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08720



United Nations Industrial Development Organization

Distr.
LIMITED

ID/WG.297/1
15 March 1979

ENGLISH

Global Preparatory Meeting for Consultations on
the Agricultural Machinery Industry

Vienna, Austria, 5 - 8 June 1979

DISCUSSION DOCUMENT*

prepared by
the secretariat of UNIDO

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Id.79-1882

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SUMMARY AND UNIDO PROPOSALS FOR THE MAIN TOPICS FOR DISCUSSION

1. The broad range of problems encountered by developing countries in the process of expanding their agricultural machinery industries was examined at two preparatory expert panel meetings. On the basis of the reports of these two panels the problems were grouped into areas which are described in detail in Section 3 of this Discussion Document.

2. To guide discussion at the Global Preparatory Meeting UNIDO proposes to concentrate the problems into two main topics. The first concerns the basic activities which a developing country should undertake to achieve the aim of producing all its requirements of the simple agricultural implements - that is to say hand tools and animal-drawn equipment, but not including power units in the first instance. Progress towards this primary objective implies setting up profiles of workshops with their ranges of appropriate metal-working equipment and supplies of materials, identifying suitable sites throughout the countryside, training men and women in technical and management skills, and organizing storage and distribution to give prompt delivery services to local farmers. Vigorous activity along these lines offers the prospect of early benefit to developing countries in expanding their capacity for producing agricultural machinery. The topic is particularly relevant to a country in the early stages of industrialization.

3. The second main topic concerns the more advanced engineering activities for the production of tractors, other prime movers, more complex cultivating equipment and self-propelled machinery. The essence of the UNIDO approach to this topic is that countries should identify the types of the more complex agricultural machinery which they are regularly importing, and negotiate the contracts for the purchase of the next consignments to cover not only the delivery of the equipment but also the start of long-term arrangements for training manpower to operate it, maintain and repair it, build spare parts for it and eventually make and assemble the complete units. As was the case for the first topic this activity will include designing, locating and equipping appropriate new workshops, and the training of additional staff

in advanced technical and managerial skills. The additional dimension needed in the assessment of the second topic is the relation of the production of machinery to the country's integrated strategy for food production, population growth, land tenure and industrialization generally. The manufacture of the more complex agricultural machinery requires substantial capital expenditure for the workshops, ties up capital over the extended life of the machinery and lays claim to skilled human resources that are also in great demand in other branches of industrialisation. The manufacture of the more complex machinery should therefore be undertaken in accordance with a strategy for the country's integrated development taking account of all relevant technical, economic and social factors.

4. The second topic is immediately relevant to countries which have already made substantial progress with their agricultural machinery industries, and will also represent a further stage in a long-term process for the less advanced countries.

5. The drive towards the expansion of the agricultural machinery industry in developing countries on the proposed lines offers great scope for international cooperation - among developing countries in the sense of sharing experience, and between developed and developing countries on the basis of long-term contracts covering the supply of equipment, training of manpower, and finance. There will be benefit to the developing countries in securing the rising standards of living which greater and more efficient agricultural production can yield, and to the developed countries in maintaining good market contacts for capital goods, agricultural machinery in the advancing stages of design, and consultancy services.

6. From the consideration of the range of problems the Global Preparatory Meeting will be asked to assist in selecting and defining the issues which should be presented to the Consultation Meeting in October 1979.

INTRODUCTION

7. The subjects for discussion presented in this document emerged from the discussions and recommendations at the two Preparatory Expert Panels held in Vienna from 23-25 November 1977 and 29 May - 2 June 1978. They are given with supporting and explanatory material from the discussions; additional supporting material is given in the Report of Working Group No VI (Production of Agricultural Machinery and Implements) of the International Forum on Appropriate Technology held in New Delhi 20-25 November 1978.

8. The Preparatory Meeting will be asked 1) to help in formulating the issues for consideration by the Consultation Meeting, which is to be held in Stressa, Italy, 15-19 October 1979; 2) to suggest courses of international co-operation that will assist the development of the agricultural machinery industry in the developing countries and 3) to define the role which UNIDO should play to assist most effectively in these courses of action.

9. The importance of agricultural machinery as a subject for a Consultation Meeting can be briefly stated. The following table quoted on page 24 of the ICIS Preliminary Study on the Agricultural Machinery Industry (May 1978) indicates that in Asia and Africa between a quarter and a third of the energy spent in agriculture comes directly from human labour, compared with less than 1% in developed countries.

Geographical zone	Proportion of labour spent in agriculture according to energy source		
	Human	Draught animal	Engine
USA	0.01%	-	99.99%
Europe	0.39%	-	99.61%
South Africa	4 %	22%	74 %
Asia	26 %	51%	23 %
Africa	35 %	7%	58 %

Source: A. MOENS: Agricultural Mechanization in Asia, Vol.III (Winter 1976)

A table on page III of the same Study shows that 95% of the useful agricultural land area in Africa is worked with purely manual farming, compared with 4% in USA and Canada. Progress towards an improvement in the standard of living in developing countries must be associated with the application of more power to agricultural operations and the production of the appropriate machinery.

10. World trade in agricultural machinery represents one fifth of the total trade described under the broad classification of non-electric machinery. The trade quadrupled in value during the period 1967-1975. In 1975 imports of agricultural machinery and pumps into developing countries accounted for 26 and 34 per cent of the total world trade in these two sectors. The dynamism of world trade in agricultural machinery created by the demands in the developing countries is not unexpected, when viewed against the importance of agriculture in the economies of developing countries and the rates of economic growth which have been maintained by those countries under the stimulus of population increase.

11. Every developing country needs to expand its capacity to meet its own demand for agricultural machinery, since the growing requirement for foreign exchange to pay for imports of agricultural machinery is a strain on the balance of payments. The First Preparatory Expert Panel considered this point and concluded that local manufacture was a necessity, starting with the simple types and progressing to the more complex. More important, eventually, for the strategic growth of industry in predominantly agricultural countries is the coupling of industrial and agricultural development.

12. The agricultural machinery which a country needs is that which is compatible with its crop and food processing systems. Broadly speaking there are four categories of farm machinery, which fit recognisable patterns of farm mechanization, and require different levels of manufacturing skill. A description of the four categories was adopted by the First Panel and is summarised for convenience:

- (i) implements that are simple to manufacture and operate - hand tools, animal drawn machines, and simple processing equipment. The manufacture of such equipment is readily undertaken in small to medium production units, using mainly simple forging, welding and drilling facilities;

- (ii) intermediate machinery - better ploughs and harrows to give quicker cultivation, weeders and sprayers to control weeds and disease, pumps and appropriate irrigation equipment, and trailers for transport, all required for the intensification of cropping. The manufacture of such machines is dominated by medium sized workshops with machining, forging and welding facilities, and access to a supply of suitable castings, bearings and steels;
- (iii) powered machinery - tractors, power-tillers, threshers and dryers as well as more complex pumping equipment necessary to meet the timeliness requirements of cultivation, planting and harvesting especially where multiple cropping is practised. Manufacture of such equipment, which is dominated by large centralized factories, requires an adequate infrastructure in the metallurgical and capital goods industry such as foundry, forging, heat-treatment, precision machining and quality control facilities;
- (iv) specialized machinery - self-propelled harvesting machinery and crop processing equipment with a high potential for saving labour. Production of such machines needs a skilled metallurgical industry, high capital production facilities and a good capability in research and development.

SUBJECTS FOR DISCUSSION

A. Basic activities

- (1) The encouragement of developing countries to install the basic metal-working equipment including facilities for forging, forming, heat treatment and welding in order to produce all their own requirements of simple agricultural implements.

13. The First Panel recommended that developing countries should aim at manufacturing all their needs of items in categories (i) and (ii) and as much as their potential would allow of the other categories. Equipment in categories (i) and (ii) is conveniently produced in small and medium workshops which can be sited throughout the countryside. Such workshops serve not only as centres for the manufacture of simple equipment, but also through their local connections as repair depots for the more complex agricultural machinery.

14. Each country will need to assess this recommendation in the light of its own circumstances, the present degree of development of its engineering workshops whether or not they specialize on agricultural equipment, and the extent to which neighbouring countries might help in providing facilities where transport conditions are favourable. Each country will need to undertake a thorough survey of its existing production facilities, and the organisational measures required to expand the facilities, group them for management purposes or supplement them with new establishments.

15. Although small rural enterprises may sometimes seem primitive in their level of technology and operating efficiency, they are usually highly competitive in overall economic performance. Their small scale nature is no disadvantage, since the investment is fixed and working capital is minimal;

and while their working methods are labour intensive, labour costs are not high. The capital cost of equipping a small workshop to serve an area having a radius of 10 km is \$20,000-50,000. Such workshops provide training centres in mechanical skills, which are widely diffused through the countryside and complement the social structure.

16. In following up the recommendation to manufacture equipment in categories (i) and (ii), developing countries should consider that it may not be just a matter of duplicating such facilities as may already be in existence, but an occasion to examine existing design and production methods in order to market machines that provide an improved level of performance for the farmers.

17. UNIDO can offer direct and positive help by drawing up a number of profiles of small workshops appropriate to different stages of engineering development with descriptions and estimated costs of equipment and buildings, labour requirements, production capacities and usage of steel and other materials - on the lines of the Annexes to the document ID/WG.282/4 dated 20 September 1978 and presented to Working Group No 1 of the International Forum on Appropriate Industrial Technology.

18. UNIDO can follow up that action by arranging regional or sub-regional consultations bringing together countries which have already made progress in the recommended direction, countries which are arranging to do so, and small-sized engineering companies from developed countries which are able to offer the simple equipment required and provide the necessary technical support to ensure its effective installation and operation. The discussion at the Global Preparatory Meeting is expected to lead to proposals for the organisation of these activities and for the type of direct negotiations to be undertaken by the parties concerned.

- (ii) International co-operation in programmes of training individuals from developing countries in the local production, maintenance and repair of agricultural machinery.

19. Training of skilled personnel constitutes an integral part of the development process and in particular of the industrialization process. The Lima Declaration pointed out "that appropriate measures should be taken by developing countries to ... establish training programmes to cover the needs of their industrial development and make possible progressive mastery of the different production and management techniques and of industrial development, thus facilitating the establishment of structures to absorb modern technologies".

20. In the design, manufacture, operation and maintenance of agricultural machinery there is need for training at all levels. Special emphasis needs to be given to practical techniques. Training in the repair and maintenance of tractors should have high priority.

21. There is a fruitful field for international co-operation in encouraging the developed countries to place at the disposal of the developing countries some of their educational and training facilities at the various levels. The main activities of the large manufacturing companies are related to machinery in categories (iii) and (iv), but there is a need for them to assist with categories (i) and (ii), which are of greater importance for many developing countries. Manufacturers and trade associations in the developed countries also include small and medium-sized firms which could be a source of management and technical skill, and appropriate technology. Some Governments in industrialized countries have set up units whose specific aim is to arrange international contacts between their small/medium-sized firms and those in the developing countries. There is a need to offer positive encouragement to co-operation between small firms in developed countries and particularly between firms in the developing countries themselves.

22. The First Panel advised UNIDO to pursue arrangements, whereby the range of contacts for the basic need of training in the maintenance and repair of agricultural machinery could be widened, and firms in developed countries be persuaded to place part of their facilities at the disposal of developed countries on a regular basis. The idea needs further discussion particularly in view of the work of other organisations concerned with industrial

training including for example the responsibility of UNESCO for vocational training. There is also the work which UNIDO has initiated at the request of the Industrial Development Board to examine ways of maximising the use of existing industrial manpower training facilities generally. The Global Preparatory Meeting is expected to clarify what is desirable and practicable in relation to agricultural machinery, considering questions such as - what degree of education, skill and experience would trainees need to begin with? How specialised should the training courses be from the point of view of engineering skill? How specialised on machinery for individual crops? Is the training most appropriately done in the producing countries' facilities or in national or regional units in developing countries?

B. Evolution of more advanced activities

- (1) The formulation of a strategic plan for the development of the agricultural machinery industry as part of each country's general industrialization programme, considering the relations among the required production of food and other crops, the level of mechanization, the agricultural techniques and the machinery requirements assessed on the national, regional and climatic zonal level.

23. In most developing countries agriculture occupies a dominant position in the economy, and in its role as provider of food impinges on the life of the entire population. A purposive expansion of the agricultural machinery industry is the last link in a long chain of considerations covering population growth, nutrition standards, types of crop and agricultural methods, land tenure, and the extent of mechanisation. Each of these elements requires a profound investigation in the light of the social, political and economic realities in each country, aided by all relevant international surveys such as the Conference on Agrarian Reform organised by the Food and Agriculture Organisation.

24. Both Panels therefore laid great emphasis on the need for a strategic plan that would relate the agricultural machinery production programme to all the other aspects of agricultural development in a country. The strategy should be based on the forward projections of agricultural production in the immediate and medium term periods. The crop production plans should be matched with the expected level of appropriate mechanization. The data should lead to a quantitative and qualitative evaluation of the country's requirements for agricultural machinery, which could then be classified into categories related to technical sophistication and the complexity of the equipment required for its manufacture. The machinery requirements of the agricultural sector might be further refined to involve a proper selection of tools and implements together with improvements to existing designs and the materials used.

25. The strategy ought to take account of all relevant factors such as the effect on the balance of payments of local production of farm equipment as compared with importing, the impetus to general industrialization and the need for adequate training and infrastructure. The social implications of changes in land tenure and utilisation might act as a constraint on the speed at which progress could be made. The aims should therefore be realistic. Each country should look first to its own needs and frame its programme for agricultural machinery in relation to its own conditions and reflecting its own potential. The decisions made at the agricultural, political and industrial levels should lead to the adoption of a technical model appropriate to local conditions for the manufacture of selected categories of agricultural machinery.

26. Both Panels saw the strategic plan as the starting point for a sound agricultural machinery policy at both local and regional levels. They also saw in it the strands of continuity of policy that would foster the steady growth of the industry. In its advanced, sophisticated, stages the strategy would link up with international arrangements including long-term associations with the producers of complex equipment in developed countries as outlined in Group C below.

- (ii) The creation of Agricultural Machinery Committees and Design and Development Centres at national and regional levels to inspire and guide a continuing programme of work on the improvement in production methods for existing types of equipment and the evolution of new types of agricultural machines needed for the specific conditions in developing countries.

27. A strategic plan would require countries to recognise the many factors influencing the nature of agricultural machinery development, and to make a conscious effort to bridge the gap which may exist between the various interests in the rural-agricultural and industrial sectors. The Second Panel made detailed proposals for a Committee at national level with a policy making role. The Committee would have representatives of the following: Ministries of Agriculture, Industry, Research and Economic affairs; the agricultural extension service; the agricultural machinery industry. The function of the Committee would be to bring together all the threads of an agricultural machinery policy at the local and national levels. It should oversee the strategic plan, provide objectives for a National Design and Development Centre and seek to co-ordinate policies at the regional level between countries with similar ecological conditions.

28. Much of the agricultural equipment now in use in developing countries has proved itself over many years as functionally suited to the purposes required. However there remain opportunities for helping developing countries to produce such equipment more efficiently and economically by using modern manufacturing techniques, and this aspect of industrial progress should receive attention simultaneously with the attempt to evolve new designs.

29. The source of innovation in agricultural machinery has been variously attributed to the farmer, the research sector and industry, but in the main it is industry which can carry through ideas from concept to commercialization. The Second Panel advised UNIDO to encourage the developing countries to adopt consistent long term policies to undertake work on the design and development of agricultural machinery, using teams of agronomists, agricultural engineers and industrialists. Design and development would best be carried

out locally because of the importance of agronomic, climatic and socio-economic conditions as factors affecting the acceptance of machines by farmers. Design and development must therefore start from an analysis of the problems of the farmers in cultivating crops, and lead to testing under local conditions to prove to the farmers that the machines were effective and robust. The production of machinery even in the simple categories (i) and (ii) can benefit from attention to design and to the selection of materials and production methods.

30. The Second Panel noted that most of the existing International Agricultural Research Institutes, which carry out successfully a wide range of crop and livestock research, do not devote much of their effort to design and development of equipment. It emphasized the importance for them to balance their programmes by devoting resources to the design of new and adapted machines suitable for manufacture and use in the developing countries. The Agricultural Machinery Committees would be well placed to provide the necessary stimulus.

31. UNIDO can offer positive help by setting up a regular series of contacts with the International Agricultural Research Institutes to press the importance of machinery development in their programmes of work.

C. Bilateral and Regional measures

- (1) The fostering of long-term arrangements between the exporters of more complex agricultural machines in developed countries and their users in developing countries to ensure that the developing countries learn to operate, maintain, repair and eventually to build the more complex machines.

32. The more complex items of agricultural machinery which are already being imported and used in a developing country provide a most appropriate target for local manufacture. The Second Panel visualized a partnership over an extended period of time between a manufacturer in a developed country and users in a developing country, with the eventual aim of local manufacture to the fullest extent practicable.

33. The scope of such an arrangement should first cover the supply of equipment in the initial stages together with adequate training of operators to ensure that the developing countries secure the fullest possible benefit from its use. The contract should then cover training in the repair

and maintenance of the equipment; the local production of spare parts; the further production of new components preparatory to assembly of the complete equipment, not excluding the possibility of having to import regularly some of the highly engineered components.

34. In this connection there have been reports that imported machines, which were satisfactory when new, were lying idle in developing countries for lack of spare parts and simple maintenance. Although the problem is an old one, its urgency has not diminished. A solution to the operation and maintenance problem involves a long term commitment and investment beyond that contained in the simple import of, for example, a batch of tractors.

35. UNIDO may be able to give practical help in drafting terms and conditions of a suitable contract providing for the satisfactory evolution of skills and facilities in developing countries.

- (11) The assessment of the need for regional units for the production and marketing of agricultural machinery to secure economies of scale for a number of neighbouring countries, which individually offer too small a market.

While the manufacture of agricultural machinery in categories (1) and (11) can normally be organized within a local and national market, the production of the more complex types needs larger factory installations which in appropriate circumstances might be shared among a number of countries in a region to economise in finance and skilled manpower.

36. The First Panel heard of the action which had been taken by some developing countries in entering the manufacture of tractors. Among the problems to be overcome were the high costs involved in installing capital equipment, of skilled expatriate management, of training operatives abroad, of production rates lower than the plant could eventually achieve. Other difficulties concerned the provision of engineering services, foundries, forges and material supplies. These factors resulted in many cases in the cost of locally produced items being substantially more than of imported items. The extra costs were accepted in the short term as being a necessary part of the learning process leading to efficient industrialization, improved agricultural production and an eventual saving in foreign exchange, but spreading the costs over a region would help to reduce them.

37. The First Panel also heard of the difficulties experienced by licensees producing tractors for sale in a regional market. Difficulties arose as the result of changes in design imposed by the licensors. Tractor manufacturers in developing countries could co-operate in exchanging their experiences in this field in order to decide whether they need to follow such changes or to evolve designs suitable to their own conditions leading to a degree of regional standardization.

38. The Second Panel noted with interest the successful regional experience of SISCOMA in Senegal, which has operated for a number of years supplying relatively simple equipment to Senegalese farmers and to a group of neighbouring countries in West Africa.

D. Finance and Investment Promotion

- (i) The consideration of international financial and contract conditions related to the manufacture and sale of agricultural machinery.

39. Two main capital requirements were identified for the agricultural machinery industry: to create a market, and to establish and sustain manufacturing. Farm machinery was different from most of the other agricultural inputs, in that machinery was usually written off over 5-8 years, and to this extent required special treatment in comparison with seeds, fertilizers and herbicides, for which finance was required annually.

40. It was important to secure for the purchasers of machinery a fair return on their investment by guarantees of good performance and a supply of spare parts for the expected life of the machine.

41. Small locally based manufacturing and repair units making equipment in categories (i) and (ii) could be financed from the funds made available for rural industrial development. The main problem was seen to be one of securing as good institutional arrangements for such entrepreneurs as for those involved in larger undertakings e.g. access to credit at relatively low rates of interest, training facilities, protected market opportunities, and adequate supplies of materials.

42. Factories making equipment in categories (iii) and (iv) required special consideration in order to make efficient use of the larger capital invested in them. At this level economies of scale should be achieved and it was worth examining the financial benefits to be derived from regional

co-operation in both production and marketing, based either on a measure of specialisation by individual countries on the production of complete machines, or on the subdivision of production into components to be assembled at a regional centre. Factories established to manufacture machinery in categories (iii) and (iv) may carry a long term commitment for foreign exchange for certain imported items, which could still account for 50 per cent of the input even after 10 years operation. In these circumstances the contractual arrangements with suppliers in developed countries should be negotiated in such a way as to ensure that the developing countries should steadily advance their manufacturing abilities and were not put at a disadvantage by a permanent need to import.

43. Financial contracts between partners in developed and developing countries should provide benefit for both sides. It would help all parties concerned in the establishment of manufacturing units in developing countries if the financial criteria to be met were spelled out clearly from the beginning and were held constant throughout the term of a contract. This referred to items such as proportion of local manufacture to be included; the proportion of local financial participation; the permissible dividend payments and the terms of licensing.

44. The partner in the developed country should take into account the special nature of the needs of developing countries for the growth of industry and for the training of manpower. Contracts should provide for the possibility of direct co-operation and exchange of parts between licensees in the developing countries. There should be a reasonable expectation of the continuity of local policies, within which the benefits of the contract might be realized by all parties concerned.



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