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Meeting on Industrial Co-operation among
Developing Countries in the Field of
Agricultural Machinery
Beijing, China
22-26 October 1991

REPORT

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CONTENTS

INTRODUCTION

The Meeting on Industrial Co-operation among Developing Countries in the Field of Agricultural Machinery was held in Beijing, China from 22 - 26 October 1991. It was sponsored by UNIDO and hosted by the Ministry for Machinery and Electronics Industries (MMEI). For UNIDO the meeting was a continuation of a number of activities supporting technical and economic co-operation among developing countries in the field of agricultural machinery going back to a Round-table Ministerial meeting in Buenos Aires in 1985. An offer by China to host a meeting bringing together manufacturers of agricultural machinery, agricultural machinery experts and government officials concerned with national development programmes in this subsector was made during the Third Consultation on the Capital Goods Industry held in Vienna in December 1989.

The purpose of the meeting was to examine the technological approaches adopted by the host country, to compare national policies and strategies for developing the agricultural machinery sector and to reach preliminary agreements concerning technical and economic co-operation among the companies, enterprises and institutions represented.

The meeting took place in conjunction with the '91 International Agricultural Machinery Exhibition which showed China's own agricultural machinery developments as well as machinery adapted from German, Italian and Soviet Union designs. As part of the meeting programme, the meeting participants visited the Exhibition and saw demonstrations of China's agricultural machinery and implements arranged by the Chinese Academy of Agricultural Mechanization Sciences (CAAMS).

I. ORGANIZATION OF THE MEETING

The meeting was attended by 68 participants, 21 from 18 countries outside China. The list of participants is attached as annex 4.

Opening of the meeting

The delegates were welcomed by Prof. Lu Zhongmin, Director, Department of Construction and Agricultural Machinery, Ministry of Machinery and Electronics Industry. His excellency, Mr. Bao Xuding, Vice-Minister, Ministry of Machinery and Electronics Industry (MMEI) formally opened the proceedings.

In a keynote speech, Mr. Bao Xuding said that the agricultural problem was one of the most important facing developing countries. Development of the agricultural machinery industry coupled with mechanization of agriculture were of great significance in raising agricultural productivity. During the past 40 years, China had developed an integrated industrial system that included R and D, marketing and maintenance services. It now comprised over 2,500 enterprises with 1.27 million employees, fixed assets of over 15 billion yuan and an annual output valued at over 21 billion yuan. China had imported 99 items of advanced technology, thus narrowing the technological gap in agricultural machinery with industrialized countries. As a result, export volume had reached over $500 million annually.

Noting that the meeting would promote mutual understanding, exchange and co-operation among developing countries, the Vice- Minister said that it would provide an opportunity for China to build closer contacts with other countries. He believed that through their joint efforts and with the support of international organizations such as UNIDO, co-operation in the agricultural machinery industry would make greater headway.

Delegates were welcomed on behalf of the Ministry for Foreign Economic Relations and Trade by Mr. Tang Yu Feng, Deputy Director, Department of International Relations. China's actively participated, he said, both in economic and technical co-operation among developing countries and in South-South co-operation within the United Nations system. South-South co-operation was one of UNIDO's import operational activities and since 1980 had resulted in China holding seminars and workshops on the design and maintenance of agricultural machinery for 245 professionals from 34 countries. These had disseminated technologies and trained professionals to assist the development of agricultural machinery in those countries.

Concluding the opening session, the Chief of the UNIDO Section for Economic Co-operation among Developing Countries thanked the Government of China, particularly the Ministry of Machinery and Electronics Industry for inviting UNIDO to organize the meeting. He also thanked the Ministry of Foreign Economic Relations and Trade and the China Association of Agricultural Machinery Manufacturers for their essential contributions to the meeting, and ESCAP for financing the participation of several delegates. Noting that agriculture was the foundation of China's economy, he said that China had built up its strength in agricultural machinery from research to maintenance and services. Chinese institutions and manufacturers were willing to establish co-operation with their counterparts attending the meeting, and a paper to that effect had been prepared by a UNIDO-recruited local consultant.

Election of officers

Madame Lu Renqi (China), Deputy Director, Department of International Co-operation, MMEI, was elected Chairman. Mr. Oduro K. Gyarteng (Ghana), Director, Agricultural Engineering Services Dept., Ministry of Agriculture was elected Vice-Chairman. Mr. Biri Deplap (Papua New Guinea), Project Officer, Department of Industry, Ministry of Trade and Industry, was elected Rapporteur.

At the request of UNIDO, Prof. Lu Zhongmin, Director, Department of Construction and Agricultural Machinery, MMEI, acted as Executive Secretary of the meeting. Mr. Yuan Xiaode, Deputy Division Chief, and Mr. Wu Qiang, Department of Construction and Agricultural Machinery, MMEI, acted as Liaison Officers.

Adoption of the agenda

The meeting adopted the following agenda:

Opening of the meeting
Election of the Chairman, Vice-Chairman and Rapporteur
Adoption of the agenda
Presentation of the host country paper, UNIDO technical co-operation and TCDC, the Regional Network for Agricultural Machinery (RNAM)

Presentation of national papers
Bilateral discussions on co-operation projects
Discussion of conclusions and recommendations
Adoption of the draft report
Closure of the meeting

The work programme is attached as annex 1. Formal papers presented or made available to the meeting are listed in annex 5.

Adoption of conclusions and recommendations

The meeting adopted the draft conclusions and recommendations at its last session on 26 October 1991 (see chapter VIII).

Closure of the meeting

Reviewing the week's activities, the Chairman said the shared experiences during the meeting, which included a visit to the agricultural machinery exhibition and demonstrations of China's equipment, would serve to promote co-operation among the countries represented. Agricultural mechanization had an important role to play in industrial development and as a developing country itself China would co-operate with other countries to exchange experience and to help them. He thanked UNIDO for its efforts and promised China's serious efforts to help materialize the intentions of the meeting. The Chairman thanked the Regional Network for Agricultural Machinery for its special contribution to the meeting.

Speaking on behalf of UNIDO, the Chief of the Section for Economic Co-operation among Developing Countries, thanked China's Ministry for Machinery and Electronics Industry for its contributions. He promised that UNIDO would play its part in the follow up, but underlined that success would only come through joint efforts. In the end TCDC was the responsibility of the co-operating partners, UNIDO could only remain involved at the request of the respective Governments.

II. SUMMARY OF STATEMENTS DELIVERED AT THE PLENARY SESSION

A detailed account of China's agricultural machinery policies, achievements and supply capabilities was given by the UNIDO consultant, Prof. Lu Zhongmin, Director, Department of Construction and Agricultural Machinery, MMEI. Highlights of his paper are given in chapter III. Chapter IV summarizes the programmes, activities and achievements of the Regional Network for Agricultural Machinery (RNAM) as presented by RNAM's project director. A representative of the UNIDO Engineering Industries Branch outlined UNIDO's role in technical assistance as a whole and reviewed the Organization's technical co-operation activities concerned with agricultural machinery in particular. Further details are presented in chapter V. All the overseas participants present short summaries of their formal papers (listed in annex 5) outlining the situation of the agricultural machinery industry in their countries. The presentations highlighted the present status of the development of this sector, the problems encountered by agricultural

machinery manufacturers and the possibilities for solving some of these problems by means of co-operation with other developing countries.

Ethiopia

Ethiopia's co-operation potential lay in the Government's implicit intention aggressively to pursue tractorization. The Ministry of Agriculture had been charged with undertaking a study leading to a comprehensive mechanization policy, an Agricultural Mechanization Corporation had been established and a tractor assembly plant set up. The Institute of Agricultural Research had become more active and rural technology promotions centres were being established all over the country. Ethiopia's delegate outlined some of the problems currently hampering the development of the sector. These included the low level of development of basic raw materials, growing difficulties in obtaining raw materials and the low capability of national engineering organizations to undertake R and D.

Ghana

Ghana offered a relatively well developed human resource base and abundant low-cost hydroelectric power. The market for agricultural machinery would be driven by growth in the agricultural sector of at least 4 per cent annually. This was to feature crop increases through higher productivity and area expansion, increased animal protein production through improved productivity and other inputs, and increased fish protein production through development of inland fisheries and rehabilitation of marine facilities. Industrial production and marketing of agricultural machinery was to increase correspondingly in areas of soil cultivation, planting, fertilizer application, weed control, harvesting, agro-processing and storage. Current manufacture included corn and seed mills, crackers, graters, tractor trailers, ploughs, harrows, non-tractor driven processing machinery, fruit presses, juice extractors, rice hullers, flour kneading machines, oil extractors.

Government policy particularly supported manufacture of hand tools, implements, agro-processing machinery and agricultural machinery for the small farmer. Identified constraints included lack of an iron and steel industry, and lack of finance and credit especially for small-scale operators. There was a need for an Agricultural Engineering Research Institute to solve problems of small-scale agro-based industries and for access by Ghana to an international network on the manufacture of agricultural machinery. Nevertheless Ghana operated a liberal economic climate with significant incentives for foreign investors.

India

In India a recent constraint analysis had indicated an enhanced role for agricultural engineering in four areas: machinery appropriate to various agro-climatic conditions (dryland, rain-fed, coastal and hilly); technology to raise productivity of plantation horticultural crops; technology to raise water availability and to optimize water utilization; and appropriate drainage technology. Government policy featured selective mechanization to reduce human and animal drudgery, dry area mechanization, and enhanced animal quality as a power and food source.

The organized agricultural machinery sector manufactured power tillers, combine harvesters, irrigation pumps, sprinklers and drip irrigation systems, plant protection equipment, power threshers, seed drills, iron ploughs and other earth-moving machinery, trailers, hand tools, sugar cane crushers, post-harvest equipment and chaff cutters. For agricultural machinery R and D, India had established a large network comprising 44 research institutes, 5 project directorates, 23 agricultural universities and 71 co-ordinated research projects. The Central Institute of Agricultural Engineering in Bhopal was being strengthened to improve manufacturing quality and training of manufacturers. Research during the next 5 years would focus on selective mechanization of dryland agriculture, technology for seed-bed preparation after rice cultivation in compacted rain-fed clay soils, rice transplanters, sprayers, dusters and plant protection equipment for tall crops, harvesting and threshing of millet, pulses, multicrop threshers, sugarcane and cotton harvesters, equipment for hill cultivation of horticultural crops, energy-efficient man-machine-material systems, and farm equipment manufacturing technology for the small-scale sector.

Indonesia

Indonesia's agricultural machinery capacities have been under-utilized in recent years, despite significant government procurement under World Bank and other loans. Other problems facing manufacturers were a shortage of standard raw materials, lack of a strong foundry base, low industrial skills including know-how on interpreting engineering drawings, and limited ability to design parts and machinery. In addition, prices of agricultural machinery to farmers have risen faster than their own unit prices. The Government has responded with policies promoting local manufacture of agricultural machinery. They included required use of local components in single-axle hand tractors and water pumps, and low-cost credit to farmers for selected equipment. The Government was also strengthening the upstream industry with improved raw material supplies and establishment of "godfather" links between industrial enterprises and workshops. The main agricultural machinery produced at present was four-wheel and two-wheel tractors, threshers, hullers, polishers and rice milling units. Extensive joint venture legislation would facilitate co-operation to manufacture agricultural equipment locally.

Kenya

Although Kenya initiated a Small Farm Mechanization Programme (SFMP) already in 1977, current interest was in an extensive proposal to formulate a new agricultural mechanization strategy for the whole country. SFMP had the specific objective of expanding the range of hand tools and ox-drawn implements to cater for more than one operation, e.g. by adding planting, weeding or on-farm transportation. This is done through design and development and by promoting local manufacture and distribution to farmers through extension and training. Ministry of Agriculture-sponsored R and D had lead to prototypes and standards for manufacturing multi-purpose tool bars, mould-board plough attachments, hand-drawn wheel hoes, a punch planter and a maize sheller. Other equipment was under development by the University of Nairobi and networks of rural and regional technology development centres. R and D faced constraints, however, in the form of a lack of locally-produced high-carbon and special steels, little exchange of information between R and D engineers and potential manufacturers, lack of properly trained R and personnel and inadequate incentive both for R and D and local manufacture.

Kenya was in fact combining a large excess capacity for local manufacture with massive spending on agricultural machinery imports. Mechanization of agriculture was grossly inadequate and a national strategy had been proposed to remedy the situation. Short-term measures would address some policy contradictions that acted as disincentives to local manufacture; back-up service would be improved by reducing the number of tractor and equipment makes on the Kenyan market; a task force would be established to determine the benefits of local manufacture of tractors, the mechanization requirements for irrigated agriculture, the long-term requirements for agricultural energy, and how to develop a system of multi-farm use and service of farm equipment appropriate to various farming systems.

Myanmar

Myanmar was undertaking progressive mechanization of farm sizes that, combined with the prevailing wet cultivation conditions in rain-fed areas without drainage and roads, ran counter to efficient utilization of 50 HP wheeled tractors. In future emphasis would be on 8-10 HP power tillers, preferably with attachments such as water pumps, reapers, insecticide sprayers, electricity generators and trailers. Myanmar's mechanization policy would emphasize mechanization of non-irrigated rain-fed areas, standardization of machine parts, interchangeability, introduction of labour saving devices without reducing employment, local manufacture of appropriate machinery and equipment, exclusion of undesirable imports of farm machinery, safety, features, custom hiring, and spare supplies and after-sales service. Facilities would be provided for R and D at various mechanization levels, to develop multipurpose, low-cost power tillers using local materials, and to improve animal-drawn equipment. Joint ventures with foreign partners, private and co-operative manufacturing would be encouraged, and tax exemptions would be granted for agricultural machinery and spare parts. The training school would be strengthened and more specialists trained in agricultural machinery fabrication skills. Myanmar called for developing countries' mechanization technology to involve design and development of selectively labour-intensive, simple mechanically-powered equipment that could be produced using systems currently available in the region. Continuing collection and dissemination of data and information on agricultural mechanization programmes in the countries of the region was needed.

Pakistan

Pakistan has so far limited its farm mechanization to tractorization. Thus, while all tractors were fitted with spring time cultivators, few other implements used. Government policy restricted the makes of tractors to five, of which one was manufactured as a joint venture. Only one of the five was close to its target of 80 per cent local sourcing. Power tillers (from China) and small (25-35 HP) tractors had been introduced with only limited success. However, the Government wished to promote small tractors for orchards and had selected six small tractor/power tillers for import. Stationary powered threshers were introduced in the 1960s, tractor front-mounted reapers (from China) in the 1980s. Tractor-mounted combines also achieved only a limited market and imported combine harvesters had declined with the appreciation of the dollar. The Government planned to specify a minimum package of implements that would be mandatory with each tractor purchase. There was growing awareness of the importance of modern agricultural machines and locally-made tractor-operated implements were gaining popularity.

Pakistan's organization for agricultural machinery was headed by the National Board for Agricultural Mechanization, which had subcommittees on farm machinery standardization and farm mechanization promotion. Three provincial organizations and three educational institutions undertook R and D, and each of four provinces had an agricultural engineering department. Of the 500 or so regular agricultural machinery manufacturers, 11 could be considered large, 40 were medium-sized. In addition, Pakistan had a well-established industry manufacturing slow-speed diesel engines in the 10-30 HP range. This however had eliminated imports of all type of diesel engine imports of level than 20 HP, i.e. light-weight, medium- and high-speed designs. In the early 1980s, CKD diesel kits were imported and a joint venture established with China to make 12-HP engines.

Constraints on manufacturing included non-availability of appropriate raw materials, shortage of trained manpower and lack of R and D facilities in the private sector. There was also a lack of marketing and export outlet organizations. As a result, the quality of locally-produced machines was questionable, reflecting also the farmers' preference for low price over quality. Nevertheless Pakistan's industrial policy, its strategy for curbing urban migration and the incentives for foreign investments made co-operation an interesting option in a number of areas: disc manufacturing, rice transplanters, rotovators, milking machines, manufacture of fast-wearing parts, fruit and vegetable processing and tea processing.

Papua New Guinea

Papua New Guinea had a policy of encouraging manufacture and downstream processing of agricultural products through joint ventures. The Government had put in place a comprehensive package of incentives for manufacturing and process firms that were judged to have potential for creating employment and creating added value. At present machinery and hand tools accounted for less than 1 per cent of manufacturing value added in the country.

Currently Papua New Guinea was spending around $1.6 million on imported hand tools. A feasibility study had been completed for local manufacture in a plant making axes, hatchets and axes, spades, bush knives, shovels, sickles, pick axes and mattocks. A common facility centre was proposed for resharpening and maintenance of tools and dies, and maintenance of machines and equipment. The high cost of raw materials, labour and services combined with low volume output meant that unit costs were slightly higher than import items. Because of the negative net profit and internal rate of return, the project had not been deemed viable.

Republic of Korea

The Republic of Korea distinguished itself by developing manufacturing technology for relatively sophisticated and high performance agricultural machinery such as tractors, rice transplanters, combine harvesters and speed sprayers. Farm mechanization was nearing the end of the fourth stage in which mechanization of rice cultivation would be completed and attention turned to horticulture, orchards and livestock. In previous phases mechanization had successively been applied to water pumping, threshing, insect and pest control, and land preparation. The trend in production and use of agricultural machinery was for an increase in tractors, rice transplanters,

combine harvesters, power cultivators and speed sprayers. Power tillers, farm engines, threshers and mist blowers were decreasing; power sprayers, water pumps and dryers were stable.

Korea itself manufactured power tillers (6, 8 and 10 HP), tractors (19-30, 31-40 and 40-50 HP), walking-type rice transplanters (4 and 6 rows), riding-type rice transplanters (4 and 6 rows), winnowers (6 rows), reaper binders (2 rows), combines (2, 3 and 4 rows), multipurpose cultivators (3.5-6 HP), grain dryers, speed sprayers, self-propelled power threshers and self-propelled power sprayers.

Sri Lanka

Sri Lanka's agricultural machinery comprises 30 large manufacturers, over sixty medium and small ones and some 230 village artisans. The large-scale manufacturers made power tillers, paddy- reapers, threshers- and milling machinery, knapsack and power sprayers, electrical- and engine-driven pumps, 9-tine tillers for four-wheel tractors, tractor parts, trailers for 2- and 4-wheel tractors, and tea and rubber processing machinery. Medium and small-scale industries manufactured paddy transplanters, seeders and weeders, cage wheels and trailers fo- 2- and 4-wheel tractors, winnowing fans, animal-drawn wooden ploughs, metal mould-board ploughs, tractor-drawn ploughs, grain processing machinery and rotor blades. Village artisans made mammoties and hoes, knives and sickles, seeders and weeders, rotavator blades, indigenous and mould-board ploughs, levellers and harrows, and farm carts. Sri Lanka's Farm Mechanization Research Centre (FMRC) had been responsible for introducing appropriate farm mechanization technologies for a manual transplanter, highland seeder, cereal harvester, rotary upland weeder and a cono weeder. Others to be introduced this year included a tube-chain water pump, an axial flow water pump, grain dehulling and splitting machinery, a high-capacity thresher for paddy, and an inverted T-seeder.

A country-wide survey in the early 1980s indicated farm mechanization priorities as (1) threshing and harvesting, (2) land preparation, and (3) crop establishment. Sri Lanka faced labour shortages in peak cultivation and harvesting periods and power shortages nearly all the time in some areas. With demand far exceeding total production capacity for some machines, prospects were good for local manufacture. Nevertheless, Sri Lanka followed a selective mechanization policy. This promoted paddy reapers and portable axial flow threshers rather than combine harvesters which would displace too much labour. Hand-operated rice transplanters were introduced rather than motorized versions. There was still a need, however, for local manufacture of local-cost power tillers, high-capacity threshers and grain processing machinery.

Agricultural machinery manufacturers' biggest problems were in the market environment. Owing partly to the low tax (5 per cent) on imported machines, there was stiff competition from imports, often sub-standard models. In contrast, import duty on machine parts, such as prime movers, was very high (45 per cent). This eliminated any possibility of local assembly from CKD kits. Small-scale manufacturing suffered from high interest rates and high cost of domestic raw materials. Smaller manufacturers were assisted, however, in an FMRC-GTZ project with drawings, jigs and fixtures, technical training for staff, low-interest loans and sales support.

Thailand

Thailand's agricultural machinery industry enjoyed an annual turnover of around $240 million and covered the major share of domestic demand. It was driven by agricultural mechanization that was now at the crossover point between labour-intensive and control- intensive machines such as powered planters and sprayers and combine harvesters. It would continue to be supported by Government policy that, inter alia, promoted joint ventures with foreign firms to import new types of agricultural machinery. Import taxes on agricultural machinery had been reduced from 20 to 5 per cent. Joint ventures had to have a capital investment of at least baht 3 million ($120,000) and produce machinery that could not be manufactured effectively locally, i.e. not two-wheel single-axle tractors.

Agricultural mechanization was most advanced in the central plains where demand was switching from single-axle tractors, water pumps and threshers to seed drills and weeders. Benefiting from farmers' increased purchasing power, manufacturers were replacing an old two-wheel tractor with one having a steering clutch, two or more forward speeds and one backward speed. Their production had jumped 40 per cent despite price rises of 10 to 20 per cent. Similarly paddy threshers had increased in size from 1-1.5 ton/hour to 5-6 ton/hour. These larger threshers were mainly used on custom hiring services and have been modified to handle soybean. In other regions demand was growing for power-intensive machinery, especially single-axle, two-wheeled tractors, sprayers and threshers.

Because of the rapid expansion of other economic sectors, agriculture faced labour shortage during peak farming seasons. There was demand therefore for an appropriate sugar cane harvester, combine harvesters for paddy (250-300 units per year), sugar can, corn and soybean, and rice transplanters (500-1000 units per year). Existing mat-type rice transplanters were too slow and power-operated types from Japan too expensive.

United Republic of Tanzania

The United Republic of Tanzania followed an agricultural mechanization policy that emphasized small farmer tools and equipment. First priority for local manufacturing was improved hand tools and animal draught equipment, which would be stepped up by the Ministry of Industries and Trade. This was followed by small harvesting and processing machines and by mechanically-powered equipment and machinery. Machinery and equipment could only be imported after technical evaluation and testing under Ministry of Agriculture supervision.

Priority regarding tractors was given to rehabilitating existing machines, first those on publically-owned farms, later those owned by villages and commercial farms. This meant improving workshop maintenance and training more agricultural mechanics. Mobile repair and service units would be expanded and various organizations encouraged to provide tractor hire services.

Research would feature a farming systems approach, drawing on the experience and development in other African and third world countries.

Manufacturing facilities in Tanzania's agricultural machinery manufacturing sector included a tractor assembly line (Valmet tractors - 1,200 per year), hot forging lines, a small foundry, a production line (poorly

designed) for hand tools, ploughs and wheelbarrows. Supporting institutions provided feasibility studies, financing planning and sourcing, marketing, design, training component supply and industrial estate services, prototype production, testing, evaluation.

The agricultural machinery sector faced problems in raw material and components sourcing, high cost of prime movers and high-interest rate loans. In addition management and marketing skills had not developed commensurately with investment in manufacturing facilities. It was recommended that no further hand tool capacity be added, since demand may be reduced with the advance of animal draught tillage -- the area of immediate need. To allow Tanzanian manufacturers to concentrate on animal-draught implements, tractor-drawn implements (disc ploughs, harrows, planters) should be sourced from other countries in the PTA. Tanzanian manufacturers should further develop their design and marketing of post-harvest machines (mills, hullers, shellers, pulpers, oil expellers, gain winnowers, animal feed grinders and mixers, grain choppers and water pumps.

III. CHINA'S AGRICULTURAL MACHINERY SUPPLY CAPABILITIES

China's agricultural development relies upon agricultural mechanization, which in turn needs a strong agricultural machinery industry to back it up. A relatively integrated system of R and D, manufacturing, sales and marketing, service and repair has been developed. By the end of 1990, there were over 2,600 agricultural machinery manufacturing enterprises with a work force of 1.26 million, fixed assets of RMB 15.7 billion yuan and a total turnover RMB 24.6 billion yuan. There were a further 1,700 enterprises at county level engaging in agricultural machinery manufacturing and repair, with 290,000 workers and fixed assets of RMB 2.3 billion yuan. The industry was supported by 8 research institutes directly under the Ministry of Machinery and Electronics Industry, 32 agricultural machinery research institutes at provincial level, 224 at prefectural level and 1,600 county-level institutions aiming mainly at the agricultural machinery extension.

China's agricultural machinery industry has 13 designated areas: tractors, diesel engines, plantation machinery, plant preservation machinery, harvesting machinery, irrigation and drain machinery, transportation machinery, forage processing machinery, farm/farm-related products processing machinery, forage processing machinery, semi-mechanized tools, tractor / diesel engine spare parts. Altogether the industry produces 16 categories of equipment consisting of 3,200 kinds of products. Tractors and their matched tools range from 2.2 to 118 kw, internal combustion engine range from 0.74 to 1,470 kw, combine harvesters are powered from 8.8 kw to 110.3 kw. In addition, there are sprinkler-irrigators, axial-flow pumps, complete sets of equipment for seeds processing up to 20,000 tons per year, pig-raising (up to 10,000 pigs), poultry-raising (up to 200,000 birds), factory-vegetable growing, fodder processing (up to 10,000 tons), down processing, yam processing (up to 1,000 tons), various kinds of rice, flour, oil, tea, cotton, hemp processing equipment, and complete sets of planting, harvesting, transporting, storing equipment for grain production of up to 1,000 hectares. The equipment is adapted to different regions - from wet to dry land, from the plains to mountainous areas, from the cold north of China to the sub-tropical south in various climatic, geographical, social and economical conditions.

While state policies and measures to promote development of agricultural production had increased prices of agricultural products over the years, agricultural machinery prices had been reduced 10 times during the period of 1961-1978. As a result, the price of agricultural machinery today is 40 per cent lower than that in 1960. This created problems for China's manufacturers, since low profits and low incomes frustrated their normal operation. These problems were now being solved.

Policies to support the agricultural machinery industry included:

- Low taxation for agro-machinery products: value-added tax on agricultural machinery is 32 per cent lower than that of other mechanical and electric products;

- Special consideration with respect to steel supply: the sector receives 700,000 tons of the State-subsidized steel annually, accounting for one third of its total requirement;

- Development of energy savings designs: 300 energy-saving products had been announced and extended, while 150 kinds of technically backward products with high energy consumption had been eliminated since 1981.

Under the Eighth Five Year Plan, the anticipated output of agro-machinery industry in 1995 would be RMB 28 billion yuan. This included 100,000 large/medium sized tractors, 1.1 million small sized tractors, 51 million internal combustion engines, 10,000 combine harvesters, large/medium sized power-drawn implements, 160,000 farm and farm-related products processing machines, 500,000 sets of livestock machinery, 150,000 sets of power plant preservation machines and tractor/diesel engine spare parts worth RMB 5 billion yuan. Development of other farm machinery would feature: machinery for complete mechanization process of wheat, rice and maize; energy-saving power machinery; livestock and forage processing machinery, poultry products collection and processing machinery; farm/farm-related products processing machinery suitable for various economic conditions.

Internal co-operation

International co-operation had enabled introduction of advanced technology from abroad. Since 1987, these included technologies for:

- Tractor chassis, 44,160 HP, 6 models (John Deere Co, USA);
- Small tractor chassis (Italy);
- Medium size tractor chassis, 45-100 HP (FIAT, Italy);
  Tractor chassis, 35-50 HP (Deutz, Germany);
- Diesel engine (MWM, Germany);
- Diesel engine, (Caterpillar, USA);
- Small gasoline engine, (Solo, Germany);
- Injection pumps (Bosch, Germany);
- grain combine harvesters, (John Deere, USA);
- Combine harvesters (Fortshritt, Germany);
- Portable power sprayers, including gasoline engine (Komatsyu, Japan)

Technology had also been imported for manufacturing components for tractors, diesel engines, combine harvesters, pumps, tea machines, oil-pressing machines, fodder machinery and wind power generators.

Personnel exchange and technical training were a vital component of international co-operation. Raising management efficiency and processing technology levels of the whole staff in the licensee's factory was critical to the task of adapting, digesting and absorbing advanced products. China sent over 100 people, from the factory director to skilled workers in Jiamusi Combine Harvester Works had been trained in Deere, for example.

After the introduction of product technology from abroad, developing countries would usually wish to supply and produce the component parts themselves. The problem was the quality and quantity of locally made components. In China's case, the performance and quality of some home made fittings parts or purchased parts as hydraulic components, diesel engines, belts, could not compare with those imported from abroad parts. This meant importing certain parts in order to guarantee the quality of whole machine. To raise the foreign currency to purchase fittings parts and accessories from abroad, one Chinese manufacturer, Jiamusi Works, sold back parts and components (castings and forging parts) to Deere and Co. to balance hard currency. In this way, foreign currency for purchasing fittings parts from abroad had been compensated and processing level of licensee's factory was improved.

As an exporter of farm machinery, China's agricultural machinery was characterized by its simple design, ease of operating and repair, high quality and reliability and, most importantly, its low price. Products, such as the small diesel engine, small tractor and power-tiller, farm/auxiliary products processing machinery, harvesting machines and power drawn tools, were well suited to developing countries and their farmer's purchasing power.

For the United Nations, China had run special farm machinery courses, training 245 high-level technical personnel on farm machinery design and manufacturing from 34 countries.

IV. THE REGIONAL NETWORK FOR AGRICULTURAL MACHINERY

Although the developing countries in the Asia region had plans to improve their national food production programmes, there was a need for technical co-operation among them to strengthen and supplement their national capabilities on the design, manufacture and extension of agricultural machinery including the necessary institutional infrastructure. It was to this end that technical co-operation among developing countries (TCDC) in the form of the Regional Network for Agricultural Machinery (RNAM)* was organized and established.

Over the last decade, the 11 member countries of RNAM had reached a stage of socio-economic development where farm mechanization was becoming not just important, but absolutely essential to achieve the overall national development goals.

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* RNAM is an inter-country project with members from Bangladesh, India, Indonesia, Islamic Republic of Iran, Nepal, Pakistan, People's Republic of China, Philippines, Republic of Korea, Sri Lanka and Thailand.

The RNAM project currently based at U.P. Los Banos, was funded by the United Nations Development Programme (UNDP), Australia, Belgium, Japan and the participating countries. It was executed by the UN Economic and Social Commission for Asia and the Pacific (ESCAP) in co-operation with the Food and Agriculture Organization (FAO), the UN Industrial Development Organization (UNIDO), the International Rice Research Institute (IRRI) and the Asian Institute of Technology (AIT).

RNAM operated through a network of National Institutes (NIs), one per participating country. Each NI, headed by a director, was the focal point of RNAM-related activities in the country.

At the national level, each participating government was encouraged to establish a National Network (NN) to be coordinated by the NI. This required the assistance and services of other institutions and organizations, including non-governmental organizations. RNAM had also emphasized that NIs work closely with manufacturers, other research institutions, extension agencies, credit institutions and other agencies dealing with agricultural mechanization programmes and projects.

RNAM was now in its fifth phase of development in which it would focus on the following subprogrammes:

- Design and development of appropriate agricultural machinery with special consideration of their use by women;
- Manufacture and commercialization through technology sharing;
- Extension of agricultural machinery especially through demonstrations and effective means of communication channels;
- Integration of women in agricultural mechanization;
- Formulation of policies and strategies.

The RNAM participating countries demonstrated an earnest desire for TCDC through their participation in human resources development, exchange/transfer of machines and drawings and study tours of manufacturers.

The activities of RNAM also facilitated successful technology transfer from one participating country to another. The far-reaching effects of these technology transfers demonstrated a practical co-operation between and among countries in eight areas:

- o Human resources development
- o Exchange of drawings
- o Mutual exchange of prototypes and commercial machines
- o Study tours of manufacturers
- o Agricultural machinery exhibition and symposium (agrimach)
- o Information dissemination and exchange
- o Local information dissemination system
- o Dissemination of mechanization information

The network concept as exemplified by RNAM was an innovative approach, the first of its kind to be established in the Asia region. The influence of the project in terms of its network concept was felt in the other regions of the world, particularly, in Latin America and in East Africa. Thus the RNAM experience was a model for establishing similar networks. Its regional office had also received indications from Malaysia, Vietnam, Fiji and Bhutan that they would like to become members.

The successful exchanges and transfer of technical information, experiences, ideas and hardware among the participating countries demonstrated the viability of the network concept in the organization of RNAM. The strengthening of the technical capabilities of the NIs, particularly through regional training courses, workshops and activities, had contributed directly to the promotion of agricultural mechanization at the country level.

The exchange or transfer of technologies in the form of hardware, production drawings and other technical information, and the increasing involvement of the manufacturers in these countries have had wide ranging influence on achieving self-sufficiency in areas of local manufacture and extension of machinery to farmers. It is now realized that what the countries could not achieve individually could be achieved collectively.

The viability of the regional network system depended upon the active participation of the NIs engaged in activities involving technical co-operation amongst themselves. These activities involved exchanges of commercial machines, design drawings and information. The RNAM Newsletter proved to be an effective medium whereby information was received from the NIs and other sources, digested and fed back to the participating countries. Other countries and organizations/individuals who received the RNAM Newsletter also benefited from the information.

There was extensive sharing of strategies for agricultural mechanization and of mechanization plans through presentations at regional workshops.. There was exchange of studies on present policies and strategies conducted by local consultants sponsored by RNAM and further dissemination of this information by international consultants knowledgeable in the subject in the Asia-Pacific countries. In addition, regional workshops, training courses and study tours had provided the participants opportunities to receive information from other network members and had catalyzed exchanges/transfer of machines and drawings.

The RNAM project had been established to foster self-reliance. This meant that assistance was given only to catalyze an activity which was critical to the attainment of the project objectives. Nevertheless, the role of the regional office had been pivotal in the network system. Many of the achievements so far attained could be attributed, in no small measure, to the co-ordination role played by that office.

The regional office helped the participating countries to forge links with other bodies. It served as a nerve centre for monitoring the different activities in the network, acted as a clearinghouse of information on mechanization relevant to the regionl and served as a medium of inter-regional co-operation. The office also served as a link between the participating countries and other international organizations, such as IRRI, FAO and UNIDO. To some degree, the regional office also served as a link between the NIs and their higher authorities dealing with mechanization, especially the Ministry/Department of Agriculture to increase or affirm their awareness of mechanization and thereby lend greater support to the NI and the planned mechanization programmes and projects.

In order to optimize the use of available resources, the project still needed to undertake as many activities on TCDC basis as possible, such as human resources development, study tours, and exchange of experts, hardware and information. RNAM also needed to take advantage of the TCDC programmes being offered by India, Pakistan, People's Republic of China and the Republic of Korea through existing TCDC mechanisms.

V. UNIDO TECHNICAL ASSISTANCE IN THE FIELD OF AGRICULTURAL MACHINERY

Technical assistance specific to local design, development and manufacture (including applications and tooling) of agricultural machinery and implements, falls within the responsibility of the Engineering Industries Branch of the UNIDO Department of Industrial Operations (IO/T/ENG). More advanced countries look to UNIDO for help in upgrading production and introduction of computer-aided design and manufacturing (CAD/CAM) equipment. Less advanced countries want to improve their capabilities in building conventional machinery and equipment, for example by increasing local content. The type of product therefore ranges from simple, low-cost equipment such as hand tools, through manually operated equipment and animal-drawn implements, to intermediate and standard equipment such as tractor-drawn implements and power-operated equipment. Also covered are low-cost transport equipment for rural areas and energy related equipment for rural electrification and mechanical workshops.

In the area of ECDC and TCDC, UNIDO was an active supporter of the Regional Network for Agricultural Machinery (RNAM) for which it provided technical consultations and project personnel, and was helping to apply computer systems in project activities. In conjunction with the host country, China, UNIDO had regularly organized an in-plant group training programme at the Jiangsu Polytechnic University in Zhenjiang. This offered participants from different developing countries detailed insights on the design and manufacture of small and medium-size agricultural machinery and implements and provided a good basis for transferring Chinese experience to other countries.

In the context of the present workshop, UNIDO would support co-operation agreements concerning:

(a) Transfer of designs from one country to another where the technological level and the environmental and working conditions were similar and the design is suitable to local conditions;

(b) Joint development programmes for manufacturing;

(c) Exchange of information in R and D;

(d) Licensing and financial participation on a joint venture basis;

(e) Export and import of ancillary parts;

(f) Extension of institutional and R and D linkages.

UNIDO would also be prepared to assist in identifying needs and drafting concepts for technical assistance projects in these areas.

Technical assistance by UNIDO and other international organizations

Based on the close relationship between the design and manufacture of agricultural machinery and implements and their use in agriculture for food production, UNIDO together with FAO and bilateral agencies could, on request:

(a) Co-operate in supporting developing countries in the design and manufacture of agricultural machinery and equipment and, in particular, in taking joint action to encourage that provision be made in the ongoing United Nations Development Programme cycle for the creation and strengthening of national centres in the design and engineering of agricultural machinery and equipment;

(b) Establish manufacturing facilities and rehabilitate existing ones, where necessary, and provide industrial and technical extension services as a matter of priority with a view to increasing the awareness in rural communities of the need to maintain agricultural machinery and irrigation equipment and to assist them in doing so.

(c) Assist in the introduction of mobile workshops for repair, maintenance and demonstration purposes capable of travelling from vilalge to village to demonstrate the use and maintenance of agricultural machinery as well as water supply and irrigation equipment;

(d) Provide assistance in training engineers in agricultural engineering centres and industry in design, manufacturing, testing and maintenance;

(e) In co-operation with the International Labour Organization, provide assistance in the training of technicians at all levels for the different tasks involved in the design, manufacture, testing and maintenance of agricultural equipment;

(f) Provide assistance in development of specialized testing and manufacturing of agricultural machinery, including irrigation equipment and spare parts.

In order to achieve the above objectives, UNIDO recommended an exchange of views and ideas related to a possible technical co-operation between different countries/organizations/institutions to manufacture agricultural machinery and equipment based on designs made in the Asian Region for three different levels of farm size:

1. Level I (manual and animal drawn equipment)

   hand tools (e.g. shovels, spades, spading forks, digging hooks, wheel barrows, simple animal drawn equipment)

2. Level II (mixed mechanization system)

   in addition to the tools and animal-drawn equipment (see above)
   - walking-type power-driven equipment 5-8 HP such as cultivators, tillers and tractors (15-18 HP)
   - irrigation and water supply by means of wind mills up to 1,5 m lift, small electric of diesel pumps up to 4,5 m lift (where available and subsidized also photovoltaic driven pumps could be used)
   - hand operated animal or mechanically powered threshes, crushes, shellers, etc.
   - mechanically powered or animal drawn harveters
   - storage bins 3-5 t capacity

Level I and II would be applicable to farms below 2 ha and 2-5 ha respectively.

3. Level III

For farms above 5 ha should be able to purchase locally manufactured equipment at competitive price level like
- 4 wheel tractors 15-40 HP with power take off attachments for ploughing, tilling, seeding, etc.
- power driven combine harvesters, 2-4 m width
- power driven cleaner, thresher, dryer.

VI. DEVELOPING COUNTRIES' CO-OPERATION NEEDS AND OFFERS

Overseas participants' interests (summary of needs)

Ethiopia

(1) Expertise to advise Government on policy and strategy to develop the agricultural machinery sector; (2) study tour and expertise to improve animal-drawn equipment; (3) assistance in preparation of a demand survey at peasant farmer level.

Ghana

(1) Prototype technology, technical and material assistance, investment and joint ventures for machinery and equipment for small-scale farming suitable for local manufacture; (2) expertise on design and local production and use of animal-drawn implements; expertise on workshop repairs and transport fleet management; (3) expertise on technology for a small-scale tractor suitable for pre- rainy season use in tropical climates; (4) low-cost, simple technology for manual-, pedal- or powered post-harvest processing; (5) expertise on fabrication, testing and adapting agricultural machinery; (6) expertise on agro-processing facilities and crop storage systems for small-scale farming; (7) expertise on engineering aspects of soil and water conservation, including irrigation equipment.

India

(1) Bilateral inter-Government agreement on exchange of prototypes, experts and experience; (2) technology for general purpose oil expeller (mechanical press); (3) expertise on low-power energy-efficient, seed bed preparation achinery for clay soil after paddy cultivation; (4) technology for a power e transplanter; (5) light-weight, 5-8 HP tillers; (6) expertise on quality rading of small-scale industry manufacture of agricultural implements and machinery.

Indonesia

(1) Study tours leading to joint ventures (with China, Republic of Korea or Thailand) and co-production in hardening and tempering (with China), design and marketing (with China and Republic of Korea); (2) On-the-job training (in China or Thailand) in prototyping appropriate technology; (3) Quality control

instrumentation (in China); (4) technology transfer/CKD assembly/import (with China, Republic of Korea or Thailand) of power tiller (<12 HP), 4-wheel tractor (25-80 HP), 4-row reaper, 2-row mini-combine, 4-row transplanter, prime mover (8.5-35 HP), water pump.

Kenya

(1) Joint venture to manufacture and assemble medium-size (50-HP) tractor and stationary diesel engines of 12-20 HP with up to 20 per cent local content; (2) study tour on advanced production methods; (3) technology for a tractor for 2-4 ha horticulture; power tillers/small tractors for rice; maize hullers; very small combine wheat/rice harvester.

Myanmar

(1) Design, development and technology for local manufacture of a simple, low-cost tiller (8-HP) with attachable reapers and trailers; (2) catalogue of manufacturers with machine types and specifications; (3) combine harvest powered by 50-HP tractor; (4) training in hand-pump testing (reference UNICEF pump used on tube wells); (5) on-the-job training in casting technology and heat treatment; (6) study tour on power tillers and farm machinery. Myanmar also seeks measuring instruments for R and D and audio-visual equipment for training and marketing of agricultural machinery.

Pakistan

(1) Expertise on tea processing; (2) training in the design of jigs and fixtures; (3) study tours on disc manufacture and rice transplanters.

Papua New Guinea

(1) Training in hand tools manufacture; (2) study tour on coffee processing and technology identification.

Republic of Korea

(1) Expertise and study tours on horticultural machinery and livestock equipment; (2) expertise on design and construction of elevators for complex grain processing systems; (3) study tour on machinery for hill cultivation.

Sri Lanka

(1) Joint ventures, technology transfer, expertise and training in rice destoning and packaging, and canning of coconut juice; (2) expertise in recycling metals for use in agricultural machinery.

Thailand

(1) Technology transfer and/or coproduction of relatively sophisticated harvesters for sugar cane, maize and soybean; (2) Expert and/or tour to study JV or co-production of agricultural machinery in Thailand.

United Republic of Tanzania

(1) Assistance in establishing the infrastructure and engineering base for agricultural machinery component manufacture; (2) feasibility study and study tour on manufacture of power tillers (alternative to CKD kits currently imported from Japan); (3) small and medium-sized tractors (5-25 f.s. and 40-45 HP); (4) motor vehicle pickups 1-2 tons.

VII. RESULTS OF BILATERAL DISCUSSIONS ON CO-OPERATION PROJECTS

The bilateral discussions, aimed at identifying specific co-operation opportunities, were held in parallel sessions on 25 October 1991. A total of 50 working agreements between Chinese representatives and their counterparts from other countries were concluded. They included exchange of information, preparation of detailed project proposals for technology transfer and feasibility studies and supply of agricultural machinery and implements.

UNIDO together with MMEI would undertake follow-up activities to promote practical realization of the working agreements, in particular by means of self-financed study tours and the use of national funds for TCDC.

The results of the bilateral discussion are summarized in annex 3.

VIII. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the plenary discussions, it was generally agreed that China had developed a comprehensive and well-integrated agricultural machinery industry ranging from research and development through manufacturing, marketing and maintenance services. The growth of the industry to the level of 2,500 enterprises, nearly 1.3 million employees and an output value of over 21 billion yuan represented a considerable achievement.

The invited participants recognized the relevance for them of China's experience in areas such as strategy and policies for agricultural machinery development, raising mechanization levels of main farm operations (ploughing, planting, harvesting, powered crop protection, irrigation, drainage, threshing and mulching), and introduction of advanced manufacturing technology from abroad.

The meeting particularly appreciated China's offer (subject to UNIDO being able to cover certain related expenses) to supply sample equipment together with expertise to assist assessment and adaptation for local use and manufacture in the participants' own countries.*

In this respect, the participants expressed their desire for further co-operation with MMEI and through it with China's agricultural machinery manufacturers and technical institutions. Technical and economic co-operation with developing countries, such as China, it was felt, would help all sides to learn from each other's experience, and to provide equipment and technology suited to their countries.

The meeting also acknowledged the important role RNAM was playing in promoting practical TCDC in the Asia region. It agreed that RNAM's successful exchanges and transfer of technical information, experiences, ideas and hardware demonstrated the viability of the network concept. Specifically this had:

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* Participants were advised to select a tractor (up to 15 HP) plus implements. Further arrangements to be discussed with UNIDO ECDC Section.

- o Strengthened the technological and manufacturing capabilities of national institutions in the network thus directly promoting agricultural mechanization at the country level.

- o Contributed to self-sufficiency in local manufacture through exchange or transfer of technologies in the form of production drawings, hardware, training and other technical information.

A key ingredient in the success of RNAM had been the TCDC among the national institutions themselves. This included exchanges of design drawings, commercial machines and information, sharing of strategies for agricultural mechanization, dissemination of policy studies by RNAM-sponsored local consultants. Publication of the RNAM Newsletter, regional workshops, training courses and study tours as well as the pivotal role of the regional office also played an important part.

The meeting agreed that a key ingredient for successful ECDC and TCDC in the field of agricultural machinery was information on technologies, manufacturing expertise and training capacities in the developing countries. It recognized the work already accomplished by RNAM in the this respect for its member countries. Given the need for this kind of information in other countries and regions and the availability of significant data, inter alia, in China, an inter-regional mechanism may be established.

The meeting made the following recommendations:

Technical co-operation

(1) The preliminary agreements negotiated during the workshop as the springboard for technical and economic co-operation between Chinese institutions and manufacturing enterprises and their counterparts in other countries should be actively followed up by the participants and the country they represent, where possible using self-financed or third-party trust funds, national TCDC funds or funds available from multilateral sources as a catalyst. In all cases participants should continue negotiations with a view to establishing legally binding agreements.

(2) UNIDO should intensify its technical assistance activities to create or strengthen developing countries' agricultural machinery manufacturing capacities.

Regional activities

(3) Recognizing the usefulness of China's experience in the field of agricultural machinery, UNIDO examine the possibility of inviting China to send teams of experts to each region to survey local ecological, agricultural and industrial conditions and to advise, on request, interested Governments on appropriate technology, equipment and machinery for acquisition and local manufacture, along with related human resource development requirements and institution-building requirements.

(4) Recognizing the success of the Regional Network for Agricultural Machinery in Asia (RNAM), UNIDO in conjunction with appropriate other international organizations should investigate the applicability of the concept in Africa and present concrete proposals to African Governments.

(5) Recognizing the special problems of least developed, island and landlocked countries with respect to acquisition and local manufacture of agricultural machinery and implements, UNIDO should feature this subsector in its special regional programme in Asia for these countries.

Documentation and information

(6) UNIDO, together with other international organizations, especially RNAM in the Asia region, should take the initiative in proposing co-operation arrangements to collect and compile technology supply information on agricultural machinery and implements on an interchangeable basis between the developing regions. In this context early advantage should be taken of the availability of information in this area from China.

Annex 1

Work Programme

Monday 21 October

Registration

Tuesday 22 October

08:30 Registration

09:00 Opening session
Welcoming addresses
Mr. Bao Xuding, Vice-Minister, Ministry of Machinery and Electronics Industry
Mr. Tang Yu Feng, Deputy Director, Department of International Relations, Ministry of Foreign Economic Relations and Trade
Chief, Section for Economic Cooperation among Developing Countries, United Nations Industrial Development Organization

10:30 Election of Bureau (Chairman, Vice-Chairman and Rapporteur)

10:45 UNIDO Technical Assistance in the Field of Agricultural Machinery and Implements, Industrial Development Officer, Engineering Branch, United Nations Industrial Development Organization

ECDC and TCDC: UNIDO Programmes in Support of Enterprise and Institution Co-operation in the Field of Agricultural Machinery, Industrial Development Officer, Section for Economic Cooperation among Developing Countries, United Nations Industrial Development Organization

14:00 Development and International Co-operation of China's Agricultural Machinery Industry, Prof. Lu Zhongmin, UNIDO Consultant

16:00 Presentation of the Regional Network for Agricultural Machinery (RNAM), Mr. Zia Ur Rahman, Project Manager, RNAM

18:30 Reception hosted by Mr. Bao Xuding, Vice-Minister, Ministry of Machinery and Electronics Industry (MMEI)

Wednesday 23 October

09:00 Presentation of country papers on national developments in agricultural machinery manufacture

10:45 Presentations of country papers on national developments in agricultural machinery manufacture (contd.)

14:30 Presentations of country papers on national developments in agricultural machinery manufacture (contd.)

16:00 Consultations on bilateral arrangements and meeting conclusions/recommendations (organized by MMEI and UNIDO)

Thursday 24 October

09:00 Organized visit to:
'91 International Agricultural Machinery Exhibition in Beijing
Chinese Academy of Agricultural Mechanization Sciences (CAAMS) to observe the field demonstration of agricultural machinery

Friday 25 October

09:00 Bilateral discussions leading to collaboration with Chinese agricultural machinery manaufacturers (all day, organized by MMEI and UNIDO

Saturday 26 October

15:00 Adoption of draft report

Annex 2
Agricultural machinery technology offered by China

China's technology offers are grouped under national institutions, and suppliers of diesel engines, tractors and power tillers, combine harvesters and implements.

Organizations	Technology offer
National institutions:	
Chinese Academy of Agricultural Mechanization Science (CAAMS), Beijing	R and D on cultivation, harvesting, processing, food and crop protection machinery; joint development of: (1) field implements (matching implements to tractors for dry land and orchards, multipurpose secondary tillage equipment for paddy fields, rice transplanters, fertilizer applicators, small-size reaper and rice combine, walking thresher, farm transpiration vehicles, wheat/rice/maize combines; (2) fodder and raising machinery (fodder processing, broiler and layer raising equipment, piggery and dairy equipment (including sterilizers), droppings processors, slaughtering and related processing equipment; (3) products processing and food machinery (processing equipment for seed, rice, flour, starch, cotton, fruit and vegetables and tea leaves, edible oil refining); (4) water conservation machinery; (5) materials and techniques (casting, nitrogen-controlled smooth finish heat treatment, coating technology); (6) energy and power (wind mill for water lifting, biogas technology; (7) metering and instrumentation (electric balance and automatic controls for fodder mixing, safety valve inspection)
China National Agricultural and Animal Husbandry Machinery Corporation (CNAAMC), Beijing	Complete designs and supply of agricultural and animal husbandry plant and equipment

China National Agricultural Machinery Export and Import Corporation (CNAMC), Beijing	Agricultural machinery, machinery for rural use and related manufacturing technologies; offers technology, experts, technicians; undertakes consultations, coproduction, countertrade and joint ventures; technical assistance and training in tractors, agricultural machinery and equipment and irrigation machinery
Huhehaote Animal Husbandry Machinery Research Institute, Huhehaote, Inner Mongolia Autonomous Region	R and D on animal husbandry and wind-power machinery
Luoyang Tractor Research Institute (LTRI), Luoyang, Henan Province	R and D, design, testing and consulting on tractors and related equipment
Diesel engines:	
Binzhou Diesel Engine Plant, Bizhou, Shandong Province	Small diesel engines
Changzhou Diesel Engine Works, Changzhou, Jiangsu Province	Assembly and coproduction abroad of small and medium-sized marine and land-use diesel engines from 8 to 36 HP
Cixi Power Machinery Works, Cixi, Zhejiang Province	CKD or SKD assembly of small diesel engines
Dezhou Shengjiang Machinery Works, Dezhou, Shangdong Province	12 and 15 HP diesel engines
Hangzhou Diesel Engine Works, Hangzhou, Zhejiang Province	Compact, light-weight, single cylinder, horizontal, 4-stroke, marine and land-use diesel engines with precombustion chamber and a variety of gear boxes
Jintan General Diesel Engine Plant, Jintan, Jiangsu Province	Diesel engines

Xiangtan Diesel Engine Factory, Xiangtan, Hunan Province	Small diesel engines
Laiyang Power Machinery Works, Laiyang, Shandong Province	Small and medium diesel engines suitable for small tractors, irrigation and drainage machinery, and farm processing machinery
Nanchang Diesel Engine Factory, Nancheng, Jianxi Province	Small and medium diesel engines from 10 to 170 HP, generating sets from 5 to 75 kw for farm products processing, irrigation and drainage and combine harvesters
Sichuan Internal Combustion Engine Works, Shizong District, Neijiang, Suchuan Province	Small diesel engines and 305 kw generating sets
Shanghai Diesel Works, Shanghai	High-speed diesel engines, boosters and fuel combustion systems (partly based on Austrian and USA technology)
Wujin Diesel Engine Plant, Hutangxiao, Nanding, Changzhou, Jiangsu Province	Small, single cylinder, horizontal, 4-stroke, diesel engines with water-cooled vaporization
Wuxi County Diesel Engine Works, Luoshe, Wuxi, Jiangsu Province	Diesel engines include water condensation types for power tillers, small tractors, tractors and pump sets
Xi'an Diesel Engine Works, Xi'an, Shaanxi Province	Small and medium diesel engines
Xiangtan Diesel Engine Works, Xiangtan, Hunan Province	Manufacturing technology for diesel engines between 4.5 and 10 HP, training in assembly in SKD and CKD kits

Tractors and power tillers:	
Changzhou Tractor Works, Changzhou, Jiangsu Province	Licensing and coproduction of 6-8 HP and 12 HP power tillers and a 30 HP tractor; experts available for 1-3 months; consultancy in power tiller design and production; on-the-job training in farm machinery assembling; one-week course on use of power tillers; R and D to adapt designs for other countries
Changzhou Diesel Engine Works, Changzhou, Jiangsu Province	Power tillers, bearing, gears for cooperative production abroad
The First Tractor Works, Luoyang, Henan Province	China's largest tractor builder (26 specialized production plants) supported by 4 research institutes and assimilated foreign technology. Offers assembly and/or production technology for 15-100 HP wheeled and crawler tractors, diesel engines and oil injection pumps; training in maintenance and operation of tractors and other agricultural machinery
Guang Xi Nanning Walking Tractor Plant, Nanning, Guang Xi Autonomous Region	Licence and transfer of technology for the Gwei Hua walking tractors; expertise and training on operation and maintenance
Hengyang Tractor Factory, Baishazhou, Hengyang, Hunan Province	Power tillers, tractors and rural transporters, including casting, forging, metalworking, punching, welding, heat-treatment, tooling, assembling, machine repair shop and power house; assembly technologies, expertise, consultants and training for two-wheel tractors
Hubei Tractor Plant, Laoxialu, Huangshi, Hubei Province	Medium-sized tractors (mainly 25 HP) and accessories
Jiangxi Tractor Works, Tanzikou, Nanchang, Jianxi Province	Tractors and rural transporters; design, drawings, technology, operation and maintenance, quality control and metrology and key equipment for manufacture of Fengshou 18 series tractor

Quingjiang Tractor Works, Huaiyin, Jiangsu Province	Small and medium-wheeled tractors and rural transporters
Shandong Tractor Factory, Yanshou, Shandong Province	Tractors for a variety of land/soil conditions including a dry-land-paddy field double use design
Shanghai Tractor Works, Shanghai	Licences, SKD assembly, testing, quality control and indigenization of production of four-wheel drive tractors and diesel engines
Shaoguan General Tractor Plant, Shaguan, Guangdong Province	Power tillers (including electric starting design), poultry depilators, mini-power tillers, tractor accessories and non-standard machine parts; short-term group training for power tiller assembly and repair; joint venture to support export sales
Xinhui Agricultural Machinery Plant, Xinhui, Guangdong Province	Power tillers, tractors and rural transporters
Xingtai Tractor Plant, Xingtai, Hebei Province	Small tractors, transmissions and related components
Xinxiang First Tractor Plant, Xinxiang, Henan Province	Technology, expertise and training in manufacture, assembly, testing and inspection of small four-wheel tractors
Yongkang Tractor Factory, Yongkang, Zhejiang Province	Power tillers (5 to 12 HP), diesel engines (15 and 30 HP) and generator sets; short-term group training in assembly, maintenance and repair, and operations; R and D in single-axle tractors, and single-cylinder/small-bore/multi-cylinder diesel engines
Combine harvesters:	
Huzhou Combine Harvester Works, Huzhou, Zhejiang Province	Specialized rice combine harvesters including 110/120 head feed 15 HP and 140 whole feed self-propelled rice/wheat models
Jiamusi Combine Harvester Works, Jiamusi, Heilongjiang Province	Assimilated USA technology used in broad tractor range include self-propelled grain harvesters

Longxi Combine Harvester Works, Zhangzhou, Fujian Province	Combine harvesters and rural transporters
Implements:	
Beifang Machinery plant, Jiamusi, Heilongjiang Province	Machine-towed harrows and plantation machinery for 60-160 HP tractors
Dahua Machinery Works, Jiaohe Province	Maize shellers, castings and fire extinguishers
Handan Cotton Machinery Factory, Handan, Hebei Province	Design and manufacture of hand-picked cotton processing and oil pressing machinery (seed cotton cleaning, ginning, delinting baling)
Hangzhou Gearbox Works, Hanzhou, Zhejiang Province	Gear boxes for marine and land use, slipping clutches, power metallurgy and large precision gears
Linyi Insecticide Machinery Plant, Linyi, Shandong Province	Crop protection machinery and small gasoline engines, including back-carried power sprayers and gasoline engines; short-term experts, consultants and research services in mister-dusters and gasoline engines
Nanpi Machinery Factory, Nanpi, Hebei Province	Large and medium side oil expellers and accessories

Shandong Yutai Machinery Factory, Yutai County, Jining, Shandong Province	Combined rice mill
Wenshan Agricultural Machinery Plant, Wenshan, Shandong Province	Milling machines based on Japanese technology and coproduction with USA manufacturer
Wujin Transplanter Works, Wujin, Jiangsu Province	Specialized transplanters
Xuzhou Agricultural Machinery Works, Xuzhou, Jiangsu Province	24-notched, heavy-duty harrows, medium-duty lifting disc harrows with 18/25 blades, mounted 3-disc plough, threshers, discs and points
Yanji Transplanter Works, Yanji, Jilin Province	Powered and manual transplanters
Yutai Machinery Factory, Yutai County, Shandong Province	Rice millers and hullers
Miscellaneous:	
Jilin University of Technology, Changchun, Jilin Province	Additives claimed to decrease engine wear by 40 percent, fuel consumption by 2 per cent and oil consumption by 50 per cent; technology for raising pressure and internal cooling of diesel engines to increase power by 40 per cent; gas flow injection combustion technology for internal combustion engines at low speed and heavy loads; technology for rodless mini-air compressors; technology and drawings for computer-controlled static twist test and twist-plus-fatigue tests for transmission shafts, for wear resistance, and for computer controlled stands for clutches and brakes, and for thresher technology; four-wheel mini-tractors; transplanting system for air-pruned root seedlings; high-speed mounted ploughs; reduced adhesion for soil processing blades; licence and technical drawings for air-blow type seed metering device and precision planters for corn and soybean; consultancy in sensing and technical measurement of agricultural machinery

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description

1281k

Annex 3

Results of Bilateral Discussions of Co-operation Projects

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description
Multicountry				
CPRGRP01	Agricultural Mechanization Dept./ Dept. of Trade and Industry	MMEI	Training, expertise, study tour	Chinese team to introduce Chinse farm machinery expertise in Papua New Guinea and Myanmar and survey market and service conditions
CPRGRP02	Rural Technology Promotion Centre	MMEI	Feasibility study	Chinese experts to undertake pre-feasibility study on local tractor manufacture in specific African regions (e.g. Eastern and Western Africa, Kenya, Tanzania, Ghana)
Ethiopia				
CPRETH01	Rural Technology Promotion Center	CAAMS	Training, expertise, study tour	Joint development of a national agricultural mechanization strategy plan in 3 stages: survey, regional classification, national strategy

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description
CPRETH02	Rural Technology Promotion Center	CAAMS	Technology transfer, joint venture, joint production	1-week study tour to assess needs and prepare transfer animal drawn farm implements technology, including blud points for low-weight designs for various types, for trailer/cart drawn by different animals and for harvestors. These would be manufactures in implement workshop centres.
CPRETH03	Rural Technology Promotion Center	CNAMC	Exhibition	Ethiopia will invite CNAMC to hold exhibition of agricultural machinery during 1992
CPRETH04	Rural Technology Promotion Centre	Xinxiang Tractor Plant, Henan	Technology transfer	18-25 HP four-wheel drive tractor
Ghana				
CPRGHA01	Ministry of Agriculture	CAAMS	Training, expertise	1-month training of trainers from Ghana (1 agricultural engineer, 1 engineering technician) on small-scale (manual-,

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description
				pedal- and small-engine driven) agro-processing facilities and crop storage systems for small-scale farming (1-2 ha). Training to be preceeded by visit of Chiense experts to assess Ghanian conditions.
CPRGHA02	Ministry of Agriculture	CAAMS	Technology transfer, training, expertise	Transfer of agro-processing facilities and crop storage systems for small-scale family approbation.
CPRGHA02	Ministry of Agriculture	LTRI	Training, expertise	Training of trainers (2 agricultural engineers, 1 agric. engineering technician) from Ghana on simple method of trial and development of agricultural machinery constructed and fabricated in Ghana and from abroad to be used in small-scale farming.

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description
India				
CPRINDO1	ICAR, New Delhi	CAAMS	R & D co-operation	Materials and treatment technology to enhance life of ferrous and non-ferrous alloys; plastics for use in agricultural machinery
CPRINDO2	ICAR, New Delhi	CAAMS	Technology transfer	CAAMS to forward technical information on oil expeller to India; mutual exchange of experts (1 week in each country)
CPRINDO3	ICAR, New Delhi	CAAMS	Training, expertise, study tour	20-day visit of 3 experts from China to India and from India to China to study use of CAD in agricultural machinery
CPRINDO4	ICAR, New Delhi	Yongkang Tractor Factory, Zhejiang	Feasibility study	Feasibility, evaluation and R&D with mutual interaction in order to explore suitability of small HP tiller for use in hilly regions in India

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description
Indonesia				
CPRINS01	Ministry of Agriculture	Xian Diesel Engine Works, Shaanxi	CKD/SKD assembly	6 and 8 HP diesel engine usual practice, export and import
CPRINS02	Ministry of Agriculture	Luoyang Tractor Research Institue, MMEI	Technology transfer, joint production, R&D co-operation, expertise	Engineer from Indonesia to test tractor in China Development of small tractor production. Exchange of programme of 2 institutes in tractor development. Mutual exchange of scientists and engineers
CPRINS03	Ministry of Agriculture	Jiangxi Tractor Plant	Technology transfer, joint venture, feasibility study, training, expertise	Import of whole machine and train local staff Set up assembly line in CKD/SKC to manufacture locally. Study tour to assess location of factory training for users and after-sales service, spare parts supply
CPRINS04	Ministry of Agriculture	CAAMS	Joint venture, Feasibility study, training	Sprinkler need survey and availability of water resources and long courses on operational assembling

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description
CPRINS05	Ministry of Agriculture	CAAMS	Joint venture CKD/SKD assembly	Transplanting with 13 HP (total quantity about 125,000 sets) First import of whole machine, then CKD, followed by SKD
CPRINS06	Ministry of Agriculture	CAAMS	Joint venture	Combine with 2 roles about 5 HP (quantity about 1,250 sets)
Kenya				
CPRKEN01	Ministry of Agriculture	CAMC	Technology transfer, feasibility study, joint venture, joint production	Transfer of tractor technology Joint tractor and combine manufacture
CPRKEN02	Ministry of Agriculture	CAMC	Technology transfer, feasibility study, joint venture, joint production, CKD/SKD assembly	Transfer of tractor technology Joint tractor and combine manufacture Assembly of initially tractor combine To assess local tractor and combine manufacture

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description
CPRKEN03	NDUME LTD.	CAMC	Technology transfer, joint venture, feasibility study, supply of machinery	Transfer of irrigation and drilling machinery Joint production of harvestor and tractor (diesel engine) To assess export of tractor NY-12 and market condition of Kenya for mist-duster Supply of sample machine 180 and tractor model NY-12
Myanmar				
CPRMYM01	Ministry of Agriculture and Forest	Changzhou Diesel Engine Works	Study tour	To survey market of small diesel engines (5-12 HP for use in small farm machines to promote mechanization
CPRMYM02	Ministry of Agriculture and Forest	CAAMS	R&D co-operation	(1) multipurpose power tillers, (2) combine harvester that can be attached to 50HP wheel tractor, (3) hand pump testing

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description
Pakistan				
CPRPAK01	FMI	CAAMS	R&D co-operation, training,	Central pivet sprinkler irrigation system 6 months training in irrigation machinery
CPRPAK02	FMI	China National Construction and Agricultural Machinery Imp.&Exp. Corp.	Joint venture	Joint disc manufacturing
CPRPAK03	FMI	China National Construction and Agricultural Machinery Imp.&Exp. Corp.	Joint production, joint venture, study tour	Joint production of equipment for round disk Joint round disk production Assessment of concrete functional co-operation programme
Papua New Guina				
CPRPNG01	Dept. of Trade and Industry	Xiangtan Diesel Engine Works	Feasibility study	Assessment of market potential of diesel generator
CPRPNG02	Dept. of Trade and Industry	Luoyang Tractor Research Institute	Feasibility study	Assess manufacture of tractors and power tillers

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description
CPRPNG03	Dept. of Trade and Industry	CAAMS	Joint venture, feasibility study	Manufacture of agricultural implements in Papua New Guinea Set up joint venture corporation
Republic of Korea				
CPRROK01	Agricultural Mechanization Institute	Dachang Yingchun Machinery Plant	Expertise	Import medium and small-sized grain storage and other equipment from China
Sri Lanka				
CPRSRI01	Agricultural Development Authority	CAAMS/CAMC	Technology transfer, joint venture, feasibility study	Transfer of coconut juice production line Establish coconut juice plant Assess local consumption and export
CPRSRI02	Agricultural Development Authority	CAAMS/CAMC	Technology transfer, joint venture, feasibility study	Transfer of fruit can production line Establish fruit can production line Assess local consumption and export

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description
CPRSRI03	Agricultural Development Authority	CAMC/Xiangtan Diesel Engine Works	Joint venture, CKD/SKD assembly	Joint production of diesel engine 5-6HP (10,000 units per year) Assembly of diesel engine 5-6HP; later sale under original trade mark and export
CPRSRI04	Agricultural Development Authority	CAMC/Beijing Agri-culture Machinery Co.	CKD/SKD assembly, training, expertise	Assembly of gasoline engine (total quantity 5,000 units per year) Engineers from China to Sri Lanka as supervisors
CPRSRI05	Agricultural Develpment Authority	CAMC/Shandong Linyi Pesticide Machinery Works	CKD/SKD assembly, R&D co-operation	Assembly of gasoline engine model IE40F, IE40F-32 and IE36F Engineers and supervisors
<u>Thailand</u>				
CPRTHA01	Dept. of Agriculture and Cooperatives	CAMC	CKD/SKD assembly	Assembly of 15 and 30 HP four wheel tractor and 8HP to 15HP diesel engine
			Feasibility study	Assess use and market of sugarcane harvester, demonstration with sample machine

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description
United Republic of Tanzania				
CPRURT01	Ministry of Industries and Trade	Changzhou Tractor Plant	Technology transfer, feasibility study, joint venture, joint production	Transfer of walking tractor technology Joint walking tractor production
CPRURT02	Ministry of Industries and Trade	Changzhou Diesel Engine Works	Technology transfer, joint production, joint venture, feasibility study	Transfer of diesel engine technology (7-18 HP and 20-24 HP)
CPRURT03	Ministry of Industries and Trade	Hengyang Tractor Plant	Technology transfer, joint venture, joint production, feasibility study	Co-operation in walking tractor plus implements and motor vehicle (1,5 t) production
CPRURT04	Ministry of Industries and Trade	China National Agric. Machinery Corp.	Technology transfer, joint venture, joint production, feasibility study	Small and medium tractors (15-25 HP and 40-45 HP; tractor implements; walking tractor (12HP)
CPRURT05	Ministry of Industries and Trade	Shijiazhuang Tractor Plant	Technology transfer, joint venture, joint production, feasibility study	Small and medium tractors (15-25 HP and 40-50HP); tractor implements
CPRURT06	Ministry of Industries and Trade	HinHing First Tractor Plant	Technology transfer, joint venture, joint production, feasibility study	Small tractor (15-25HP); tractor implements

Agreement No.	Proposer or Main Beneficiary	Chinese Counterpart Organization	Type of Co-operation	Project Description
CPRURT07	Ministry of Industries and Trade	LTRI	Technology transfer, joint venture, joint production, feasibility study	Motor vehicle (transport equipment) 1-2t; small and medium tractors (15-25HP and 40-50HP); tractor implements; walking tractor
CPRURT08	Ministry of Industries and Trade	Changzhou Diesel Engine Works	Technology transfer, joint venture, joint production, feasibility study	Co-operation programme in diesel engine production (7-18HP and 20-40HP)
CPRURT09	Ministry of Industries and Trade	China National Agric. Machinery Corp.	Technology transfer, joint venture, joint production, feasibility study	Small and medium tractors (15-25HP and 40-50HP); tractor implements; walking tractor (12HP)
CPRURT10	Ministry of Industries and Trade	Hengyang Tractor Plant	Technology transfer, joint venture, joint productio ,	Walking tractor plus implements
CPRURT11	Ministry of Industries and Trade	Changzhou Tractor Plant	Technology transfer, joint venture, joint production	Walking tractor (12HP)

Annex 4

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Annex 5

Formal Papers Presented or Made Available at the Meeting

National papers

Mr. Tesfaye Berhanu	Agricultural Mechanization in Ethiopia
Mr. Oduro Kwadjo Gyarteng	The Agricultural Machinery Sector in Ghana
Dr. Dipankar De	Country Paper from India
Mr. R. Dadang Tarmana	Indonesia Country Report
Mr. Gichuki Muchiri	A Proposal for Agricultural Mechanization Strategy Formulation for Kenya
Mr. U. Maung Maung	Country Report of the Union of Myanmar
Mr. Abdul Waheed Zafar/ Dr. Abdul Shakoor Khan	Country Report of Pakistan
Mr. Biri Deplap	Country Paper of Papua New Guinea
Mr. Choe Kwang-Jae	Country Report of the Republic of Korea
Mr. A.D.M. Karunaratne	Country Report of Sri Lanka
Mr. Chak Chakkaphak	An Overview of the Present Situation of Agricultural Machinery in Thailand
Mr. O.S. Mageni	An Overview of the Present Situation of the Agricultural Machinery Sector in Tanzania

Background papers

Development and International Co-operation of China's Agricultural Machinery Industry (Prof. Lu Zhongmin, China)

RNAM's Experiences in Promoting Co-operation among Developing Countries (Dr. Zia ur Rahman, RNAM, Philippines)

ECDC and TCDC: UNIDO programmes in support of enterprise and institution co-operation in the field of agricultural machinery (UNIDO)

UNIDO Technical Assistance in the field of Agricultural Machinery and Implements (UNIDO)