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**INTERNATIONAL SYMPOSIUM ON INDUSTRIAL  
DEVELOPMENT**

Athens, 29 November-20 December 1967  
Provisional agenda, items 2 and 3 (b)

**REQUISITES OF PRODUCTION, PROCESSING AND UTILIZATION  
TO DEVELOP AGRICULTURE, FORESTRY AND FISHERIES**

Prepared for the Symposium

Presented by the Food and Agriculture Organization

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.

## Introduction

1. The contribution that agriculture, fisheries and forestry can make to a national economy by providing the raw materials for a wide range of specific industries is well recognized. There are few of the developing countries today in which national development plans do not include the setting-up of new, or the expansion of existing industries for processing and transforming the products of agriculture, fisheries and forests.
2. Increased productivity in agriculture, forestry and fisheries is vital to increase food supplies as well as to provide the raw materials for local industry, to expand exports, and especially of processed or semi-processed products, and as a result to improve standards of living and give a greater volume of more remunerative employment.
3. To increase agricultural productivity is, however, an extremely complicated process, involving many factors. It varies from country to country, calls for considerable material resources, and a steadily rising degree of practical, technical and managerial skills.
4. Some of the factors involved may be defined as institutional, since they presuppose the alteration of existing socio-economic systems, such as the modification of restrictive systems of land tenure, or the setting-up or improvement of credit facilities for producers as well as the establishment of co-operatives.
5. Other factors fall under the heading of infra-structure and include roads and communications, irrigation networks, soil and water conservation works on a regional or national scale, and port and harbour facilities.
6. There is, however, a group of important industries that manufacture requisites or inputs which have a very great effect on productivity. These material inputs are in the main the fruit of long research, and are the products of many different branches of industry.
7. The chemical industry provides fertilizers and pesticides; the pharmaceutical industry produces drugs, antibiotics and biological products; the engineering industry makes tools, implements, tractors and power units and machines, while the seed-processing industry produces and distributes improved high-yielding seeds.

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8. Agriculture is also a major consumer of fuel and power, and of construction materials for farm buildings and storage facilities. Forestry requires many specialized tools and equipment, and fisheries are an important customer, not only of the ship-building industries and ice plants, but of the makers of highly specialized gear and electronic equipment. In more advanced economies, the preparation of compound animal-feeding stuffs is another important industry, usually closely allied to the food-processing industries and often based on their by-products. Finally, a wide variety of manufactured equipment and materials are required for the preprocessing, processing, packing and transporting of crop, livestock, fishery and forest products.

9. It is the purpose of this paper to examine some of these industries serving agriculture, especially those producing specifically for agriculture rather than for other sectors as well, and to discuss briefly some of the principal considerations to be taken into account in planning for their establishment in developing countries.

#### General considerations

10. Even more than the industries which use the products of agriculture, fisheries and forestry as their raw materials, the industries serving agriculture are still, in the main, located in the developed countries. Their establishment generally requires a much wider industrial base, especially of industries producing intermediate inputs such as basic chemicals, iron and steel, and cheap power. These industries are often highly capital intensive, and subject to substantial economies of scale. Many are therefore best considered as being particularly appropriate for establishment in the context of regional co-operation between developing countries. However, demand for many of the products of these industries is rising rapidly in the developing countries, and as agricultural development proceeds, it is likely that the establishment of economically viable domestic industries to reduce or completely replace imports will become increasingly possible.

11. Undoubtedly the key questions in deciding whether to commence domestic manufacture of a particular industrial product are the cost of its production, the cost at which it can be sold to the user. If the cost to the user is such that he cannot afford to buy it, or if the domestic demand is so limited that the home-

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manufactured product cannot be absorbed, then there is no alternative but for the industry to try to sell in highly competitive world markets or to cease production.

### Fertilizers

12. From the time of their introduction about 1850 until 1950, the use of fertilizers steadily expanded to a consumption rate of 9 million tons<sup>1/</sup> a year.

13. Since the Second World War, usage has increased more rapidly and consumption in 1964/65 totalled 40 million tons. Of this very large total, 35.2 million tons were consumed in the developed countries, and only 4.8 million tons in the developing countries, whilst the production figures show that the developing countries only produced 2.3 million tons.

14. The limited number of industries in developing countries processing chemical fertilizer is a reflection of the many difficulties involved in their establishment. For most types of fertilizer manufacturing the costs of both installation and production are relatively much higher for small than large plants, and few of the developing countries as yet have domestic markets justifying plants of a size that can compete with imported fertilizers. It is, for example, considered that the lower limit of plant size for the economic production of nitrogenous fertilizer is about 30,000 tons per year. Indeed, the capital costs of fertilizer plants are so high, and have such a heavy import content that in many countries the use of available foreign exchange for fertilizer imports rather than for the construction of a fertilizer plant is distinctly more attractive, especially as such plants tend to "age" rapidly in the technological sense. The establishment of a fertilizer industry is not favoured by employment considerations, as fertilizer plants once in operation, use little labour relative to the capital invested or to the value of the output, and the labour that is used has to be highly skilled.

15. On the other hand, in deciding on investment priorities between different development industries it is not sufficient only to take account of the capital-output ratio of the fertilizer industry itself. Decisions should be based on the ratio of the increase in output of agriculture, the total capital invested

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<sup>1/</sup> Expressed as tons of  $N + P_2 O_5 + K_2 O$ .

both in the fertilizer industry itself and in associated activities needed to promote fertilizer use. This ratio will be much more favourable, because of the large increase of agricultural production in the developing countries to improve diets and avoid inflationary pressures. It also largely explains the emphasis that has been placed on the establishment of fertilizer industries in the developing countries.

16. The FAO publication Fertilizer Use - Spearhead of Agricultural Development sets out a list of factors which must be taken into account in setting up fertilizer plants, which are additional to the preliminary considerations on policy but which do affect costs, as follows:

(a) General factors affecting any type of fertilizer plant

Climatic conditions, particularly maximum temperature and humidity (chiefly a matter of storage of fertilizer material).

Water supply

Local (or national) facilities for fabrication and structural steel work and simple items such as tanks, low- and medium-pressure vessels, pipelines, etc.

Availability of skilled and semi-skilled labour for erection

Availability of managerial staff and skilled and semi-skilled labour for operation and maintenance.

If local skills and experience are not available, will overseas training be necessary?

Will customs charges be levied on imported plant and materials?

(b) Factors affecting any given type of plant

End product to be manufactured.

Availability of raw materials.

Water and power supply for manufacturing as distinct from constructional requirements.

Foundation conditions at site: whether piling will be necessary for heavy loads.

Drainage conditions: will treatment of effluents before disposal be necessary?

State of development of the immediate area of the site: will housing have to be provided for workers? Must provision be made for amenities such as hospitals,

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schools, markets, etc.? State of communications for materials and personnel to and from the site. Location of site in relation to markets. Transportation facilities for raw materials to the site, and for fertilizer from the site. Location of the source of supply of main plant items in relation to the site for the purpose of estimating sea freight and insurances.

17. With fertilizer factories in general, and with factories based on ammonia synthesis in particular, the size of the factory affects very profoundly the capital cost of installed capacity and also the production costs. Comparing a factory for the production of say 100,000 tons of nitrogen per year with one of only 20,000 tons, the capital cost per ton of installed capacity of the smaller factory could well be double that of the large one. It is indeed doubtful whether the smaller factory could produce at prices competitive with world prices for imported fertilizers from large factories, notwithstanding the sea freight and possibly customs charges on imported fertilizers. This problem is greatly intensified if plants cannot be operated at full capacity, and in fact the effect of idle capacity on production costs is more serious than almost any other factor. The effect of idle capacity on the production cost of urea is shown in the following table:

<u>Percentage utilization of rated capacity</u>	<u>Relative production cost index for urea</u>
100	100
90	107
80	115
70	127
60	142
50	168
40	196

Source: FAO preliminary report of the survey of the fertilizer economy of the Asia and Far East region, Rome, 1960

Capital costs

18. From the foregoing paragraphs it is clear that in setting up a fertilizer factory of any type there will be great variations in the capital costs according to the particular local and national conditions. The order of magnitude of these variations may be seen from estimates prepared in a number of countries in 1960. Then the total investment for a nitrogen plant with an annual capacity of 50,000 to 70,000 tons of nitrogen varied from the equivalent of \$US20-30 million.

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Tools, implements and machinery

19. At the present stage of development, agriculture in many of the developing countries is still largely dependent on the use of manual labour in agricultural operations. At the lowest stage of development, human power may be the only source of power available to the producers, and it is necessary that the workers are equipped with suitable hand tools to enable their power to be effectively used. A great variety of hand tools are used in agriculture, and over the centuries many improvements have been made in the design of hand tools to improve the performance of the workers, and to make their work easier. The greatest advance has been made in the improvement of hand tools has been the advent of high specification steels, and the use of wood for handles and shafts which is durable, shock absorbing and which can be shaped so that maximum use is made of the workers' power without discomfort and fatigue.

20. Many of the hand tools used in the developing countries are produced by workers in metal and wood, engaged in traditional crafts. These workers are highly skilled, but in many instances the tools that they produce are extremely inefficient because the materials used are themselves of inferior quality. Most of the developing countries therefore import higher quality hand tools which are used not only in agriculture and forestry, but also in general civil engineering and construction work. The equivalent of hand tools, both in number and money value, however, is extremely high, and the possibility of local manufacture is being explored in many countries.

21. Hand-tool manufacture offers many possibilities for establishing an industry which is comparatively labour-intensive and in which the capital investment is comparatively low. The greatest difficulties that have been encountered in establishing domestic hand-tool industries have been those of ensuring supplies of steel of suitable specification for the tool heads, and of suitable wood for shafts and handles, and it is unfortunate that because of the use of steels and timber of poor quality the home-produced hand tools have not always been favourably received by users.

22. A development of particular interest in the hand-tool industry has been made possible in recent years by certain hand-tool manufacturing enterprises in developed countries associating themselves directly with industry in developing

countries. Supplies of correct specification steel, and the heavy presses and forges necessary for low-cost, quantity production of tool heads are available in the developed countries. Finishing, tempering, and other heat treatment involve a comparatively high amount of labour, which in the developed countries is expensive and in many instances increasingly difficult to obtain. A joint production has therefore been commenced. The unfinished tool heads or blanks are produced in the developed country using the heavy plant and forges already existing. The finishing of the tool heads, involving a comparatively low investment in plant and equipment, but employing a comparatively large amount of labour, is then carried out in the developing country. Where such operations have commenced, expenditure of foreign currency has been reduced, and the price at which the hand tool can be offered to the user has also been reduced. Shafts and handles have been produced locally from imported woods, where the locally available woods are not suitable.

23. The improvement in performance and output of manual labour when equipped with high-quality hand tools is quite remarkable, and in speaking of productivity of manual workers this very important factor of hand-tool quality is seldom sufficiently stressed. Similarly, little thought has been given in the majority of development plans to the provision of the hand tools without which human labour is virtually useless; and the establishment of hand-tool producing industries in the developing countries merits attention.

24. Proceeding along the path of mechanization of agricultural production, the use of animals as a source of power is now normally accepted in most of the developing countries, and it is probable that, despite the theoretical availability of mechanical power units, agriculture in the developing countries will continue for many years to come, to rely in part on both human and animal power.

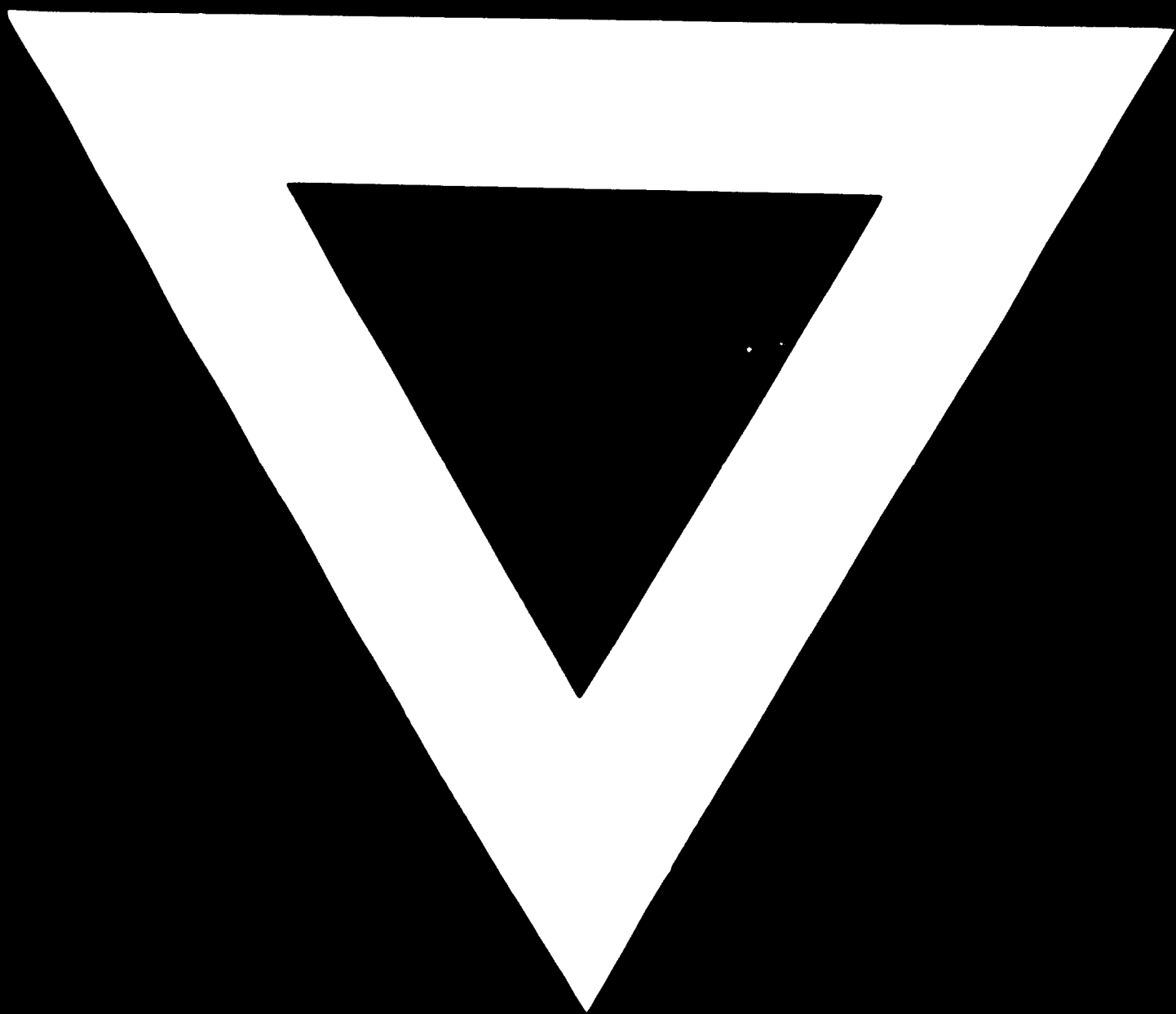
25. As with the human power employed in agriculture, animal power requires that implements and machines be available for work to be done, and it is therefore important that the greatest attention be devoted to the development and improvement of the small equipment for use with animals.

26. The change-over from animal power to mechanical power has proceeded so quickly in the developed countries that production of animal-drawn and animal-operated equipment in those countries has been very greatly reduced, and in

some cases completely eliminated. It is becoming increasingly difficult to import requirements of animal-drawn and animal-operated equipment, and it would appear probable that in the majority of the countries in which animal power is widely employed, home production of this type of equipment is essential.

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