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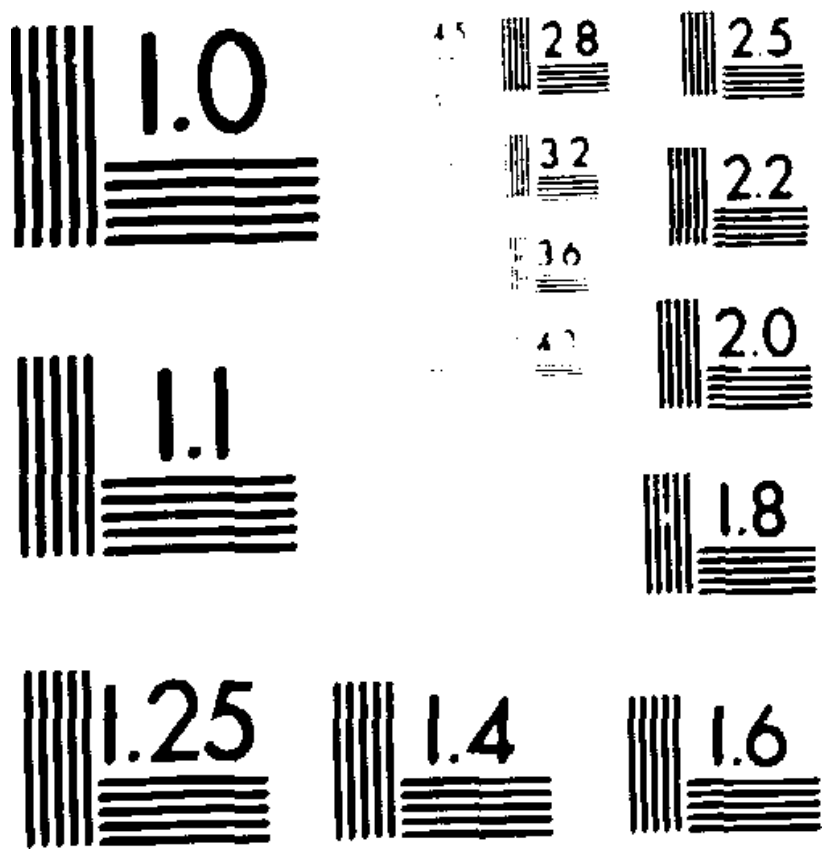

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Expert Group Meeting on the Development of
Multi-purpose Agricultural Machinery Plants

Guangzhou, P.R. of China, 13-18 November 1984

REPORT *

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I. INTRODUCTION

1. The Expert Group Meeting on the Development of Multi-purpose Agricultural Machinery Plants was convened at Guangzhou, People's Republic of China, from 13 to 18 November 1984. It was organized by UNIDO in co-operation with the Government of the People's Republic of China, as a direct follow-up activity of the Second Consultation on the Agricultural Machinery Industry, held in Vienna, Austria, 17-21 October 1983.[1/] The Expert Group Meeting was attended by 13 participants from 11 countries, a representative of FAO and a representative of the ECA/UNIDO Joint Industry Division (see Annex 1).

2. The multi-purpose approach to the manufacture of agricultural machinery had been recognized as a key issue at several meetings organized by UNIDO in the fields of agricultural machinery and capital goods. In particular, the First Regional Consultation on the Agricultural Machinery Industry in Africa, held in Addis Ababa, Ethiopia, from 5 to 9 April 1982[2/], adopted a Global Plan of Action with a special programme for the development of African capacities of design and manufacture of adapted agricultural and rural equipment with emphasis on new forms of manufacture (multi-purpose production units). As a follow-up to that Regional Consultation, a Workshop on the Design and Development of Agricultural Equipment in Africa was organized in Cairo, Egypt, from 17 to 28 October 1982, to discuss the characteristics of decentralized small-scale and multi-purpose workshops for the manufacture and maintenance of simple agricultural equipment.[3/]

3. A main conclusion of the Second Consultation on the Agricultural Machinery Industry was the recognition of "the validity and applicability of the concept of the multi-purpose production units for the manufacture of agricultural and capital goods equipment in developing countries"[4/]. Along those lines,

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1/ See report of the Second Consultation on the Agricultural Machinery Industry, ID/307, para.12.

2/ See report on the First Regional Consultation Meeting on the Agricultural Machinery Industry, ID/285.

3/ See report of the Workshop on Design and Development of Agricultural Equipment in Africa, UNIDO/PC/85.

4/ See ID/307, para.10.

the Consultation recommended the establishment of an international group of experts whose main responsibility would be "to work out particularly the details of the application of the multi-product approach and demonstrate practical ways of implementing this approach by establishing pilot multi-purpose plants, by up-grading utilization of existing plants and adapting, as far as possible, techniques and products"[5/].

4. In order to contribute to the implementation of that recommendation, the Government of the People's Republic of China offered to host the first meeting of the group of experts. UNIDO prepared a project proposal entitled "Promotion of the Multi-Purpose Approach to the Manufacture of Agricultural Machinery and Other Related Capital Goods", which was approved under UNIDF financing with a Chinese contribution[6/]. That project enabled not only the preparation and organization of the first meeting of the group of experts, but also foresaw the implementation of concrete follow-up actions in line with the recommendations of the meeting.

5. The main objectives of the Expert Group Meeting were:

- To discuss and define the concepts and characteristics of the multi-purpose approach;
- To exchange information and ideas on practical experiences of various countries and regions gained in the promotion and operation of multi-purpose agricultural machinery plants, with special emphasis on the case of the People's Republic of China. The various inter-related critical aspects of the multi-purpose approach should be considered on the basis of the diversity of national experiences and experts' knowledge;
- To identify the main actions to be taken by developing countries individually and/or within the framework of South/South co-operation, by the international community and by UNIDO, to promote the establishment of multi-purpose plants or to rehabilitate/reinforce existing plants (Plan of Action).

6. Several documents were prepared for the meeting (see Annex 2). Most important among them were the studies prepared by two high-level experts from the Ministry of Machine Building, Beijing, on experiences in the development and design of multi-purpose agricultural machinery plants. The discussion

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5/ ID/307, para. 12(a).
6/ Project UC-UD/GLO/84/127.

paper prepared by UNIDO[7/] was based on a study entitled "Essay on the multi-purpose production plants - Theoretical considerations and practical applications", undertaken by a UNIDO consultant on the basis of long-term research on the Analysis of Technological Complexity (ATC) in the capital goods industries.

7. UNIDO warmly thanks the Government of the People's Republic of China, in particular the representatives of the Ministry of Machine Building and of the Chinese Academy of Agricultural Mechanization Sciences (CAAMS), as well as the representative of UNIDO in Beijing, for all their efforts in organizing and holding the Expert Group Meeting.

II. MAIN CONCLUSIONS RELATED TO THE CONCEPT AND CHARACTERISTICS OF MULTI-PURPOSE PRODUCTION OF AGRICULTURAL MACHINERY

Introduction

8. The following attempts to summarize the main ideas and the consensus which emerged from the meeting on the concept of multi-purpose production of agricultural machinery so as to provide a useful technical reference for the benefit of future activities.

Conclusions

9. In line with the conclusions and recommendations adopted by the Second Consultation on the Agricultural Machinery Industry, Vienna, October 1983[8/], the group of experts recognized the advantages of promoting the multi-purpose approach for the manufacture of agricultural machinery, rural equipment and other related capital goods in many developing countries.

7/ ID/WG.449/1, "The Conceptual Framework and Aspects of Multi-purpose Production of Engineering and Agricultural Machinery Products - Some Proposals by UNIDO"

8/ ID/307, para.12.

10. As clearly demonstrated by the information given on the wide and successful Chinese experience, as well as on other national experiences, this approach could contribute to solving an important problem: the inability of some classical patterns of specialized industrial production to satisfy the diversified requirements of farmers and to make the manufacturing units profitable.

11. Those deficiencies were due to several technical, economic and social factors, in particular the rigidity of the production process and its inability to adapt to the changes and to the small size of the market, the insufficient adaptation of the complexity of the products and of the processes to the prevailing conditions and resources of the recipient countries.

12. It was recognized that the multi-purpose approach is neither universal nor uniform, nor without limitation. The necessity and practical modalities of that approach varied greatly in function of the existing conditions in each country or region, in particular according to the sizes of the markets and the existing technological and industrial levels.

13. The participants proposed the following concept and technical rationale of the multi-purpose approach to the manufacture of agricultural machinery, and related capital goods:

- A multi-purpose agricultural machinery plant was an enterprise which produced various products and services in the field of agricultural machinery, rural development and other related capital goods, embracing the areas of product adaptation/design and development, manufacturing, marketing, after-sales service, repair and maintenance;

- The activities should be geared mainly towards the satisfaction of the needs of the farmers and the modernization of the rural sector, in nature and quality;

- The manpower, equipment and manufacturing processes should be flexible enough to permit adjustment to the variations of the market demands, and to the existing national/local technological capabilities;

- There should be a strong coherence between the choices of the markets/products and the manufacturing processes and equipment so as to ensure that the best and most profitable use is made of the available equipment and manpower[9/];

- Multi-purpose production will contribute to raising the technological level of the manpower (training function).

14. The "management of complexity" necessitated by the diversity of products/services required multi-purpose and highly qualified managers and technical staff. However, it was also essential that multi-purpose plants be designed, operated and developed according to rational and precise rules. In particular, the strategy of the enterprise should be developed around certain common dominant and homogeneous characteristics which were mainly related to the available process and equipment, to the know-how and skills of manpower and to the market.

15. Product development constituted a central problem and involved various agents of the industrial and agricultural national system. In most cases, some design capabilities were necessary in the plant itself. The critical issue, however, was the analysis of the needs and the satisfaction of the specific requirements of the users, i.e. detailed market analysis in a dynamic environment.

16. The multi-purpose concept was one of evolution. In fact, multi-purpose agricultural machinery plants could play an active role in the strengthening/establishment of specialized manufacturing capacities, i.e. by means of sub-contracting, when the conditions were met for large-scale production of certain products. They had a high potential for contributing to the overall development of engineering and capital goods industries.

17. The promotion of multi-purpose agricultural machinery plants needed strong support from the national authorities, in particular at the beginning of their operation, in order to overcome some general, and also some specific constraints, in particular as regards the availability of raw materials, design of products, training and financing.

9/ Each machine should be used beyond a certain "critical mass", that is beyond the minimum work load (measured in terms of hours of use or volume of production) so as to ensure a reasonable productivity of machine and personnel and to cover indirect costs involved.

III. RECOMMENDATIONS

18. General recommendations

To promote effectively the multi-purpose approach in the manufacturing of agricultural machinery, it was recommended that UNIDO play a catalytic role in connection with the following:

a) Encouraging Governments to upgrade and rehabilitate existing agricultural machinery manufacturing units having low machinery utilization into multi-purpose production units or to establish new multi-purpose units. Special emphasis should be directed at the diagnosis of existing enterprises, identification of rural needs, design of new products and improvement of technical and managerial capabilities.

b) Promoting the multi-purpose approach, which should, as much as possible, be designed within the framework of the country's integrated agricultural mechanization and manufacturing policies, strategies and programmes. Specific fiscal and economic measures should be adopted, such as tax and tariff incentives, foreign exchange allocations, credit facilities and others.

c) Encouraging existing institutions at the national, regional and sub-regional levels (e.g. Regional Network for Agricultural Machinery (RNAM) in Asia, African Regional Centre for Engineering Design and Manufacturing (ARCEDEM) in Africa) working in the field of design of engineering products, training of managers and technical staff, to develop specific programmes for the promotion of multi-purpose agricultural machinery plants.

d) Strengthening ECDC and TCDC programmes by organizing training activities (study tours, in-plant training) and by exchange of information and experiences (in particular with the People's Republic of China).

19. Proposed action programme

UNIDO should:

a) on the basis of the papers prepared by the participants, collect additional information for preparing guidelines on the multi-purpose approach in the agricultural machinery industry for the use of industrial planners, engineering firms, manufacturers, project managers and others;

b) upon request of developing countries, and in co-operation with FAO, provide assistance for the development of an integrated agricultural mechanization and local manufacturing strategy, which should include the multi-purpose approach on the production of agricultural machinery;

c) actively promote technology transfer and information exchange in the agricultural machinery sector through interregional and regional co-operation and encourage manufacturing projects through development of local R&D as well as through licensing and joint ventures;

d) organize an interregional workshop in 1986 to exchange experiences and information on the establishment/rehabilitation and operation of multi-purpose agricultural machinery plants in order to promote the development of the agricultural machinery industry and co-operation among developing countries;

e) co-operate closely with the United Nations Economic Commissions in the implementation of specific regional, sub-regional and national programmes for the promotion of the multi-purpose approach in the agricultural machinery industry, in line with the recommendations made hereafter.

20. Regional recommendations

On the basis of the regional group discussions, the Expert Group Meeting adopted the following recommendations:

A. Africa

a) ECA/UNIDO Engineering Industry Development Programme should include the promotion of multi-purpose production units.

b) UNIDO/ECA should promote intra-African co-operation through the exchange of information and prototypes.

c) In order to promote multi-purpose production of agricultural machinery, the African Regional Centre for Engineering Design and Manufacturing (ARCEDEM), in close co-operation with UNIDO, should send a mission to each member country to:

   i) Identify agricultural machinery, tools, equipment and engineering products suitable for multi-purpose production;

   ii) Prepare detailed product and manufacturing designs for prototype manufactures at the national level. National design centres or other appropriate institutions at the national level should be given priority support in that respect;

   iii) Assist member countries to take appropriate policy measures to promote local production so that import substitution could be achieved as early as possible.

d) ARCEDEM, in close co-operation with UNIDO and ECA, should organize more extensively training courses in product design, adaptation and manufacturing techniques for the African industries, particularly for multi-purpose production units.

e) UNIDO, in co-operation with ARCEDEM and ECA, should organize comprehensive training programmes to include workshops, study tours and in-plant training for multi-purpose production.

f) UNIDO should organize specific training programmes to upgrade critical skills needed, particularly in management, engineering design, tool and dye design/production, foundry technology, metallurgy, quality control and maintenance.

g) UNIDO and ECA should carry out surveys in the African countries in order to identify areas of internal and inter-country subcontracting arrangements for multi-purpose production.

B. Asia

h) UNIDO should send a team of experts to selected countries to identify the present situation, including the needs and gaps in the field of agricultural machinery, and to promote the multi-purpose approach by advising on managerial, organizational and technical aspects of the plants visited. The team of experts should also prepare a project document for the long-term promotion of multi-purpose agricultural machinery plants at the regional and national levels. That work would contribute to UNIDO's guidelines on the promotion of multi-purpose agricultural machinery plants.

C. Latin America

i) UNIDO should conduct surveys in selected countries on available industrial capacity in engineering industries in order to identify the potential for adopting the multi-purpose approach.

j) Upon request of individual countries, UNIDO, in co-operation with FAO, should provide assistance for the formulation or evaluation of integrated agricultural mechanization and industrial policies and strategies.

k) UNIDO and ECLAC, in co-operation with FAO, should promote the establishment/upgrading of design and development centres specialized in agricultural machinery. Special emphasis should be directed towards the strengthening of linkages with manufacturers.

l) Exchange of experience and information among these centres and manufacturers should also be promoted.

IV. ORGANIZATION OF THE MEETING

Opening of the Expert Group Meeting

21. The Meeting was first addressed by Mr. A.W. Sissingh, UNIDO Senior Industrial Development Field Adviser (SIDFA) in Beijing. He pointed out that the UNDP office in Beijing was opened in 1977, but that even before there had been co-operation between the United Nations, in particular UNIDO, and the People's Republic of China. That co-operation had often taken place within the framework of training programmes, particularly in the field of agricultural machinery. China had gained much experience in that field and considered that its experience could be relevant to other developing countries. Mr. Sissingh thanked the Chinese hosts for making it possible to hold the Expert Group Meeting in China.

22. Mr. G.R. Latortue, Head of UNIDO's Negotiations Branch, thanked the participants for accepting UNIDO's invitation and welcomed in particular the representative of FAO. He emphasized UNIDO's strong will to work in close co-operation with FAO. He expressed his gratitude to the Government of the People's Republic of China for the planning and organization of the Meeting. He explained that the participating countries had been chosen in order to guarantee the representation of different levels of development and different economic systems. The experts could certainly learn from China's experience with multi-purpose plants in the agricultural machinery industry.

23. On behalf of the Ministry of Machine Building Industry and the Guangdong Province, Mr. Sun Yi extended a warm welcome to the experts. He said that although the machine building industry was already well developed in the Guangdong province, there still remained a long way to go. He hoped that the participants would get a better idea of the Chinese approach after visiting the multi-purpose agricultural machinery plants in the Guangdong province. He requested the experts to express their personal opinions since China was still a developing country and could certainly benefit from other countries' experience. He wished the Meeting much success.

Plant visits

24. To illustrate the Chinese experience with multi-purpose agricultural machinery plants, the Chinese authorities had organized field visits to three representative plants in the Guangdong province, i.e.:

- Guangdong Agricultural Machinery Plant,
- The Second Agricultural Machinery Factory in Shunde,
- The Third Agricultural Machinery Plant in Zhongshan.

25. All of these plants had been reorganized to become multi-purpose plants several years ago. Each of them consists of several workshops, like foundry and forge, and had its proper design and development unit. Of particular interest was the boat-type tractor produced at the Third Agricultural Machinery Plant in Zhongshan; it was developed for use in deep soil water fields, was easy to operate, durable and cheap. In all the plants the multi-purpose approach has proven to be successful.

V. SUMMARY OF DISCUSSION

Introduction

26. The subject of the Expert Group Meeting was introduced with a presentation of the Chinese experience by Mr. Wang Wanjun and Mr. Liu Hong-shu, based on their two case studies[10/]. The main discussion was organized around the following selected issues, i.e.:

Issue 1: The problematics of multi-purpose agricultural machinery plants
Issue 2: The technical rationale of the multi-purpose approach
Issue 3: Product development

10/ ID/WG.449/3, "Experiences in the Development of Multi-purpose Agricultural Machinery Plants" and ID/WG.449/2, "Design and Study of Multi-purpose Agricultural Machinery Plants".

Issue 4: Managerial aspects of multi-purpose plants

Issue 5: Other critical aspects for the successful functioning of a multi-purpose plant

Issue 6: The establishment of multi-purpose agricultural machinery plants

Issue 7: The rehabilitation and/or transformation of existing plants into efficient multi-purpose units

The Chinese experience:

27. Mr. Wang's intervention demonstrated that multi-purpose production of agricultural machinery was wide-spread and dynamic in China, with approximately 2000 multi-purpose plants at the county level alone. Those plants were not only multi-product, but multi-service, oriented towards satisfying the priority needs of the farmers working in their area. They often began as small co-operative blacksmith workshops, primarily engaged in repair and maintenance activities. The multi-purpose approach was a matter of necessity in the agricultural machinery industry at the county level because of the diversity of the farmers' needs. After implementation of the job responsibility system, the farmers' production activities had been expanded from crop-planting to almost all sectors of rural construction and industry. For that reason, the agricultural machinery plant, besides making production of agricultural machinery its top priority, had to produce other capital goods to meet the rural needs, and at the same time, make the best use of the production facilities and manpower available. Agricultural machinery plants which had handled the multi-purpose concept well, had benefitted both farmers and plants. The multi-purpose approach adopted for the operation of an agricultural machinery plant would, of course, vary according to the local conditions. The development of specialized units for the production of key parts and components would enable the multi-purpose plant to produce a variety of products with higher quality at lower cost. In order to construct and run a multi-purpose agricultural machinery plant successfully, favourable Government policy, planning and financial support were needed. Moreover, facilities and personnel had to be chosen with a view to their flexibility and capability to deal with changing requirements.

28. Mr. Liu gave an outline of his paper on the design of a small- and a medium-scale multi-purpose agricultural machinery plant. He said that those types of plant could be considered as a starting point for building-up a national agricultural machinery industry, but they needed a very careful approach in their design, taking into consideration the various local conditions. Some basic aspects should be emphasized in each step of the design process. In particular, the plant should be equipped with universal machines and a powerful "second line" would increase the self-reliance of the plant. The plant lay-out and its facilities had to be flexible for further expansion. The workers and technicians ought to be experts in one field and good at many. A feasibility study had to be carried out to ensure the future profitability of the plant. A solid backing of the local infrastructure was always crucial.

29. In response to questions raised by the participants after their presentations, Mr. Wang recalled, among other things, that the existing agricultural machinery mechanization level was still low in China. In the 1980s, the Chinese authorities had realized that it was not possible to implement a full mechanization policy and had switched to a more practical policy called selective mechanization policy. Its main charateristic was the broadening of the scope of mechanization. Another significant feature of that policy was the new responsibility system through which decisions as to what products were to be produced were no longer taken by a central institution but largely left to the management of the plants. The most important criteria for those decisions were the farmers' needs and the organization of the market. The new system also encouraged the grouping of farmers for the acquisition of costly equipment.

30. As to the relative importance of process and product factors, Mr. Wang said that the design of machines had to be in line with existing technologies and facilities. In that context the technical infrastructure at county level played an important role.

31. Mr. Liu explained that a major policy issue for existing plants was that they had to make a profit; non-profitable plants were closed down. Therefore, it was necessary to carry out pre-investment and feasibility

studies. In so far as the problem of vertical versus horizontal integration of multi-purpose versus basic infrastructure was concerned, the present trend in China was to discourage vertical integration and to encourage sub-contracting and proper balancing between large and small enterprises.

32. Mr. Wang said that the county-level factories had their own design and technology departments and that 10 per cent of the production was foreseen for spare parts. Almost all county-level factories in China had become multi-purpose plants.

Issue 1: The problematics of multi-purpose agricultural machinery plants

33. The UNIDO secretariat introduced the issue by recalling why and how the concept of multi-purpose production had been promoted by UNIDO for the development of agricultural machinery production in developing countries.[11/] That development was a necessity because developing countries accounted for less than 10 per cent of world production whilst representing more than 50 per cent of the world farming population. It had been noticed that on the one hand, enormous needs for agricultural and rural equipment existed but were not satisfied, and continuously aggravated food shortage and rural poverty in many parts of the world. On the other hand, when capacities of production existed, they often operated at low rates of utilization and faced difficulties, basically because they had been designed for specialized production in relatively high series, exceeding the requirements of the national market. In fact, in many countries, especially of small and medium size, the needs of the farmers and of the rural world in general were large in terms of variety but small in terms of quantity. Hence the double justification of multi-purpose agricultural machinery plants:

- to meet the diversified requirements of farmers (also for rural activities such as storage, transport, irrigation, construction etc.);
- to form a nucleus for the starting/strengthening of the industrialization process in developing countries, mainly using local resources and manpower, and for the acquisition and mastery of effective adapted technologies.

11/ See ID/WG.449/1, Part II, page 4.

34. The multi-purpose approach corresponded to the search for a possible recombination of technological potentialities and resources into efficient production/manufacturing systems, capable of meeting the two basic objectives stated above. Because of the variety of countries, existing levels of development and agricultural needs, it was clear that there was no standard multi-purpose agricultural machinery plant nor was that approach universal and could solve all problems without having some difficulties of its own. On the contrary, there were various types of multi-purpose agricultural machinery plants characterized by different sizes, levels and types of technology, etc. However, multi-purpose agricultural machinery plants should have a certain technical rationale in common which UNIDO tried to identify/formalize[12/].

35. The participants discussed extensively the justification and concept of multi-purpose production, in particular the differences between horizontal and vertical integration, the modern/traditional character of the technologies used, the relation with the local industrial environment and the nature of the fundamental link between agricultural and industrial systems and policies. Multi-purpose production was recognized as an important and necessary form of production to benefit developing countries within the framework of a general manufacturing strategy which should, at the same time, consider the overall development of engineering and metal working industries, the upgrading of existing facilities and the strengthening of capabilities for adaptation and design of products/technologies of products.

36. The representative of FAO, Mr. von Hülst, Head of the Agricultural Engineering Service, Agricultural Services Division, expressed his appreciation of the good collaboration between UNIDO and FAO in the field of agricultural machinery. He emphasized the necessity for each country to design and implement a sound and realistic agricultural mechanization strategy. It was the role of the Governments to create an environment favourable to the success of such a policy and to contribute to the essential collaboration between farmers and manufacturers in particular, and between agriculture and industry in general. FAO was planning to conduct regional training workshops for policy makers in this field, starting in 1985 for East African countries. Mr. von Hülst recalled the historical development of farm

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12/ See ID/WG.449/1.

mechanization, starting with the blacksmith and evolving into a well functioning system associating farmers, local artisans, dealers and manufacturers, and stressed the importance that FA attaches to the concept of multi-farm use for the development of mechanization.

Issue 2: The technical rationale of the multi-purpose approach

37. In its introduction to the issue, the UNIDO secretariat explained that behind the diversity of forms and characteristics of multi-purpose plants and the flexibility that form of production was offering, it was necessary to identify precise parameters or rules for the design and operation of multi-purpose plants which would give them their technical coherence, enable them to exercise control over their various fields of activities and minimize their constraints (difficulties with the management, for example). The research carried out for UNIDO[13/] identified about 11 criteria for the multi-purpose concept and could serve as the basis of a technical discussion.

38. A practical example of multi-purpose production was presented by Mr. Ogier (France)[14/]. He explained that CINAM's[15/] approach was first to find out what could be done in rural Africa, knowing that the "dominant" technology was adapted to the big markets of developed countries but ultimately not to most of the needs of rural farmers and remote communities. The choice of technology had to be guided by the necessity of lowering the "critical mass" of production equipment, i.e. the amount beyond which such machinery could no longer be used economically, and by the intention of raising the technological level of the users. From that analysis, CINAM developed specific technologies, products and multi-purpose workshops, with 5 to 10 people, using certain technological "tricks" which permitted the production of certain equipment and maintenance activities without complex and costly machinery (lathes, milling machines or forged and casted pieces, etc.), using mainly a drilling machine, a mechanical saw and arc-welding.

13/ "Essay on the Multi-purpose Production Plants - Theoretical Considerations and Practical Applications", by F. Vidossich.

14/ See "Proposal of a Methodology for Initiating General Engineering Manufactures Using Appropriate Technologies", by Maurice Ogier.

15/ CINAM - Compagnie d'études industrielles et d'aménagement is a French engineering firm involved in "alternative technologies".

39. That experience was found interesting, although it was not applicable in all cases, since the choice of technology depended on various factors and greatly varied with each country. It was noticed that the availability of appropriate design support was a basic problem in many countries.

40. Mr. Amichi (Algeria) then spoke of the experience he had gained as manager of the multi-purpose agricultural machinery factory at Rouiba, Algiers.[16/] The performance of that plant had been recognized as being very successful by the Algerian Government which intended to introduce the multi-purpose approach more frequently. Mr. Amichi proposed some basic parameters on which the successful operation of a multi-purpose plant of this type depended: the adaptation of the plant configuration to the prevailing conditions in the country (size, technological level, existing infrastructures etc.); the careful choice of the basic products to be manufactured (often imported goods with a strong potential for local production); the size of the unit that ought to be small enough to avoid major management problems; the autonomy of the unit with regard to decisions on technical innovations and marketing; its role as a training centre for technical and management staff; the possibility of deconcentrating production to other industrial units (sub-contracting) in order to enable the development and production of other types of equipment; its role of catalyst of local/regional industrial development. The quality of the staff, in particular of the management, was a basic precondition for the success of the plant. According to the expert, the character of flexibility of the multi-purpose plant/industrial team was most important. In the case of Algeria, the plant had a pioneer function as regards the national industry because it demonstrated how the spontaneous demand for new products that are mainly imported could be met quickly and correctly.

16/ See "Design and Manufacturing of New Products in an Agricultural Machinery Plant based on the case of the Factory at Rouiba, Algeria", prepared by S. Amichi.

Issue 3: Product development

41. The issue was introduced by Mr. von Hülst, FAO, and Mr. Ela Evina (Cameroon). In his intervention, Mr. von Hülst emphasized the necessity of creating a favourable environment for the development of mechanization for the mutual interest and benefit of agriculture and industry, taking into consideration the specificity and complexity of that linkage which singularized agricultural machinery from the rest of the capital goods industries. It was very important to build an appropriate mechanization system with a good division of labour and co-operation between farmers, blacksmiths and rural workshops, dealers and manufacturers in each country. The most important actor remained the farmer, in particular for the development of new products. The farmer needed appropriate equipment, not a specific level or type, but simply adapted to his needs and to the local conditions.

42. Mr. Ela Evina proposed an analysis of the various key parameters which had to be taken into consideration when designing agricultural equipment, both from the point of view of the farmer and that of the manufacturer. It was up to the Government to coordinate those two views and requirements, in particular through designing and supporting a comprehensive national mechanization policy and through establishing a national mechanization centre which, inter alia, woud have the responsibility of translating the needs of the farmers into appropriately designed machinery, testing such equipment and providing the necessary extension-services. The importance of multi-purpose production of agricultural machinery depended directly on the existing levels of mechanization and industrialization in the country. The role of artisans remained essential, e.g. as regards their activities associated with medium centralized enterprises for ensuring the maintenance/assembly and manufacture of spare parts.

43. In the course of the discussion the importance of product development, research, development and design (R,D&D) was emphasized. Those services could be provided locally or by external sources, e.g. foreign or international institutions whose designs could be acquired through licensing or joint ventures, enabling the short-cutting of product development. Local design

through enterprises and national institutions was considered essential. Most of the manufacturers should have simple (re-)design capabilities. No matter where the design was made, it was crucial to carry out product development programmes, comprising extension and after-sales services, and where the latter could even become the key to further product development. It was recalled that, as far as the nature of the products was concerned, the multi-purpose units should consider dedicating themselves not only to agricultural machinery in the strict sense but to the whole spectrum of equipment for the rural economy. In view of the importance of the design issue, it was proposed that, with joint support, particularly of FAO and UNIDO, relevant programmes should be strengthened to create/expand networks of exchange of information on design, training and other relevant activities, so as to increase the product development capabilities in developing countries.

Issue 4: Managerial aspects of multi-purpose plants

44. The issue was introduced by Mr. Seghir (Algeria), and Mr. Karki (Nepal).

47. Mr. Seghir presented the basic conclusions drawn from the experience of the Rouiba factory[17/] with regard to personnel and management matters, namely:

- Design and development personnel should be given some degree of autonomy to be able to fully express their talents and skills;
- Production personnel should have some versatility to master different techniques commonly used in manufacturing;
- Inventories in a multi-purpose factory were much more difficult to manage and costs were much higher than in a classical factory;
- Overall management of a multi-purpose factory had to be sound in order to be able to face the constraints of flexibility, which was the keyword in such plants.

46. The Rouiba factory example had shown that the diversification could not keep pace with the increase of the different constraints mentioned above, which could quickly lead to a critical situation where management could get

17/ See also issue 2, page 18.

out of control. One way of avoiding such a situation was to continuously promote subcontracting activities with other manufacturers and to set up "satellite" workshops to handle simple products and parts to "relieve" the main factory.

47. Mr. Karki summarized the experience of the Agricultural Tools Factory Ltd. in Birgunj, Nepal.[18/] That plant, set up in 1965, was experiencing difficulties when major changes were introduced in 1982, in particular the concept of a flexible production system. Besides diversified production, R&D activities, after-sales services and market research were initiated, as well as subcontracting to blacksmiths. That in particular helped the company to deploy its experienced workers to produce more sophisticated and diversified products, such as storage and construction equipment and electrical hardware. All those efforts provided positive results and made the plant profitable. The management factor appeared crucial, in particular because the diversification of products could increase the production costs and make the planning of production more difficult. Moreover, structural problems had to be solved, in relation to the inadequate technical infrastructure (availability of raw materials, etc.).

48. Adequate profiles of managers were discussed by the participants. Since many companies started as small businesses, it was often necessary to compensate the lack of management experience of the technical owner by appropriate information and training on marketing, financing and management as a whole. In China, if technicians had to take managing responsibilities within a plant, their managing ability was recognized as one of the essential criteria. In big firms, where good technicians were responsible for those aspects, technical capability was less important than in small plants. However, the manager of a multi-purpose plant had to be multi-purpose himself and had to have the ability to be a leader and to take industrial risks, daily facing important decisions due to the diversity of products. In a plant producing rural equipment, the manager should be convinced of the importance

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18/ "Experience in the Operation of Multi-purpose Agricultural Machinery Plants in Nepal", by Amar B. Karki.

of the agricultural sector for his country, and should be interested in maintenance and after-sales services. Besides the manager himself, the role of good technicians, for example designers and tool makers, was again emphasized. Technical skills, as well as the capacity of organization, formed the basis for the success of multi-purpose plants and guaranteed that problems would be solved.

Issue 5: Other critical aspects for the successful functioning of a multi-purpose plant

49. The topic was introduced by Mr. Vargas (Venezuela).[19/] He recalled that a detailed analysis of those critical aspects based on the Chinese experience had been proposed by Mr. Wang Wanjun during his presentation.[20/] Proper design and site of the factory, solid backing of infrastructure, qualified labour force and management, appropriate training, quality control and standardization, existence of effective so-called "second-line"/support departments (for example for tool-making), after-sales services as well as strong support from the Government, were some of the critical key aspects for the successful functioning of a multi-purpose plant. The organization and financing of the market was also put forward by Mr. Vargas as a crucial factor which influenced directly the choice of products and production technologies of the plant. In the course of the discussion, it was reaffirmed that one of the objectives of multi-purpose production was to make even small quantities/series of production profitable. Training, standardization and quality control were again emphasized as being of crucial importance.

Issue 6: The establishment of multi-purpose agricultural machinery plants[21/]

50. The issue was introduced by Mr. Follosco (Philippines).[22/] He identified the proper choice of products to be manufactured as one of the major points in the framework of a generally market-oriented approach. For

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19/ "Some Considerations about the Agricultural Machinery and the Capital Goods Industries and the Concept of Multiproduction in Venezuela", by Carlos E. Vargas-Arenas.

20/ See ID/WG.449/3, and page 13 of this report.

21/ See also ID/WG.449/2, in particular the Sequence Flow Chart of MPAMP Design Works, represented in Annex 4.

22/ "The Establishment of Multi-product Manufacturing Plants - The Philippine Experience", by Ceferino L. Follosco.

each product, careful studies should be carried out. The product mix/diversification should be based on existing similarities in market demand, manufacturing processes, manpower skills and research and development.[23/] Careful attention had to be given also to the choice of the configuration of the plant, either towards a rather full integration (so-called vertical integration) or with more emphasis on the relations with other technical facilities (horizontal integration). While presenting his own experience based on successful subcontracting, Mr. Follosco indicated that each choice should be individual, taking into account the local conditions. The manufacturing technology also depended on those conditions, and on product sophistication. The right marketing system was also indispensable. Finally, the most important criteria identified for the success of a multi-purpose plant was the productivity in the areas of labour, materials, equipment and capital. He then recalled the significance of projects and programmes aimed at promoting agricultural machinery in developing countries and quoted the example of the RNAM project which associated 197 manufacturers from India, Indonesia, the Philippines and Thailand.

51. The UNIDO secretariat proposed a scheme for the design of a multi-purpose production plant. The necessary flexibility of the production process could be better achieved if the various activities/services involved, such as R&D department, prototype selection, process planning, marketing, etc. were fully communicating and cooperating.

Issue 7: The rehabilitation and/or tranformation of existing plants into efficient multi-purpose units

52. Mr. Mitra, Joint ECA/UNIDO Industry Division, highlighted the activities carried out in the past in connection with the promotion of multi-purpose production units in the African region. The overview of the activities of the African kegional Centre for Engineering Design and Manufacturing (ARCEDEM), located in Ibadan, Nigeria, further pinpointed present and future promotional activities of multi-purpose production units in the region. The role of ARCEDEM as a focal point for all activities in Africa would not only provide the member states with design and manufacturing information, but would also cater for the supply of prototypes for future production programmes of African

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23/ See ID/WG.449/1.

industries. He explained the trends of existing multi-purpose production units, their characteristics and role with regard to industrialization in Africa. In order to promote multi-purpose production units, he suggested an approach through the expansion of core engineering industries, upgrading of existing industries and the creation of institutional and technological interlinkages at the national levels. Intra-African and interregional co-operation would accelerate the expansion of multi-purpose production units in the African region.

53. In the discussion that followed, clear emphasis was put on the necessity of solving the problem of existing plants and of better satisfying the farmers' needs for agricultural machinery, whilst at the same time bearing in mind the temptation to produce for more profitable markets. That needed, in particular, expertise in design and production technology and governmental support.

54. It was reiterated that the failure/difficulties of many existing plants would vary and therefore should be investigated case by case. Multi-purpose production for agricultural machinery was one alternative but not a universal solution.

55. The importance of having a clear definition of the concept of multi-purpose production was reemphasized. In that respect, the concept of optimum utilization of the industrial capacity in the range of small series of production was put forward while stressing that multi-purpose production was not attached to any specific level of technology.

56. Developing countries should not give priority to the manufacture of too highly sophisticated machinery but rather import when necessary from other developing countries. Nevertheless, the multi-farm use system could permit the farmers to use more complex/costly machinery providing them with the power they require. The role of blacksmiths was again underlined.

57. In order to formulate concrete recommendations, the participants split into three groups representing Africa, Asia and Latin America.

59. The recommendations of those groups were adopted in the closing session of the Meeting.

ANNEX I

List of Participants

Algeria

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Philippines

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United Nations Economic Commission for Africa

Aloke Kumar Mitra, Regional Adviser Engineering Industries, Joint ECA/UNIDO Industry Division, P.O. Box 3005, Addis Ababa, Ethiopia

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Wang Hong, Senior Engineer, Chinese Academy of Agricultural Mechanization Sciences, Beijing

Zhang Wencan, Chief of Division, Guangdong Bureau of Machine Building Industry, Guangzhou

Guan Shaoning, Vice-Director, Guangdong Research Institute of Agricultural Machinery, Guangzhou

China, People's Republic of (Cont'd.)

Wu Shaoshan, Head of Division, Guangdong Research Institute of Agricultural Machinery, Guangzhou

Du Haitao, Engineer, Guangdong Research Institute of Agricultural Machinery, Guangzhou

Lin Hanwen, Director, Third Agricultural Machinery Factory in Zhongshan

ANNEX 2

List of documents

UNIDO papers discussed at the meeting

Background and Objectives of the Expert Group Meeting on the Development of Multi-purpose Agricultural Machinery Plants

The Conceptual Framework and Aspects of Multi-purpose Production of Engineering and Agricultural Machinery Products: Some Proposals by UNIDO, ID/WG.449/1

UNIDO background documents

Report of the First Consultation on the Agricultural Machinery Industry, Stresa (Italy), 15-19 October 1979, ID/239

Summary of the World-wide Study on the Agricultural Machinery Industry, UNIDO/ICIS.119/Add.2

Report of the First Regional Consultation on the Agricultural Machinery Industry in Africa, Addis Ababa (Ethiopia), 5-9 April 1982, ID/285

Agricultural Machinery and Rural Equipment in Africa - A New Approach for a Growing Crisis, UNIDO/IS.377

Report of the Workshop on Design and Development of Agricultural Equipment in Africa, Cairo (Egypt), 17-28 October 1982, UNIDO/PC.85

UNIDO/IS.379

Report of the Second Consultation on the Agricultural Machinery Industry, Vienna (Austria), 17-21 October 1983, ID/307

Establishment of a multi-purpose agricultural machinery plant, prepared by Wang Wanjun for UNIDO, beginning 1984

Appropriate Industrial Technology for Agricultural Machinery and Implementation - No. 4, ID/232/4

Papers prepared by the participants:

Wang Wanjun and Liu Hong-shu, Experiences in the Development of Multi-purpose Agricultural Machinery Plants (ID/WG.449/3)

Wang Wanjun and Liu Hong-shu, Design and Study of Multi-purpose Agricultural Machinery Plants (ID/WG.449/2)

S. Amichi, Design and Manufacturing of New Products in an Agricultrual Machinery Plant - The Case of the Agricultural Machinery Factory at Rouiba, Algeria

E.R. Ela Evina, La place des ateliers polyvalents dans l'industrialisation du machinisme agricole dans les pays en développement - Le cas du Cameroun

C.L. Follosco, The Establishment of Multi-product Manufacturing Plants - The Philippine Experience

Lin Hanwen, Some Experiences in Developing the Third Agricultural Machinery Factory in Zhongshan, Guangdong

A. Kanyilili, Some Recent Experiences in the Planning and Manufacturing of Farm Implements in Tanzania

A.B. Karki, Experience in the Operation of Multi-purpose Agricultural Machinery Plants in Nepal

A.K. Mitra, Some Aspects of the Promotion of Multi-purpose Production Units Manufacturing Engineering Products in the African Developing Countries

M. Ogier, Proposal of a Methodology for Initiating General Engineering Manufactures Using Appropriate Technologies

R. Orovic, Product Development and Design Problems Connected with Multi-purpose Agricultural Machinery Plants

C.E. Vargas-Arenas, Some Considerations about the Agricultural Machinery and the Capital Goods Industries and the Concept of Multiproduction in Venezuela

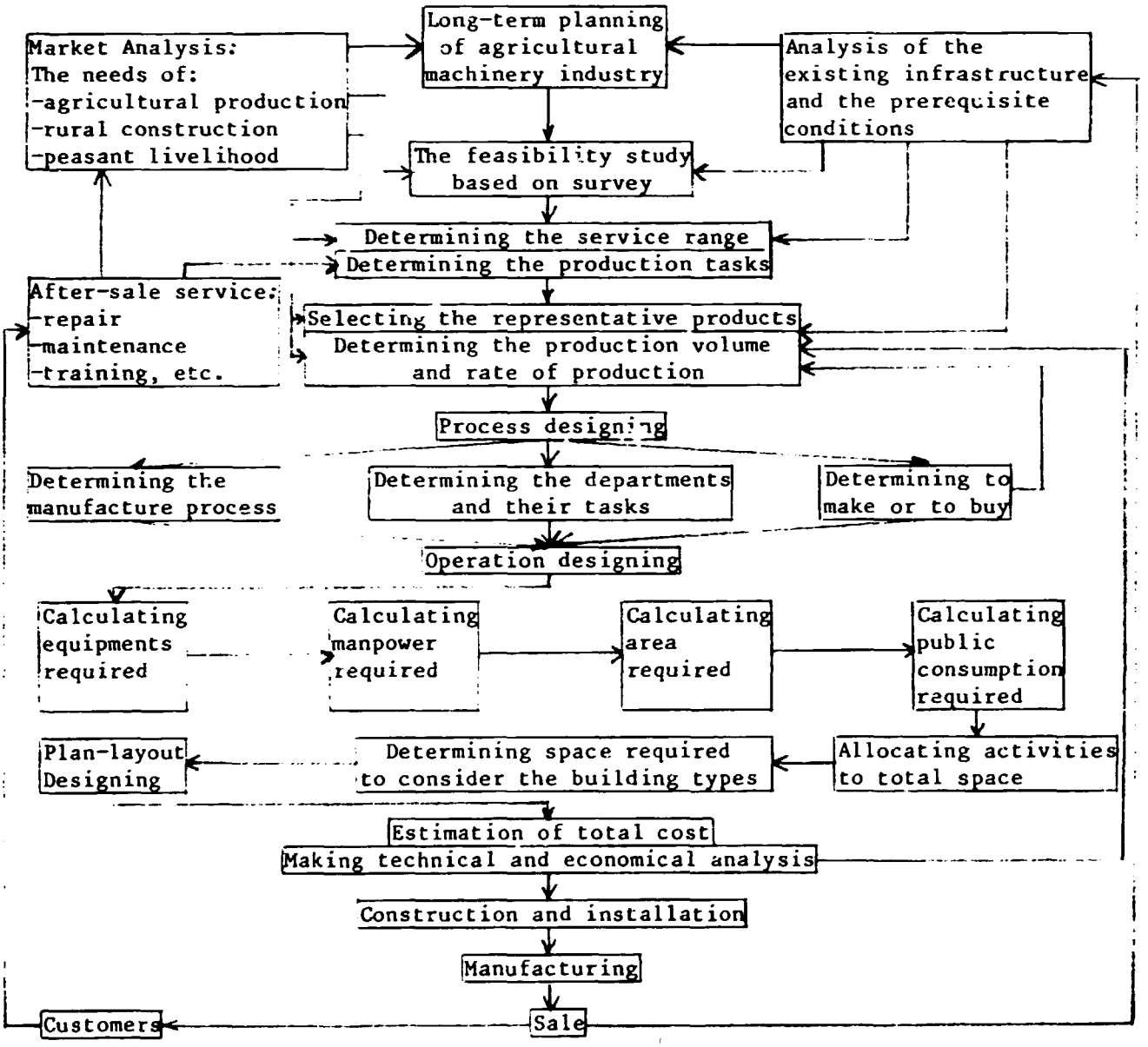
ANNEX 3

Agenda of the meeting

Monday, 12 November 1984	
20.00 - 21.00	Preparatory Meeting
Tuesday, 13 November 1984	
9.00 - 10.00	Opening session
10.30 - 12.00	"Experiences in the Development of Multi-purpose Agricultural Machinery Plants", by Mr. Wang Wanjun
13.30 - 15.00	"Design and Study of Multi-Purpose Agricultural Machinery Plants", by Mr. Liu Hong-shu
15.00 - 17.00	Issue 1: The problematics of multi-purpose production of agricultural machinery, by the UNIDO secretariat
18.00 - 20.00	Banquet
Wednesday, 14 November 1984	
8.00 - 12.00	Visit of the Guangdong Agricultural Machinery Plant and Sightseeing in Guangzhou
14.00 - 16.30	Issue 2: The technical rationale of the multi-purpose approach
Thursday, 15 November 1984	
9.30 - 11.30	Visit of the Agricultural Machinery Factory in Shunde Travel to Zhongshan
Friday, 16 November 1984	
8.00 - 11.30	Visit of the Third Agricultural Machinery Plant in Zhongshan
14.00 - 17.00	Issue 3: Product development Issue 4: Managerial aspects
19.30 - 21.00	Issue 5: Critical aspects for the successful functioning of a multi-purpose plant
Saturday, 17 November 1984	
8.30 - 12.00	Issue 6: The establishment of multi-purpose agricultural machinery plants Issue 7: The rehabilitation and/or transformation of existing plants into efficient multi-purpose units
14.00 - 17.00	Issue 8: Follow-up activites (Plan of Action)
19.30 - 21.00	Conclusions and recommendations
Sunday, 18 November 1984	
16.00	Closing session
18.00 - 20.00	Banquet

ANNEX 4

Sequence flow chart of design of multi-purpose agricultural machinery plants*



*Extract from ID/WG/449/2, Wang Wanjun and Liu Hong-shu, Design and Study of Multi-purpose Agricultural Machinery Plants.