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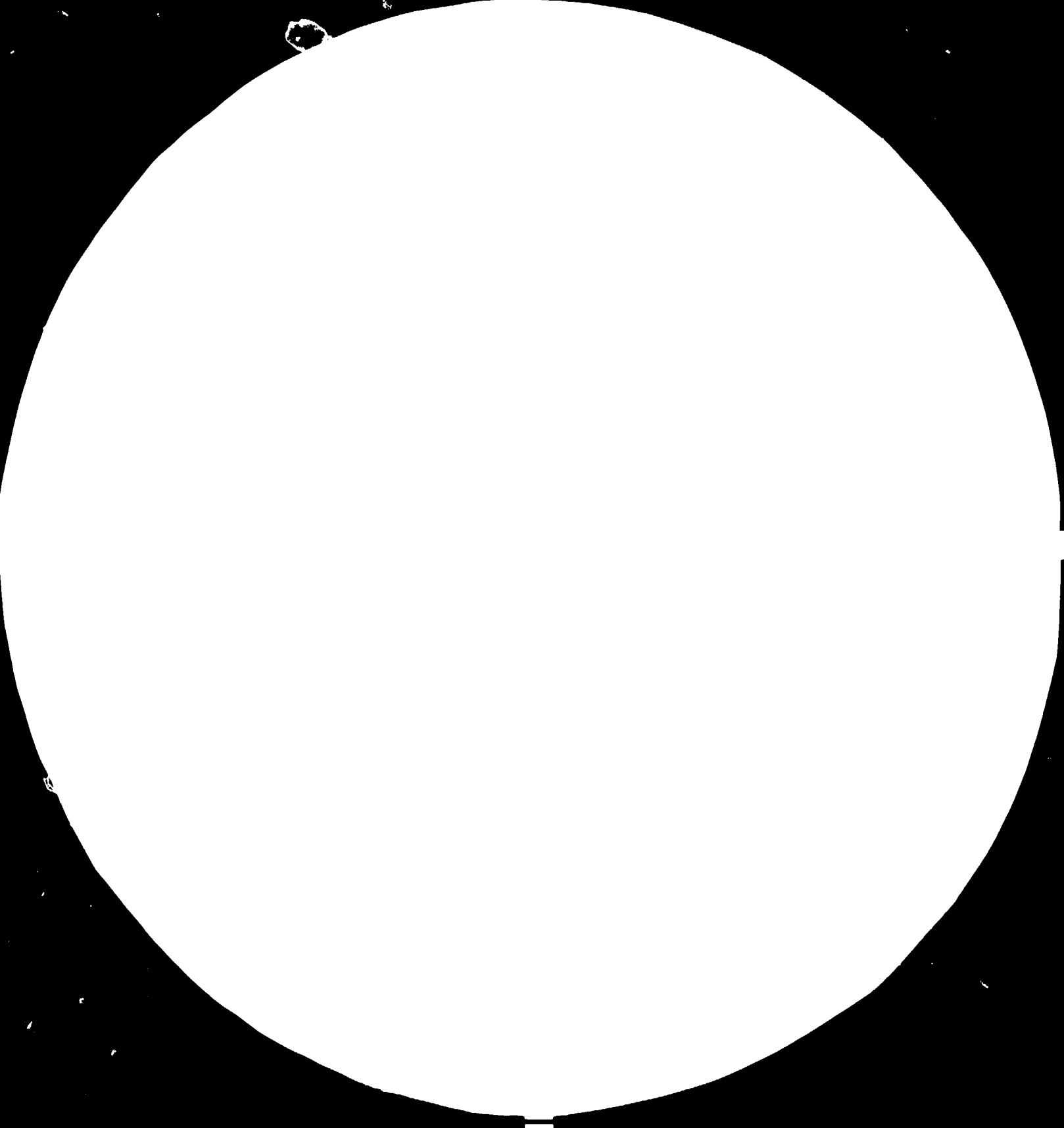
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ECONOMIC AND TECHNICAL CO-OPERATION  
AMONG DEVELOPING COUNTRIES FOR PROMOTING  
AGRICULTURAL MACHINERY INDUSTRY.

(First Draft).

Prepared by

WANG WANJUN

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1. INTRODUCTION

1.1 UNIDO's activities for promoting international co-operation on agricultural machinery industry:

One of the major functions of UNIDO is to provide assistance to developing countries in the promotion and acceleration of their industrialization, in particular in the development, expansion, modernization and operation of their industries, including agro-related industries and basic industries.

On promoting agricultural machinery industry, UNIDO has been proceeding numerous fruitful activities, such as the first and second Consultation Meeting on the Agricultural Machinery Industry, Regional Consultation Meeting on Agricultural Machinery Industry in Africa, Meeting on Exchange of Experiences and Co-operation Among Developing Countries in the Development of Agricultural Machinery Industry in Beijing, and lots of other regional, bilateral and multi-lateral activities concerning agricultural machinery industry have been carried out under the auspices of UNIDO or other organizations of United Nations.

One of the underlined issues, discussed, stressed and practiced in all these meetings or activities, is the strengthening of international co-operation for accelerating the agricultural machinery industry with the purpose to expediate the solution of or easing up of the food problems in the developing countries.

1.2 ECDC/TCDC as a suitable form for promoting agricultural machinery industry:

ECDC/TCDC activities passes some special characteristics or merits which any other forms of international co-operation do not have. The

developing countries have similar economic conditions and technical levels, and fact the similar kind of tasks in building-up industries for promoting agricultural production, They have to apply some forms of appropriate technology which might have been obsolete in developed countries. They understand each other's needs and have similar experience in dealing with the problems. So, the co-operation among the developing countries would be most direct, practical and acceptable to both sides.

1.3 China's capacity for continual participation in ECDC/TCDC to promote agricultural machinery industry:

Based on the principle of self-reliance, China has been developing agricultural machinery industry for more than 30 years. Before the revolution, China was a backward purely agricultural country, having practically no agricultural machinery industry at all. Now, thousands of agricultural machinery factories of different scales from ten to tens of thousands of personnel per factory, at different levels (national, provincial, county, commune and village level), produce agricultural machines of thousands of categories to meet the farmer's diversified requirements.

Accompanied with building-up agricultural machinery industry, China has set up many agricultural machinery institutions which are indispensable for continuous development of the industry, such as agricultural machinery research and development centres, experimental stations, test and evaluation centres, agricultural machinery colleges and professional high schools.

Since the beginning of the 1960's, China, in co-operation with other African and Asian developing countries, has trained hundreds of experts and sent out hundreds of specialists and built tons of agricultural machinery plants manufacturing tools and implements, and repairing tractors and automobiles.

So, China has the capacity of and has been carrying on numerous ECDC/TCDC activities.

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## 2. SOME FEASIBLE FORMS FOR ECDC/TCDC

The feasible forms for ECDC/TCDC are many and will be varied according to the practical conditions of the co-operation partners concerned. The following ones are presented, based on the capacity of and the experience concerning ECDC/TCDC activities in which China has participated.

### 2.1 Exchange of information and experiences:

2.1.1 Exchange of information pertinent to new products and research and development activities is the easiest way to obtain the materials which are valuable to the interested institutions.

It will suggest some ideas or some hints worthwhile to follow-up and eventually may lead to the solution of some problems. For example, the newsletter, published by RNAM on the new reaper designed by the Chinese Academy of Agricultural Mechanization Sciences (CAAMS) and adapted in co-operation with IRRI, has stimulated great interest of many engineers and resulted in copying or adaptation at least in 4-5 countries.

However, the status quo of agricultural machinery information exchange is far from being satisfactory. This might be due to the lack of necessary funds for translation, reproduction and dissemination. Another reason might be the lack of an authorized international coordinator to organize the job. Experience revealed that exchange of information on a voluntary basis does not last long. Probably UNIDO may be helpful in addressing the issue which will benefit almost all developing countries for developing their agricultural machines.

Just for reference, the national agricultural machinery institutions of China have published quite a few periodicals worthwhile recommending:

1. "Agricultural Machinery" - monthly, introduction of new products, correct operation and maintenance, repair techniques.
2. "Tractor Operator" - monthly, on the correct operation of different tractors, knowledge on repairing.
3. "Internal Combustion Engines" - monthly, research and development of various international combustion engines mainly used in agriculture.
4. "Research and Development of Tractors" - monthly.
5. "Pumps for Irrigation and Drainage" - monthly.
6. "Animal Husbandry Machinery" - monthly etc.

Besides, every province publishes at least one kind of periodical to popularize agricultural machinery knowledge and deal with agricultural machinery technique specific to the province.

The Information Division of the Chinese Academy of Agricultural Mechanization Sciences (CAAMS) collects all the periodicals and relevant materials, assimilates the essentials and makes abstracts, and prints and circulates among institutes, colleges, factories and individuals. The abstracts include some agricultural machinery information of foreign countries.

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2.1.2 To organize experience exchange meetings or seminars to discuss some specific subject is a good form for studying issues in more depth. Subjects selected must be interesting to most developing countries and the participants must be well informed of the problems demanding urgent solution. As the meetings are pertinent to agriculture, the time and the place for the meeting must be well considered in order to enable the participants to see the practical application or to operate the machines personally.

The following subjects are some which often confront the agricultural machinery people in developing countries:

- (1) appropriate technology
- (2) feasibility study for establishing multi-purpose plant
- (3) the basic research and development facilities, logical but practical sequence of the research and development of agricultural machinery
- (4) the management of a multi-purpose agricultural machinery plant
- (5) experience and lessons on international co-operation for establishing plants
- (6) technical problems about design implements etc.

It would be advisable for the "co-ordinator" from UNIDO to make some survey or send questionnaires to the relevant institutions and sum up some urgent problems to be discussed and arrange a timetable for discussion

## 2.2 Training:

2.2.1 Training of research and development personnel: In China, the Kingsu Institute of Technology, in co-operation with RNAM, has

set up a training centre to teach the trainees the basic knowledge of agricultural machinery. Aside from classroom education, the best way to train the research and development personnel is to train them at the corresponding research institute so as to get practical knowledge.

The following institutes are specialized in one or more fields of agricultural machinery. Training courses with specific needs may be arranged in these institutes through consultation:

- Research and development of intermediate and sophisticated implements - Chinese Academy of Agricultural Mechanization Sciences
- Research and development of tractors - Loyang Tractor Institute
- Research and development of internal combustion engines - Shanghai Internal Combustion Engine Institute
- Research and development of rice production machines - Kwanglung Provincial Agricultural Machinery Institute
- Tropical crop production machines - South China Tropical Crop Production Machinery Institute
- Tea planting and processing - Anhwei and Hangchow Tea Machinery Institute
- Peanut production machines - Yentai Agricultural Machinery Institute
- Sugar beet production machines - Heilungkiang Provincial Agricultural Machinery Institute
- Animal production machines and equipment - Inner Mongolia Animal Husbandry Machinery Institute

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- Biogas production and utilization - Chinese Agricultural Engineering Academy
- Pond fishery production equipment - Kiangsu Provincial Agricultural Machinery Institute
- Poultry and milk cow production equipment - Chinese Academy of Agricultural Machinery Sciences
- Pumps for irrigation and drainage - Zhikiang Provincial Agricultural Machinery Institute
- Technologies for manufacturing agricultural machines - Caams.

#### 2.2.2 Training of manufacturing and repairing personnel:

According to specific needs, training courses may be arranged either in multi-purpose plants for general technique of manufacture and repair, or may be arranged in plants of specialization production for specific technique training. As mentioned in paragraph 1.3, there are about 2200 agricultural machinery plants in China of various sizes with different products. Many plants have had the experience of organizing training courses for foreign trainees. For example, Loyang Tractor Factory has organized training courses on tractor manufacturing, and the Shanghai Diesel Engine Factory on diesel engine manufacturing, and the Kiangmuse Agricultural Machinery Factory on schresher manufacturing etc.

#### 2.2.3 Training of teaching staff for professional schools:

In order to consolidate and expand agricultural machinery industry, it needs a great number of technicians and workers besides some advanced qualified engineering staff. It would be desirable to establish some

professional schools in the countries for the purpose of continual training and up-grading of technical men.

Agricultural Machinery Colleges of China may be commissioned for:

- (a) training of teaching staff
- (b) supply of instruments, test rigs, models of agricultural machines and other facilities for training
- (c) compiling textbooks

### 2.3 Joint Activities:

2.3.1 Research and development activities: According to the practical environmental conditions and the fixtures of the assignment, research and development may be carried out in either country with the participation of experts from both sides. The prototype of implement must be tested and evaluated at the country where the implement is expected to be used.

Appropriate institutes of China, as mentioned in paragraph may be commissioned for designing and fabricating the prototype and send it to the country for testing and evaluation. This is practicable and also could save time and money as long as the specific and detailed requirements for the implement could be submitted beforehand, and prompt communication and correct mutual understanding could be achieved.

2.3.2 Despatch of experts, bringing along the implement deemed being applicable to the receiving side, test, evaluate, and make

modification or adaptation over and over again, until it suits the local requirements. All this work will be carried out so-operatively by experts of both sides.

2.3.3 Despatch only the machines to the receiving side, try and evaluate the machines by the local experts. Submit the report detailing the drawbacks to the Chinese institute for modifying. In case the facilities for making adaptations are available, the prototype may be modified locally.

2.3.4 Despatch the prototype of the implement to appropriate Chinese institute for testing and evaluation. Power unit, such as internal combustion engines, not related with soil and farming conditions, could be tested and analysed with good results.

#### 2.4 Production co-operation:

The construction of plants for manufacturing one or more items from the following categories of agricultural tools and machines, as well as other forms of technical assistance pertinent to the manufacturing of these tools and machines, could be arranged as production co-operation:

1. Simple hand tools and manual operated implements: hoes, spades, axes, knives, sickles, sprayers, dusters, hand pumps, pedal-type threshers (the tools and implements are applicable to tropical and humid areas).
2. Intermediate animal drawn implements: plows, planters, cultivators, carts, waterlifting devices.

3. Motorized implements: all types of tractor-drawn and tractor-mounted implements for various field operations, threshers (simple and complex ones), seed cleaner and graders, grain dryers, pull-type and self-propelled combines, trailers with various capacities and self-unloading options.
4. Power units for agriculture and allied sectors:  
tractors: small and medium size, hand tractor from 4 hp up to 12 hp, wheel tractors from 15 hp up to 60 hp;  
diesel engines: small and medium size, from 3 hp up;  
small water turbines: water head from 1 metre up;  
engine-generator set: small and medium size
5. Pumps for irrigation and drainage: centrifugal, axial, mixed flow, deep well, sprinkler, for deep well pump, lifting head up to 300 meters; for large axial flow pump, impeller diameter up to 4.5 metres.
6. Plant protection equipment: hand operated sprayers and dusters, knapsack engine-powered sprayers and dusters, tractor-drawn and tractor-mounted sprayers, airplane-attached ultra-low-volume sprayers.
7. Chicken farm equipment: complete sets, for small family unit and large state-owned unit.
8. Compound feed mills: complete sets, up to 15,000 tons per year.
9. Tea processing equipment: complete sets, for green tea and black tea.
10. Small flour mills, used in countryside.
11. Small rice mills, used in countryside.
12. Oil press, small scale for countryside
13. Cotton ginning equipment, complete sets.



14. Biogas generator, for family use and public utility.
15. Spare parts for tractors, engines and implements.
16. Repair and service equipment.
17. Tractor and engine test rigs and equipment.
18. Food processing equipment.

2.4.1 Feasibility study of plants: If an agreement of establishing agricultural machinery plant, or some other project related to agricultural machinery industry, is preliminarily arrived at, the offering side, say the Chinese institutions, will participate in or to be responsible for working out the feasibility study of the plant, to be submitted to the receiving side for approval.

2.4.2 Planning, designing and construction of plants: Only after the feasibility study of a project is finally approved by the receiving side, the planning and designing institutes could be arranged for planning and designing work, and only after the designing work is completed and approved, then the construction work may be started.

In China, the Tianjing Institute of Plant Design is specialized in the design of agricultural implement plants, and the Loyang Institute of Plant Design is specialized in tractor plants.

2.4.3 Supply of production equipment and facilities: According to the contract agreed upon, the offering side will be responsible

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for supplying all the equipment and facilities as stipulated in the design. China is capable of supplying all the equipment for manufacturing and repairing tractors and implements.

2.4.4 Supply of materials, parts and components: In certain developing countries, particularly at the beginning of industrialization, it is necessary to purchase from outside the materials, parts and components to expediate the fabrication of machines, to meet farmer's needs. In this context, standardization is very important. It is requested to adopt the International Standards (ISO) to facilitate international co-operation.

2.4.5 Assembly plant: In case a certain kind of machine, after intensive test and study, is proved suiting the local conditions very well (like engines and other power units), besides, there is no possibility to build a manufacturing unit in a short time, it is advisable to set up an assembly plant to guarantee quality and timeliness of production.

2.4.6 Transfer of technology: Transfer of technologies either on the design of a product or on manufacturing "know-how" is a form of co-operation worthwhile considering, it is applicable particularly to the complicated machines and the factory which is capable of mastering the technique, and put it into production once it has obtained the "know-how".

3. CHINA'S ACTIVITIES IN ECDC/TCDC FOR PROMOTING AGRICULTURAL MACHINERY INDUSTRY

3.1 Construction of manufacturing and repairing plants:

Since the beginning of the 1960's, in accordance with the agreement on economic and technical co-operation between the Chinese Government and the relevant developing countries, she has helped them with the projects of construction of agricultural machinery manufacturing and repairing plants (see the following table). As these projects were completed and put into production, they played a good role in helping the developing countries to develop their industry and agriculture.

Country	Project	Time	Scale and Products
Zaire	Farm tool Factory	1976.4- 1979.2	Hand tools 1946 tons/year (hoes, spades, machetes, sickles) building area 7600 sq.m. 273 men, principal equipment 132 units
Mali	Agricultural Machinery Repair Shop	1975.3- 1976.3	Repair of tractors 150 units, 1815 sq.m., 40 men, equipment 80 units
Guinea	Farm tool Factory	1972.4- 1973.6	Hand tools and animal traction implements 1300 tons, 7000 sq.m., 290 men, equipment 210 units
Tanzania	Farm implement Factory	1967.9- 1969.9	Hand tools and animal traction implements 1013 tons/year, 5170 sq.m., 223 men
	Farm implement Factory (extension)	1978.3- 1980.5	Hand tools and tractor spare parts 2700 tons/year, 6781 sq.m., 240 men, equipment 55 units

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Country	Project	Time	Scale and Products
	Agricultural Machinery Repair Shop	1967.8-1968.3	Tractors repaired 50 units/year. 1850 sq.m., 39 men, equipment 93 units
Niger	Reformation of Agricultural Implement Shop	1976.4-1980.3	Yearly production: rice threshers 305 units animal drawn hoes 3000 units rice hoes 500 units
Albania	Tractor Spare Part Factory	1963.5-1966.10	Spare parts for 6000 tractors (standard units) cast steel 2500 tons, 23965 sq.m., 1038 men, principal equipment 648 units
	Extension of Spare Part Factory		Spare parts for 14,000 tractors, other parts for 4,000 tractors (standard units), cast steel 1500 tons, 14200 sq.m., 980 men, principal equipment 1550 units
Vietnam	Agricultural Sprayer Factory	1974-1975	Knapsack sprayers 10,000 units, 4690 sq.m., 344 men, principal equipment 270 units
	Repair Shop for Small Diesel Engines and Motors	1969	500 units/year
	Small Machine Manufacture		
Korea (DPR)	Fuel Pump and Injection Nozzle Factory	1975.6-1978.5	

Some experience on building such plants:

1. Preparation is of vital importance:
  - a. In the feasibility study for building plants, identification of range of products and scope of service could only be done through

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careful survey and investigation. In planning, allowance for extensive must be provided in case more demand in the near future is certain.

b. Proper choice of the plant site is also important for successful running of the plant. Transportation is a prime factor to consider. It is desirable, if it is possible to locate the plant in the place with good infrastructure, especially the transportation facilities.

c. Use advanced but simple and reliable technology. Use universal machine tools, equipment and some simple special repair rigs. All in all, put "RELIABILITY" on the first priority. Usually the co-operation partners are far apart by thousands of kilometers, prompt or timely repair of major breakage is often unrealistic.

2. The supply of materials and purchased parts and components must be well arranged at the beginning. Some forms of contract with appropriate suppliers from outside should be contrived. Experience has shown that stoppage in production due to shortage of material or delay in supplying is not rare at the plant already running for a long time.

3. Management staff and workers must be trained, better in plant, to acquire the ability of dealing with problems accompanied by "Multi-purpose".

4. Right from the very start, up to the finish of the project, the active and responsible participation of the "receiving" side is

side is indispensable for correct assessment of the demand or the market of the "receiving" side, which is important in identifying the range of products and the scope of services. The active participation of "receiving" side through the whole course may also contribute to shortening the turn-over period and smoothing operation of the plant afterwards.

5. It is advisable to stipulate a rigid economical link of common interest to both parties to share benefits and risks alike, so as to encourage or to force both parties to do their best for the implementation of projects. In certain cases, "turn-key" is not the appropriate form. After the project is completed some forms of co-operation, such as despatch of technicians and qualified workers to work together with the counterparts in the newly built plant until they master the technique, are necessary and beneficial for the receiver.

### 3.2 Supply of products and technical services:

China now provides products which are designed for different soil and weather conditions and various crops. They are small and medium in size, simple and sturdy in structure, convenient for operation and maintenance, and low in price. All these features also suit the conditions of most developing countries. China has so far sold products to 80 countries and regions.

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China has also despatched experienced experts to the countries concerned (in Asia, Pacific, Africa and South America) to help the customers to master the techniques for operation and maintenance.

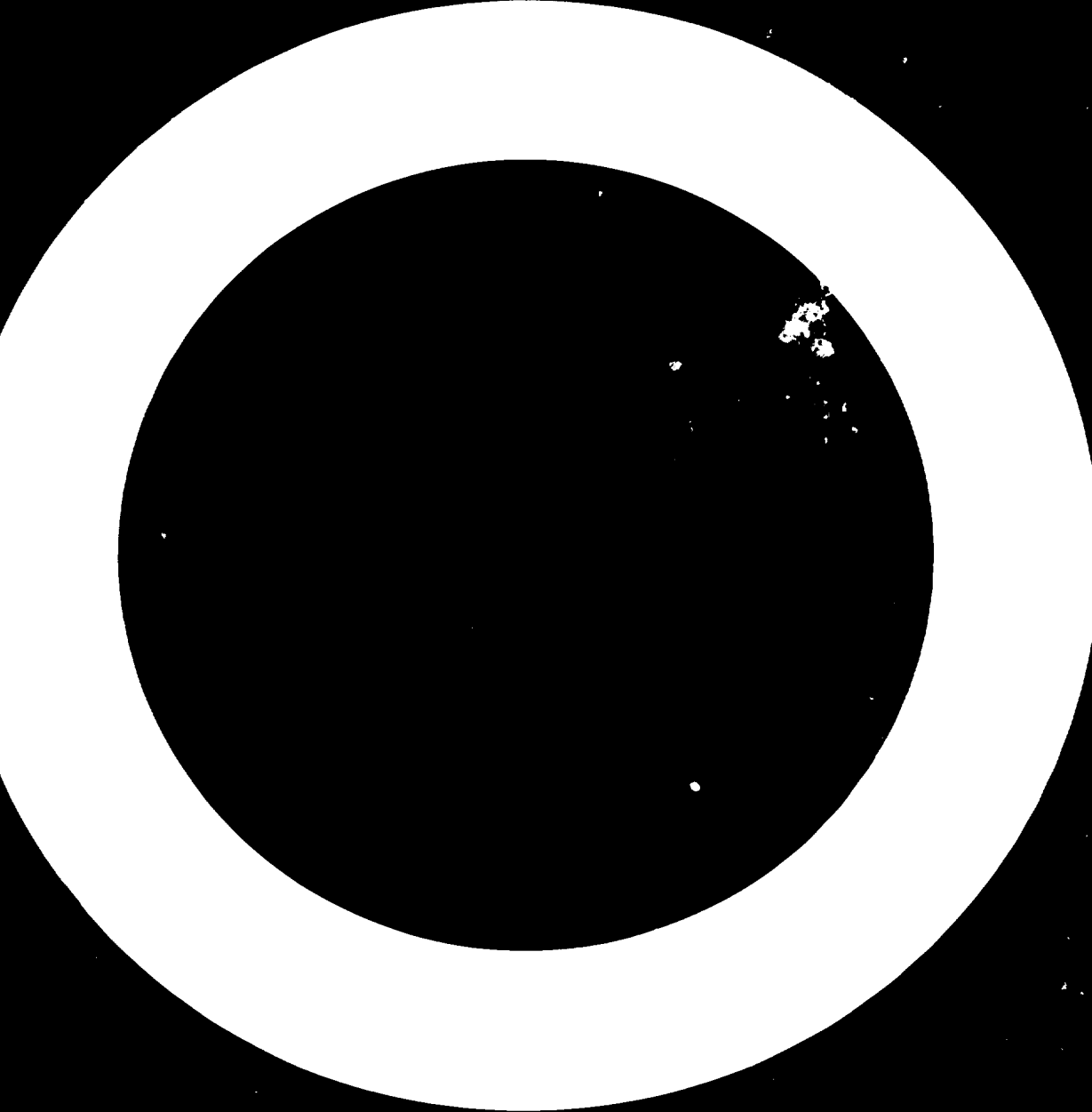
### 3.3 Joint activities in research and development of agricultural machinery:

The Chinese agricultural machinery institutions have carried out quite a few joint projects with satisfactory results. For example, the Chinese Academy of Agricultural Mechanization Sciences (CAAMS), in 1980, sent a group of experts to the Philippines, in co-operation with the International Rice Research Institute (IRRI) to design and adapt a reaper for harvesting rice and wheat. The design was successful and had a very good field performance. Taking this model as a basis, several countries have made adaptations which have won favourable comments from experts and farmers, and put into production for extension.

Now, CAAMS, under the co-operation agreement with IRRI, has despatched engineers to co-operate in designing an implement for deep-placing the fertilizer with the purpose to maximize the fertilization effect for rice production.

### 3.4 Training activities:

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4. CONCLUSIONS AND RECOMMENDATIONS

1. Economic and technical co-operation among developing countries, sometimes with necessary financial and technical aid from developed countries, has been proven to be a suitable and effective form for promoting agricultural machinery industry. As this form of co-operation is on the basis of mutual assistance and self-help, it possesses a deep and lasting significance and will have a great impact on the important issue of building-up industry and agriculture of the developing countries. So, it deserves close attention from all relevant sectors to give their full support to ensure its successful operation.

2. Feasible forms for ECDC/TCDC are many and will be varied according to the needs and conditions of the partners. However, the exchange of information and exchange of experience should be considered as the readiest one and vital to all. In the era of informations, the exchange of information and experience for the developing countries should be greatly enhanced. As mentioned in paragraph 2.2.2-2.1.2, UNIDO could play an important role in this respect. Under the auspices of UNIDO or in co-operation with UNIDO, a centre or a co-ordinator must be and could be established to take charge of this assignment.

3. The draft project programme of the establishment of "International Centre for the Promotion of Agricultural Machinery Industry in Developing Countries" was discussed and endorsed by relevant government officials and senior specialists in 1981. It was put aside

if not entirely denied due to finance shortage. The immediate objective of the centre is "exchange of experience and co-operation among developing countries". The failure or delay in the implementation of the objective of the proposed project did cause some loss or at least some inconvenience to all relevant countries.

4. The Chinese Government has decided to expand and consolidate the Chinese Academy. Agricultural Mechanization Sciences (CAAMS,, wherein the proposed international centre is to be located), to serve as the research and development centre of agricultural machinery for the whole of China. One objective of expanding the Academy is to strengthen the domestic and international exchange activities concerning all aspects of agricultural machinery and agricultural mechanization. In this connection, the Academy will be provided with 6 conference rooms, the biggest one can hold 300 persons, all conference rooms are equipped with video and translation facilities. The Division of Information of the Academy is expanded as the Institute of Information of the Academy and will serve as the centre of information of the whole country. The exhibition hall has selected and displayed thousands of agricultural tools, machines and equipment produced by factories all over China. The exhibition has attracted, in 6 months, 30,000 visitors including hundreds from developing countries.

The Academy (CAAMS) is responsible for preparing and organizing 3 international meetings to be held in 1984: (1) Exchange of

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Experience in Agricultural Machinery - sponsored by ESCAP,  
(2) Exchange of Experience on Hand-Pumps - sponsored by WHO and  
UNDP and the World Bank, (3) A Seminar on Research and Development  
of Water Pumps and Water Turbine - co-sponsored by CAAMS and  
Japanese Society.

5. For the purpose to strengthen ECDC/TCDC, on promoting  
agricultural machinery industry, especially in the respect of  
exchange of information and experiences (as well as training  
programme), it is necessary to reconsider the project of International  
Centre drafted in 1981. Certain modifications and simplifications  
could be made to reduce the input. It is not necessary to establish  
a separate or independant organization. Within the framework of  
CAAMS, there will be a special division, entitled "International  
Centre", specially devoted to the activities stipulated by the  
project. UNDP or UNIDO only finances the approved activities, as  
well as the necessary personnel and facilities for implementing  
the activities. The Government will nominate one of the deputy  
directors of CAAMS to serve as the director of the International  
Centre. UNIDO or UNDP will despatch officials or advisors to the  
Centre for checking and helping activities whenever deemed necessary.

