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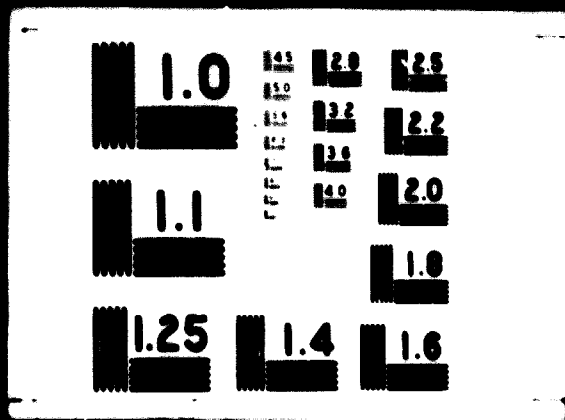
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provisional agenda

**POLICIES, PLANNING AND THE ECONOMIC, SOCIAL AND INSTITUTIONAL  
ASPECTS OF INDUSTRIAL DEVELOPMENT, BASED ON AGRICULTURAL  
FORESTRY AND FISHERIES RESOURCES**

Prepared for the Symposium

Presented by the Food and Agriculture Organisation

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.

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## I. CHARACTERISTICS OF PROCESSING INDUSTRIES

1. The industries based on agricultural, fishery and forest products as raw material comprise a very varied group. They range from simple preservation (such as sun drying) and operations closely related to harvesting, on the one hand, to the production by modern capital-intensive methods, at the other extreme, of such articles as textiles, pulp and paper.

2. Since their products all have the same end use, the food industries are much more homogeneous and easier to classify than the non-food industries. Most preservation techniques, for example, are basically similar over the whole range of perishable food products, whether fruit, vegetables, milk, meat, or fish. In fact, the processing of the more perishable food products is to a very large extent for the purpose of preservation.

3. For the non-food industries, much more markedly than with the food industries, there is in most cases a definite sequence of operations, leading through various intermediate products to the final product. Because of the value added at each of these successive stages of processing, the proportion of the total cost represented by the original agricultural raw material diminishes steadily.

## II. THE CASE FOR PROCESSING INDUSTRIES

4. Although industrialization is one of the chief objectives of any developing country, there has sometimes been a tendency to concentrate on heavy industry and to neglect agriculture and the industries processing agricultural, forestry and fishery products, or supplying those industries with the necessary inputs. However, industries based on agricultural raw materials played a major part in the early stages of the industrialization of the developed countries, and they are no less important in the industrialization now under way in the developing countries. Such industries are estimated to account for about half of the total value added and almost two thirds of the employment in manufacturing industry in the developing countries at the present time,

and their share in the developed countries, although smaller, is still substantial. The development of these industries also has many beneficial feedback effects on agricultural production itself.

5. The industries serving agriculture may also make a notable contribution to a country's industrial development, and their role in raising the low levels of agricultural production and productivity in developing countries is even more crucial.

6. The following paper sets out to show the important and potential contribution to development of these industries and the central economic issues in their choice and establishment in developing countries, including type of technology, size of market and problems of competition and trade. It goes on to indicate measures that could be taken by Governments to stimulate the development of such industries, concluding by an outline of measures being taken through bilateral and multilateral aid (with special reference to FAO) to assist developing countries in this field.

7. Statistical data indicate that industries using mainly agricultural raw materials accounted in 1958 for 33 per cent of the value added and 48 per cent of total employment in world manufacturing industry (excluding the USSR and eastern Europe). The difference between these two figures indicates that productivity per worker is generally lower in these industries than in those using non-agricultural raw materials. This may be expected to result partly from their usually lower capital intensity. In consequence, they present advantages to developing countries which have considerable supplies of labour but are short of capital.



8. Of the groups of manufacturing industries distinguished in the United Nations tabulations, food, beverages and tobacco come second, in terms both of value added and of employment, being exceeded only by metal products. Textiles take fifth place in terms of value added but in terms of employment move up to third place. In fact, it is the relatively labor-intensive textile industries that are mainly responsible for the higher contribution of industries using agricultural raw materials to employment than to value added. While in almost all countries (a) food, beverages and tobacco, and (b) textiles are the largest of the main groups of industries using agricultural raw materials, in a few countries other groups, e.g. wood products and rubber, occupy a very important place as a result of the availability of particular raw materials.

Changes with economic development

9. The contribution to industry as a whole of the industries using mainly agricultural raw materials is proportionately much larger in developing than in developed regions. Statistical data indicate that in 1958 they accounted for 31 per cent of total value added in manufacturing industry in the industrialized countries with market economies, as against 51 per cent in the less industrialized countries. In terms of employment these industries were responsible in 1958 for no less than 64 per cent of total industrial employment in the less industrialized countries, as compared with 39 per cent in industrialized countries.

10. For the world as a whole the share of these industries declined from 44 per cent of value added in manufacturing industry in 1938 to 33 per cent in 1958. At the world level all the major groups of industries using mainly agricultural raw materials shared in the proportionate decline, except for paper and paper products. In the less industrialised countries, as a group, there appears to have been a rapid decline in recent years in the share of the food industries in the total value added in manufacturing industry, which fell from 27 per cent in 1953 to 23 per cent in 1958, and in that of textiles, which dropped from 15 to 12 per cent during the same period. The share of paper and paper products, however, has continued to rise in almost every region.

11. However, the fall in the share of industries using agricultural raw materials in industry as a whole does not reflect a decline in these industries in absolute terms, but a greater proportionate rise in heavy manufacturing, especially metal products. This in turn reflects the changing pattern of demand as incomes rise.

12. In the world as a whole (including the USSR and eastern Europe), the value added in the industries using agricultural raw materials rose by about a quarter in the period 1953-58, in comparison with an increase of about 10 per cent in the population. The rise in the numbers engaged has been very much smaller (4 per cent) and, in fact, considerably less than the growth of population.

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Agricultural products in the industrialisation of individual countries

13. Although industries based on agricultural raw materials now account for less than a third of the total value added in industry in the developed countries, in most cases they played a crucial role in the early stages of the industrialisation and general economic development of these countries, especially in Australia and New Zealand ( for further details, see SOFA 1966, pages 91-92).

Situation in the developing countries

14. In most of the developing countries, industries using agricultural raw materials are still responsible for a substantial portion of total industrial activity. Even though many of these countries are now embarking on heavy industries at a much earlier stage of their economic development than was the case in the countries now industrialised, the industries based on agricultural raw materials are likely for some time to come to account for a large share of their total industrial output and employment. Moreover, they have an important role in paving the way for the more advanced types of industry.

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15. Two recent examples of the contribution to economic development of industries using agricultural raw materials are of particular interest. In China (Taiwan), although sugar production has not expanded for ten years' or so, the sugar industry has had a steadily increasing effect on the economy through the establishment of new industries using by-products, including the manufacture of alcohol and yeast from molasses, the use of molasses in the manufacture of monosodium glutamate, and the manufacture from sugar waste of bagasse board and particle board for export. The sugar industry has also been a factor in the rapid expansion of the canning industry, which has made possible the export of large quantities of fruits and vegetables. Exports of canned foods increased more than sixfold between 1957 and 1963, and their share in the total value of exports rose from 3 per cent to 9 per cent. Because the canning industry is highly labor-intensive, it has also helped to alleviate the employment problem.

16. The rise of the fish meal industry in Peru in recent years is especially noteworthy. Production of fish meal increased from 31,000 tons in 1956 to 1.5 million tons in 1964 (equivalent to nearly 9 million tons of fish), when Peru accounted for about half of the world output. The associated increase in the fish catch took the country from 26th place among world fish producers in 1956 to first place only nine years later. Almost all of the fish meal is exported, and by 1964 fish and fishery products had become Peru's most valuable export.

#### Foreign exchange earnings

17. Industries processing agricultural commodities are important not only for their contribution to the national product, but also as a

means of increasing export earnings or substituting imports and thereby enabling developing countries to import badly needed investment goods. In the previous century (and even earlier in the case of the United Kingdom), many countries which are now highly industrialized paid for their imported capital goods largely by agricultural exports. In the last three decades of that century, for example, Japan was able to achieve an eightfold increase in its already substantial exports of silk and silk products. Most developing countries are forced in the same way to rely on exports of agricultural raw materials to obtain development imports. They have, in fact, made considerable efforts to increase such production for export. However, prices of agricultural products on world markets have for many years tended to decline (in spite of some recovery in 1962-64), in part because of the large volume of exportable supplies resulting from these efforts, as well as the slow growth of demand in developed countries. Thus, the agricultural export earnings of the developing countries have expanded much more slowly than the volume of their exports.

18. The difficulties of these countries in finding the foreign exchange needed for industrialization have been further increased because world prices of manufactured goods, in contrast to those of agricultural products, have been slowly rising. The purchasing power of their export earnings for manufactured goods has therefore been gradually eroded.

19. These considerations make it all the more important to develop processing industries. In addition, when a product formerly exported in raw form is processed before export, or when a processed commodity previously imported is produced locally, a country can obtain for itself the value added that formerly accrued elsewhere. Not all of this value added, however, amounts to a net gain in foreign exchange.

20. Because of the need to import all except the simplest processing equipment from developed countries, there is usually a high import content in the capital costs of industries using agricultural raw materials in developing countries (and equally those using non-agricultural raw materials). Some of the current inputs for agricultural processing industries also have to be imported at present by most developing countries. Containers provide a good example. The import content of most canning costs is estimated at about 13 per cent in Paraguay and 20 to 30 per cent in some African countries. Other inputs that have to be imported by most developing countries include the chemicals and dyes used in textile manufacture, fabric for tire manufacture, and tanning agents.

21. Nevertheless, the processing of agricultural products either for export or for import substitution generally brings a net gain in foreign exchange. It may be estimated, for example, that, for every dollar's worth of jute exported in manufactured form instead of raw, Pakistan earns an extra dollar in foreign exchange. Increased exports of processed agricultural products were in fact singled out by the United Nations Conference on Trade and Development as one of the main ways of increasing the foreign exchange earnings of the developing countries. At present only a small proportion of the agricultural exports of these countries is shipped in processed form. Thus, in many cases agricultural products are re-exported after processing in the industrialized countries, sometimes even to the country that originally exported the raw product.

22. For a group of the major processed agricultural commodities it is estimated that the value of exports from developing to developed countries in 1959-61 was US\$ 1,348 million, as compared with US\$ 1,757 million for the developing countries' imports of these commodities from developed countries. The biggest deficits were for pulp and paper, cotton manufactures and rubber manufactures.

23. Forest products provide a good example of the pattern whereby developing countries export products in raw form while importing some of the same products in processed form for their own domestic consumption. In 1959-61, unprocessed roundwood constituted 54 per cent of these countries' total forest product exports, sawwood and plywood 41 per cent, and pulp and paper products 5 per cent. For imports the position was completely reversed, with roundwood 6 per cent, sawwood and plywood 28 per cent, and pulp and paper products 66 per cent.

24. In the last few years, exports of many processed agricultural products from the developing countries have increased rapidly. Over the period of roughly a decade from 1953-55 to 1962-63, the total value of their exports of the main processed agricultural products rose by more than 40 per cent. This is about 20 times as fast as the increase in their exports of the same products in unprocessed form. As noted above, however, the increase in net foreign exchange earnings would have been smaller to the extent that the processing industries involved foreign exchange costs.

25. The value of exports of fiber and rubber manufactures rose by about 50 per cent, apparently at the expense of exports of the raw product. Exports of processed forest products rose by more than 80 per cent, but because of an even more rapid increase in roundwood exports there was a fall in the share of processed products in the total. The growth was slowest in the case of food products, for which the share of processed products is also lowest at about 20 per cent. For both wheat and vegetable oils the more rapid increase was in exports of the raw product.

26. The problems involved in obtaining further increases in the developing countries' foreign exchange earnings from processed agricultural products are discussed in a later section of this paper.

Suitability of industries using agricultural raw materials for  
developing countries

27. The characteristics of many of the industries using agricultural raw materials make them particularly suitable for the early stages of industrialization of the developing countries. Firstly, the products of these industries cater for the basic needs of food, clothing and shelter and are therefore in demand at these stages. Secondly, in most developing countries agricultural products are the most readily available raw materials for industrialization. Where, as in many cases, the raw material represents a large proportion of total costs, its ready availability at reasonable cost can often to a large extent offset such disadvantages as the lack of infrastructure or skilled labour in these countries. Cost structures do, in fact, vary considerably, but FAO estimates, based on data for a number of countries,



indicate, for example, that the raw material is generally 75 to 85 per cent of the total cost in vegetable oil extraction, 70 to 80 per cent in sugar manufacture, 60 to 70 per cent in leather manufacture, 50 to 70 per cent in sawmilling, 50 to 60 per cent in starch manufacture, 40 to 60 per cent in canned fish and in fish meal, 30 to 50 per cent in pulp and paper and in plywood, and 20 to 40 per cent in fiber-board production.

#### Linkage

28. Processing industries stimulate other industries. The processing industries generate demand for the products of other industries. This phenomenon is known as linkage.

29. The establishment of certain primary processing industries can lead to a number of more advanced industries, a process known as forward linkage. Forestry industries are particularly valuable as a base on which other industries can be established in this way. Once paper and board production has been started, a large number of conversion industries - such as the manufacture of paper bags and sacks, stationery, boxes and cartons - becomes more readily possible. Sawmilling and the production of wood-based panels give rise to joinery, wood package, furniture and a wide range of timber products.

30. There are numerous industries which can be established by making use of by-products of waste products (sideways linkage). These help to reduce the cost of the main product by making possible the fuller use of the raw material.

31. Animal feed industries can be based on a wide variety of by-products and waste products, including milling by-products, whey, oilseed presscakes and blood, carcass and bone meal. The less refined elements of animal residues can be used for the manufacture of glues, gelatins and fertilizers. Fish meal, for animal feed, can be produced from the residues of food fish processing.

32. The waste products of many industries using agricultural raw materials can be used as fuel. Thus sugar mills, sawmills and palm oil factories, for example, are generally self-sufficient in fuel. In some cases, however, this may be an extravagant use of a raw material that may be used more profitably (for example, bagasse for paper pulp, fiberboard and particle board, and palm fruit residues for fertilizer).

33. Finally, industries using agricultural raw materials give rise to a demand for a wide variety of machinery, equipment, packaging materials and intermediate goods used in the processing itself.

### III. DISADVANTAGES AND COMPLICATIONS

#### Relative absence of economies of scale

34. The developing countries are penalized in the field of processing as compared with the developed countries in the same ways as they are for industry in general. Developed countries, for example, are able by virtue of (among other things) the size of their markets to take advantage, in industries using agricultural (and, of course, non-agricultural) raw materials, of economies of scale, so that minimum average costs of production can be reduced as the scale of plant is increased.

35. The importance of economies of scale should not, however, be exaggerated. They have little relevance, for example, when, as in many cases in developing countries, plants are in operation for only one shift a day and thus are utilized well below their full capacity. The lower cost per unit of production with a large-scale plant results not only from the spreading of capital and other overhead costs, but also from the frequently smaller labor requirements of the large plant, and this aspect is of less importance in developing countries where labor costs are low. Economies of scale may also be outweighed by other factors such as the poor and costly transport network in most developing countries, so that a very large part of the processing of agricultural products is still carried out by small units.

36. In fact, an important trend in recent years has been the increasing development of smaller scale equipment for agricultural processing, so that in many industries using agricultural raw materials economically efficient and profitable production is now possible on a much smaller scale than formerly. Examples include the development of light semi-portable sawmills which can be operated in or near the forest, small oil expellers, hydraulic presses, sisal decorticators, equipment for canning factories, mills for rice, grains and sugar-cane, and equipment for coir manufacture. This trend toward smaller equipment also provides much greater flexibility, for in many cases (for example, in modern flour milling and oilseed crushing) the plant may be expanded mainly by the addition of further relatively small units.

Small size of markets

37. Where there are considerable economies of scale (as in the production of rubber tires and pulp and paper), large markets are of course essential. The size of market needed for economic production in such cases may be far in excess of the domestic market in individual developing countries, where it is limited not only to the low level of per caput income but also by the frequently small size of the total population. The production of the raw material in one country may also be insufficient to sustain a processing unit of economic size.

38. The opportunity they afford to increase the size of the market for industrial products is one of the chief reasons for the various schemes for sub-regional economic cooperation proposed in recent years. Most of these schemes have so far paid rather little attention to industries using agricultural raw materials. Yet recent surveys have shown that there are more possibilities in this regard than are generally realized. Such schemes afford possibilities for specialization within a particular industry, as, for example, cotton textiles where there is a great variety of end products.

Tariff barriers

39. An expansion of exports in processed form was one of the principal ways singled out by the United Nations Conference on Trade and Development (UNCTAD) in which developing countries could increase their foreign exchange earnings. There are, however, a number of circumstances which tend to hinder the expansion of exports of processed agricultural products from developing to developed countries. These are mainly: the presence

of tariff and non-tariff barriers in developed countries; difficulties of marketing processed products in developed countries and other new markets; and the weak initial competitive position, in terms of both price and quality, of the products of the developing countries. The question of the protective effect of import duties is a very complex one. Virtually all of the developed countries, while permitting raw materials to enter free or at low rates of tariff, apply tariffs on processed products which as a rule are progressively higher, the more highly processed is the imported product. This naturally tends to inhibit exports of processed products from developing countries, and favors the expansion of trade in raw or relatively less processed forms.

40. The matter of tariff barriers does not, however, end there. In the first place, as is being increasingly recognized, the nominal duty rates do not in themselves express the degree of protection accorded. That protection is expressed by what is called the "effective" or "implicit" rate of tariff, which takes account not only of the tariffs paid on the final product, but also the value added in processing and of the duties that may be paid on materials used in the process of production. It follows that the differences between the duty rates applied to imports of raw and processed products do not necessarily give a full picture of the tariff protection actually accorded to agricultural (or other) processing industries.

41. Secondly, even the level of the effective tariff rate is not a complete measure of the degree of protection it affords. Another factor

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is the supply and demand elasticities for the product in the exporting and importing countries. If both are high (and assuming that the tariff change results in price changes), even a relatively small decrease in the effective tariff rate may lead to substantial increases in imports, and vice versa. Clearly these elasticities will vary not only from product to product but also from country to country, so that even identical changes in tariff structures will not always lead to the same changes in trade.

42. Finally, the effect of tariff changes on trade will also depend on the comparative advantage of the exporting and importing countries in producing the goods in question. The effect of tariffs is restrictive if they offset the comparative advantage of the exporting country. Conversely, they are of little or no effect when levied on products for which the importing country in any case has a comparative advantage.

43. The complexity of the question of tariff protection has several policy implications. In the first place, it remains true that, even though in most cases the effective protection of agricultural processing in developed countries is not known, a reduction in the nominal tariff rate will of necessity result in a decrease in the effective protection. Given the urgent need of the developing countries to expand their exports as well as to develop their industries, the case therefore remains strong for a speedy reduction or elimination of the nominal duty rates on processed agricultural and other products imported from the developing countries.

Non-tariff barriers

44. In addition to tariff barriers, developed countries (as well as other importers) apply a number of quantitative restrictions on imports of processed products from developing countries. Such quantitative restrictions are contrary to the General Agreement on Tariffs and Trade (GATT), to which virtually all industrial countries are contracting parties, but they derive their legal justification from special GATT waivers pertaining to balance of payments reasons and, more recently, the doctrine of "market disruption".

Marketing difficulties

45. Even if there were no tariff or other administrative barriers to trade, the expansion of exports of processed products from developing to developed countries would require much time and effort. There are many difficulties in creating new market outlets, particularly for new exporters with little experience in export marketing. The difficulties are numerous enough with raw materials of relatively homogeneous nature, sold through well-established markets to a limited number of processing industries, but they are considerably multiplied with processed products of widely varying characteristics, which often have to meet exacting requirements, and for which the final consumers may need to be "educated" to accept a product which may differ from those to which they are accustomed, if not in objective quality, then at least in some aspects of appearance, packaging, etc. Many processed products, especially canned goods, are difficult to market except under well-established brand names.

46. For the marketing of finished products, skills in advertising, sales campaigns, packaging and presentation are required, and such skills are in short supply in developing countries. The developing countries are also often short of the financial resources required for establishing new market outlets, including the setting up of agencies, offices, consignment stocks, etc., in the importing countries.

#### Competitive weakness

47. Given both these marketing difficulties and the time required until industrial production in any given line reaches a certain size and a maturity, developing countries may be unable to compete with older established industries, even if given protection. The weaknesses may be in quality or in price. National and international measures, in exporting or importing countries, may be required to assist the processing industries in the developing countries to overcome such initial difficulties. In exporting countries, possible solutions include tax reliefs, duty refunds on imported inputs, multiple exchange rates to favor the exported products, and outright export subsidies. In importing countries possible measures include grants of preferential tariff treatment, unilaterally or in agreement with other importing countries, and technical and financial assistance.

48. A further aspect of the competitive weakness of the developing countries arises from the fact that most of them do not produce any of the various man-made substitutes for natural raw materials, especially synthetic rubber and fibers.<sup>1/</sup> In many end uses, mixtures

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<sup>1/</sup> Some of the larger developing countries, however, including India and Brazil, have established industries producing such products as rayon and synthetic rubber.



of natural and synthetic raw materials have become firmly established, and in others the final product may be made entirely of man-made raw materials. While in the former case the developing countries may be able to remain competitive by spending foreign exchange on importing man-made raw materials, in the latter case the market will be largely lost to them.

#### IV. CRITERIA FOR SELECTION OF INDUSTRIES

##### General requirements

49. Processing industries, then, offer considerable advantages to developing countries. But to which of these industries should priority be given and on the basis of what criteria in a particular country at a particular time? Because of the great variety of these industries, it is difficult to lay down detailed recommendations. Clearly, however, the most suitable industries for establishment will be those which maximise total output and returns to scarce factors such as capital, foreign exchange, skilled labor and management, and use as much unskilled labor and local raw materials as possible.

50. Few, if any, industries may be expected to fulfil these requirements completely. Indeed, a review of some of the main characteristics of different industries in relation to their suitability for establishment in developing countries indicates that most industries combine both advantages and disadvantages in this respect. Thus, in considering the suitability of an industry, favorable and unfavorable factors must be weighed carefully against one another in the context of the conditions in a particular country or area. Furthermore, the potential advantages

can be realized only if the industry is efficiently operated. Success will depend on the size and type and on subsequent efficient operation of the enterprise.

51. Often the margin between success and failure is very small. The capital investment involved is sometimes very large (for example, between \$ 12 and \$ 20 million for a medium-sized pulp and paper plant), but even where it is much smaller the developing countries can ill afford any waste of this scarce resource. Only through detailed planning and feasibility studies is it possible to avoid the further proliferation in the developing countries of the "white elephant" projects that are already all too common in the industrial field. Many such projects, although fulfilling the highest engineering requirements, have failed because their planning has neglected the economic environment in which they must operate. Thus engineers, agricultural specialists and economists must combine in the necessary pre-investment studies, and the initial establishment of plant on a pilot scale may often be advisable. A guide to the carrying out of feasibility studies for agricultural processing industries is at present in preparation in FAO, and the following paragraphs summarise some of the main points that have to be considered.

#### Market research

52. Market research forms a basic part of such a study. The analysis of consumer demand would cover such questions as levels of consumption, the type of consumer who buys the product, the fluctuations that occur in demand, the most suitable packaging, the present quality of

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the produce and how it could be improved, whether the consumer would pay higher prices for better quality, and the relationship between consumer demand for unprocessed and processed products. Where new products have to be introduced, studies on consumer acceptability must be carried out. Competition from other suppliers must be studied, not only in respect of similar products but also the competition from other products which can to some extent be considered as substitutes. A projection of demand has to be made at least for the lifetime of the processing equipment envisaged. The need for promotional measures will also need to be studied. As well as the main product, market research should cover the possible utilization of by-products and waste products.

#### Raw material supply

53. Certain of the peculiar characteristics of processing industries make it imperative to plan for the phased flow of raw materials and for the maintenance of a certain type and level of quality. However, the ready availability of renewable raw materials is to some extent offset by the difficulty of planning a regular supply flow because of their biological nature. Since processing is only one link in a continuous chain between raw material production and final consumption, the production of the raw material can obviously be planned realistically only in the light of the demand for the final product.

54. Because of the effects of the weather and of pests and diseases, the level of crop and livestock production cannot be controlled or

even predicted with any great accuracy, and tends to vary sharply from year to year.

55. The production of most crops tends to be concentrated in a particular season. It is therefore advantageous for processing enterprises, particularly those engaged in canning and freezing, to arrange for the production in a particular area of a suitable range of crops and varieties maturing in different seasons, so as to ensure that the processing facilities are in operation for as long as possible. The perishable nature of many crops and livestock products also requires close contact between producer and processor, and advance planning if losses are to be kept to a minimum.

56. Most of all, however, the need for this close contact arises from the possibility of controlling the quality of the raw materials. Their quality can be influenced by such factors as the choice of seed, the application of fertilizers, the control of weeds, pests and diseases, sorting, and cleaning. The processor is interested not only in obtaining uniformity in the quality of his raw material supplies, but also, in some cases, his needs are quite specific. Particular varieties of some crops (for example, of tomatoes, apples and pears for canning) have long been grown for processing, but the need for such varieties is increasing as food technology develops more advanced processes. Often there are specific requirements for such factors as shape, size, texture, color, flavor, odor, acidity, viscosity, maturity, specific gravity, soluble solids, total solids, and vitamin content. The initiative for the introduction of such varieties and practices has usually had to come from the processing industry.

As a result, for some commodities, especially fruit and vegetables for canning and freezing, raw material production and processing are increasingly "vertically integrated" in the developed countries through various forms of contract farming. In the developing countries, the large-scale plantation production of such crops as sugar, coffee, tea, sisal and rubber is based on the vertical integration of raw material production and processing.

57. Careful study, then, is needed of the present availability of raw material, with regard to quantity and quality, and seasonal and annual fluctuations. Where the available raw material is not sufficient, it is necessary to investigate the scope for expanding the supply, improving its quality and lowering its price. This involves analysis of the introduction of new varieties, the improvement of cultivation methods, and the feasibility of organizing storage programs. In the case of forest products and tree crops, a long period may be required for the expansion of the supply of raw material. The economies of production in relation to those for other crops have to be taken into account. The possibilities for the multi-product utilization of the plant should be investigated, especially for highly seasonal products such as fruit and vegetables. Attention has to be given to the attitude and behavior of farmers concerning new outlets and their reaction to incentive measures. An analysis of the existing marketing channels and services is also needed, with regard both to the purchasing of raw materials and the sale of processed products. An assessment must be made of the marketing organization that will be required, including the extent and form of vertical integration that is desirable.

Plant capacity, investment needs, and management

58. Concerning the plant itself, one of the most crucial decisions relates to the determination of the most appropriate capacity. This involves, in addition to the careful assessment of the likely supply of raw materials and demand for the processed product, consideration of economies of scale, the influence of various degrees of capacity utilization on the unit processing cost, the relationship between size, transport costs and other factors, and the effect of fluctuations in supply and demand on the unit processing costs. The determination of capacity should always be based on a dynamic view of the situation, allowing for the future expansion of raw material supplies and of market outlets, especially as in some cases the establishment of processing facilities is an essential prerequisite for the growth both of supplies and demand. This should, however, not be overdone. As should be particularly stressed in the case of dairy plant, over-optimism in estimating the capacity likely to be required is one of the most frequent causes of failure. This is sometimes reinforced by a tendency of construction firms to advocate large-scale equipment. Instead of enjoying the economies of large-scale production, such plant must operate far below full capacity, so that unit costs are burdened with excessively heavy capital charges. It is much better to establish a plant whose capacity is fairly close to present requirements, embodying provision for future expansion as supply and demand increase.

Location of plant

59. A further important consideration is the determination of the most suitable location for the plant. An analysis is needed of how location

is influenced by transport costs for the raw material and finished products, by the availability and cost of labor, water supplies and power, and by taxes and other factors. The existence of adequate transport facilities is particularly important for perishable products and for products such as pulp and paper, which involve the transport of very large quantities of bulky raw materials. Water supplies are a major factor in the location of a number of industries, including textiles, pulp and paper, and hides and skins.

60. Most agricultural products either lose weight and bulk in processing so that they can be transported more cheaply after they have been processed, or they are perishable and can more easily be transported in processed form. Generally, industries based on these products are "raw-material oriented" and can be most economically set up in the area where the raw material is produced. They can therefore contribute to the relief of the rural under-employment, characteristic of developing countries.

61. For most grains, however, shipment of the raw material in bulk is frequently easier, while many bakery products are highly perishable and are therefore "market-oriented". Oilseeds (except for the more perishable ones like olives and palm fruit) are also exception and can be transported equally easily and cheaply in raw form or as oil and cake or meal, so that there is technical freedom of choice in the location of processing.

62. It is often advocated that a major part of the processing of the latter type which is not tied on technical or economic grounds to the

raw material source should also be carried out in rural areas. The reasons advanced are the need to relieve rural under-employment and to restrict the growth of vast urban population centers, with their attendant social evils.

63. Unfortunately, the effect on rural under-employment of the industries that are tied to the raw material source tends to be limited by the fact that their demand for labor often coincides with the existing peak demand at the harvest period. This is obviously the case with perishable products, which have to be processed immediately after harvest, but because of the high cost of storage it also applies to many other products as well. Thus, if much impact is to be made on rural under-employment, additional industries must be located in rural areas.

64. However, there are a number of possible disadvantages in such a policy. Although wage rates are generally lower in rural areas, actual labor costs may be higher, since the labor force is less skilled than in urban areas. Other external economies enjoyed by industries in urban areas derive from the sharing of transport, power and related infrastructure. Furthermore, the relief of urban unemployment is even more urgent in most developing countries than that of under-employment in rural areas, for the rural under-employed generally have the possibility of obtaining at least their own minimum needs for subsistence.

#### Choice of technology

65. The choice of technology constitutes a difficult problem. The selection will depend to a large extent on the raw material and the type



of finished product. The equipment to be chosen is, however, also influenced by the capacity of the plant, the costs of labor, capital, etc. To attain the lowest unit costs, particular attention has to be given to the full use of the cheap labor available in developing countries.

66. A careful study should also be made of the investment required and a budget drawn up of income and expenditure, including foreign exchange requirements. The budget should cover several years of operation, not only the first, and a breakdown of the annual budget into monthly periods may also be necessary. Working capital needs should be carefully estimated.

67. The success of a processing project depends very heavily on the efficiency of its management and administration. Particular attention must be given to training. Although in many industries using agricultural raw materials the requirement of skilled labor is small, it is almost always a key factor.

68. The overall evaluation of the project must be made according to various criteria: not only commercial profitability but also national economic profitability, foreign exchange benefits, and so on. However, the central issue is perhaps that of sophisticated machinery against what is now called "intermediate technology". On the one hand, the use of the modern technology developed in the high-income countries holds out the promise of a significant reduction in the time and sacrifices needed to achieve a high rate of growth. On the other hand, these production techniques appear ill-adapted to the factor availabilities in developing countries, where unskilled labor is

plentiful and capital (especially foreign exchange for the purchase of machinery) and skilled labor scarce. It is therefore frequently suggested that they should use a technology better adapted to their own conditions.

69. It is only in certain circumstances, however, that there is a real choice of technology. For example, in comparing two technologies from the strictly economic point of view of resource utilization, if one of them uses more labor or more of any input, in combination with the same quantities of all other inputs, but output remains the same and, if the net foreign exchange earnings are roughly equal, that technique is clearly inferior. The real economic issue arises when, for the same level of output, alternative technologies require more of some productive factors and less of others. In terms concretely applicable to developing countries, this is when the capital-output ratio can be reduced by increasing the ratio of labor to capital. Developing countries can increase the degree of labor intensity by choosing either labor-intensive industries, or labor-intensive techniques within a given industry, or a combination of the two. Regarding the first, it is clear there is considerable variation in capital intensity in the production of different commodities. In general, consumer goods industries, especially those suited for medium- or small-scale operation and using agricultural raw materials, would seem to be more labor-intensive than the capital goods industries, and this is one reason why developing countries are frequently urged to give higher priority to the former in their industrialization programs. But the extent to which it is possible to choose labor-intensive products is obviously limited by the composition of demand and the degree of substitutability between products.

70. Regarding the second possibility, the freedom to choose alternative technologies is not present in all industries. Thus, labor-intensive technologies would be quite inappropriate in the electronics industries. In some others they can result in such an enormous difference in the quality of the product as to be of very limited use, for example, in the Chinese attempt to produce steel by backyard techniques. Nevertheless, there are a number of industries in which there is a real choice of alternative technologies. In weaving cloth, for example, there is a wide range of efficient techniques varying from the handloom to the automated power loom, and in oilseed crushing from hand presses to solvent extraction plants.

71. There are, in addition, certain phases or processes in production which accord greater flexibility in the choice of technology. The choice in the central production process may be restricted, but in subsidiary, peripheral operations, in particular those having little effect on the quality of the final product, labor-intensive techniques could be used. Examples are in the construction phase of a project and in the handling of raw materials.

72. The choice of technology is also influenced by the objectives, strategy and time horizon of development. Labor-intensive techniques lay emphasis on the short-run aspects and the objective of creating employment. However, if the major objective is the long run maximisation of the rate of growth, it might be more appropriate to choose a capital-intensive technology because the distribution of income to which it gives rise is more conducive to the creation of surpluses and thus re-investment.

73. There are some other factors to be taken into account in deciding on the choice of technology. The continuing introduction of new technological processes in the future may be influenced by the techniques chosen now. This has happened in labor-intensive industries which have opposed, often successfully, any innovations. There is a danger that the promotion of labor-intensive technologies in certain industries will create a "dual economy" in industry such as exists already in the agriculture of many developing countries and that, as the modern capital-intensive sector expands, the labor-intensive sector will require larger and larger subsidies and protection to enable it to survive. Furthermore, considerations of quality and price, resulting from differences in technology, become important especially on export markets. On the other hand, the experience of Japan shows that small-scale, labor-intensive industries and methods are not invariably inimical to technological or economic progress.

74. Much more information is needed on the range of technological substitutions that are possible, including quantitative data on the levels and variability among the different inputs associated with each technology. There should be continuing research into new techniques especially suited to the conditions in the developing countries. Most of the technological research takes place in the developed countries, where labor is a scarce factor, and it is therefore directed to labor saving. With the increasing demand of the developing countries for equipment, however, manufacturers have already begun to pay more attention to their special needs.

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75. A related and highly controversial question is the use of second-hand machinery, which is sometimes advocated as a means of limiting capital expenditure in the industrialization of the developing countries. Here there would appear to be no general answer, but the relative advantages and disadvantages of using such machinery should be carefully weighed in the circumstances of each industry.

76. Another consideration which is very relevant is that of the net earnings of foreign exchange. If it is decided to select an industry solely or primarily on the basis of the amount of employment which it will provide, even though it will earn less foreign exchange than another industry, this fact must be clearly realized and its consequences taken account of.

#### V. GOVERNMENT MEASURES TO PROMOTE PROCESSING INDUSTRIES

77. In some cases the governments of developing countries have themselves participated directly in the establishment and operation of industrial enterprises. This applies particularly to new industries, where the government plant is in the nature of a pilot project, which it is hoped will lead later to the establishment of privately-owned plant. More often, however, government activities in this regard are confined to various measures of assistance to the private sector, and the provision of the necessary infrastructure, especially marketing, transport and power facilities.

78. One of the most important areas of government responsibility is research. This is needed regarding not only the processing operations

themselves but also raw material production, including the development of varieties more suitable for processing. As already noted, research is particularly needed for the development of industrial technologies better suited to the conditions of the developing countries, and into appropriate processing equipment. Investigations are needed into new uses for local raw materials and for by-products and waste products.

79. The provision of industrial training is an essential prerequisite for the development of industries in primarily agricultural countries without an industrial tradition and a pool of industrial labor. Until a skilled labor force has been built up, the advantage of low wage rates remains largely illusory. Many of the simpler agricultural processing industries can serve as stepping stones to the development of more complex industrial skills. Special schemes can be formulated to encourage private industry to provide the necessary training, as for example in Brazil, where a small amount to be used specifically for training is added to loans made by the Banco Nacional de Desenvolvimento. In addition, provision has to be made for the training of the necessary scientific, technological and engineering staff, and also of managerial personnel.

80. Governments may also need to take special measures to assist new industries with credit and finance. Small plant, processing agricultural raw materials, whose financial requirements are not excessively large, may be a suitable investment for rural cooperative societies. Special reserved funds may have to be made available to those cooperatives to finance small-scale to medium-sized industries. The larger, more complex processing industries can be financed by state credit agencies

such as development banks or industrial banks. This type of agency should not only supply financial assistance but also planning, managerial, and technical assistance, as is being done, for instance, by the Industrial Development Company of Puerto Rico. Subsidies, tax relief, tariff protection, and similar protection may also be required in the early stages of development of an industry, but the danger should be avoided of setting up industries that need permanent assistance of this kind.

81. In some cases, Governments may find it advantageous to seek investment from foreign sources which also bring in technical knowledge, business management, and top level supervisory personnel. Generally, specific guarantees are provided for foreign capital invested in the country. In some cases the Governments of developing countries have themselves entered into partnership with private foreign firms for the establishment of industrial enterprises.

82. Finally, it is essential for the Government to have a clear-cut policy regarding industry. If the policy for certain industries is to promote small-scale, labor-intensive enterprises, this should be clearly defined and its economic consequences realistically assessed. A consistent policy is also needed concerning state and private participation in industry. Policies should be fully integrated, so as to avoid situations where, while encouraging the establishment of a particular industry, the Government continues to tax the import of essential raw materials (for example, tin-plate for canning).

## VI. INSTITUTIONAL ARRANGEMENTS

83. If the agriculture-related industries are to receive due attention in industrial planning, certain special institutional arrangements may

be necessary in some developing countries. Agriculture and industry are handled in separate government departments, and that concerned with industry is usually occupied chiefly with the so-called "strategic" heavy industries. Thus the industries processing agricultural raw materials and to some extent also those serving agriculture tend to fall between two stools. Often the best solution will be to establish in the agricultural ministry a special unit to deal with the industries related to agriculture, though clearly such a unit would have to work very closely with the department responsible for industries in general.

#### Economic planning

84. As observed above, processing is only one link in the chain between producer and final consumer, and the need for close contact between the agricultural producer and the processing establishment is reinforced by certain effects of the biological nature of agricultural production. This has been reflected in developing countries by plantation systems of production for certain crops, whereby production, processing and marketing are carried out by the same enterprise, and in developed countries in recent years by various systems of vertical integration based on contracts between producers and processors. The latter are likely to increase in developing countries as the demand for processed products expands, and as technological developments in industry continue to change raw material requirements.

85. It is especially in projects for the overall development of particular areas within a country that it is possible to take full account of these inter-relationships in economic planning. This is

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the case in a number of such projects, mainly in Mediterranean countries, for which FAO is the Executing Agency for the United Nations Development Program. The resources of the areas concerned are primarily agricultural, and the development of industries processing agricultural products in these areas has not only given a start to their industrial development but has also expanded the outlets for agricultural produce.

86. For the country as a whole, the close integration of agricultural development and processing industries is vital. The implications of any measure encouraging progress in one field should not be hampered by deterrents in the other, as when a fruit canning industry is stimulated and simultaneously a heavy tax is placed on tin-plate.

#### Infrastructure, etc.

87. In the same way, the country's infrastructure - transport, housing, power and water - should be planned by the government with the potential industrial development in view and coordinated with it. There are a number of other measures which the Government authorities should take, but in some cases they differ little, if at all, from those measures called for in the case of industry as a whole in developing countries.

#### Training and protection

88. These measures include the strengthening of arrangements to train managers and technical staff, to create a climate of confidence which will make it possible to obtain - at least in the initial stages - skilled personnel, finance and equipment from abroad. Development banks or corporations are needed which can offer loans and advice

to the entrepreneurs wishing to set up a factory. One of the functions of such banks or corporations should be to accumulate information on industries suitable for establishment in the country in question, which can be used either by the bank itself or by the entrepreneur concerned as a basis for carrying out the feasibility studies to which reference was made above.

89. Lastly, whether because of the choice of a labor-intensive technique, or the high foreign exchange cost of setting up a particular industry, or of the time which must usually elapse before a new factory can hope to compete with powerful competition on the export market from the developed countries, preferential terms of guarantees may be needed to enable the new enterprise to get over its teething troubles. Where the products are mainly for home consumption, protection should normally be achieved through preferential terms. However, where a series of products of a particular branch give the importer a strong bargaining position over a smaller variety of the corresponding local products, other measures may be necessary.

## VII. INTERNATIONAL ASSISTANCE

90. A considerable amount of international assistance is now available to back up these efforts. Many different industrial enterprises using raw materials or producing requisites for agricultural production have been established in developing countries in recent years with financial and technical assistance from the various bilateral aid programs.

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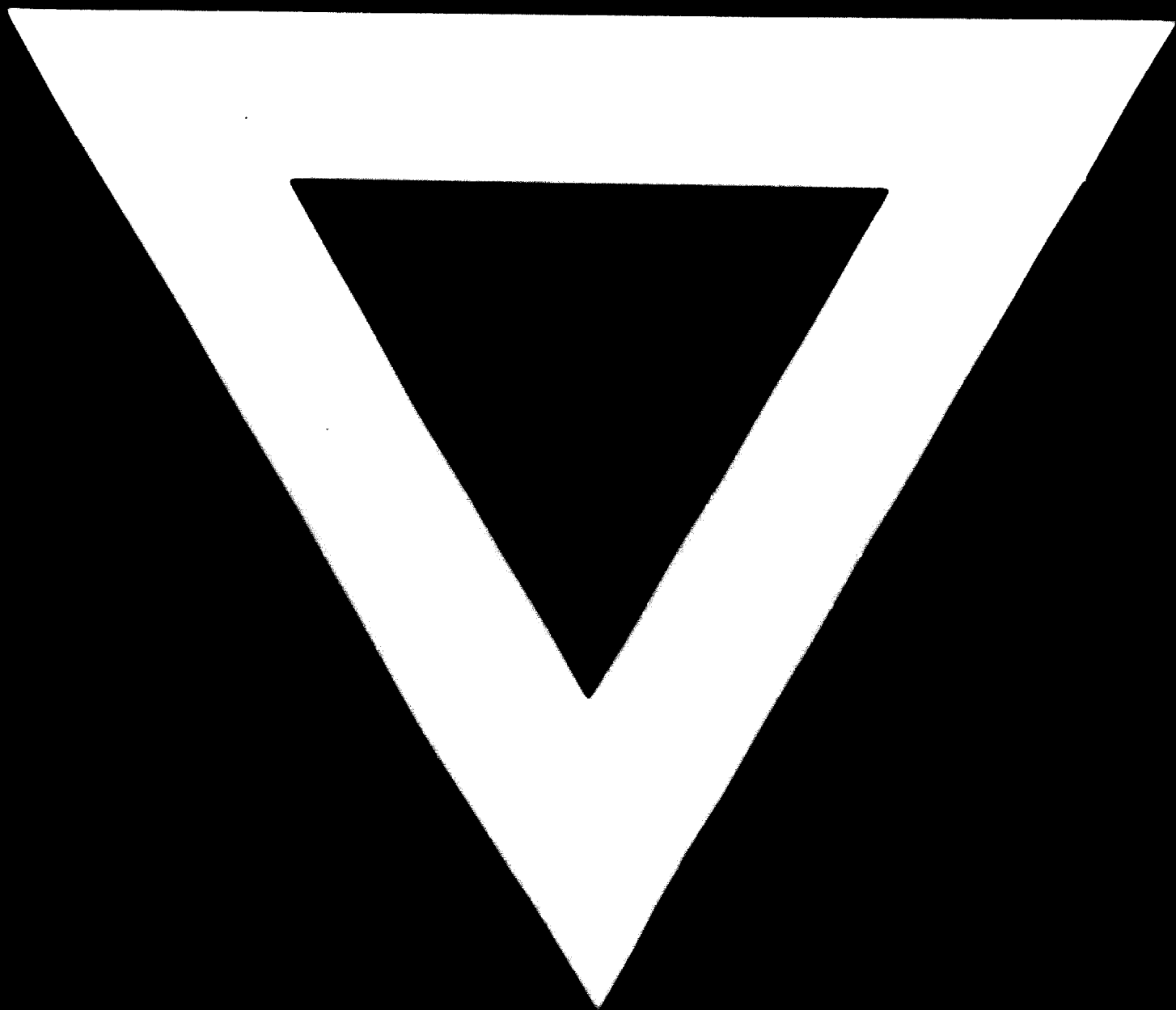
91. Among the multilateral agencies, FAO is itself providing increasing assistance in the establishment of such industries, in particular, following a resolution of the Twelfth Session of the FAO Conference in 1963, which called for the strengthening of its activities in this field. Although this is not the place for a detailed description of FAO's programs in this regard, it may be useful to conclude this study with a brief account of the main lines of such assistance.

92. Training and demonstration have always been major elements. Permanent training institutes have recently been set up in various countries under the United Nations Development Program for personnel working in different agricultural processing industries and also in agricultural engineering, while many shorter training courses and seminars are also conducted. Research is promoted through a wide range of projects, including the establishment of permanent institutes for research in such subjects as food technology and in the technology of processing specific agricultural, fishery and forest products. Pre-investment surveys, feasibility studies and pilot projects are carried out for industries using agricultural raw materials. Under the FAO/IBRD Cooperative Program, countries are assisted in the preparation of such projects for financing by the World Bank. FAO has also collaborated with UNICEF in the establishment of dairy plants in many developing countries.

93. Further details about the FAO program, including the work under the FFH and the FAO/Industry Co-operative Program, are dealt with in six other papers spread over a number of other agenda items.

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