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TYPES OF AGRO-INDUSTRY^{1/}

prepared by

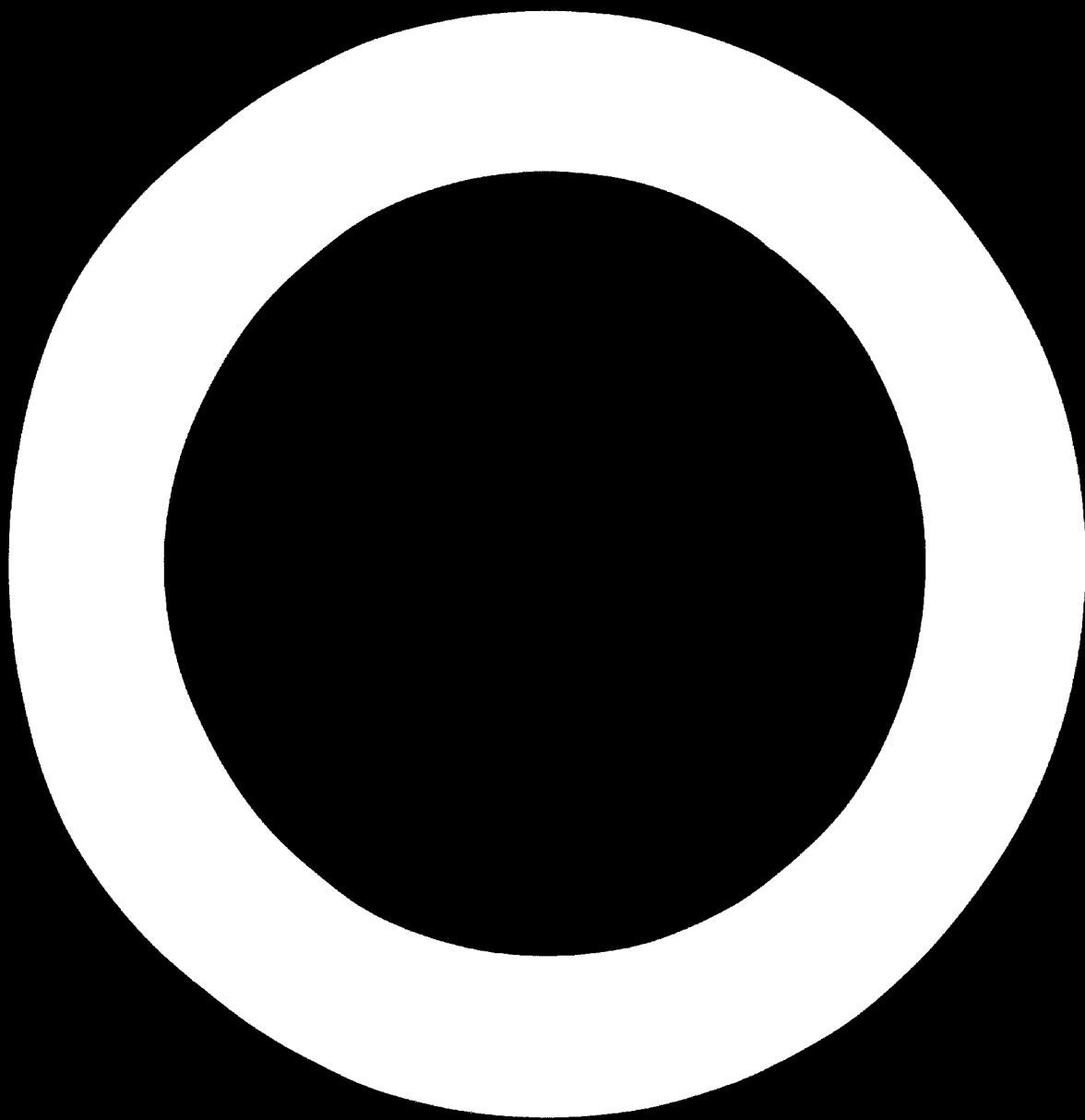
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I Introduction

"The power of population is indefinitely greater than the power in the earth to produce subsistence for man".

Thomas Malthus, 1798

In view of the world food shortages and the tendency for the gap between needs and means of production to increase, all efforts should be made to speed up the changes required in order to produce more food and reduce wastage. In UNIDO's recent Second General Conference, held in Lima, it was stated that "in view of the basic complementarity between industry and agriculture, every attempt should be made to promote agro-based or agro-related industries which, besides arresting rural exodus and stimulating food production activities, provide an incentive for the establishment of further natural resource-based industries".

Food production is a very complex and sensitive socio-economic activity; it draws on factors from agriculture, industry, transport and commerce. Since food is a basic necessity, its supply intimately affects the social and political stability of any society. A very small indication of future shortage or surplus of food products greatly influences prices. On the other hand, because of its basic nature, food is subject to government controls regarding quality and measures are often taken to regulate imports, exports, stocks and particularly, prices. If considered necessary, government action is taken to remove areas from cultivation in order to reduce the level of production; or, at other times measures are taken to stimulate production. Furthermore, food is essentially a perishable product requiring quick action to bring it onto the market or sophisticated methods of processing in order to increase its shelf-life.

For all the above reasons, food production is a very complex activity; it has a major influence on the economy as a whole. Not long ago prices for such items as sugar, cereals, soya, fish meal, meat, reached highs which could not have been foreseen. The prices of all these items have since declined considerably on the international market, adversely affecting the economy of developing countries, since they are exporters of many raw materials

for food production. This fact, combined with high prices for imported items, especially oil, created situations which could not be managed, resulting in increasing deficits in the trade balance of payments of those countries.

It is said that today at least one third of the world's population is undernourished and it is predicted that in twenty-five years it will be impossible to supply the world's food demand with the technology available today.

All over the world urgent measures are being taken to develop new technologies to increase food production. In the USA a joint government and private enterprise effort is being made to change food production in all aspects, from genetic to processing and distribution. The effort and investment envisaged is as large as that employed to produce the atomic bomb.

This brings us to another very important matter affecting food economy. Today there are shortages and surpluses simultaneously. What is more surprising in such unbalanced economies, high losses occur in the food sector. In India, it is estimated that only 50% of the food produced or imported reaches the consumer. Even in the USA about 10% of the soyabean crop is lost every year, just in harvesting. A large, but unrecorded amount of sugar cane is grown in the Indian sub-continent in tiny plots of a few hundred square metres each. A great deal of it is processed as a cottage industry. This cane is crudely milled by bullock power and the juices boiled down to a nutritious sticky brown mass of crystals, using the crushed cane fibres (bagasse) as fuel. However, the bagasse contains upwards of a quarter of the original sugar content of the cane, so this extensive cottage industry is a wasteful one compared to modern, large mills which extract over 90 per cent of the sugar in the form of crystallized sugar and molasses.

These are only three examples and many others could be mentioned, illustrating the losses in food which occur due to improper means of processing, transportation, storage and distribution. They all direct attention to the focal point in the rationalization of food production, namely, the function of the food processing industry. Traditionally this industry

processed surpluses to immediate consumption needs, with the object of reducing losses and increasing the shelf life of perishable products. In addition to losses arising from inadequate methods of production, as in the examples given above, it must be said that enormous investments in the establishment of processing industries in many developing countries are badly used, which is also a loss.

In several African countries, for example, meat processing plants are idle due to the non-existence of cattle to slaughter and thus of meat to process. A recent survey made by UNIDO in the Middle East countries showed that most of the sugar mills and vegetable oil, fruit and vegetable processing plants were operating at 30 - 40 per cent of their capacities, again due to the shortage of raw materials to process. In these cases, the inadequacy of the plans to establish and run processing plants proves an additional source of loss to the economy.

The above summary indicates that food production, particularly in developing countries, urgently requires a plan of action based on a more balanced and rational integrated approach and containing measures dealing with all stages from research work to the distribution of food to final consumption. Such a plan should lead to the establishment of a co-operative programme of mutual assistance between developing countries on a regional or international basis.

II. Agro-industry development.

As a general concept, agro-industrial development entails the complete vertical integration of food production, from the field to final consumption. To be more realistic and to face the real challenge of the world's food requirements, the concept should be broadened to include laboratory research and development phases, since it is said that there is no possibility of feeding the world's population in the year 2000 by using the technology that exists today. In countries like the USA research work is being carried out to change the biology of plants and animals, with the aim of increasing food production and shortening the length of the production cycle. Taking into account the shortage of arable land and the limits of what fertilizers can achieve in relation to their cost, the scientists are trying to find ways to "rationalize" the agricultural process, to create new plants, to eliminate unnecessary functions etc.

The world's food needs present opportunities and call for action towards development. To mention only one opportunity, the production of white sugar has been increasing at nearly 4 per cent compound a year from 1957 - 1972, from 40m to 70m tons a year. The projected rate of increase is now about 2.7m tons a year, each making 60,000 tons a year, equivalent to the output of 45 large factories,

Co-ordinated action should be taken to promote agro-industrial development on a modern basis, aiming at the best use of all factors involved. Agro-industrial development depends upon a comprehensive, in-depth knowledge of (1) all the factors which comprise the agro-industrial system(s), including the basic elements which support production right through to retailing of the various kinds of finished products and by-products; and (2) the total relevant environment into which the system(s) is to be introduced. It is only through a thorough knowledge of (1) and (2) that the necessary adjustments can be made in the systems which will ensure an enduring link with the total agro-industry of the region being developed. Although basic agro-industry models exist, the details must be modified to accommodate the realities of each region. Some of these modifications are designed to overcome regional disadvantages. To quote an example, relatively heavier capitalization in terms of tomato harvest equipment is necessary in Yugoslavia and Hungary than in California because of the shorter harvest

season. Other modifications are designed to take advantage of regional advantages. For example, beneficial rotation of vegetable crops with wheat can nearly always be adopted in Eastern Europe, whereas in California the producers are forced very often into monoculture, with all its related problems. The following are the basic conditions for proper agro-industry development:-

- 1) Research capability, so that new situations which arise can be understood and problems solved;
- 2) Staying power, to nurture the developing agro-industry through the first critical years and thus ensure that the links established within its region and with the world economy, with regard to both imported material and/or exported products, remain firm; and
- 3) The existence of an organization capable of bringing together the necessary material and personnel in the region to be developed and of providing the contact and continuity to ensure the successful completion of the task.

In order to plan the establishment of modern agro-industry, various sequential steps are required. It is necessary to analyse the potential markets for agro-industrial products. At the same time, the most suitable assortment of potential products must be determined. For this analysis, production, trade and market information from international and national organizations are used, together with significant economic data and resource information such as climatic characteristics, size of production units, soil, water, labour and technological resources. The programme is designed to bring to light the areas with the greatest potential for both agro-industrial development and sales of the products. Once this phase is completed a more detailed analysis is made to determine the most suitable agro-industrial system(s) for speedy and profitable development. Once the system(s) is defined studies should be made of available information about similar systems already existing in the world. This gives an intimate working knowledge of the components in the system and expected trends in its further evolution. Various approaches are simulated and by means of a

sensitivity analysis the complete agro-industry to be established is designed. The plan for implementing the project should be listed according to the chronological order of steps to be taken, such as the following:-

1. Personnel selection,
2. Detailed on-site data, material and labour requirements;
3. Equipment and material purchase, packing, transport, delivery and assembly;
4. Land preparation;
5. Choice of varieties for production and drawing up of schedule;
6. Construction of factory and installation of equipment;
7. Irrigation;
8. Weed control;
9. Disease and insect control;
10. Sowing seeds/planting;
11. Fertilizer application;
12. Harvesting;
13. Bulk transport;
14. Processing ;
15. Experimental programmes;
16. Documentation;
17. Training.

The above list of 17 items is given to indicate the complexity of the operation which includes aspects from market, agriculture, industry, commerce and management. The list is not exhaustive and other steps could be indicated. However, the most important point to note is the sequence of steps. It starts from the market. It is becoming more and more essential, with the increasing shortage of arable land, to find out first what are the market's requirements. In order to make the best use of the scarcest

resource, it is necessary to find the most suitable assortment of products by reference to the market and then to plan where and how to produce that assortment.

This approach helps to define the most suitable relation between inputs and outputs and to select the best processes, equipment, plant size, layout, products, packaging etc. There are several ways of combining the various factors in distinct types of production units. In the next section of this paper, some of what are considered to be the most representative types are discussed.

III. Types of agro-industry organizations

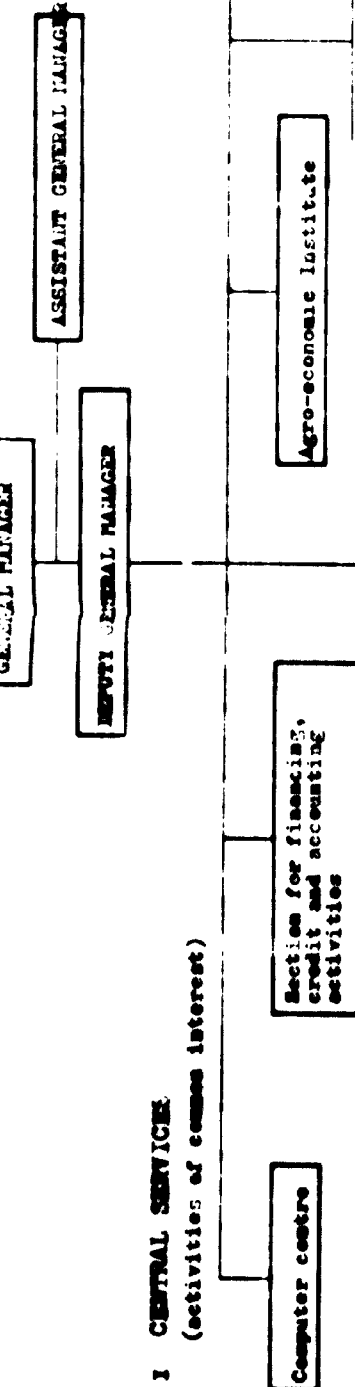
In Austria there exist integrated agro-industrial enterprises which are a model for their suitability to both market and production requirements. One of them, which belongs to a multinational company, was established to produce fruit and vegetable products, especially frozen products such as peas, green peas, asparagus, carrots etc., and the various combinations for soups, convenience foods etc. The product range has increased during the last few years, now including ice cream and beverages. Although it is completely integrated, it does not control its supply of agricultural raw materials. The plant was established near large farmers who produce beet as their main crop. Between two crops of beet there is just sufficient time to produce the vegetables required by the processing plant. Therefore the farmers produce, under contract, the vegetables needed by the factory. The enterprise provides them with all the agricultural inputs and technical assistance to produce the best species for processing. This is a very successful enterprise which produces premium quality products at the most competitive prices on the European market. The balance between agricultural, industrial and commercial factors, is such that it maximizes the advantages of such a privileged situation.

Another very interesting case of agro-industrial development is the Yugoslavian experience. Urban concentration and a high level of economic development resulted in a concentration of food products demand, calling large scale standardized production, which required an organization operating on several levels within the same business complex, in other words, vertical integration. An agro-industrial enterprise in Yugoslavia is called a combinat (combine). One of the most important is the Beograd Combinat which was founded in 1946. Initially it undertook crop-farming and stock breeding; later, processing of farm crops was introduced and the delivery of finished products to the final consumer was merged.

Today Beograd Combinat is a very complex organization (see Table I), comprising forty-two enterprises ranked eleventh in 1972 among the 200 major Yugoslavian economic enterprises. All the means of

Table 1.

ORGANIZATIONAL CHART OF THE AGRICULTURAL COMBINE "REOGARD" - FYB



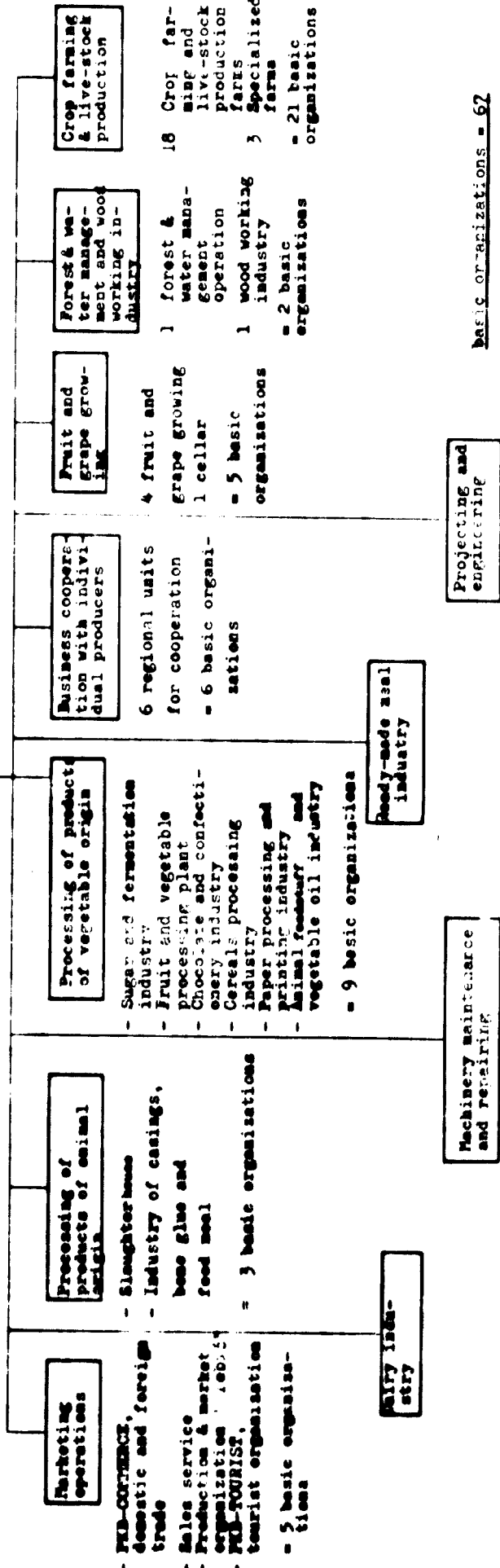
I CENTRAL SERVICES
(activities of common interest)

II PRODUCTION ACTIVITIES
(production, trade and services)

- 10 specialized departments

Training centre

Department for maintenance of housings



NOTE: Basic organizations are constituted of several units depending on the nature of their activity, region and other conditions.

production, including land, belong to the combine. Its activities include scientific research work; long and short-term programming and operational analysis; investment and its short and long-term planning; computer processing of its financial, statistical and other data; marketing; and advertising. The structure of the Beograd Combinat, one of the most advanced in Yugoslavia, is very similar to that of the multi-national enterprises operating in food production. Moreover, there are frequent contracts between the various Yugoslav combines and multinational enterprises for technical assistance in purely technological matters or in management. The essential fact is that the organizational structures were determined by production requirements. The growing demand for food processing was the basic reason for the enlargement of the enterprises, their increasing complexity and integration, which required a more and more complex and sophisticated management.

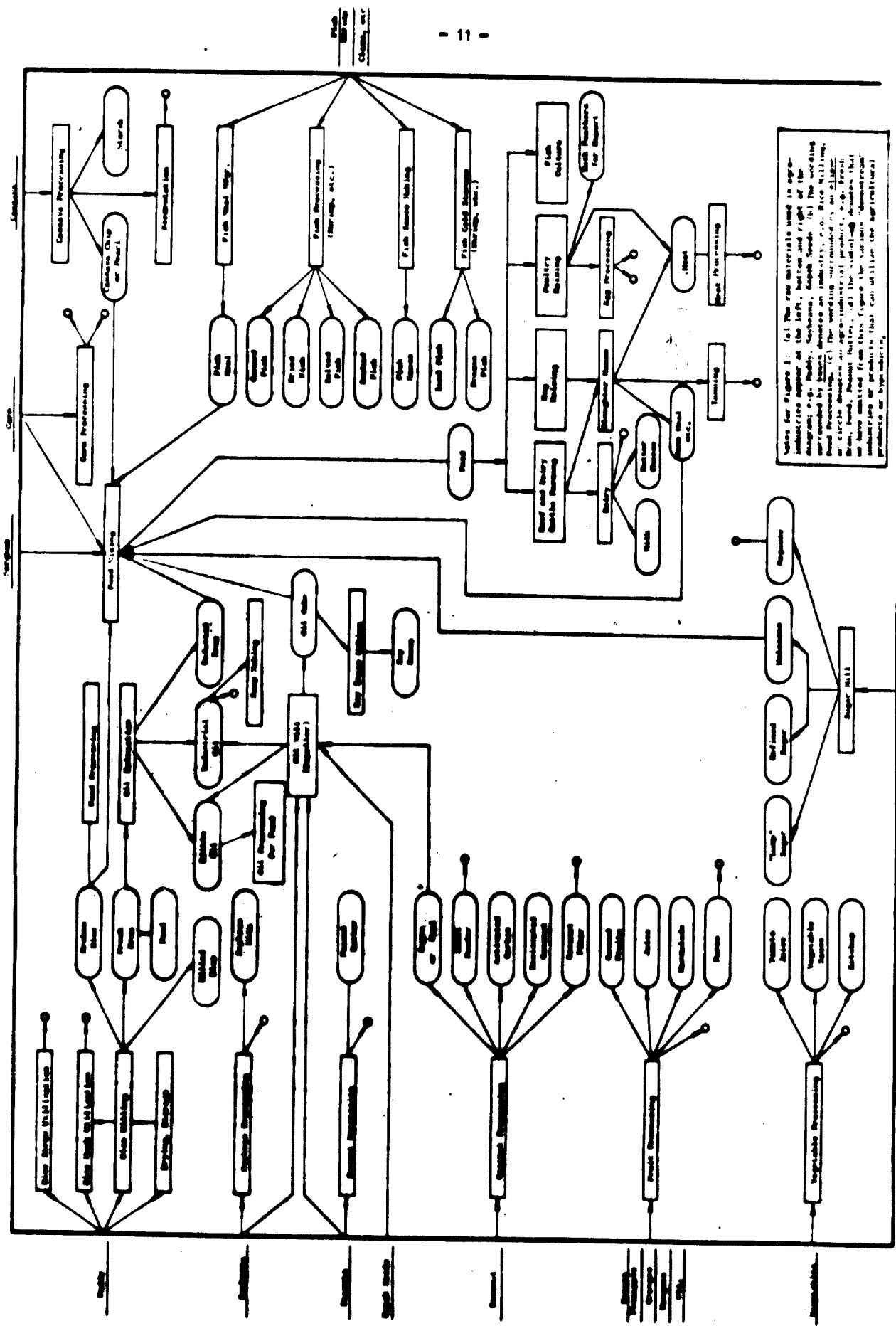
Just to mention what has happened in Yugoslavia as regards the training of professional cadres in the application of modern technology we must indicate that, while in 1945 there were only two agricultural faculties and two faculties of veterinary science, today experts in various specialized branches are trained at eight faculties for agriculture and agricultural foodstuffs and four veterinary faculties. The expansion has made it possible to train about thirty thousand agronomists, veterinarians, and agro-economists since the end of the world war. Yugoslavia has acquired particularly valuable experience in creating comprehensive and logical ties between agriculture, the food processing industry and food distribution; all three sectors are enclosed within a framework of agro-industrial complexes.

Recently, an American firm of consultants drew up at the request of UNIDO, a master plan for the agro-industrial development of a certain region in Asia. From Table No. 2 we can see the complexity of the system recommended and that no basic difference exists between the inter-relationships which it proposes and those existing in Yugoslavia.

In the scheme proposed by the American consulting firm, the agro-industry enterprise would possess only a minor part of the land required to produce its raw material. The main source would be foodstuffs to be produced by individual farmers.

INTER - RELATIONSHIP OF AGRICULTURE - INDUSTRIES

TABLE 2.



Notes for Figure 2: (a) The raw materials used in agriculture appear at the left, bottom and right of the diagram; e.g. Rubber, Soybeans, Kaffir Seeds. (b) The products of agriculture are shown in boxes, e.g. Rice Milling, Cereals Processing, etc. (c) The waste products are shown in circles, e.g. Rice Husk, etc. (d) The by-products are shown in ovals, e.g. Rice Bran, etc. (e) The products or by-products of agriculture are shown in rectangles, e.g. Rice Flour, etc.

A very interesting example of agro-industry is to be found in Mountain Valley in Canada ✓ which will be briefly summarized here. Its origins date back to 1970, when a committee of local representatives decided to take action "to stabilize and improve the valley's economy and to remove the dependence upon wheat and other grains". The outcome was a business undertaking with assets of about \$10 million, production diversification and the establishment of a processing plant in the cultivation area, which is about 400 miles from the consumer market.

Once it had been agreed that new activities must be developed, a market survey was carried out and a plan for agro-industry drawn up. It was considered that frozen potatoes offered market possibilities, but investigation showed that the valley's produce would not be competitive if traditional processing and packaging means were used. In order to make the project commercially viable a new technology was needed. The Department of Industry, Trade and Commerce in Ottawa, under its Program for the Advancement of Industrial Technology (PAIT), agreed to provide half the estimated \$300,000 with which a new food processing technique (thermal processing in film pouches) was developed. The research project was undertaken by the University of British Columbia, Department of Food Science. The new technology preserves fully-cooked food in laminated foil-plastic pouches for up to two years without refrigeration or freezing.

The enterprise was formed on a co-operative basis to exploit this discovery. The total capitalization amounted to about \$10 million, made up as follows:-

| | |
|------------------------|--------------|
| Buildings | \$ 2,650,000 |
| Land | \$ 2,500,000 |
| Equipment | \$ 1,500,000 |
| Waste Management | \$ 1,000,000 |
| Agriculture | \$ 2,350,000 |

✓ See McDonald, Hugh: The Creston Plan: Modern Food Processing in Mountain Valley Inter-American Development Bank.

The first \$500,000, in the form of equity, was subscribed by Creston citizens and private Vancouver capital sources. Approximately \$ 1 million was funded by the Federal Government and another \$ 1 million by bank borrowings. The use of commercial bank credit, however, was limited by the short-term nature of Canadian bank loans, and interim construction loans were guaranteed by State Government sources. However, the main source of resources was the Federal Government. The Department of Agriculture made a guarantee of a \$5 million loan and the Government of British Columbia made a guarantee of another \$2.5 million.

The project duly became operational and is a model of co-operation. The whole project started from a discussion about production diversification. All subsequent steps were rationally determined, including the development of a new technology. Included in the programme were local producers, consultants, research centres and governmental financing authorities.

With the description of this type of agro-industry, which is organised on a co-operative basis, we close this section. In the next and concluding section, we present a short analysis of the main points which have been made in this paper.

IV. Conclusions

In the earlier sections of this paper we described various aspects of food production, particularly agro-industry development and agro-industry models. There is no doubt that agro-industry can be an efficient means of increasing food production and of matching production more adequately to market needs.

Agro-industry is a form of enterprise which can help and be used to promote technological development. Although it is market-oriented and can be profit-making the risks involved are high, the investment required is large, and a highly complex type of organization is necessary. Consequently agro-industry needs financial and technical assistance from outside to be successful. The Canadian example shows the difficulties but also the advantages of establishing such enterprises. The favourable aspects derived in this case from the planning and establishment of a single well-organized agro-industrial enterprise. The enterprise owes its existence to an idea supported by a group which put it into practice.

The project was elaborated according to modern techniques of project formulation, with an analysis of all the alternatives, their advantages and disadvantages. The establishment and operation of the enterprise was dependent on a technological development which was carried out by local researchers in the local university laboratory. Special government financial support was given for setting up the production facilities. The scale of and the product were planned according to market requirements, product competitiveness and consumer acceptability.

In many ways, it was a modest enterprise, but it was sufficiently large to have a positive impact on the economic and social life of the community.

We wish to stress the importance of the rationale of the whole exercise. In looking for a new technology the only objective was to solve a technological problem. The process selected and developed was a modern one, technically and economically viable and producing a quality product as required by the market. This procedure is essential with regard to food products. Many times

for reasons that are not rational, the selection of the process is made by reference to other criteria, such as employment. The result is the production of products of low quality and great wastage of raw materials.

Another aspect which needs to be emphasized is the starting point of the project, which was the analysis of market requirements. The market research not only indicated the potential viability of the project, but also defined the main conditions for product acceptance on the market. Finally, the project showed that special financial and other aid were required from the Government to make the enterprise economically, technically and financially viable.

The examples given indicate that many types of organization are possible in agro-industry, especially with respect to ownership of the means of production. However, from the technical and economic points of view, there must be a suitable supply of raw materials; this is the main condition for proper processing operations. Processing adds to the requirements for equipment, investment, training of personnel etc. Such additional economic and social resources are justified only if they are properly used in increasing the value added to the raw products and if they are fully employed.

Although in Latin America numerous agro-industries already exist, we would recommend studies with a view to establishing a certain number of agro-industries to be operated on a regional basis. The need exists to increase food production in Latin America and so do the basic means for such a development. There are institutes which could be used to develop or adapt technologies and consultants capable of carrying out the studies and formulating the projects; there are also factories able to produce much of the required equipment and, finally, financial institutions to give support to such enterprises. The co-operative programme which we recommend is briefly outlined in the next section of this paper.

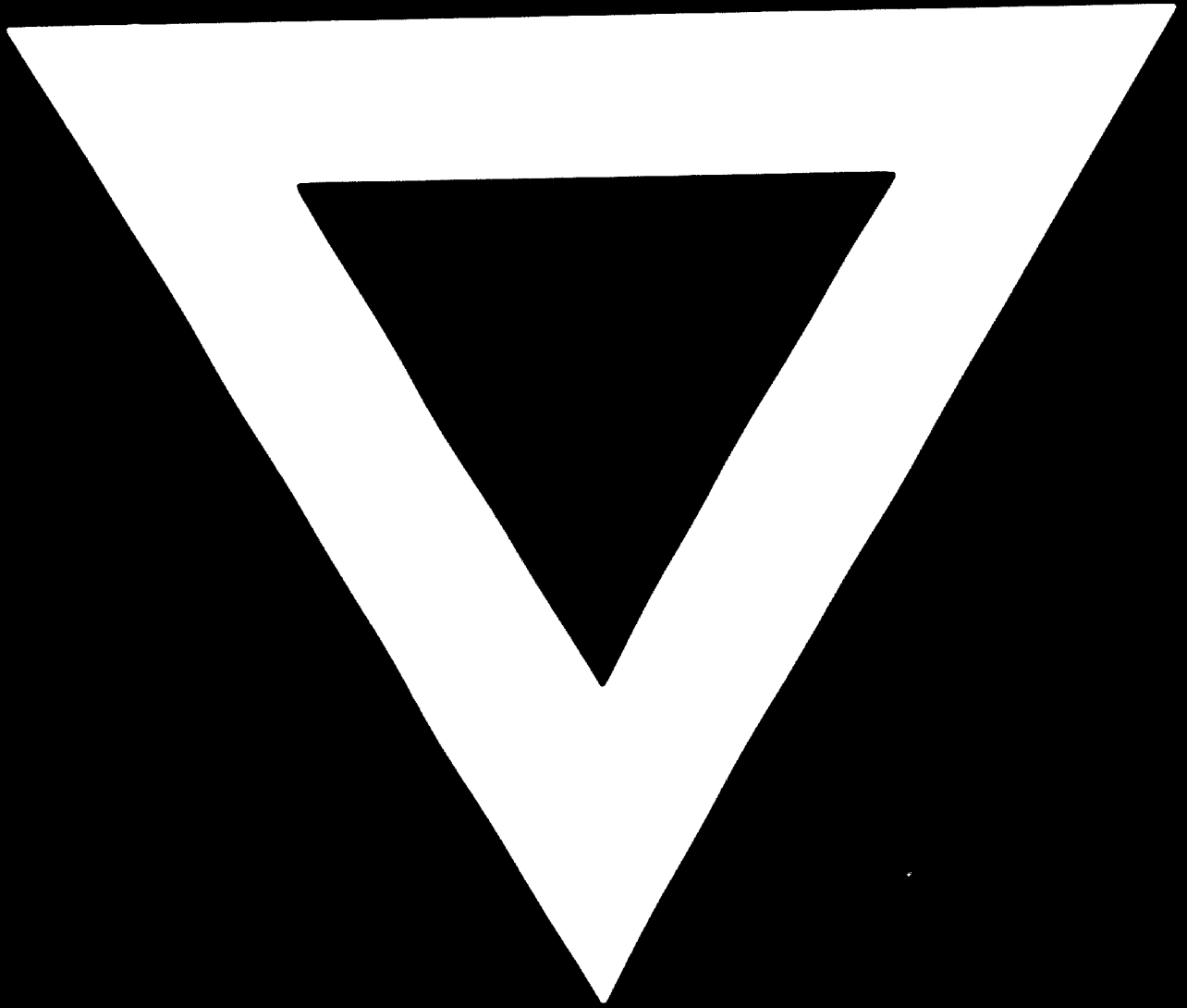
V. Recommendations

It is recommended that a co-operative programme be initiated in Latin American countries with the assistance and participation of national, regional and international organizations, to study agro-industry in these countries and to establish a series of model agro-industrial enterprises. The objective is to devise models which can serve as ready-made projects for financing by national, regional and international organizations. The models should be the most suitable agro-industrial system(s) for use in selected countries; they should be based on facts and take into account all the social and political factors of the regions in which they are planned to be established. The projects should be formulated by consultants working as a team.

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