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UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION

STUDY TOUR ON THE EXCHANGE OF EXPERIENCE

AMONG DEVELOPING COUNTRIES IN THE FIELD OF AGRO-INDUSTRY,

YUGOSLAVIA, 25 SEPTEMBER - 6 OCTOBER 1977.

VC/INT/77/020

Explanatory notes

A full stop (.) is used to indicate decimals.

A comma (,) is used to distinguish thousands and millions.

The term "billion" signifies a thousand million.

References to "tons" are to metric tons, unless otherwise specified.

Use of hyphen between dates (e.g. 65) indicates the full period involved, including the beginning and end.

References to dollars ($) are to United States dollars, unless otherwise stated.

The monetary unit in Yugoslavia is the dinar (Din). During the period covered by the report, the value of the dinar in relation to the United States dollar was approximately $US 1=Din 18.20.

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I. INTRODUCTION

Since a substantial part of the population in most developing countries lives in rural areas and is employed in agriculture, which is very often the most important economic sector, Governments pay great attention the development of agroindustry. Agroindustry implies co-ordination of agricultural production, the processing of agricultural raw materials and by-products, and the marketing of final products.

Numerous types of agroindustry exist according to the line of production, level of integration and applied technology. Besides the question of whether they are linked by contracts, co-operative settlements or unity of ownership, agricultural production must be balanced in quality and quantity with the processing requirements and the goods produced must be in accordance with the market needs.

The advantages of agroindustry are numerous. It enables the rural population to remain within its environment and to enjoy steady employment, higher incomes, and better living conditions etc. It contributes to the higher utilisation of agricultural resources by producing the products required on the market and avoiding unnecessary losses and increasing the utilisation by making better use of by-products. Therefore, it helps to increase the value added of agricultural production.

Agroindustries vary in complexity. However, from the most simple to the most complex, planning is required in order to make the best possible use of available resources. Therefore, it is important to have a clear idea of the type of agroindustry to be established.

A study tour of agroindustry, organized by the United Nations Industrial Development Organization (UNIDO) in co-operation with the UNIDO - Yugoslav Agroindustry Centre for participants from developing countries, was held in Yugoslavia from 23 September 1977 to 6 October 1977. The purpose of the study tour was to give the participants, through lectures and discussions and visits to various agroindustries and institutions, an insight into the Yugoslav agroindustry and in its different forms, such as large and complex combines with a developed scientific and research structure, and combines mainly oriented to a particular branch of production of farming, such as livestock, food and vegetable production.

II. ORGANIZATION AND PROGRAMME

The study tour was financed through the UNIDO Voluntary Contribution Fund. It was initially designed for 20 participants but because of the response, it was enlarged to enable 24 participants from developing countries to attend.

The participants visited integrated agroindustry combines, starting with processing plants. They visited industrial plants for milk and dairy products, sugar production, bakeries, chocolate factories, wineries, and plants processing meat and vegetable oil products. From these processing plants, they went to visit farms to observe the relationships between farms and industry. They also visited supporting technological research and development institutes to acquaint themselves with the work done and the way the institutes operate, particularly with respect to finance. The visit to the combines also gave the participants the opportunity to study the distribution of the final products.

During most of these visits films were presented that gave participants a complete view of the agroindustry combines. Finally discussions were held with Yugoslav policy-making authorities, managers, farmers, professors, scientists etc. to clarify the agroindustrial system of Yugoslavia.

III. THE STUDY TOUR IN THE FRAMEWORK OF THE UNIDO AGROINDUSTRIAL PROGRAMME

The agroindustrial programme of UNIDO comprises various supporting and promotional activities and direct technical assistance. The aim is to present to developing countries an integrated approach to planning, establishing and running agroindustrial organizations. With respect to supporting activities, UNIDO convenes seminars, publishes papers, and organizes study tours to inform representatives of developing countries on all aspects of agroindustry. The next phase is to assist in the establishment of an agroindustry in developing countries to serve as a model. UNIDO is assisting Brazil, Cape Verde, Dominican Republic, Guinea-Bissau, Madagascar, Morocco, Nigeria, Sao Tome and Principe among others to establish an agroindustry. For Benin, Mexico, Venezuela and Zaire technical assistance with the same aim is being formulated.

The study tours on agroindustry are important because they enable the participants of developing countries to obtain, in a relatively short time, an overall view of agroindustry.

Annex I

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Annex II

THE ROLE OF AGROINDUSTRIES IN THE INDUSTRIALIZATION OF DEVELOPING COUNTRIES a/

Background

Agriculture is the predominant sector in the economy of most developing countries and has been regarded by many as a base from which to launch industrialization and rapid economic growth. It is now realized, however, that neither industry nor agriculture can proceed very far without parallel and balanced development of the other. Growth of agricultural output is usually a critical determinant of the rate at which industrialization can proceed. Conversely, insufficient industrial support for agriculture and lack of manufacturing facilities to process agricultural output represent a major constraint on agricultural productivity. In other words, the interdependence of industry and agriculture is represented by the commodity flows between the two sectors, either in the form of industrial support of agriculture (fertilizers, pesticides, agricultural machinery, tools, implements etc.) or industrial processing of agricultural raw materials (food processing and non-food processing). It is this last aspect of industry-agriculture interdependence with which this paper is concerned.

Industries using raw materials in the form of renewable resources from farms, grassland, forests, and the sea may be classified as food-processing and non-food-processing industries. The former include processing of wheat, rice, barley, pulses, oil-seeds, maize, sorghum, sugar, meat and dairy products, fruit and vegetables, coffee, cocoa, tea and fish.

Food-processing industries increase the quantity and quality of food by reducing waste, preserving perishable products, and utilizing by-products for animal husbandry; and thus they satisfy a larger final demand for food from a given unit of land and other resources. That is of particular value in the current world food situation.

Non-food industries mainly satisfy human requirements for clothing and shelter and produce such commodities as natural fibres, cotton, jute, wool, kenaf, coir and allied fibres for the textile industry and rubber; wood and wood products; paper products; and leather and leather goods. Almost all the

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a/ Previously issued as UNIDO/IOD.1, 29 March 1976.

non-food agricultural raw materials lend themselves to a higher degree of processing than food raw materials, and thus the proportion of value added in this type of processing tends to be higher than in food processing. Another feature is that non-food industries face competition from synthetics and from man-made fibres used in combination with natural raw materials.

Processed food and non-food agricultural products exhibit lower price elasticities than agricultural raw materials, since quality and marketing considerations tend to reduce the relative importance of price as a factor affecting demand. Processed agricultural products therefore exhibit greater price stability than agricultural raw materials, and producing them permits developing countries to obtain greater value added than exporting the corresponding raw materials. Their production also enables farmers to participate in commercial markets and thus helps to transform subsistence agriculture into commercialized agriculture.

In spite of wide variations in the pattern of development, industries using agricultural raw materials seem to have characteristics that make them especially suitable for developing countries, namely:

High labour intensity
Many employment linkages
Modest capital and skill requirements
Prospects for rural development
Prospects for export-led growth

Many of these resource-based industries have proved to be pioneer industries in developing countries, as they were in industrialized countries several generations ago.

Thus, these industries can perform an important function in stimulating production, productivity and diversification in the primary sector and can be strategic elements of development in many countries if the concept of development is defined as the gradual increase in social welfare through a fuller realization of the potential of the individual, social progress, technological advance and economic betterment.

A precondition to fuller realization of human potential is an adequate supply of food, clothing and housing. This supply is closely linked to the industrial processing of raw materials from agriculture.

Social progress implies a fairer exchange between agriculture, industry and marketing than exists at present. It also involves a more equitable distribution of national income, better relations between individual citizens and society and concern for future generations. All these aspects of social progress can be influenced in most developing countries by the industrial processing of agricultural raw materials. In addition, processing of certain agricultural raw materials in the country of production instead of abroad in developed countries would result in a fairer distribution of wealth on an international scale.

Technological advance, the third major development area, is also closely related to industrial processing of agricultural raw materials through the application of post-harvest technology. Considerable quantitative and qualitative losses of agricultural produce can be avoided by proper storage, milling facilities, utilization of by-products, manufacturing, packaging and transport services. All these activities can be undertaken on a small or medium scale, and they tend to be capital saving and labour absorbing. They usually have a multiplier effect. The production of necessary containers and packages such as fibre and paper bags, wooden crates and tin and plastic containers, in turn stimulates the engineering and construction industries and various services.

Even simple processing involves the production of equipment such as crushers for sugar-cane, meat- and fish-drying apparatus, rice-milling equipment, grain-grading machines and various types of related implements. A long chain of increasing complex industrial activities usually follows, which provide backward and forward linkages with other industries and services. In this way, new employment opportunities and sources of income are generated, and economic betterment is achieved.

Agricultural processing industries can also serve to stimulate numerous agricultural activities. Thus, in many countries grain production was encouraged by the development of transport and storage terminal facilities; fruit and vegetable farms were expanded around co-operative grading and packing sheds and processing plants; and poultry farms multiplied around feedstock compounding plants, hatcheries and poultry-processing plants. Such integrated agricultural development schemes linked with processing enterprises have been the most important factor in promoting farmer participation in commercial

markets. Agricultural processing industries seem to help motivate farmers to expand and undertake new activities. They provide farmers with regular outlets, access to reasonable credit, training and technical assistance. Hence, this type of development appears to be of special importance to countries in need of a transition from subsistence to commercial farming.

The integrated approach to agroindustry

The integrated approach to agroindustry involves the vertical integration of the entire production process of food, or other agriculture-based consumer goods, from the field to the final consumer. Vertical integration means that all stages of the process and their planning are managed, or perhaps owned, by a single market-oriented authority (having an industrial approach) pursuing a policy suited to market demands. Such an authority takes profitability as the only criterion for success and endeavours to produce and process acceptable products using an industrial approach that would improve agricultural performance.

Such an approach catalyzes its own growth through the reinvestment of profits, partly in enlarging its own capabilities and partly in direct and indirect reconstruction of the rural area in which it is applied. It evokes a chain reaction of socio-economic development, including road building, improvement of water supplies, housing, credit facilities, as well as training, educational and even cultural activities. Its chances for diversification of industrial activities would be quite substantial.

An integrated agroindustrial complex will include the following groups of activities:

(a) Production of basic crops and collection or catch of raw materials. This group of activities includes the complete range of large-scale agricultural operations involved in the production of crops specifically grown for processing. Industrial production takes various forms, in particular where the catching of fish or game and the picking of wild fruits, berries, and vegetables are concerned;

(b) Preprocessing, transport and storing of basic crops, catches and preprocessed products. This group of activities includes harvesting, cropping operations, cold storage, sorting, grading, drying, washing, dehydrating, chopping or other forms of preprocessing of raw materials to put them in a cleaner or more concentrated form for further industrial processing;

(c) A basic food-processing industry adjacent to and dependent on the production of raw materials. This group of operations comprises the basic, primary food-processing industries, including the production of sugar, and products based on sugar such as fruit and vegetable preserves; vegetable oil and oil cakes; and the production of flour and products based on flour, such as pasta and biscuits;

(d) Production of animal feedstuffs for up-to-date animal husbandry of the industrial ranching type. The producer of animal feedstuffs is the most important entrepreneur of today as far as profitable production of meat, eggs, milk and wool is concerned;

(e) Production of animal proteins using industrial ranching methods. This group of operations consists of industrialized animal husbandry based on the fattening or feeding of a large number of animals in "animal protein factories", which are often located near the markets or adjacent to processing facilities (slaughter-houses, meat-processing plants, dairies etc.) creating a logical combination of the animal feedstuff factory, industrial cattle farm, processing facilities and marketing facilities;

(f) Food production for direct consumption. The fast-growing, secondary food-processing industries in this group are supplied with raw materials direct from groups (a), (b), (c) and (e). The materials are combined into a rich assortment of ready-made foods that can be distributed directly to, or consumed by, the individual purchaser. Labour-saving engineering techniques for manufacturing products of high nutritional value are used;

(g) Distribution and marketing. This group of operations consists of all the technical and commercial facilities (cold storage, cold transport facilities, catering services, restaurant and food chains) necessary for supplying food products to the domestic and export markets.

Integration of all these groups of activities is not always necessary. Sometimes a group can be eliminated or can be replaced by co-operative operations. Sometimes it is not feasible to implement all the operations at once but only gradually. Some lines of food products can also be developed successfully as small-scale, individual operations. However, whenever integrated food processing is feasible it should be preferred to all other production methods, especially in developing countries.

Through this approach the industrialisation of rural areas can be directed by industry and the benefits associated with the application of industrial technology to the agricultural sectors of developing countries can be achieved.

An agroindustrial complex can find sources of finance that will permit it to advance to the collaborating farmer the inputs he will need to increase his production. Its impact on the upgrading of local skills at all levels cannot be overemphasized.

Examples of possible agro-industrial complexes

Sri Lanka

Sri Lanka seems to offer possibilities for establishing an integrated food-industries complex. Figure I gives a diagram of such a complex as informally envisaged by the Ministry of Agriculture and Lands. It could be set up in collaboration with UNIDO.

Uganda

A diagram of a food-processing complex based on existing industries in Uganda (a least-developed and land-locked country) is shown in figure II. The urea factory and tannery are envisaged as future additions to the complex and illustrate the potential multiplier effect of the approach. Other possible future additions are cold-storage facilities, a milk-products factory, an animal-glue plant, a leather-goods factory, a margarine factory and a candy factory.

The Upper Volta

Also a land-locked, least developed country, the Upper Volta would greatly benefit from the food-industries complex presented in figure III. Since most of the industries to be included are not yet in existence, the proposed complex should be built up gradually over a period of 10 years.

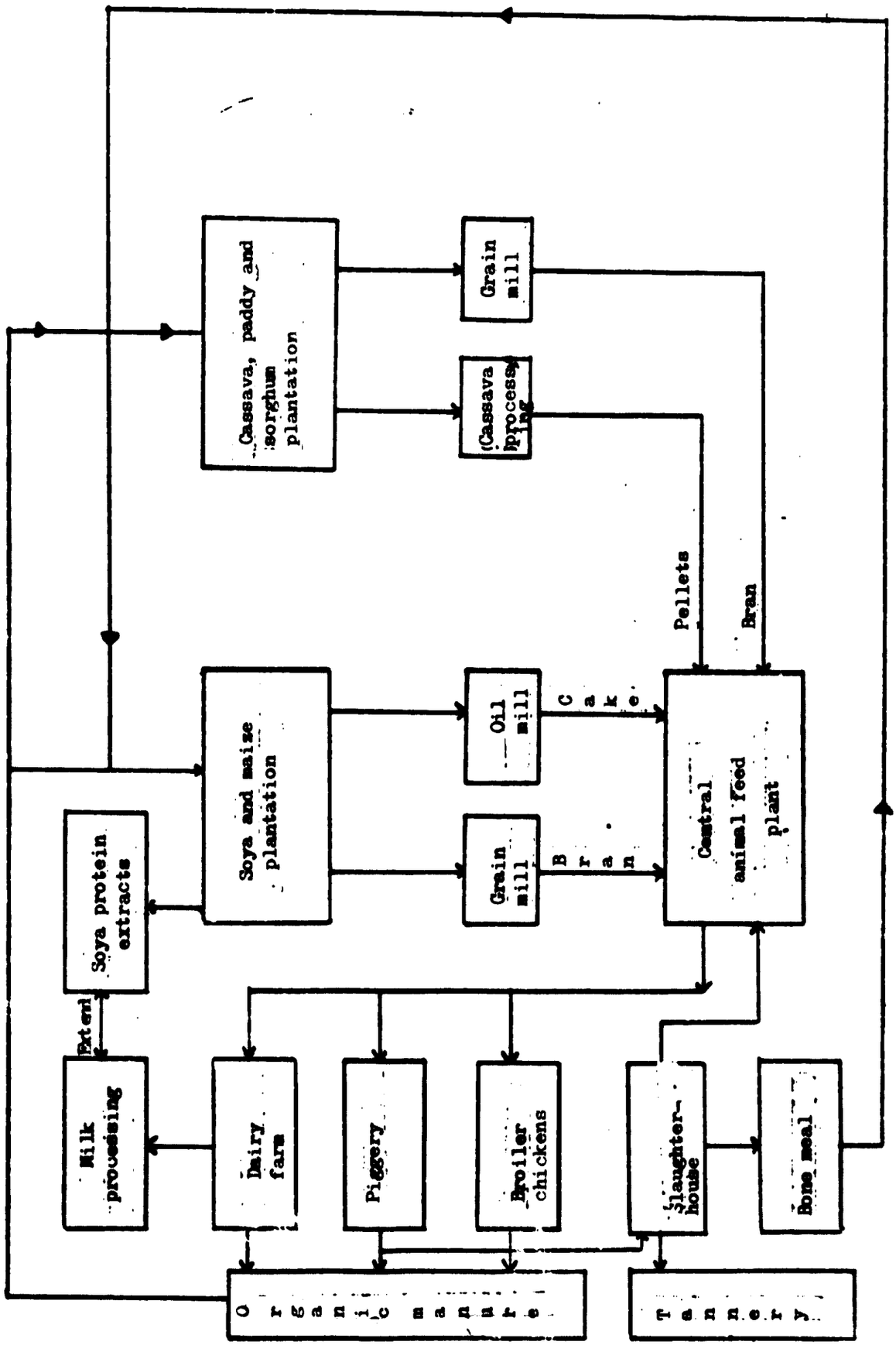

Figure 1. Plan for an integrated food-industries complex, Sri Lanka

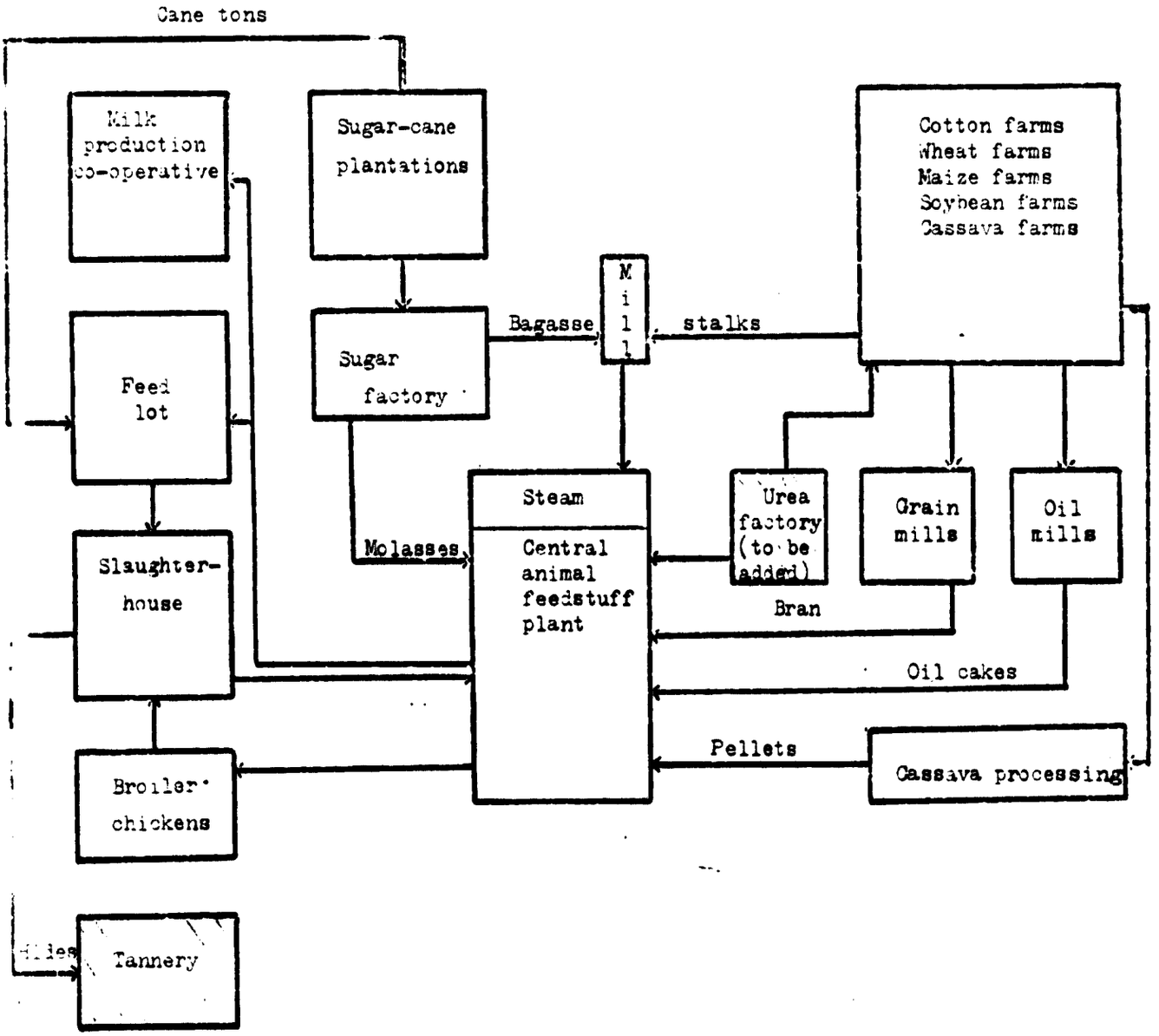

Figure II. Scheme for a food-industries complex in Uganda

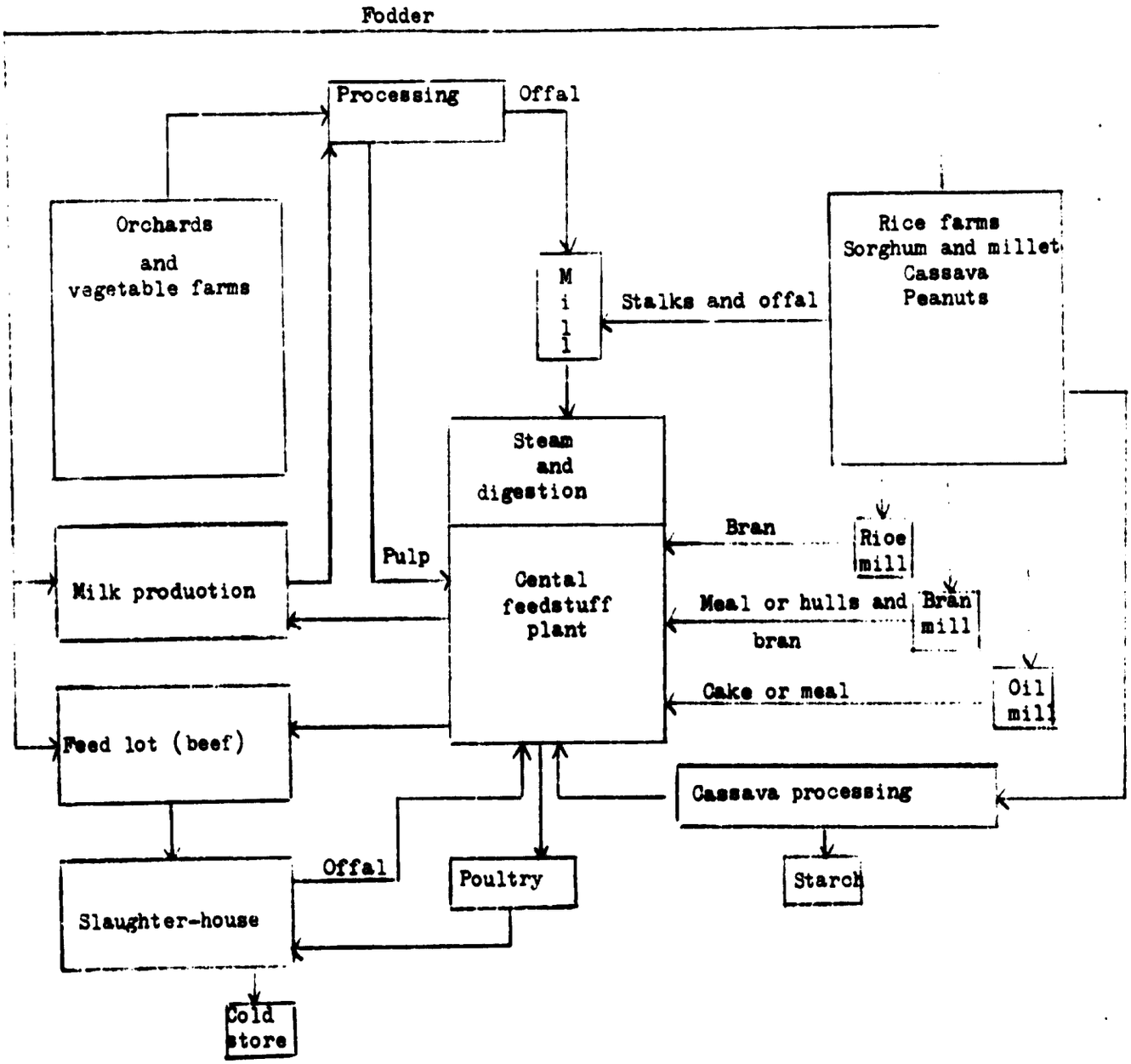

Figure III. Plan for a food-industries complex for Upper Volta

Application of the approach by United Nations agencies

The first step in applying the agroindustrial approach in developing countries through United Nations agencies would be to hold a meeting of the three organs most involved namely, UNDP, UNIDO and FAO. Joint consultation would result in a further refinement of the approach and the identification of a few countries at different stages of development in which it could be applied.

A first step in the implementation would be to send joint UNDP-UNIDO-FAO missions to the countries concerned for a period of four to six months to determine the feasibility of introducing the approach. Each mission would be composed of an economist, a food-processing engineer and an agronomist and would have the following tasks:

To identify existing industries that could be incorporated in a food-industries complex

To determine the number of farmers, area of farms and present and potential amounts of food material to be included in the complex

To determine the capacity and condition of existing machinery, transportation facilities, water supplies etc.

To investigate the availability of technical and managerial manpower and identify areas where training is required

To propose an administrative structure for the complex giving an estimate of the costs

To determine the cost of necessary improvements or additions to existing buildings and machinery

Annex III

DEVELOPMENT OF AGROINDUSTRIAL COMBINES IN YUGOSLAVIA AND THEIR ACTIVITIES IN DEVELOPING COUNTRIES[a]

Agrarian development policy

The economic system of Yugoslavia is based on the principles of social ownership of the means of production, planning of economic and social development and certain elements of the market economy. Agriculture plays an important role in the social and economic development of the country. It is intended gradually to socialize agricultural production, to further the development of agroindustrial combines and to promote co-operation between private producers and agroindustrial combines on a voluntary and mutually profitable basis.

The present economic situation requires greater agricultural production for several reasons:

(a) The structure of domestic demand for agricultural products has changed and increased in volume;

(b) The processing industry requires an increasingly large supply of raw materials;

(c) Demand for food in the international market is increasing;

(d) Larger and more stable reserves of food are needed.

The main elements in the development of the agroindustrial production of Yugoslavia are agroindustrial combines, co-operatives, business associations in agriculture and scientific and research institutions.

After the Second World War, particularly in the last 20 years, considerable progress was made in the production of food and in rural development. Yugoslav agriculture passed through three stages:

(a) The period 1945-1955 was characterized by administrative management in agriculture and collectivization and, later, reorganization of co-operatives. The growth rate of production was low; investment was insufficient; and industry and the market remained underdeveloped;

(b) The period 1955-1965 was characterized by increased production, larger investments, introduction of up-to-date machinery and technologies, development of agroindustrial combines, and the establishment of co-operation between private producers, on one side, and agroindustrial combines and co-operatives on the other;

(c) In the period 1965-1975 an emphasis was placed on economy of production and improvement of supply for the domestic and foreign markets.

A comparison between the present stage of development of the agroindustrial complex and the situation in the period 1930-1939 shows that:

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[a] Previously issued as UNIDO/IOD.108, 9 August 1977.

(a) The volume of agricultural production has doubled;

(b) The proportion of the agricultural population has decreased from 47 per cent to 23 per cent;

(c) The production of the food-processing industry has increased by a factor of 10;

(d) The industries of agricultural machinery, fertilizers, chemicals for plant protection and equipment for the processing industry have grown rapidly. Today, these industries not only satisfy the domestic demand, but also produce a considerable volume of exports;

(e) The market for agricultural products has expanded;

(f) A strong scientific basis for agriculture and the processing industry has been laid, which has led to original technical and technological solutions in food production.

Table 1 illustrates the growth of agriculture in Yugoslavia, 1930-1976.

Table 1. Growth of agriculture in Yugoslavia, 1930-1976

Crop	Production of staple crops (thousand tons)				Index
	1930-1939	1946-1955	1956-1965	1966-1975	(basis: 1930-1939)
Wheat	2 430	2 075	3 205	4 700	192
Corn	4 300	3 268	5 263	7 600	177
Sugar-beet	616	1 187	2 040	3 250	527
Beef	100	93	170	255	255
Pork	171	167	253	340	200
Poultry	47	40	65	120	255

Balance of foreign trade for food
(million dinars)

Year	Export	Import	Difference (+ -)
1956	4 123	7 096	- 2 973
1971	3 985	2 421	1 561
1975	5 259	2 133	3 126
1976	7 366	4 520	2 846

It can be seen that Yugoslavia managed to switch from being an importer to being an important exporter of food in a relatively short period.

Such vigorous growth of the agroindustrial complex resulted, to a large extent, from the rapid development of the system of education for all categories of agricultural and other experts, as well as from the research and development work and the application of the scientific results. Today, over 10,000 students attend the schools of agriculture in the country, and 53 institutes are engaged in research on agricultural problems. These institutes employ 1,150 scientists and research workers.

It is agricultural policy to stimulate food production by offering premiums and other incentives and guaranteeing prices. The production of wheat, soya wheat, soya beans, milk, meat and the application of fertilizers have been subsidized in recent years as follows (million dinars):

1974	1 395
1975	3 281
1976	4 394

These expenditures have increased the production and the consumption of agricultural products.

The results obtained in agricultural production demonstrate the validity of the agroindustrial measures applied. To synchronize the overall development of the agricultural complex, production has remained directed.

Until a few years ago, plans for the development of agroindustrial combines and other agricultural organizations were based on the plans of the republics and provinces. Later on, the plans and measures agreed upon were based on the national plan. A plan for the development of agricultural was drawn up for the period 1973-1975, which increased the average annual expansion of production from 1.9 per cent in the period 1970-1972 to 3 per cent in the period 1973-1975. Production in the later period, in comparison with the former, increased by the following percentages: wheat, 8.4; corn, 15.1; sugar-beet, 21.1; sunflowers, 13.2; soya beans, 283; and tobacco, 23.2.

The increase in production was achieved through the introduction of quality seed materials and increased use of fertilizers and agricultural machinery. Progress was also achieved in animal husbandry and in the production of meat, milk and dairy products. The increase in production

... (percentage): beef, 16; pork, 3; mutton, 2; poultry, 21; and milk, 27.

A characteristic of the period 1973-1975 was the establishment of protective and guaranteed prices for staple agricultural products, based on the so-called principle of expenditure (production costs); introduction of premiums to enhance agricultural production; and provision of financial resources, both domestic and foreign, for developing the processing industry (sugar refineries, oil mills etc.).

The plan for the development of the agroindustrial complex for the period 1976-1980 has the following basic objectives: to satisfy the increasing demand for food, to decrease and finally eliminate the import of those agricultural and processed commodities that can be produced profitably in the country and to increase the export of food. By 1980 a production target is 45 million hectolitres of milk and 4.5 billion eggs. Other targets are (thousand tons):

Cereals	18,000
Sugar-beets	8,730
Oil crops	957
Vegetables	7 100
Fruits and grapes	3 416
Raw tobacco	101
Meat	1 286

An average annual growth rate of 4 per cent is planned for the agricultural production and 8 per cent for the processing industry.

The following aims of the plan are: intensification of agricultural production; improvement of arable land through drainage and irrigation; redistribution of land through leasing; further extension of arable land in the social sector, including purchases from private producers; further introduction of up-to-date machinery and technologies; development of scientific work and application of scientific and technical achievements; improvement of the work organization; increase in investments; change to the cultivation of high-yielding crops; and introduction of more productive breeds of cattle.

To provide conditions for achieving these rather ambitious targets, the plan regulates prices and premiums, the market and financing of production and supplies etc.

Role of agroindustrial combines

In early 1976, there were 868 agroindustrial combines and agricultural estates in Yugoslavia covering an area of about 1.5 million ha and having a cattle population of 355,000. The value of the assets is Din 35 billion and their output is valued at Din 15 billion.

The average area of an agroindustrial combine is 5,200 ha, whereas the largest combines possess more than 100,000 ha.

The agroindustrial combines can be broken down according to size as follows:

Number of combines	Area (thousand hectares)
119	1-2
44	2-2.5
117	2.5-5
69	over 5

The yields per ha at the combines are already high and are constantly increasing, as table 2 shows.

Table 2. Crop yields on agroindustrial combines (t/ha)

Year	Wheat	Corn	Sugar-beets
1971	41.3	54.7	400
1972	37.4	56.7	464
1973	43.0	52.7	419
1974	49.9	58.2	453
1975	40.7	60.8	421
1976	51.2	53.4	470

Likewise, the average milking capability was increased at the combines from 3,779 litres in 1971 to 4,128 litres in 1975.

The number of agricultural machines owned by the agroindustrial combines is also constantly increasing. Today, they own 19,000 tractors, 7,700 harvesters and over 2,000 trucks. There is 192 hp per 100 ha of arable land. One tractor covers 50 ha of land, a harvester, 120 ha.

The main emphasis at the combines is on an increase in productivity and economy of production through the introduction of up-to-date technologies. Recent surveys have shown that the use of machinery has increased in crop production. The highest use is found in the production of sugar-beets (31 h/ha), followed by corn production (18 h/ha) and wheat production (12 h/ha). In cattle production, machinery has been increasingly used for milking, supplying water to animals, removing the manure, transporting cattle feed etc.

The highest productivity has been reached in the production of wheat, then of corn. It takes one hour of direct manual labour at the combines to produce the following (kg): wheat, 170; corn, 92; alfalfa, 45; and sunflowers, 27. It also takes 4-4.6 hours to produce 100 litres of milk and 16-18 hours to produce 100 kg of pork. The productivity of the combines is approaching the world's top performances; some combines have surpassed productivity in the most advanced agricultural countries.

The financial results at the combines in 1976 were better on the whole than in the previous year. At the same time, several basic indicators (volume of production, total income, realized income etc.) were better for the agroindustrial complex than for the other branches of economy. In 1976, the volume of production in agriculture was higher than the average for the entire economy by 2 per cent; total income, by 4 per cent; and realized income, by 7 per cent.

The first agroindustrial combines were established in the 1950s. From the beginning they were the major means of promoting the technical, technological and social transformation of agriculture in Yugoslavia. The work of the combines and the intensified production increased the efficiency and productivity of agriculture as a whole, facilitated the specialization of production and contributed to an increase of marketable goods. The combines successfully managed to incorporate into their operations basic agricultural production, processing and marketing. Their success also resulted from

co-operation with scientific and other institutions, although the largest combines have their own research departments and training services.

The combines incorporate over 200 processing factories (oil mills, slaughter-houses, sugar refineries, dairies, meat-processing plants, fruit and vegetable canneries etc.) and a marketing network of over 4,000 shops. Over 70 per cent of the total food industry of Yugoslavia is found on the combines.

The combines facilitate the efficient integration of agricultural production, processing industry and marketing, on a long-term basis They are the meeting point of economic interests of all the participants in the chain of production from the producers of raw materials, through the workers in the processing industry, to those engaged in marketing. They affect the economy, since they take into account all factors affecting agricultural development. Even though the combines possess only 15 per cent of the total arable land of the country, they produce 46 per cent of the total marketable goods. For some products, however, the combines produce 70 per cent or more of the marketable goods.

The integration of production with processing and marketing at the combine makes possible the planning of development and production programmes, work organization, specialization, joint research work, joint purchase of materials, joint marketing and a more efficient utilization of agricultural experts and other workers. It also improves the utilization of available land areas and processing capacities, market conditions and use of raw material in processing and marketing.

About 85 per cent of the arable land in Yugoslavia is owned by private farmers. In the area of most intensive agriculture (north), the social sector (agroindustrial combines) owns 20-50 per cent of the arable land.

The social sector produces 40-70 per cent of the marketable crops of staples (wheat, corn, sugar-beets, sunflowers, fruits and grapes etc.) thanks to its high productivity, the application of up-to-date machinery and technologies, and the efficient organization of work. Thus, the social sector, particularly the agroindustrial combines, is the dominant element in the agricultural complex.

The agroindustrial combines have an immediate and positive effect on the production of the private farmers. In all agricultural regions, particularly in the most developed ones, numerous forms of co-operation in crop production between private farmers and agroindustrial combines have been developed. This co-operation, contracted for one or more years, is voluntary and protects the interests of both sides in the partnership. At the same time, it assists the private farmers to produce more food more economically and contributes to rural development. Such co-operation is particularly well-developed in the production of wheat, corn, sugar-beets, sunflowers, raising of hogs and poultry and breeding cattle. This co-operation is especially important for those combines that are unable to provide their processing plants with sufficient quantities of agricultural raw materials. These combines obtain the additional raw materials from the private farmers. The increasing application of up-to-date technology in the processing plants of agroindustrial combines means that more raw materials are needed, which, in turn, leads to a further enlargement of the agroindustrial combines. As a result, the types and forms of co-operation with private farmers have changed. In addition, many former agricultural co-operatives have merged with the combines to become their units of co-operation with individual farmers.

Certain experience was acquired in the process of co-operation, and a need evolved to combine the labour and assets of the social sector, in particular the agroindustrial combines, with the labour and resources of private producers to increase agricultural production. By using the experience, machinery and up-to-date technologies of the combines, private farmers have been able to expand their knowledge and to increase their living standard.

Tables 3 and 4 give some indicators of the development of co-operation between the social and the private sectors in crop production.

The results achieved are considerable, but they are only a part of the potential for further increases in food production. Only one fourth of the private producers in Yugoslavia co-operate with the combines and co-operatives. Therefore, more private producers could be brought into association with the combines, with the goal of increasing agricultural production, income, productivity and the living standard in rural regions.

Table 3. Co-operation in agriculture between the social and private sectors, 1962-1975

Year	No. of private farmers co-operating (1 000)	Services (1 000 ha)			Supply (1 000 tons)			
		Ploughing	Planting	Harvesting	Wheat seed	Corn seed	Fertilizer	Chemicals
1962	730	937	222	150	169	4	588	6
1967	872	931	282	305	86	14	989	12
1972	588	399	307	316	67	18	1 067	9
1975	527	424	281	255	72	13	1 143	11

Table 4. Co-operation in animal husbandry between the social and private sectors, 1962-1975

Year	No. of private farmers co-operating (1 000)	Animals supplied to private producers (1 000)			Supply of feed concentrate (1 000 tons)
		Cattle	Hogs	Poultry	
1962	244	144	763	427	102
1967	279	367	1 078	9 838	343
1972	287	422	1 479	23 208	573
1975	312	419	1 650	36 849	625

Co-operation with developing countries

Because of their achievements in production and their broad technical and technological experience, the combines have been able to participate in several projects concerned with food production in developing countries.

The Yugoslav model of agroindustrial combine has, in view of its achievements in food production in Yugoslavia, aroused an understandable interest in the developing countries. Various countries have expressed the wish to become familiar with this model, and Yugoslav assistance has been requested in developing agroindustrial complexes in these countries.

As a result of this interest, Yugoslav organizations have been increasingly engaged in projects dealing with food production, transfer of technical and technological knowledge in food production, processing, transportation and storage, training of experts, provision of water, construction of agricultural settlements, improvement of land, protection of crops and livestock and, finally, the building of complex agroindustrial combines.

The major initiative in the co-operation with developing countries has been taken by the agroindustrial combines, which, employing Yugoslav experts from other fields, in particular the manufacturers of agricultural equipment, participate in projects to improve land; and to plan, build and organize agroindustrial combines, farms for meat and milk production, fruit and vegetable canning factories, silos, slaughter-houses, dairies and fish-processing factories. The results of these projects are impressive: 60 t/ha of corn and over 50 t/ha of wheat were produced in the Sudan and the yields of sunflowers were quadrupled in Iran. The Yugoslav experts apply the most recent scientific achievements in their work, introduce new crops and develop new varieties and high-yielding hybrids.

The agricultural combine "Belgrade" is building in Iraq, in co-operation with other Yugoslav organizations (for instance, Dunav-Tisa-Dunav, from Novi Sad, which is in charge of soil reclamation and the building of a hydro-system), a complex of agroindustrial combines (Dujaila) covering 75,000 ha of arable land. The combine Belgrade also undertakes similar projects in Algeria, Mexico, Peru and Venezuela. The Agricultural and Food Processing System, Osijek, is engaged in research work and agroindustrial projects in Algeria, Ethiopia and Sudan, "Emona", Ljubljana, is involved in the production of coffee and other tropical crops in the Central African Empire. These and other combines, contracting companies and equipment manufacturers have been

engaged in surveys, designs and supply of engineering and equipment for slaughter-houses and meat-processing plants, fruit and vegetable canneries, sugar refineries, oil mills, pastry and confectionary factories, refrigeration plants and storage houses in Egypt, India, Libyan Arab Jamahiriya, Mali, Morocco, Sri Lanka, Togo, Uganda, Venezuela, Zambia and other developing countries.

Yugoslav manufacturers of agricultural machinery and irrigation equipment are also involved in projects in developing countries. They export dredges, bulldozers for clearing and levelling, tractors, universal combines for wheat, corn, sunflowers and rice, accessory machines for cultivating soil, irrigation pumps, transport vehicles, agricultural aircraft and feed-processing plants, as well as machines for cultivating and harvesting fodder crops, machines for applying chemicals and silos for storing small grains and fodder crops. Yugoslavia also exports meat, bone and fish meal plants, convenience-food plants and self-service shops with all facilities.

Yugoslav companies have built water supply networks (dams, irrigation systems, provision of water in desert areas by drilling, etc.) in Iran, Iraq, Libyan Arab Jamahiriya, Morocco, Panama, among others. Yugoslav scientific institutes are introducing various crops and providing seeds in several developing countries; sunflowers and corn are being introduced in Iran, Iraq, Libyan Arab Jamahiriya and Sudan.

The co-operation between Yugoslavia and developing countries in this field is conducted on a commercial basis, which has included extension of long-term partial credits and technical assistance. Recently, more developed forms of co-operation have been introduced, for example, joint ventures (e.g. production of coffee in the Central African Empire and fertilizer production in Ghana).

Yugoslav experts are working in various developing countries on the basis of bilateral or multilateral technical assistance arrangements. A number of foreign experts are carrying on regular studies in Yugoslavia or are undergoing specialized training in agriculture and food processing. There are specialized centres in the country for the training of all categories of agricultural experts from developing countries.

Summary

Considerable results were achieved in the development of agriculture and the food-processing industry in Yugoslavia in the post-war period, particularly in the last 20 years. The volume of production and yields increased several times, while the quality and assortment of agricultural products improved. The development of agriculture was accelerated by the growth of the processing industry and other related industries (agricultural equipment, fertilizers, chemicals for plant protection, food-processing equipment etc.), the establishment of a strong scientific and research basis and the application of scientific results in practice, and the expansion of the domestic food market, and exports. The economic policy of the country and the social and economic progress stimulated agroindustrial development.

Agroindustrial combines are the driving force in the development of an agroindustrial complex. They incorporate all technical, technological and economic functions - primary production, processing and marketing. The combines have achieved significant results in the increase of production and yields, organization of work, modernization of production processes, practical application of scientific achievements etc. The basic objectives of the combines are: high economy of production; the most economical utilization of land, machinery and workers; and high productivity.

In addition to the positive results achieved in their own production, the combines have been successful in developing co-operation with private producers. Today 300,000 private farmers co-operate with the combines. Different forms of co-operation and association have increased the production and income of private producers, which, in turn, has raised their living standard. These forms of co-operation also bind economically the social and private sector in food production.

The plan for the development of the agroindustrial complex (covering the period 1976-1980) and the present social relationships have created even more favourable conditions for further development of agriculture, agroindustrial combines and co-operatives, as well as for co-operation between the social sector and private producers.

Several years ago, the agroindustrial combines and other organizations began to participate in projects in developing countries. The intention of the combines is to use their experience and knowledge of technologies and work organization to increase food production in these countries. The results obtained so far are encouraging. However, conditions are favourable for more intensified and diversified co-operation in development of agroindustrial complexes in developing countries, and interest in such co-operation on both sides exists.

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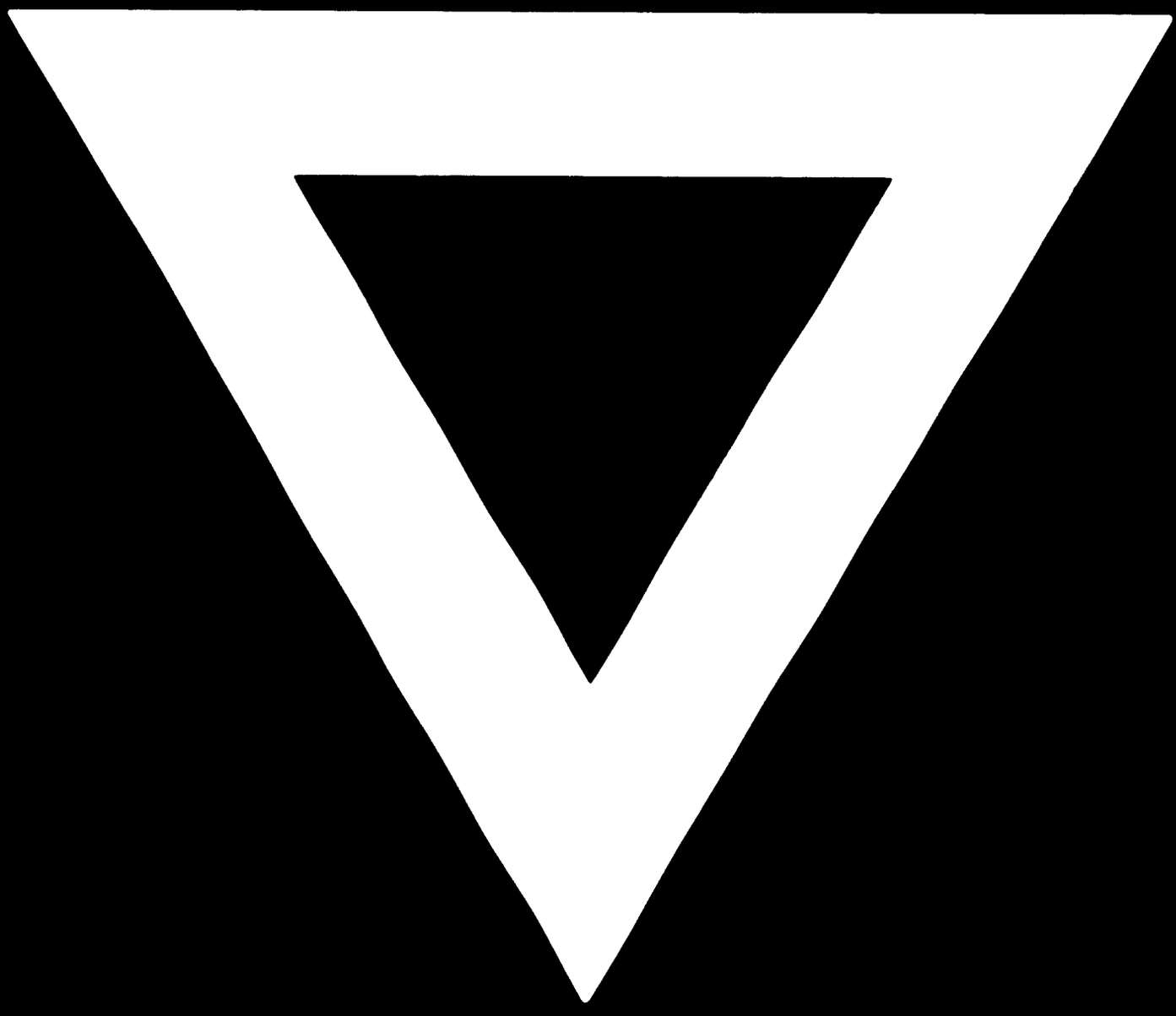

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