can be defined as the gross value of the output of a firm or industry, as the case may be, less the cost of purchased materials and other payments for productive services such as transport, insurance, etc. The net value added constitutes the amount available for distribution as wages, salaries and profits. Thus, the expansion of processing and manufacturing activities raises a country's national income which is the aggregate sum of value added at all stages of production. Figures of value added by the agricultural processing sector as a whole are not readily available, especially those including small processing units located in rural areas. Some isolated figures are available on an individual industry basis but these are so variable and depend on so many factors that generalizations are not likely to be valid. For example, it was found that "value added by oilseed crushing in developing countries varies. In the Federation of Malaya in 1961 there was a difference of 24 percent between the price of copra and the combined value of crude coconut oil and copra cake produced from a ton of copra. Per unit export values of copra and its products from the Philippines in 1956 and 1958 show a difference of about 12 percent." 3/ Value added by the meat processing industry in Mexico has been estimated at 24 percent of the industry's output in 1960 while in French-speaking African countries value added by individual factories producing only corned beef ranged between 15 to 25 percent of the value of total output.

Similar wide variations in value added by processing are found among industries processing agricultural raw materials. Thus, the value added in processing cotton textiles may be of the order of two-thirds of the value of the finished product but in the case of jute and allied fibres it may be only one-third of the value of the finished goods.

23. When countries that have been exporting an agricultural commodity in an unprocessed form start to sell it abroad in a processed or manufactured form, the difference would constitute an increase not only in value added but also in foreign exchange earnings to an equivalent amount. (If a commodity previously imported is produced locally, foreign exchange to the amount of value added is saved). To calculate the net gain (or saving)

1/ Circular letter by the Director-General to Ministers of Agriculture No. 90, August 1965.
2/ This section has drawn extensively from the material contained in the FAO Commodity Review, 1964 Special Supplement - Trade in Agricultural Commodities in the United Nations Development Decade.
3/ Trade in Agricultural Commodities in the UN Development Decade, Part III, Page 24. FAO Commodity Review, 1964 Special Supplement.

to the balance of payments as a result of establishing domestic processing industries, it is necessary to deduct from the foreign exchange earned (or saved) the amounts spent on importing the capital equipment and any raw materials needed for its production. Thus, an analysis of canned meat exports showed that in several developing countries the import content of processing is high since cans and even labels and sealing materials must be imported and these items constitute as much as 25 to 35 percent of variable production costs. Although determining such import content precisely presents some quite formidable difficulties, it is frequently possible to estimate, more or less, whether a particular industry is a net earner (or saver) of foreign exchange, and there is little doubt that the export in a processed rather than in an unprocessed form adds to the net foreign exchange earnings of the developing countries. It has, for example, been estimated that for every dollar's worth of jute exported in the manufactured instead of the raw state, Pakistan earns an extra dollar in foreign exchange and similarly that in the Mexican cordage industry the net foreign exchange earning for every dollar's worth of fibre exported in manufactured form is 50 cents.

24. These industries also assist the balance of payments through import-substitution when domestic production increasingly takes the place of imports. One instance of this is the growth of the jute and sack industry in Thailand which now produces sacks for its rice exports. Another well-known example is cotton manufactures where the developing countries as a whole have succeeded in reducing their imports from the developed and centrally planned countries from $824 million to $768 million between 1953/55 and 1959/61. Even though exports from developing to developed and centrally planned countries rose in the same period from $52 million to $177, they still remained net importers of cotton manufactures to the extent of $591 million which gives an indication of the scope still remaining for import substitution. A similar situation prevails for several other commodities. Processed fruit exports from developing to developed countries in 1960/61 were $84 million but their net foreign exchange earnings were reduced to $55 million owing to imports of $29 million from the developed countries.

25. A policy of import substitution is the most obvious and the safest one for a newly industrializing country to pursue. Indeed, one of the more striking features of economic development is the continuous increase in the range of domestically produced articles replacing imports, and even though these industries may enjoy a sheltered market through various protective devices, the resulting social benefits may justify such a situation. On the other hand, it must be recognised that for a <u>single</u> commodity there may be limits to an expansion in production <u>in the long run</u> if demand is confined entirely to the domestic market. Once domestic production has displaced the previous level of imports, further increases in demand would largely depend on rising levels of income in other sectors, particularly in agriculture. Restriction to the domestic market would moreover affect the choice of industries since the more advanced forms of processing and manufacture, in which economies of scale are usually significant, would generally require a market larger than the purely domestic one prevailing in several, especially in the small, developing countries.

26. The possibility to export a portion of output would assist in overcoming this handicap. Although some processed and manufactured goods are exported even now to developed countries, such exports are frequently inhibited by the fiscal and trade policies in the importing countries. Developing countries could attempt to counteract these with other measures such as export subsidies but it would, in general, be preferable if the developed countries facilitated access to their markets of manufactured

products from developing countries. So far as the developing countries are concerned, the necessity to compete, in terms of quality and price, with similar products manufactured in the importing countries may require the progressive withdrawal of protection from the sheltered, infant industry after a stipulated period of time.

(b) The feedback effect of agricultural processing industries on agriculture

27. The establishment of agricultural processing and manufacturing industries has several beneficial effects on agriculture. One of the most direct is perhaps the stimulus it provides to increasing agricultural production through the expansion of the market to domestic producers. A well-known example is that of the Anand milk plant in India, which was established in 1948 with a daily capacity of 300,000 lbs. (now increased to 500,000 lbs.). The establishment of the dairy resulted in a rapid increase in milk production per animal, as well as in the number of animals kept. Supplies to the plant rose from 6 million lbs. in 1949/50 to 24.5 million lbs in 1955/56 and to 62 million lbs. in 1963/64, while the sales value of the milk which passed through the plant rose from Rs. 7.4 million (US$1.5 million) in 1955/56 to over Rs. 60 million (US$12.6 million) in 1963/64. Among its side-effects have been the construction and improvement by the Milk Union of neighbouring roads and the building of a new water supply scheme for members. Where, however, a plant is set up to process a commodity previously exported in unprocessed form, the feedback effect is likely to be less pronounced.

28. A substantial increase in employment in the primary producing sector for the procurement of the raw material is another frequent effect of the setting up of these industries. Although the actual industrial process may be capital intensive in terms of plant operations as in certain forest and fish industries, considerable employment is generated in providing the raw material base. The fish meal industry of Peru is a case in point. Of the 35,000 to 40,000 persons employed in the industry as a whole, two-thirds are fishermen and only one-third are employed in the manufacturing plants. In addition - and this provides one of the clearest indications of the potential impact these industries can have under favourable circumstances on an economy - other auxiliary industries have been established; almost all the machinery and equipment required by the fishing fleet (except marine motors) is supplied locally; local boat building yards are fully employed; a large proportion of the packing equipment required by the fish meal industry is supplied by Peruvian firms and new industries, such as those for the manufacture of jute bags and floats for nets, have sprung up.

29. One other major repercussion on agriculture is worth noting. It was pointed out earlier that several agricultural processing industries may necessarily have to be located in rural areas or that this would be advantageous. The development of processing and manufacturing industries requires the provision of economic infrastructural facilities, e.g. transport and power networks, and the impact of these on agriculture can be quite significant and, unlike when provided to urban residential areas, economically valuable and stimulating. The effect of transport development in opening up new markets and bringing in new tools, equipment and supplies for farming is obvious. The availability of cheap power in rural areas can induce farmers to install items of modern machinery, thus opening the way to an improvement in agricultural production and productivity. This has happened in Pakistan where the availability of power in certain areas has led to the installation of irrigation pumps and equipment.

Conversely, the heavy investment in transport and power facilities would become more economical if supplemented by small additional investments at local level to establish rural networks, designed to bring to bear on agriculture the potential impact of these services.

(c) Repercussions on other sectors and industries

30. Mention has already been made of how the growth of the Peruvian fish meal industry has stimulated other associated industries, thereby adding to the national income and employment. Although it has several exceptional features, this example indicates one aspect of the relation of processing industries to other industries. As users of other intermediate goods, processing industries may make it more economic to establish or enlarge such intermediate goods industries. Quite frequently, the growth of industry in a developing country is a process of "filling in" the vacuum between final demand and primary production through the establishment of industries producing components and other intermediate goods. The establishment of such intermediate goods industries also affects favourably the balance of payments since, if they have to be imported, the net balance of payments effect may be negligible. Thus, the import content of the meat canning industry in Argentina has been estimated at 0.1 percent because of the existence of its own can and other intermediate goods producing industries. In general industries based on agricultural raw materials create a demand for the products of a wide range of other industries, e.g. chemicals for pulp and paper manufacture, tanning for leather processing, etc. and this demand quite often leads to the establishment of further industries. Another instance is the rapid development of the food and food products industries in those countries where consumers increasingly consume food in a processed form. This has led to the rapid growth of a rather complex chain of connected industries, such as packing materials, glass, aluminium tinplate, plastics, paper products, as well as industries providing equipment such as refrigeration. Although not of general applicability to developing countries, consumption of processed food is rising in urban centres in these countries and it is quite possible that similar developments will take place there.

31. The processing of agricultural products can also induce the spontaneous establishment of a number of supporting or complementary industries. Industries that use by-products or waste products tend to spring up, and those linked to the processing of forestry, fisheries and livestock products can be quite numerous. For instance, the mechanical conversion of wood leaves residues that can be utilised by other branches of forestry industry, e.g. the manufacture of particle board, blockboard and pulp. Animal feed industries can be based on whey from cheese, oilseed presscakes and other agricultural waste and by-products, as well as on animal products such as blood, carcass and bone meal. The less refined elements of the latter can also be used for the manufacture of glues, gelatins and fertilizers. Likewise a fish meal industry can handle residues from fish processing plants.

32. Much more important, however, is the fact that the establishment of a primary processing industry in a country can lead, through forward linkage, to the setting up of a number of secondary and tertiary industries. The pulp industries are particularly valuable as a base on which other industries can be established. Once paper and board production is underway a large range of conversion industries becomes possible - paper bags and sacks, manufactured stationery, boxes and cartons, etc. Sawmilling and wood-based sheet materials industries give rise to joinery, wood packaging, furniture and a wide range of timber and wood panel fabrications. Many

other agricultural processing industries also share this characteristic. Sugar processing and refining give rise to a number of supplementary industries, and some raw materials like vegetable oils and rubber are used in a number of manufacturing industries, many of which are suitable for establishment in the early stages of industrialization. From the hides and skins produced as by-products of animal production, tannery operations can be established and linked with the industries manufacturing footwear, clothing and many other forms of leather goods.

III. Government Policies for the Promotion of Industries based on Renewable Natural Resources

33. The previous section has indicated in broad outline some of the economic characteristics of industries based on renewable natural resources, and the advantages that would accrue to the economy by their establishment. However, if such industries are to be set up and make a significant impact on the economic condition and development of a country, active government support and assistance is essential. Some of the more important forms of such assistance are (a) Research, (b) Education and Training, (c) Improvement of Marketing Systems, (d) Credit and Finance, and (e) Improvement of Public Utilities and other Infrastructure. Some aspects of each of these, particularly those that affect industries based on renewable natural resources, are considered below in turn. It is necessary to emphasise that all these various aids and schemes should be available and provided simultaneously to ensure maximum effect. In addition, since different government ministries would normally be responsible for administering these programs, it would be advisable to establish a coordinating body, perhaps in the central planning organization, to ensure uniformity of approach and policy towards these industries.

(a) Research

34. Research of a technical nature in this type of industry must not only cover the manufacturing aspect but also extend backwards into the raw material production and procurement phases. Thus, for a successful fruit canning and pressing industry, new varieties which have the required properties for processing may have to be developed.

35. An important aspect of research from the manufacturing point of view is to define the appropriate scale and technology for an enterprise. Several milk plants and meat packing firms have been established in developing countries with a large excess capacity and consequently with overhead costs so high that their operation becomes uneconomic. Other research tasks would be to work out economically viable, efficient and competitive alternatives to the capital-intensive technologies generally available, in favour of those more suited to factor availabilities in a country, and to investigate new uses for locally available raw materials or for the by- and waste-products of local industries. These and other forms of technical research could be carried out by a specially established national or regional research institute for these industries, or as part of the research program of a general Industrial Research Institute. It would also frequently call for the establishment of a pilot plant to demonstrate, in an operational manner, the economic and technical feasibility of research results.

36. The establishment of this type of industry also requires an integrated investigation covering all interrelated stages of the raw material's production, processing and manufacturing. For example, the establishment of a milk industry in a country needs a sound pre-investment survey which should reflect all the conditions and potentials of fodder supply, improvement

of livestock and other production problems, the scale and location of the manufacturing plant and collection centres, marketing regulations, analysis of production costs of milk producers and milk plant, producer and consumer pricing, the size of the market, capitalization of the plant, etc.

37. FAO has been assisting governments to carry out such pre-investment surveys from the early days of its existence. These surveys, which are now largely financed by the United Nations Special Fund, increasingly include projects for the development of industries based on renewable natural resources. In the regional development plans formulated for Turkey and Greece, for example, industrial consultants have been employed to survey industrial possibilities and draw up detailed programs of investment. FAO's forest pre-investment surveys in a number of Latin American countries, as well as in Greece, have led to investment interest in industrial circles. The industrial possibilities of the livestock industries in East Africa, together with their investment requirements, are being investigated as part of the FAO/UNSF East Africa Regional Livestock Development Plan. It can be expected that studies of this type will be increasingly undertaken by FAO in the future.

(b) Education and Training

38. The provision of industrial training is a pre-requisite for promoting a program of industrialization in a primarily agricultural country without an industrial tradition and a pool of industrial labour. Fortunately, agricultural processing industries enable this shortage to be overcome relatively quickly and economically, since the simpler types of processing industries - established at first - utilize the less complex forms of technology, or intermediate technology.

39. The essential basis of any training program is literacy of the individual - juvenile and adult, which would imply universal primary education, and in some developing countries, a special literacy program. When this is achieved real technical training for specific jobs may begin. Alternatively, it may begin after a period of secondary education (first or second cycle) or even after higher education. The higher the level of technical training, and almost inevitably subsequent retraining, the greater is the need for a sound general education on which to base it.

40. Technical training per se will vary according to the skill to be acquired. Simple skills to illiterate workers would most appropriately be taught on the job. However, as a general rule for the skilled worker the short intensive course of up to one month may be quite adequate. It could be taken as in-service training during the first months of employment. Most training, but not all, would be of a practical nature, stressing the skillful manipulation of raw materials and tools and the use of equipment in a scientific manner. Special schemes could be formulated to encourage industry to provide such training as in Brazil where a small amount is added to loans made by the Banco Nacional do Desenvolvimento to be used specifically for labour training.

41. At whatever level training were provided, the advantage that most of the trainees would be of rural origin should be recognised. An understanding of the basic raw materials, and their properties, and uses would facilitate the learning of processing techniques, and at the same time encourage an appreciation in local markets for the final product; systems and courses of training should therefore give special emphasis to industries either existing or to be established in a region, thereby achieving a certain degree of regional specialization. Where possible, training

programs should also be planned to coincide with slack periods in the rural production cycle to minimize loss of income to rural families.

42. Education and training requirements for the large-scale capital-intensive industrial undertakings are limited in both number and quality since relatively few highly trained scientists and engineers are required. The standard university and technological training institutions, providing a training in the sciences related to industrial processes, modelled on those of developed countries, are in many cases already able to cater for present demands. They would be expected to develop according to known needs from the industrial sector, and at this level there is less likely to be any problem about financing or technical link-up with the industry concerned.

(c) Improvement of Marketing Systems

43. The establishment of new agricultural processing industries would be accelerated if adequate and efficient marketing services were provided by governments. Such services would include information on markets, assistance in improving marketing systems and functions such as assembly of raw material, transport, storage and distribution of processed products, introduction of standardized grades, export inspection, credit for marketing enterprises, etc.

44. The successful organization and operation of a new processing industry requires detailed and accurate information on the present and future demand for processed products, as well as on the present and future supply of competitive enterprises. The commercial information provided should be sufficiently detailed to enable production to be planned and directed towards a particular market; it should, therefore, include information on market prices, packaging, etc. Where information is lacking on consumer preferences, it may often be necessary to distribute samples of processed products before any large-scale production is commenced, and where the supply of distant export markets is envisaged, to organise trial shipments. Thought should also be given to the presentation of the product, including the type of packaging material and labelling, as well as to consumer education and advertising in order to ensure adequate sales of the processed products.

45. Assistance may have to be given to farmers and traders to ensure that raw material of the required quality is supplied at the right time and in the required quantity to enable continuous processing. Very often this entails the organization of an intensive extension program covering harvesting, storage, packaging and transport of the agricultural products. Where highly perishable products have to be processed, close vertical integration of production, processing and marketing functions is needed, involving special contractual arrangements for the timely supply of goods and services. The government should provide the services to facilitate satisfactory arrangements for each participant in such a vertically integrated production processing marketing organization.

46. Another area of government assistance may be in the establishment of specific marketing institutions. For example, food storage and processing is often needed because of the seasonality of agricultural production, whilst consumption, on the other hand, is usually spread evenly throughout the year. Where private enterprise does not offer the necessary services efficiently or economically, a semi-autonomous governmental institution may have to be established to handle both the storage and processing, thereby not only stabilizing prices and consumer supplies but also contributing to the better nutrition of the population. Similarly, institutions may be

required to handle and/or regulate exports and at the same time carry out some of the functions already mentioned, as grading standards, quality controls, etc. Such boards or corporations have been set up or approved by a number of governments and have been given considerable freedom of action. They have taken over the supervision and control of processing and marketing of farmers' produce, sometimes with considerable success and benefit to the farmers.

(d) Credit and Finance

47. A problem facing many new industries, particularly small-scale industries, is the lack of credit for the purchase of capital goods and for operating expenses. Credit terms for small industrial ventures are less favourable not only because of their small size which heightens the risk involved but also because of the deficiencies in technical knowledge, managerial skill, and poor planning usually found in these ventures.

48. Since the primary forms of food and agricultural raw material processing are often located in or near villages, and the financial requirements are usually not excessively large, they would tend to be a suitable investment for rural cooperative societies. While cooperatives of industrial producers have never attained importance relative to other forms of cooperative enterprises in developing countries - perhaps owing to difficulties in management and marketing - rural processing industries would constitute a suitable investment for cooperative financing both from the point of view of investment diversification and for increasing the economic viability of the area. However, as private savings in these areas are usually low and much of this is needed for agriculture, special reserved funds may have to be made available to these cooperatives to finance small-scale to medium-sized rural industries. The larger, more complex processing industries may be financed by state credit agencies such as development or industrial banks. This type of agency should not only supply financial assistance but also provide planning, managerial, and technical assistance, as is being done by the Industrial Development Company of Puerto Rico.

49. For the development of large and complex industries based on agricultural raw materials, the state may find it advantageous to seek investment or financing from foreign sources which provide not only capital but would also bring in technical knowledge, business management, and top level supervisory personnel. Several wheat mills set up recently in developing countries have, for example, been financed wholly or partly by external sources.

50. Realizing this, FAO has for a number of years been in contact with many industrial enterprises with interests in processing industries in the developing regions. This cooperation has been achieved through advisory committees or special industry panels established under FAO's Regular Program and more recently within the framework of the Freedom-from-Hunger Campaign. (See also Paper No. VII: "FAO's Relations with Industry through the Freedom from Hunger Campaign"). Owing to the success of these contacts, more extensive consultations have recently been initiated with leading industrial firms and other international organizations for the exchange of information on investment needs and prospects; planning for raw material supplies; pre-investment surveys; better information for the public on world food problems; joint support for research institutes, and field demonstrations; industry sponsored training of skilled manpower and joint efforts to study and change food habits. Very recently a small group of industrial leaders from developed countries met in Rome and made specific recommendations on how this intensified cooperation could be best organised. Although this type of wide consultation is still at a

rather preliminary stage, it holds promise that the growing interest of private industry in FAO's activities will result in a significant increase in the rate of private industrial investment in the agricultural products processing and requisites manufacturing industries of the developing countries.

(e) Improvement of Public Utilities and other Infrastructure

51. Countries planning any type of industrial development must provide the necessary infrastructure in which transport and power are of central importance. While all industries would be equally dependent on these facilities for their successful establishment, agricultural processing industries are distinguished by two special features. In the first place, many agricultural raw materials are bulky and this may require considerable investment in transport facilities and equipment. The bringing of large quantities of raw material to the pulp and paper mills and the shipping of the finished products can be cited as examples. Thus, for a 100 ton production per day mill daily transport tonnage may average 500 to 1000 tons and considerably exceed these figures at peak periods. Secondly, if these industries are located in rural areas, the provision of power may be costly because of the extensive and dispersed transmission networks required.

52. One possibility which would tend to minimize government investment in infrastructure as well as encourage the establishment of industry would be the creation of the industrial estates which provide industrial sites equipped with basic utilities, access to transport facilities, and sometimes factory buildings at low rental. Industrial estates in rural areas may appropriately be located in agricultural marketing centres or in areas selected for intensive agricultural development.

Conclusions

This paper has argued that industries based on the agricultural sector have particular characteristics which render them appropriate as a starting point for, and essential component of, industrialization. It is essential, however, that a clear and coherent system of priorities should be worked out for the development of such industries, taking into account the relevant economic and technological factors, and that the resultant plan should be carefully integrated into the overall development plan in view of the close interdependence between industrial development and agriculture. Modern industry and agriculture both call for great technological skill. They are usually complementary and self-reinforcing. The potential stimulus of industrial development on agriculture is a consideration to which FAO attaches the highest importance.

FAO carries direct responsibility for assisting governments to establish industries based on renewable natural resources, and within its Program of Work and Budget industrial development is receiving a very high priority. FAO has initiated several new programs of assistance in these fields, the descriptions of which lie outside the scope of this paper.

APPENDIX I

One method to increase available food supplies for the urban population is to reduce the degree of waste and losses now occuring all along the line between the primary producer and the utlimate consumer. These losses and waste are generally caused by the traditional methods of crop production, field handling, transportation, storage, etc. While it is difficult to assess the volume and value of these losses, there is little doubt that in some countries and for some products they are substantial, and result not only in a reduction of available food supplies but also in increased costs for the consumer.

It is not possible within the scope of this Appendix to discuss in detail precisely where losses and waste occur, nor how they can be reduced or minimised at the various stages between production and ultimate consumption. But, in view of its seriousness and complexity, only a general indication of the problem and some necessary approaches to it are given below.

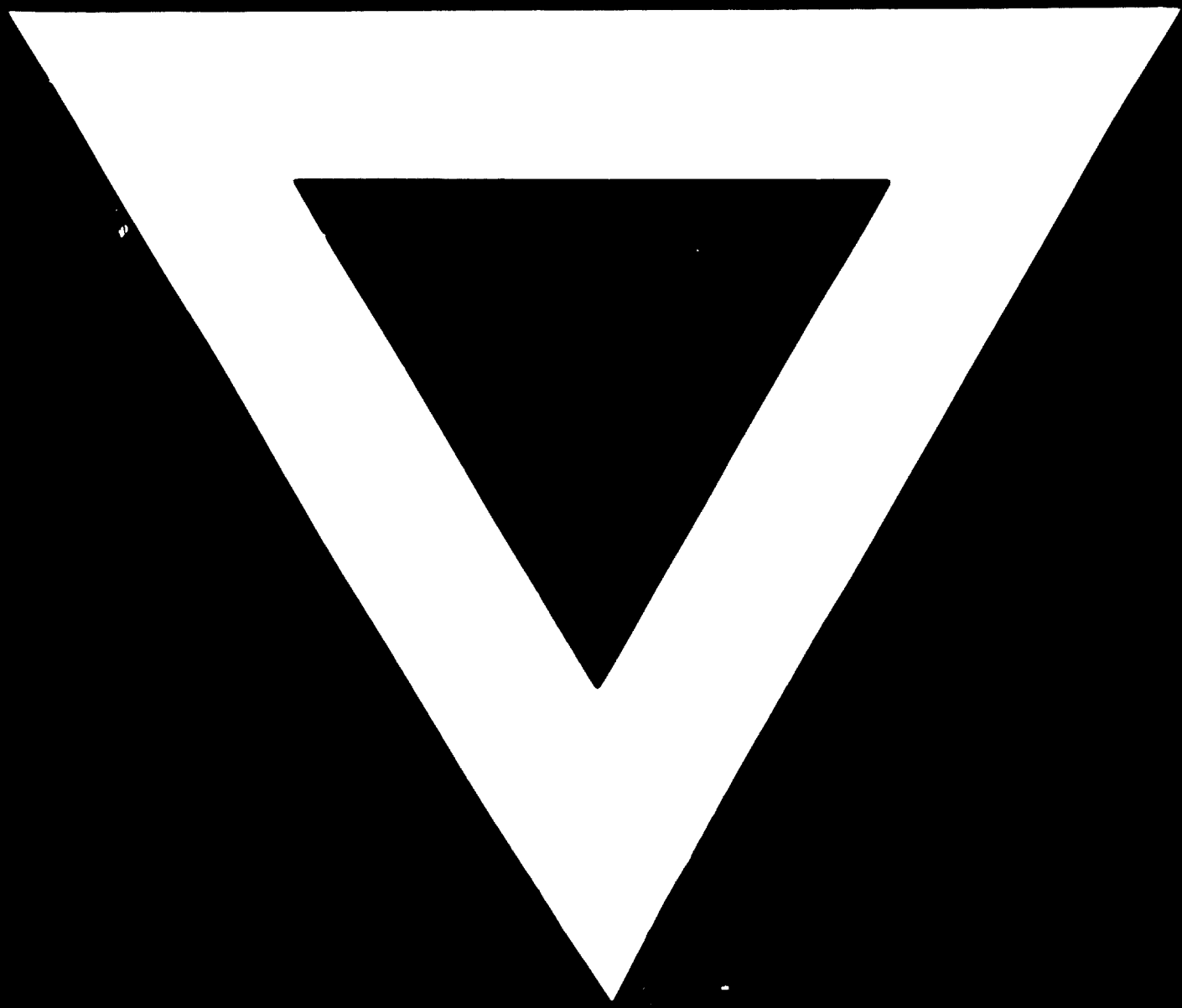
Since many crops pass through the stages of field handling, transportation, storage, preservation, processing, marketing, storage and distribution, and at each stage of which losses and waste tend to occur, it is essential that improvements should be initiated at every point in this chain to permit control of losses and elimination of waste as well as possible.

One step towards this aim is the establishment of food and food products industries in the primary production areas. These industries would permit the utilization, where possible, of waste and by-products and lead to the setting up of complementary industries. Molasses, bagasse, coconut husks, and slaughterhouse offal, among others, all constitute the basis of several industries, but they are now unutilised in several countries.

Another essential step would be to improve transportation, refrigeration, cold storage, marketing and distribution facilities. The measures required in all these fields and the necessity that for maximum effect they should be implemented simultaneously, may suggest the ultimate development of a vertically integrated system which would have elements of, and be comparable to, in several respects, the supermarket system which is now becoming increasingly popular in developed countries. The development of such a chain would naturally require a considerable volume of investment, particularly in the processing industries, as well as in the institutional and organizational structure serving agriculture. But the potential returns to this investment can be substantial and occasionally rapid.

The establishment of food and food products industries can, in addition, bring about discoveries of new food products derived from various sources, as cheap protein-rich materials. Campaigns to promote acceptability of these new products will be needed to inform the potential consumer about the nutritional and low-price advantages of such products.

It is hoped therefore that this problem will receive intensive attention by governments when reviewing institutional arrangements, and formulating development programs, leading ultimately to a reshaping of policies and planning.



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