ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

INTER-COUNTRY CO-OPERATION IN AGRICULTURAL MACHINERY MANUFACTURE AND POPULARIZATION

UNITED NATIONS

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ST/ESCAP/300

Except for the report of the Seminar, this publication has been issued without formal editing.

September 1984

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12. The Status of Farm Mechanization and the Agricultural Machinery in Bhutan, by Mr. Sherub Gyaltshen, Deputy Agricultural Engineer, Agricultural Department of Bhutan.

13. Status of Farm Machinery Manufacture and Popularization in India - The Problems and Prospects and the Efforts made by CIAE, by Mr. H.S. Biswas, Scientist (FM&P), Bhopal, India.

14. The status of Farm Mechanization and the Agricultural Machinery Industry in Peninsular Malaysia, by Mr. Poh Seng Chai, Agricultural Engineer, Department of Agriculture, Kuala Lumpur, Malaysia

15. The status of Farm Mechanization in Nepal, by Mr. A.B. Karki, Chairman-cum-General Manager, Agricultural Tools Factory, Birgunj, Nepal

16. Country Paper on Agricultural Mechanization in the Philippines, by Dr. Marietta S. Adriano, Agricultural Staff, National Economic and Development Authority (NEDA), Manila, Republic of the Philippines

17. Design, Development and Adaptation of Agricultural Machinery in Sri Lanka, by Mr. H.M. Tilakaratna, Agricultural Engineer in Charge, Farm Mechanization Research Centre, Maha Illuppallama, Sri Lanka

18. Thailand Farm Machinery Industry by Mr. Charmroon Malaigrong and Mr. Phipath Patanaphan, Engineer, Industrial Economics & Planning Division, Ministry of Industry, Bangkok, Thailand.

FOREWORD

Most developing countries of the Asian and Pacific region have launched efforts to modernize agriculture so as to increase agricultural output and thus improve the social and economic conditions of their vast rural masses. Mechanization is a vital ingredient in this modernization process, raising as it does the productivity and income of farmers while reducing the drudgery of farm operations.

In pursuit of these objectives, the programme of agricultural mechanization has been accorded a high priority by ESCAP for more than 15 years. The establishment of the Regional Network for Agricultural Machinery (RNAM) in 1977, with eight participating countries, opened a new phase in strengthening the mechanization and manufacturing capabilities of those nations. During its seven years of operations, RNAM has greatly assisted the participating countries in formulating their mechanization policies, in design development and manufacture, in industrial extension, in the popularization of machinery, in information exchange and in training. Its activities have had such a profound impact at the national level that it is often referred to as a success story with growing effectiveness and benefit to participting countries. RNAM has clearly demonstrated that rising agricultural productivity is linked with technological changes such as mechanization to appropriate degrees. Mechanization is usually the most visible and easily recognized transformation of the rural scene. Apart from increasing agricultural output, it provides opportunities for employment, development of skills and proliferation of non-farming rural activities.

The Meeting of Ministers of Industry preparatory to the Fourth General Conference of UNIDO, held at Bangkok in March 1984, recommended the extension of the project at least until the end of the UNDP programming cycle for 1987-1992. This recommendation was endorsed by the Commission at its fortieth session held at Tokyo in April 1984. With such support, RNAM will, in the years to come, increasingly strengthen its operations to lend greater thrust to the manufacture of agricultural machinery and the popularization

/programmes

programmes of the developing countries in the region. It is also envisaged that the membership of RNAM will be enlarged and its financial resources augmented correspondingly in order to provide adequate technical and advisory services to participating countries and to strengthen its operational efficiency as an inter-country project of excellence.

The secretariat was pleased to organize the ESCAP/UNIDO Seminar on Manufacture and Popularization of Agricultural Machinery, Tools and Equipment in China in May 1984, in co-operation with China's Ministry of Machine Building Industry (MMBI). It provided an opportunity to deliberate on the exchange of experiences and the promotion of inter-country co-operation. ESCAP will implement the inter-country activities through the existing institutional mechanism of RNAM.

This publication contains information on the exchange of experiences, the immense potential for inter-country co-operation as well as background documents contributed by participants in the Seminar. It is expected that the publication will serve as a useful reference material and will further stimulate inter-country co-operation in the manufacture and popularization of agricultural machinery in the region.

Bangkok
September 1984

S.A.M.S. Kibria
Executive Secretary

PHOTOGRAPH 1

Opening of the Seminar at the China International Centre of Economic and Technical Exchange, Beijing

PROGRAMME

6-7 May 1984 (Sunday-Monday)	Arrival at Beijing and registration
	<u>Contacts</u>
	Mr. Chen Nailong, Director(Adviser), Bureau of Agricultural Machinery Industry, Ministry of Machine Building Industry, 12 Fu Xin Men Wai St., Beijing
	Cable: EQUIMPEX, Beijing Tel: 361169, 362561-581 Telex: 22186 EQUIP/CN 22610 EQUIP/CN
	Mr. Wang Wanjun, Chief Engineer, Chinese Academy of Agricultural Mechanization Sciences, Beijing
	Mr. Huang Tieshan, Director of Import Department of Foreign Affairs Bureau, Ministry of Machine Building Industry, 12 Fu Xin Men Wai St., Beijing
	Mr. Yuan Jiaping, Chief of Foreign Technical Division, Chinese Academy of Agricultural Mechanization Sciences, No. 1 Beishatan, Deshengmen Wai, Beijing Cable: 7651, Beijing Telex: 441331
	Mr. Tao Zhen, Project Officer, Foreign Affairs Bureau, Ministry of Machine Building Industry, 12 Fu Xin Men Wai St., Beijing
8 May (Tuesday)	
Morning:	Free
Afternoon:	Visit to Beijing Combine Harvester Plant, Beijing Cable: 3510 Tel: 363431

/<u>Contacts</u>

Contacts

Mr. Pan Yao Guan, Director

Mr. Lee, Chief Engineer

Mr. Wu, Chief Engineer

9 May
(Wednesday)

Morning:

Opening of the Seminar at the China International Centre of Economic and Technical Exchange, Beijing

Statements by:

(1) Dr. V.J. Ram, Chief, ESCAP/UNIDO Division of Industry, Human Settlements and Technology, ESCAP

(2) Mr. Song Zhensui, Senior Industrial Development Officer, Section for Economic Co-operation among Developing Countries, Division of Policy Co-ordination, UNIDO, Vienna

(3) Mr. Tao Henxiang, Chief Engineer, MMBI, Beijing

Afternoon:

Presentation of background papers:

(1) "Development of Agricultural Mechanization in China", by Mr. Hu Nanqiang

(2) "On the Agricultural Machinery Industry of the P.R.C.", Mr. Chen Nailong

(3) "Research and Development of Agricultural Machinery of China", Mr. Wang Wanjun

(4) "UNIDO/TCDC Training Activities in the Field of Agricultural Machinery Industry in China", Mr. A.W. Sissingh, UNIDO SIDFA, c/o UNDP, Beijing

10 May
(Thursday)

Morning:

Visit to Chinese Academy of Agricultural Mechanization Sciences (CAAMS) and National Exhibition of New Farm Machinery and Electrical Appliances, No.1 Beishatan, Deshengmen Wai, Beijing

Cable: 7651 Beijing

Tel: 441331

/Contacts

	Contacts
	Mr. Hua Guozhu, Director
	Mr. Feng Hingyuan, Vice Director
Afternoon:	Visit to Huairou County Agricultural Machinery Factory, Chezhan Road, Huairou County, Beijing
	Cables: 9214
	Tel: 127.180
	Contacts
	Mr. Hou Re Xing, Director
	Mr. Sheng Rui Zheng, Deputy Director
	Mr. Li Ren Huan, Chief Engineer
11 May (Friday)	Free
12 May (Saturday)	
Morning:	Visit to the Forbidden City
11.50 a.m.	Departure for Nanjing by train
13 May (Sunday)	
Morning: (6.26 a.m.)	Arrival Nanjing Free
Afternoon: (16.55 p.m.)	Departure Nanjing by train
17.53 p.m.	Arrival Zhenjiang
19.00 p.m.	Welcome speech by Mr. Li, Vice Mayor
19.30 p.m.	Dinner
14 May (Monday)	
Morning:	Visit to Jiangsu Institute of Technology, Zhenjiang, Jiangsu

/Contacts:

Contacts

Mr. Song Ya Xin, President

Mr. Weng Jiachang, Vice President and Professor

Mr. Luo Ti-qing, Dean of Study

Mr. Liu Xingrong, Director of the Scientific Research Department

Mr. Wang Yuen, Head of President Office

Ms. Wang Yuefeng, Interpreter

Afternoon:

Visit to Zhenjiang Thresher Factory, 60 Sinho Sian, Zhenjiang City, Jiangsu Province

Cable: 2814

Tel: 21063, 21450

Contacts

Mr. Cao Yang, Director

Free

Music show

15 May (Tuesday)

Morning (7.48 a.m.) Departure Zhenjiang by train

9.04 a.m. Arrival Changzhou

Visit to Changzhou Diesel Engine Factory, 219 Huai de Road, Changzhou, Jiangsu

Tel: 3256

Contacts

Mr. Wang Zhijun, Vice Director and Chief Engineer

Mr. Zhao Hongwei, Interpreters, Changzhou Agricultural Machinery Import and Export Corp., Xixinqiao, Changzhou, Jiangsu

Cable: AGRIMEXCZ

Telex: 34063 AMCCZ CN

Tel: 6658

/Visit

Afternoon:	Visit Changzhou Tractor Factory <u>Contacts</u> Mr. Lin Jinwei, Chief of the Designing Department Mr. Zhong Yong, Engineer Madame Wang Jinwei, for reception
16 May (Wednesday)	
Morning:	Departure Changzhou by bus Visit Wuxi Pump Works, Wuxi Nan-Men, Jiangsu Cable: 3119 Tel: 24456 <u>Contacts</u> Mr. Ren Cheng Yong, Director Mr. Xu Han Wu, Manager Mr. Yu Mei Liang, Senior Engineer Mr. Tu Zhongliang
Afternoon:	Free
17 May (Thursday)	
Morning:	To Huzhou, Zhejiang by boat and change to Hangzhou by bus
Afternoon:	Arrival Hangzhou
18 May (Friday)	
Morning:	Visit to Hangzhou Gearbox Works, Xiaoshan, Hangzhou, Zhejiang Cable: 2134 (Xiaoshan) Tel: 25823 (Hangzhou) <u>Contacts</u> Mr. Ren Wenang, Sales Director Mr. Xu Qin Mo, English Interpreter

/Visit

Afternoon:	Visit to Hangzhou Tea-Making Machinery Factory, Zhejiang Fuyang Xindeng
	Telex: 0555
	Tel: 127
	Contacts
	Mr. Zhang Huangshen, Director
	Mr. Tian Zude, Second Director
	Mr. Lu Xuejia, Third Director
	Mr. Shun Cengye, Engineer, Chief of Design Office
	Mr. Wu Ruixun, Chief of the office
	Mr. Chen Peili, Engineer
19 May (Saturday)	
Morning:	Free
Afternoon:	Departure for Shanghai by train
20 May (Sunday)	Visit to Jin Shan Agricultural Machinery Works, Shanghai
	Contacts
	Mr. Ding Qi Rong, Deputy Director
	Mr. Lu Nanxing, and
	Mr. Lu Zhihui
21 May (Monday)	
Morning:	Visit to Shanghai Tractor Works, 1059, Xiangyin Road, Shanghai
	Cable: 8230
	Tel: 480006
	Contacts
	Mr. Shi Jiamu, Vice Director
	Visit to Shanghai Internal Combustion Engine Works, 535 Jianpu Road, Shanghai
	Telex: 33102 STCFU CN CLIENT 317
	Tel: 451010

/Contacts

	Contacts
	Mr. Xue Yongchun, Vice Director
	Mr. Fu Fuyuan, Vice Director
Afternoon:	Visit to Luodian People's Commune and demonstration of selected agricultural machinery in the field
	Contacts
	Mr. Shi Mei-ting) Heads of People's Mr. Qian Shen) Government of Bao Shen County
	Mr. Shu Wen-hao, Head of Management Committee of Luodian Commune
	Mr. Wang Lu-Fu, Station Leader at Management Station Division
	Mrs. Wang Xiu-Zhen, Head of Agricultural Agricultural Machinery Research Institute
22 May (Tuesday)	Discussions on the exchange of experiences
Evening:	Entertainment Song and Dance Drama
23 May (Wednesday)	Discussions on the identification of areas of ECDC/TCDC Co-operation
Evening:	Entertainment - Acrobatic show
24 May (Thursday)	
Morning:	Free
Afternoon:	Discussions of the draft report of the Seminar and its adoption
	Closing session addressed by:
	(a) Mr. Ye Gong-qi, Vice-Mayor of Shanghai Municipality, 12 Zhongshan Road, E.1, Shanghai
	(b) Mr. Han Tong Yu, Chairman of the Council of Shanghai Agricultural Machinery Society and Deputy Director of Shanghai Agricultural Machinery Bureau, 14 Zhongshan E, 1 Lu, Shanghai

(c) Mr. Chen Nailong, Chairman of the Seminar

(d) Mr. H.G.R. Reddy, ESCAP and

(e) Mr. Song Zhensui, UNIDO

5 May Friday)	Departure of participants from Shanghai to their respective duty stations

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PHOTOGRAPH 2

Participants of the Seminar at the reception given by Mr. Tao Hengxian of MMBI, at Beijing Hotel on 9 May 1984

FOR PARTICIPANTS ONLY

IHT/SAMTE/1
7 August 1984

ORIGINAL: ENGLISH

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

REPORT OF THE ESCAP/UNIDO SEMINAR FOR PROMOTING ECONOMIC AND TECHNICAL CO-OPERATION AMONG DEVELOPING COUNTRIES IN ASIA AND THE PACIFIC IN THE FIELD OF MANUFACTURE AND POPULARIZATION OF AGRICULTURAL MACHINERY, TOOLS AND EQUIPMENT

8-24 MAY 1984, CHINA

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INTRODUCTION

1. The guiding principles in the development of agro- and allied industries in the ESCAP secretariat during the last several years have been an uncompromising emphasis on issues of poverty, unemployment, income distribution and social justice as being central to the meaning of development. In pursuance of these principles and in co-operation with the participating member countries, a large number of operational projects have been implemented during the last several years. Agricultural mechanization programmes have caught the imagination of the policy- and decision-makers in the developing countries of the region as indispensable activities to increase the agricultural productivity and income of the farmer. In recent years there has been evidence of increasing resources being deployed at the national level for mechanization programmes. In recognition of their multifarious benefits to the economy, primarily their contribution to income generation and distribution to alleviate poverty. ESCAP has long been committed to assisting the developing countries in strengthening their agricultural mechanization programmes.

2. The United Nations Industrial Development Organization (UNIDO) attaches great importance to economic and technical co-operation among developing countries. The agricultural machinery industry has been one of the priority areas for promoting ECDC/TCDC activities.

3. Within this context the Economic and Social Commission for Asia and the Pacific (ESCAP) and the United Nations Industrial Development Organization (UNIDO), in co-operation with the Government of China, organized the ESCAP/UNIDO Seminar for Promoting Economic and Technical Co-operation among Developing Countries in Asia and the Pacific in the Field of Manufacture and Popularization of Agricultural Machinery, Tools and Equipment in China from 8 to 24 May 1984.

I. ORGANIZATION OF THE SEMINAR

A. Attendance

4. Participants nominated to attend the Seminar were: Mr. Sherub Gyaltshe (Bhutan), Mr. Chen Nailong (China), Mr. H.S. Biswas (India), Mr. Poh Seng Chai (Malaysia), Mr. A.B Karki (Nepal) Dr. Marietta S. Adriano and Dr. Carlos del Rosario (Philippines), Mr. H.M. Tilakaratna (Sri Lanka), and Mr. Chamroon Malaigrong and Mr. Phipath Patanaphan (Thailand). The Project Manager of the Regional Network for Agricultural Machinery (RNAM) of ESCAP also participated in the Seminar. ESCAP and UNIDO were represented.

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B. Opening of the Seminar

5. During the opening session the representatives of ESCAP, UNIDO and the Government of China addressed the Seminar.

6. The Chief of the ESCAP/UNIDO Division of Industry, Human Settlements and Technology expressed the view that the Seminar would provide a valuable opportunity to discuss problems of common interest, with the overriding objective of promoting economic and technical co-operation among the developing countries in the region in the field of manufacture and popularization of agricultural machinery, tools and equipment. He mentioned that China had been actively participating in the programmes of activities of ESCAP and in recent years China had made available its host facilities to provide opportunities for the developing countries in the region to share its experience in specific sectors, such as medium- and small-scale industries and the integrated silk-processing industry, as well as the agricultural machinery industry. He pointed out that ESCAP had been promoting agricultural mechanization programmes in the region for over 15 years. The member countries of ESCAP, after a series of consultations at the expert, intergovernmental, legislative and commission levels, had established the Regional Network for Agricultural Machinery (RNAM) with its headquarters at Los Banos, Philippines. ESCAP was its executing agency. The Project came into operation in 1977 and had gone through 2 phases so far. Its programme of activities had had great impact at the national level in strengthening national technological and manufacturing capabilities. China had associated itself with the activities of RNAM and provided facilities for two training courses in the country in 1980 and 1982. It had also provided five cereal harvesters and a technical team of experts to demonstrate the use of the harvesters in the RNAM countries.

7. The fortieth session of the Commission held at Tokyo, from 17 to 27 April 1984, inter alia, endorsed the recommendation of the ESCAP Preparatory Meeting of Ministers of Industry for the Fourth General Conference of UNIDO that the RNAM Project be extended through 1985 and 1986, with a further extension of five years to coincide with the UNDP Programming Cycle for the Regional IPF, 1987-1992.

8. He also pointed out that the current Seminar was of particular importance as it was the first sectoral follow-up activity to the Asia and Pacific Regional Intergovernmental Consultations for the Formulation and Implementation of Programmes for Technical Co-operation among Developing Countries (Beijing, November 1983).

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9. Mr. Song Zhensui, Senior Industrial Development Officer of UNIDO, underlined the importance of economic and technical co-operation among developing countries and explained that commonality, similarity and complementarity justified economic and technical co-operation among developing countries. In order to achieve maximum results in ECDC/TCDC, in his view, the principles of solidarity and mutual assistance, equality and mutual benefit, stress on practical results, diversity in forms and common development, should be observed. He gave an account of UNIDO's activities for promoting and implementing ECDC/TCDC, especially in the field of the agricultural machinery industry. He mentioned that the recent discussions on ECDC/TCDC were concerned with a functional approach based on matching needs and capabilities of co-operating countries. The Solidarity Ministerial Meetings for Co-operation in the Industrial Development of some least developed countries (in Asia: Afghanistan, Bangladesh and Nepal), organized by UNIDO, and the ESCAP Intergovernmental Consultations on TCDC were two examples of that kind of approach. In the context of those experiences and their adaptation to specific industrial sectors, the Seminar could be viewed as an initial and important preparatory step for a high-level ECDC/TCDC meeting. He suggested that the participants might take the opportunity provided by discussions and field visits to exchange information on the needs and capabilities of ECDC/TCDC in that field. He hoped that at the end of the field visits some concrete possibilities for co-operation would be explored and identified. He also wished that the discussions in Shanghai would focus on concrete proposals for further co-operation among the ESCAP developing countries in the field of the agricultural machinery industry and that some specific proposals would be adopted for further action.

10. Mr. Tao Hengxian, Chief Engineer of the Ministry of the Machine Building Industry, Government of China, stated that since the foundation of the People's Republic of China, the agricultural machinery industry had developed rapidly. He said that the guiding principle of making the economy more flexible internally and of carrying out an open policy externally had resulted in a new development of the national economy in China. In the countryside the responsibility system for agriculture production gave a great incentive to agricultural development resulting in new and higher demands on the agricultural machinery industry, which had to produce what the farmers needed He observed that the participants

/were

were all from developing countries and that they had their own experiences in developing their agricultural machinery industry which could be exchanged. He expressed the wish to discuss ways and forms of technical co-operation among the participating countries and to develop friendly relations. He emphasized that the Government of China had constantly paid great attention to developing south-south co-operation. He wished to develop technical co-operation relationships by means of international practices and forms, such as licensing to acquire advanced technology and transfer of technology to other countries, joint design, joint research, joint production, technical advisory services, training as well as expansion of trade.

C Election of officers

11. Mr. Chen Hailong, Director, Bureau of Agricultural Machinery Industry, Ministry of Machine Building Industry in China, was elected Chairman; Mr. H.G.R. Reddy of the ESCAP/UNIDO Division of Industry, Human Settlements and Technology and Mr. Song Zhensui of UNIDO were elected co-chairmen.

D. Adoption of the agenda

12. The Seminar adopted the following agenda:

1. Opening of the Seminar
2. Election of officers
3. Adoption of the agenda
4. Exchange of experience in the field of manufacture and popularization of agricultural machinery
5. Identification of areas and forms of co-operation
6. Conclusions and recommendations
7. Other matters
8. Adoption of the report
9. Closure of the Seminar

E. Summary of activities

13. The programme consisted of three parts. In the first part the participants met in the plenary session at Beijing, at which the opening statements were made and the main papers from the host country were presented. The second part included field visits to a number of factories, research institutions and technical colleges, as well as field demonstrations of agricultural machinery. A brief report on the field visits is attached as annex III. The third part was the further exchange of experience and identification of areas and forms of co-operation in the field of the agricultural machinery industry.

II. EXCHANGE OF EXPERIENCES IN THE FIELD OF MANUFACTURE AND POPULARIZATION OF AGRICULTURAL MACHINERY

14. A meeting was arranged in Shanghai from 22-24 May 1984 to discuss the exchange of experiences during the visits to the various institutes/factories in China and those of other countries participating in the Seminar. The following issues were discussed:

A. Policies

15. The Seminar noted that, on the basis of observations during travel through various parts of China, by and large traditional methods of agriculture were being used. It also noted that the newly-introduced responsibility system had fragmented landholdings to such a small size (about 1/15 of a hectare/person in the South) that it was not conducive to mechanization. The Chinese participant explained that the level of mechanization at present was low and gave the following figures:

Operation	% by mechanical power
Seedbed preparation	36% of total cultivated area
Planting and sowing	12% of total cultivated area
Harvesting	4% of cereal crops

However, the Chinese authorities were optimistic about increasing the level of mechanization since the Government was making a conscious effort to encourage the creation of a diversified economy in the rural areas, the result of which was that farmers were enthusiastic about increasing the mechanization of their forms so that labour could be released for participation in the diversified economic activities. The cycle of mechanization for wealth and wealth with mechanization had begun in some areas.

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16. The application of farm machinery in China was facilitated by the following.

(a) Machinery from the old commune system was being leased to individuals for special operations. This machinery included seed-bed preparation equipment, plant protection equipment, harvesters, etc., to increase the individual and family incomes;

(b) Encouragement to families to own equipment collectively;

(c) More affluent individuals were from families owning their own equipment;

(d) China Agricultural Machinery Sales and Service Corporation would lease new machines to communes or individuals;

(e) The Government was reducing the price of high-cost machinery to encourage its purchase by farmers/families;

(f) Interest-free and soft loans were being made available to manufacturing industries to promote higher production of agricultural machinery.

Components used in agricultural machinery were 30 per cent cheaper than the same components used for other purposes.

17. These incentives were already beginning to show positive results as evidenced by the following comparative production figures from Sichuan province:

	1979	1983
(a) Walking tractors	79,000	145,000
(b) Threshers	320,000	460,000
(c) Horsepower	5.7 million	9.0 million

18. It was noted that the priorities for mechanization for the Southern part of China were different from those of the Northern part. In the early years after the founding of the new nation, priority was given to irrigation and drainage, i.e., machinery and improvement of water courses in the South; while in the North equipment for seedbed preparation was emphasized. Later, it was realized that irrigation machinery was also required for the North. Now sideline products, i.e., brick-making, raising vegetables, poultry, pigs, sheep, and commodities production (converting primary products into commodities such as sugarcane into sugar), were also being emphasized for both North and South. In the future, in addition to these, development of plant protection equipment, processing machines, machines for cash crops (cotton, jute, sugar cane, beat, etc.) would command higher priority.

/8.

B. Institutional framework

19. The Chinese institutional framework for agricultural machinery/mechanization is given in the chart below. In this context the Seminar noted that the mechanization programmes in the RNAM countries were the responsibility of the Ministries of Agriculture. National Farm Mechanization Committees had been established with guidelines and technical and advisory services provided by RNAM. In order to integrate all mechanization activities the concept of national networks was gaining ground.

/INSTITUTIONAL

INSTITUTIONAL FRAMEWORK

MINISTRY OF THE MACHINE BUILDING INDUSTRY (MMBI)

Bureau of Ag. Machine Bldg Industry	Bureau of Education	Bureau of factory Planning and Design	Div. of Planning	Div. of Production	Div. of Science & Technology	Div. of Quality Control

R & D institutes (State, 9 units) ↓ R & D Institutes provincial (35 units) ↓ R & D institutes (prefecture) ↓ R & D institutes (commune) specialized in popularization of agricultural machinery (more than 2000 units)	Factories (State) Also some R & D institutes ↓ Factories (provincial) ↓ Factories (prefecture) ↓ Factories (county) ↓ Factories (commune) All together = 2200 manufacturing works 2000 repair and manufac-turing works	Universities colleges (10 major in agricultural machinery) also some research units	Sales & service corp. (State) ↓ Corp. (Provincial) ↓ Corp. (prefecture) ↓ Corp. (county) All together 12,000 units; 160,000 persons	Agricultural Machinery Export Corp.	Agricultural Machinery Factory Planning and Design Institute (State, 3.) also engaged in the research of agricultural machinery manufacturing factory and special machines/ design such as multi-head machines, foundry production line.

Ministry of Agriculture, Forestry, Livestock and Fishery

- Bureau of Agricultural Mechanization
- Bureau of State Farms
- Test and Evaluation Centre
  - Test and Evaluation Centre (Provincial)
- Institutes of agricultural engineering
- Institutes of agricultural mechanization
  - (only a few at provincial and county level)
- University and colleges
  - (40 have department or division with major in agricultural mechanization)

The Ministry of Light Industry also had some research institutes engaged in R & D work relating to machines and implements for special use related to agriculture.

C. Research and development

20. The Chinese network for R & D consisted of the following State institutes:

- Chinese Academy of Agricultural Mechanization Systems (CAAMS) at Beijing
- Tractor Institute at Luoyang
- Internal Combustion Engine Institute at Shanghai
- Animal Husbandry Mechanization Institute in Inner Mongolia
- Fuel Injection Equipment Institute at Wuxi, and
- Three agricultural machinery plant planning and design/ manufacturing technology institutes

21. In addition every province had at least one machinery development institute and another for mechanization (some of them were specialized in certain fields such as peanut machinery). Every prefecture and county also had its own mechanization research institute.

22. The State institutes were engaged in more sophisticated and basic research, the provincial institutes in machinery for local requirements, while the prefecture and county-level institutes were primarily meant for farm machinery popularization. There were other institutes for major cash crops, situated at appropriate locations.

23. The institutes regularly tested and evaluated machinery imported from foreign countries for adaptation. In some cases licenses were bought for local manufacture. A recent example was the purchase of a licence for tractors of John Deere design.

24. In most of the other countries in Asia R & D work was being carried out by the national institutes, as well as by the private industry.

25. In the RNAM countries R & D was being carried out through testing and evaluation of prototypes exchanged between the participating countries. The linkage between R & D, manufacture and popularization was being accomplished through industrial extension and agricultural extension activities.

/D.

D. Manufacture

26. Most of the agricultural machinery was being produced in factories employing more than 200 workers in China. Animal-drawn implements and hand tools were being fabricated at the cottage industry level or in light industry.

27. China had established large manufacturing plants such as the Luyang factory which employed more than 30,000 workers and in some of their factories they used a high level of sophistication and automation. China did not hesitate to enter into technical collaboration for production of high technology machinery; it had, for example, done so with John Deere for production of some 1,000 tractors of over 100 hp per annum. In exceptional cases, such as to meet the requirements of state farms with holdings larger than 60,000 ha., import of machines for e.g. combines of 150 hp capacity were allowed. The state farms constituted 5 per cent of total cultivated land area. As a general policy, the local industry was protected from foreign competition. However, competition within the country was encouraged.

28. The Seminar noted that Malaysia allowed duty-free import of agricultural machinery, while Nepal levied 1 per cent and Pakistan 10 per cent duties on most agricultural machinery products.

E. Standardization

29. The advantages of standardization of agricultural machinery were noted to be:

(a) Interchangeability of parts or sub-assemblies;

(b) More efficiency in production;

(c) Better quality control;

(d) Easy export.

RNAM had attached great importance to standardization and had organized a workshop in 1983, which was followed by a 6-week training course in 1984. RNAM had distributed the available standards from different countries as exchange of information. As a long-term goal RNAM aimed at bringing about harmonization of standards which would allow interchangeability of products, and permit joint ventures between countries. China was planning to discard those national standards which were contradictory to international

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standards and would work mainly with the standards set by the International Organization for Standardization (ISO).

F. Popularization

30. China employed three methods of popularization:

(a) Successful prototypes were multiplied and communes which were willing to test them, were given those prototypes. Testing was assisted by county-level institute personnel;

(b) Factories and research institutes gave demonstrations to invited representatives of farmers,

(c) MMBI invited or ordered farmers' representatives to witness demonstrations and participate in farmers' fairs.

RNAM countries popularized their machines through:

(a) Demonstrations;

(b) Farmers' fairs;

(c) Television programmes (RNAM has provided audio-visual equipment to participating countries to prepare such programmes);

(d) Radio, newspaper and pamphlets.

In Nepal, machinery was being popularized by making available brochures to progressive farmers by mail, in addition to other means.

G. Training

31. In China engineers working in the institutions of the agricultural machinery industry were trained at various institutions under the state universities and, mostly, the Ministries of Agriculture and Machine Building Industries. The former took care of engineers specializing in mechanization, while the latter took care of those specializing in more engineering oriented subjects.

32. Training for technicians was conducted through several arrangements such as factory-arranged classes/courses; county training classes, for after sales service; driver/operator training courses (Note: operators provide the first-line maintenance); professional technical training schools for technicians in every province.

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H. TCDC

33. The Seminar noted with interest that the main thrust of the RNAM programme was on TCDC. Principally, TCDC programmes were in areas of exchange and dissemination of information; exchange of prototypes and manufacturing drawings, and training. The rich technical expertise of the developing countries of the region, particularly in design development, manufacture and popularization of agricultural machinery could be used increasingly and thereby the TCDC programme further strengthened. The Seminar felt that RNAM was one of the useful mechanisms which could be used for strengthening intercountry co-operation.

III. IDENTIFICATION OF AREAS AND FORMS OF CO-OPERATION

34. On the basis of exchange of experience and field visits the participants discussed the possible areas and forms of economic and technical co-operation among developing countries of the ESCAP region and identified specific areas. The discussion was held for the purpose of matching the TCDC/ECDC needs and capabilities of the participating countries.

35. The implementation of each project was subject to the detailed preparation and the approval of the respective authority concerned.

36. During the discussion the following areas and forms of co-operation were identified:

A. Technical exchange

37. The participants felt that technical exchange including seminars, study tours, exchange of technical information and prototypes, was the primary and the most flexible form of technical co-operation. The following suggestions were discussed.

(a) Seminar on the Standardization of Farm Machineries and Implements: It was suggested that ESCAP and UNIDO sponsor the seminar in co-operation with the Ministry of the Machine Building Industry of China which was suggested to be the host country. The participants from Bhutan, China, India, Malaysia, Nepal, the Philippines, Sri Lanka and Thailand expressed their interest in the Seminar;

/(b)

(b) Seminar on Agricultural Irrigation Machinery and its Application: It was suggested that ESCAP and UNIDO could sponsor the seminar in co-operation with the Ministry of the Machine Building Industry of China which was suggested to be the host country;

(c) Seminar on Motorized Farm Vehicles: It was suggested that ESCAP and UNIDO could sponsor the seminar in co-operation with the Government of Thailand which was suggested to be the host country. The participants from China, India and Nepal expressed their interest in participating in the seminar. The participant from Bhutan wished to send an observer to the seminar;

(d) Semihar on the Rice Mill Machinery Manufacturing Industry: It was suggested that ESCAP and UNIDO could sponsor the seminar in co-operation with the Government of Thailand which was suggested to be the host country. The participants from Bhutan, China, Nepal, the Philippines and Sri Lanka expressed their interest in the seminar;

(e) Study Tour on Small-Scale Agricultural Machinery: It was suggested that the study tour be organized in China for technical personnel from developing countries in the region, including the member countries of RNAM;

(f) Observation Study Tour on the Agricultural Machinery Industry in China: The participant from Nepal was extremely interested in sending 7 persons for a duration of 2-3 weeks. The suggestion was accepted by the participants from China;

(g) Despatching of prototypes from China: The participant from RNAM requested the prototypes of (i) multipurpose thresher, (ii) thresher produced in Zhengjiang, and (iii) rice transplanter seen at Luodian, for RNAM member countries. The participant from India requested a prototype from China for testing and evaluation of a small 4-wheel tractor (Taishan) of 12 hp with all attachments. The participants from China stated that the requests could be considered case-by-case with the understanding that only prototypes of the products which were already commercially produced would be despatched, and that China would send the technical people to test and demonstrate the operation of the prototypes;

/(h)

(h) Providing of manufacturing drawings: The participant from Nepal requested the manufacturing drawings of the TDG 400 thresher and 5IZ 100 axial flow thresher. The participants from China preferred to send the prototypes of those machines together with the experts for testing and demonstration;

(i) Study Tour on the Farm Cultivation System and its Mechanization. The participants from China indicated their interest in such a study tour to India, Indonesia, Malaysia, the Philippines and Thailand. The participants from the countries concerned and the representative of RNAM expressed their willingness to receive the study team;

(j) Study of the Production of Small Diesel Engines in India: The participants from China indicated the interest of their country in sending 3-4 experts to study the production technology of small diesel engines in India and it was accepted in principle by the participant from India.

B. Training of personnel

38. The participants identified training of technical personnel at different levels as being an important area for technical co-operation in the field of the agricultural machinery industry. The following suggestions were discussed:

(a) Training course on design and manufacture of the agricultural machinery industry: All participants indicated their interest in such a course. The Ministry of the Machine Building Industry (MMBI) of China would make its training facilities (including Jiangsu Institute of Technology and concerned factories) available for undertaking this course for the developing countries including the RNAM member countries;

(b) Training course on testing and instrumentation of agricultural machinery: The MMBI of China would make its training facilities (including Jiangsu Institute of Technology and concerned factories) available for undertaking this course for developing countries including RNAM member countries;

(c) Training in small farm-tools and implements (utilization of production): The participant from India indicated the capability of his country to host the course. The participants from Bhutan, the Philippines, Sri Lanka and Thailand expressed their interest in the training course;

/(d)

(d) Training course on post-harvest processing technology (design and testing, operation and maintenance): The participants of the Philippines indicated the capability of their country to host the training course. The participants from Bhutan, India, Malaysia, Nepal, Sri Lanka and Thailand expressed their interest in the training course;

(e) Village craftsmen training course (fabrication, repair and maintenance of simple hand tools and implements): The participants from the Philippines indicated the capability of their country to host the training course. The participants from Bhutan, Sri Lanka and Thailand expressed their interest in this training course;

(f) Training of semi-skilled manufacturing engineers: The participant from Bhutan enquired about the possibility of getting Bhutanese engineers trained in China, and possibly financed from the country IPF of Bhutan. The Chinese participants indicated that the MMBI would make the training facilities available if a request were received.

(g) Training on strengthening, testing and evaluation of capabilities and research and development of agricultural machinery: The participants from the Philippines indicated their needs on the above subject. It was considered that those needs could be met by training courses (a) and (b) above.

C. Expert Services

39. The participants felt that the experts from developing countries might better appreciate the technical problems faced by other developing countries and, therefore, their expertise could constitute and important area of technical co-operation. The following suggestions were discussed:

(a) Experts to advise and give on-the-job training of personnel engaged in the field of manufacture: The participant from Bhutan enquired about the availability of an expert from China to advise and give on-the-job training, especially in connection with the possible purchase of machines and equipment produced in China. The participants from China indicated the availability of the expertise if such a request were received;

(b) Instructors in the field of operation and maintenance of farm machines: The participant from Bhutan requested China to send an experienced

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instructor to Bhutan. The participants of China indicated the availability of expert services;

(c) The participant from Malaysia enquired about the possibility of obtaining expert services from China for a period of $1\frac{1}{2}$ - 2 years to be attached to an agency in Malaysia. The expertise required was in the area of research, development, testing and/or evaluation of agricultural machinery. The participants from China indicated the availability of expert services and their willingness to despatch the experts if a request were received. The concrete job description of the experts would be communicated to China by Malaysia if it were decided to avail itself of that technical assistance;

(d) Experts to give training in the field of repair and maintenance of machines produced in China and sold in large numbers in Malaysia: The participant from Malaysia enquired about the possibility of obtaining the above expertise from China. The participants from China expressed their willingness to send experts if such a request were received,

(e) Utilization of rice hull for internal-combustion engines (ICE): The participants from China indicated the capability of their country to send experts in the above field. The participants from Malaysia, Nepal and the Philippines indicated their interest in that expertise;

(f) Testing, design and improvement of farm implements attached to 25-35 hp tractors: The participants from China indicated the capability of their country to send experts in the above field. The participant from Nepal expressed his interest in that expertise;

(g) Testing and improvement of 3-5 hp tractor and implements: The participants from China indicated the capability of their country to send experts in the above field. The participant from Nepal expressed his interest in that expertise;

(h) Testing and improvement of cassava digger: The participants from China indicated the capability of their country to send experts in the above field. The participants from the Philippines expressed their interest in that expertise;

(i) Providing technique and machines for animal-drawn farm implements: The participants from China indicated the capability of their country to

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send experts in the above field. The participants from Bhutan and the Philippines expressed their interest in that expertise.

(j) Providing factory design and production technique for small- and medium-size agricultural machinery: The participants from China indicated the capability of their country to send experts in the above field. The participant from Nepal indicated his interest in that expertise.

D. Research and development

40. The participants felt that the research and development of agricultural machinery constituted another area of co-operation. The participant from RNAM expressed his willingness to co-operate with the Chinese Academy of Agricultural Machinery Sciences in popularization of new prototypes of agricultural machinery. The participants from China expressed their readiness to co-operate with RNAM. The content and form of co-operation would be finalized through correspondence.

41. The possibility of expansion of trade and joint production and joint ventures among developing countries in the field of the agricultural machinery industry was also mentioned. It was felt that this kind of economic co-operation activity could be promoted and implemented mostly through bilateral channels.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

42. On the basis of the deliberations the importance of agricultural mechanization in the developing countries was reiterated. It was agreed that mechanization was an inevitable choice and the policies to be adopted would be country specific.

43. The participants were of the unanimous view that the Seminar was fruitful and the exchange of experiences was useful.

44. The Seminar agreed that there was a vast potential for ECDC/TCDC in the field of agricultural machinery.

B. Recommendations

45. The Seminar requested the participating countries, ESCAP and UNIDO to consider the possibilities of implementing the TCDC proposals contained in the report.

/V.

V. OTHER MATTERS

46. The participants in the Seminar wished to place on record their gratitude to the Ministry of the Machine Building Industry, People's Republic of China, the provincial Governments, the prefectures and counties in Zhenjiang, Changzhou, Wuxi and Shanghai, and also the Luodian Peoples Commune in Shanghai Administration, for their warm welcome, detailed arrangements, technical discussions and their hospitality from 8-24 May. It had been a most memorable experience for the participants in the Seminar.

VI. ADOPTION OF THE REPORT

47. The Seminar adopted the report at Shanghai on 24 May 1984.

VII. CLOSING SESSION

48. The closing session on 24 May was addressed by the Hon. Mr. Ye Gong-Qi, Vice-Mayor of Shanghai, Mr. Chen Nailong (Chairman), Dr. H.G.R. Reddy (ESCAP), and Mr. Song Zhensui (UNIDO).

/Annex I

Annex I of the report of the ESCAP/UNIDO Seminar for Promoting Economic and Technical Co-operation among Developing Countries in Asia and the Pacific in the field of Manufacture and Popularization of Agricultural Machinery, Tools and Equipment, China, 8-25 May 1984

Annex I

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Annex II

LIST OF DOCUMENTS

Economic and Technical Co-operation among the Developing Countries in Asia and the Pacific in the field of Manufacture and Popularization of Agricultural Machinery, Tools and Equipment, Note by the Secretariat

Constraints in Farm Mechanization and the Role of Regional Network for Agricultural Machinery (RNAM), by RNAM, Los Banos, the Philippines

Economic and Technical Co-operation Among Developing Countries for Promoting Agricultural Machinery Industry, prepared by Mr. Wang Wanjun, Chief Engineer Chinese Academy of Agricultural Mechanization Science, Ministry of Machine Building Industry, UNIDO Consultant.

Suggested Areas and Measures for Co-operation among Developing Countries in the Development of Agricultural Machinery Industry, by the ECDC Section of UNIDO.

Introduction on Popularization of Agricultural Machinery in Jiangsu Province, by Mr. Liu Jingxi, Section Chief, Machine Building, Department of Jiangsu Province.

On the Agricultural Machinery Industry of the People's Republic of China, by Mr. Chen Nailong, Director (Advising), Bureau of Agricultural Machinery Industry, Ministry of Machine Building Industry, Beijing, China.

The Development of Agricultural Mechanization in China, by Mr. Hu Nanqiang, Assistant Chief, Engineer, Agricultural Mechanization Administrative, Bureau of the Ministry of Agriculture, Animal Husbandry and Fishery of China.

Research and Development of the Agricultural Machinery Industry in China, by Mr. Wang Wanjun, Chinese Academy of Agricultural Machinery Industry, MMBI, China.

On the Development of the Agricultural Machine-Building Industry in Changzhou, by Mr. Qian Xhixing, Deputy-Director of Changzhou Agricultural Machinery Research Institute and Mr. Shu Bainain, Chief Secretary of Changzhou Tractor Corporation.

Training More Senior Technicians in Manufacturing and Repairing Agricultural Machinery for Various Countries to Develop Co-operative Relationship among Nations in Asia and Africa, by Mr. Liu Xing-rong, Director of Scientific Research, Department and Associate Professor, Jiangsu Institute of Technology.

Outline of the Export of Chinese Agricultural Machinery, by Mr. Jiang Zhaorong, Deputy Director, Department of China National Agricultural Machinery Import and Export Corporation.

/Status

The Status of Farm Mechanization and the Agricultural Machinery in Bhutan, by Mr. Sherub Gyaltshen, Deputy Agricultural Engineer, Agricultural Department of Bhutan.

Status of Farm Machinery Manufacture and Popularization in India - The Problems and Prospects and the Efforts made by CIAE, by Mr. H.S. Biswas, Scientist (FM & P), Bhopal, India

The Status of Farm Mechanization and the Agricultural Machinery Industry in Peninsular Malaysia, by Mr. Poh Seng Chai, Agricultural Engineer, Department of Agriculture, Kuala Lumpur, Malaysia.

The Status of Farm Mechanization in Nepal, by Mr. A.B. Karki, Chairman-cum-General Manager, Agricultural Tools Factory, Birgunj, Nepal

Country Paper on Agricultural Mechanization in the Philippines, by Dr. Marietta S. Adriano, Director, Agriculture Staff, National Economic and Development Authority (NEDA), Manila, Republic of the Philippines

Design, Development and Adaptation of Agricultural Machinery in Sri Lanka, by Mr. H.M. Tilakaratna, Agricultural Engineer in Charge, Farm Mechanization Research Centre, Maha Illuppallama, Sri Lanka.

Thailand Farm Machinery Industry by Mr. Charmroon Malaigrong and Mr. Phipath Patanaphan, Engineer, Industrial Economics & Planning Division, Ministry of Industry, Bangkok, Thailand

/Annex III

Annex III

SUMMARY OF FIELD VISITS

Visits to 12 selected factories of different sizes, manufacturing different agricultural machinery, two training and research institutes and a People's Commune were organized during the Seminar. Field demonstrations of various farm machinery were also organized during the visit to a People's Commune in Shanghai. The factories visited included small- and medium-sized factories employing labour-intensive production processes and large factories with a certain degree of automation. Thus the visits provided an opportunity to study different levels of the farm machinery production industry in the People's Republic of China. The highlights of the visits and the major issues which emerged during the discussions are summarized below:

A. Huairou Agricultural Machinery Factory, Beijing

The factory is one of the biggest of its kind in the country, manufacturing more than 40,000 sets of sprayers annually. The main products of the factory are WFB-182C knapsack sprayer, WFY-2 electric sprayer and 3WCD-5A hand electric ultra-low volume sprayer; the first is the major product. The factory employs 840 employees including 40 engineers and technical personnel. The production lines of the factory are labour-intensive. The quality of the products is maintained by testing samples drawn at random from the assembly line. The participants were of the view that more attention to the safety of the workers may be considered by the management.

B. Beijing Combine Harvester Plant

The factory manufactures 4LZ-2.5 self-propelled combine harvester and FD 1.6-50 wind-powered generator. Production of the main product, the combine harvester, is 500 per year. Production of the wind-powered generator has recently been started and is likely to reach 4,000 a year. The factory employs 1,037 staff members including 19 engineers. It was mentioned that 1,500 man-hours are required for the production of one combine harvester. The percentage of machine utilization of the factory was 85 per cent. The production in the factory was labour-intensive. The demand for the products was higher than the production. It was mentioned that more attention could be given to safety aspects of the combine harvester. The price of the combine harvester (¥ 10,000) was considered quite low.

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C. Chinese Academy of Agricultural Mechanization Sciences

The major tasks of the Academy are to identify mechanization needs, carry out research, develop and test agricultural machinery, and manufacturing promotion, standardization etc. The Academy has been instrumental in the development of many machines which have gone into commercial production. The Academy has ten laboratories for conducting research and testing, of which five were visited by the participants. The Academy has a permanent exhibition of various agricultural machinery produced in the country, which was visited with great interest by the participants. Many of these machines may be successfully utilized by the developing countries in Asia. The Regional Network for Agricultural Machinery could play a vital role in popularizing the selected Chinese machines in the participating countries.

D. Jiangsu Institute of Technology

The Institute is a well-equipped teaching institution for graduate and postgraduate studies in engineering. The Institute has eight Departments with 30 laboratories used for teaching, research and testing. The Institute has conducted 2 special courses for engineers from RNAM countries on manufacturing technology and also provided training to UNIDO-sponsored trainees. The Institute was requested to formulate a training course on Design for RNAM engineers with special emphasis on jigs and fixtures, design and fabrication of prototypes and testing. A course outline developed by RNAM in collaboration with the Philippines would be made available to the Institute for this purpose.

E. Zhenjiang Thresher Factory

The major products of the factory were the TDG 400 thresher and 5TZ axial flow thresher for rice and wheat crops. The factory employs 700 staff members of whom 60 are technical personnel. The annual production of the factory is about 10,000 units of threshers, of which about 20 per cent is exported. The factory runs on semi-automatic production lines. The factory has 43 technical personnel including 16 engineers working in the design department. A thresher for wet crops is under design at present.

F. Changzhou Diesel Engine Factory

The factory produces Dong-feng 8 to 36 hp diesel engines for agricultural and other purposes. The factory is a large one employing 2,772 persons including 836 females, 182 technicians and engineers and

281 administrative staff members. Out of the 23 main production lines, 10 are semi-automatic. The annual production is 90,000 units of which 20 per cent is exported to more than 60 countries. Strict quality control, testing, continuous product improvement and proper management are the major reasons for the high demand for and output of their engines. The participants took great interest in observing the large, modern factory with its high degree of automation, neat and clean production lines with systematic layout and great discipline.

G. Changzhou Tractor Factory

The major product of the factory is the Dongfeng-12 walking tractor, though a few more models of walking tractors and a four-wheel tractor are also produced. The production of the factory is about 35,000 units per year. The factory employs 1,376 staff members including 384 females, 83 engineers and technicians and 167 administrative staff members. The factory has a high degree of automation. There are 13 automatic and semi-automatic production lines. The semi-automatic painting shop is designed by the engineers of the factory. There are strict quality control measures and random testing and inspection of tractors. About 20 per cent of the production is exported to 42 countries. The high degree of automation and labour displacement due to shortage of manpower in that city made essential to have automation to ensure high output with greater efficiency in manufacturing and better quality.

H. Wuxi Pump Works

The Wuxi Pump Works manufactures water pumps for agricultural, industrial and civic purposes. The factory employs 1,150 workers producing about 10,000 pump sets a year. About 25 per cent of the products are exported to 20 different countries. The product range includes centrifugal pumps, axial flow pumps, mixed flow pumps, turbine pump etc. The turbine pump making use of kinetic energy of water flowing at high speeds in hills to drive another pump, for lifting water, is an important item especiallly for hilly areas.

I. Hangzhou Gearbox Works

The factory manufactures 20 models of gearboxes with 40 speed reduction ratios especially for marine and heavy agricultural machinery. The factory employs about 4, 000 workers with 10 per cent engineers and technicians. There are 13 workshops equipped with modern machinery.

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The induction heat treatment and powder metallurgy caught the special attention of the participants. This factory is also large, with automatic, semi-automatic and labour-intensive production lines.

J. Hangzhou Tea-Making Machinery Factory

The factory manufactures tea-making machinery, e.g., spiral roller tea leaf cutter, dryer, stalk selecting machine, tea-twisting machine, grading machine, etc. The factory employs about 1,000 workers in the labour-intensive production lines, producing about 1,500 sets of tea-processing machinery every year. The dryers - manual, semi-automatic and automatic types - were of considerable interest to the participants. The possibility of using similar dryers for drying paddy was discussed.

K. Jin Shan Agricultural Machinery Works

The factory manufactures poultry equipment for breeding flocks in cages and raised-mesh floor. The special equipment manufactured are egg graders, incubators, hatchers, raised beds with automatic feedings devices, brooder cages d ropping scrapers, egg-collectors, debeakers, etc.

L. Shanghai Tractor Works

The factory produces 50 hp four-wheel tractors for agricultural use. The total manpower of the factory is 2,800, of which 208 are engineers and technicians. Annual production of the factory is about 8,700 per year - mostly for domestic use. The factory has six production workshops and two auxiliary workshops. Proper quality control tests are conducted on the tractors. For fatigue tests the tractor is subjected to 600,000 bumps; however, it was pointed out that a minimum of 1,000,000 bumps are essential for proper conclusions on fatigue.

M. Shanghai Internal Combustion Engine Works

The factory produces 25 to 75 hp engines, generating sets, power sprayers, marine engines etc. The factory has automatic, semi-automatic and labour-intensive production lines. The factory employs a total of 2,000 persons including 280 engineers and produces 10,000 units of 50 hp diesel engine which is the main product. The engines are run-in, tuned and tested on test benches and the performance is recorded in the control room.

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M. Luodian People's Commune and Farm Machinery Field Demonstration

The commune consists of 5,700 households with 21,500 family members. It is organized into 13 brigades each having 10 production teams. Each production team has about 40 households. The commune is well mechanized with 4 hp/ha farm power. There are 232 tractors, 32 combine harvesters, 39 trucks, 7 seed selectors (graders), rice transplanters, etc. Average grain production is 12,[illegible]75 kg/ha per year. Besides farming the commune is engaged in textile industry, furniture making, small industries, livestock raising, etc.

A good field demonstration of the following farm machinery was arranged by the commune: combine harvester, power thresher, float pump, sprinkler system, mat-seedling growing and operation of rice transplanter, land preparation implements, trenching machine, mole plough, ultra-low volume sprayer, knapsack sprayer, dryer grader, etc.

The technical discussions held during the visits to various institutes and factories in selected areas in China created a new awareness of the status of the agricultural mechanization programme in the country. The field visits and the discussions had promoted exchange of experiences. An interesting point that emerged was that there were no patent rights at present in China (although there will be, effective from 1985) and that many of the prototypes and manufacturing drawings of agricultural machinery were supplied by R & D institutes for commercial manufacture. The hope was expressed that China would enlarge its co-operation by extending this facility to other developing countries in the region, as in fact, it had done in the past by supplying prototypes of cereal harvesters to RNAM countries. The Seminar was of the view that there were distinct possibilities for strengthening co-operation with China in the future.

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Address by Dr. V.J. Ram, Chief, ESCAP/UNIDO Division of Industry, Human Settlements and Technology at the Opening Session

On behalf of the Executive Secretary of ESCAP, Mr. S.A.M.S. Kibria and on my own behalf, I have great pleasure in welcoming you all to the Seminar. The Seminar has been made possible due to the offer of generous host facilities by the Government of the People's Republic of China. We wish to express our deep sense of gratitude to the host government for the excellent arrangements that they have made for the Seminar. In particular, we wish to thank the Ministry of Machine-Building Industry (MMBI) which has taken the responsibility for making substantive and administrative arrangements. As you are aware, this Seminar has been organized in collaboration with UNIDO. I wish to take this opportunity to express our gratitude to the Executive Director of UNIDO and the UNIDO staff concerned with this programme for their assistance and co-operation in organizing the Seminar.

We are happy to know that there are participants from nearly 10 countries in the region and considerable thought and deliberation have gone into the preparation of the programme by MMBI. It is our expectation that it will provide a valuable opportunity to discuss problems of common interest, with the overriding objective of promoting economic and technical co-operation among the developing countries in the region in the field of manufacture and popularization of agricultural machinery, tools and equipment.

We are happy to mention that the Government of China, has been actively participating in the programmes of activities of ESCAP, and in recent years they have been providing increasing opportunities by making available their generous host facilities for the developing countries in the region to share the development experience of China in specific sectors of economic and social development. In the field of industry, we wish to recall with gratitude the seminar that was

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organized by ESCAP in China on the medium and small-scale industries in 1978 which, for the first time, gave an opportunity for representatives of the ESCAP member countries responsible for policy and decision-making in this field to get acquainted with the experience of China in the planning and implementation techniques and also development, application and transfer of technology.

In September 1982, the Government of China, once again, generously offered host facilities for the organization by ESCAP of a Seminar on Integrated Silk Processing Industry. It was also for the first time that the participants from other developing countries in the region got acquainted with the phenomenal developments in the field, in China. I am happy to say that in ESCAP we are taking follow-up action in further strengthening co-operation in the development of integrated silk processing industry among the developing countries in the region.

ESCAP has been promoting agricultural mechanization programme in the region for over 15 years. The member countries of ESCAP, after a series of consultations at expert, intergovernmental, legislative and commission level, have established the Regional Network for Agricultural Machinery (RNAM) with its headquarters at Los Banos. ESCAP is its executing agency. The project came into operation in 1977 and has gone through two phases so far and its programme of activities have had great impact at the national level in strengthening national technological and manufacturing capabilities. The Government of China has evinced keen interest in the RNAM programme and, in fact, senior technical experts from the ministries concerned with this industry in Beijing have participated in the deliberations of the Technical Advisory Committee of RNAM and have shared their valuable technical knowledge and experience. We wish to express our deep sense of gratitude to the Government of China for their continuing interest to assist the developing countries in the region in their agricultural mechanization programmes.

/ESCAP

ESCAP previously organized the Regional Intergovernmental Consultations for Formulation and Implementation of Programmes for Technical Co-operation among Developing Countries in China in November 1983. The organization of this seminar in China, with the main thrust being on technical and economic co-operation among the developing countries, is of particular significance, as it is the first time that an opportunity had arisen, on a sectoral basis, to share the knowledge and experience of China and other developing countries in collectively identifying programmes through the implementation of which inter-country co-operation programmes will be strengthened.

Most of the developing countries of Asia and the Pacific have undertaken the challenging task of modernization of their agriculture with a view to enhancing productivity and production and thereby improving the socio-economic conditions of the vast masses of the rural population. Agricultural mechanization is a basic and vital input for modernization of agriculture, to improve the productivity and incomes of the farmers and to reduce the drudgery of agricultural/ farm operations and the costs of agricultural production. It has been observed that costly inputs such as high-yielding varieties of seeds, chemical fertilizers, pesticides and irrigation water are most effective only when used in conjunction with appropriate and improved agricultural implements and machinery.

The long-term benefits of the above programme would be the promotion of agricultural development through the provision of appropriate industrial inputs for agriculture in general, and agricultural machinery and implements in particular, with emphasis on strengthening the linkage between industry and agriculture, the engineering, technological and industrial manufacturing capabilities need to be strengthened with a view to achieving self-reliance in the requirements of agricultural machinery, tools and equipment of individual countries. Such machinery should be made available at a

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cost that the users can afford. The strengthening of engineering design, manufacturing capability and entrepreneurship are necessary components of the agricultural mechanization programme of the developing countries. In China, there is a wealth of experience and a level of technological development appropriate to the requirements of most of the developing countries in the ESCAP region which could be adopted to accelerate their manufacturing and popularization programmes.

China has associated itself with the activities of RNAM and provided facilities for two training courses in the country in 1980 and 1982. It has also provided five cereal harvesters and a technical team of experts to demonstrate the use of the harvesters. These cereal harvesters have since been commercialized. This is a unique opportunity for the developing countries in the region to get acquainted with agricultural mechanization and manufacturing programmes in China with the overriding objective of promoting technical and economic co-operation among developing countries.

The Meeting of Ministers of Industry Preparatory for the Fourth General Conference of UNIDO held on 15 and 16 March 1984 noted that RNAM had proved to be an extremely useful inter-country project. It had contributed substantially to mechanization and modernization of the agricultural sector among the participating countries. The Meeting generally approved the extension of the project through 1985 and 1986. The work programme was currently under preparation and was due to be considered at the next session of the Technical Advisory Committee by the middle of 1984. It noted with appreciation the support given by the Governments of Australia and Japan.

The Meeting also recommended a further five year (1987-1992) extension of the project, by which time it could be more self-sustaining, the beneficiary countries would have substantially increased their contributions and the UNDP contribution would also continue to be available for programme support.

/The 40th

The 40th session of the Commission held at Tokyo from 17-27 April 1984 inter alia, endorsed the recommendation of the Ministers of Industry and in particular that the RNAM project be extended through 1985 and 1986, with a further extension of five years to coincide with the UNDP programming cycle for the regional IPFs, 1987-1992.

The Meeting recommended that the secretariat should take the necessary steps to strengthen the RNAM programme further and also to secure additional funding in view of its usefulness and the increasing impact of its work in promoting agricultural mechanization and manufacture of agricultural machinery in the countries of the region.

At the primary processing level, machinery and equipment will have to be redesigned, developed, manufactured and popularized. At the secondary processing the selection of machinery would require careful consideration. There is an urgent need for modernization of machinery already in use and to introduce recent technological developments to reduce energy consumption, improve productivity, and the quality of the products. In view of the conditions prevailing in a large number of developing countries in metal processing and engineering industries there is every justification for an ECDC-TCDC programme to develop the machine building capability, while it is readily recognized that the requirements of such capital goods would be country-specific, consideration may be given for a long-term development programme for a wide range of machinery for agricultural raw materials. In fact, there is an urgent need to inculcate an engineering and technological temper in the processing of agricultural raw materials in the developing countries of the region, one of the effective means by which this could be implemented is to have a sustained programme of mechanization. With the growth and development of the infrastructure, particularly for metal processing industries, the developing countries should concentrate on strengthening their machine building capability which includes repair and maintenance, engineering and design, consultative services etc. TCDC-ECDC programmes would be invaluable in achieving this goal.

/The level

The level of industrial processing in the developing countries cannot progress rapidly without an indigenous repair and maintenance capability, spare parts production, and eventually the manufacture of capital goods. We are considering these requirements only for the basic sector of agricultural and rural development. In order to provide a fillip to the process of development, suitable mechanisms, as may be relevant to individual industrial sector, will have to be considered for sharing the available technological developments, know-how and operating capabilities with due emphasis on the programme of ECDC-TCDC which takes into account the common interests and reciprocal capabilities of the participating countries. We are confident that China will increasingly share their knowledge and experience with the developing countries of the region through the operational activities of ESCAP.

Opening Statement by Mr. Song Zhensui, Representative of UNIDO to the Seminar for Promoting Economic and Technical Co-operation Among Developing Countries in Asia and the Pacific Region in the Field of Manufacture and Popularization of Agricultural Machinery, Tools and Equipment in China, 8 - 24 May 1984

Your Excellency, Mr. Tao, Dr. Ram, Fellow Participants and Observers, Ladies and Gentlemen,

It is a great pleasure for me to be here at the Opening Session of the Seminar for Promoting Economic and Technical Co-operation Among Developing Countries in Asia and the Pacific Region in the field of Manufacture and Popularization of Agricultural Machinery, Tools and Equipment in China, co-sponsored by ESCAP and UNIDO in co-operation with the Government of the People's Republic of China. On behalf of the Executive Director of UNIDO, I would like to express my sincere thanks to the Chinese Government, in particular the Ministry of Machine Building Industry, for its generous offer to host this Seminar and the excellent programme arranged for the discussion and field visits. I would also like to express my deep appreciation to our sister organization, ESCAP, its Executive Secretary and our dear colleagues, for their great initiative and co-operation for this important undertaking.

As we are all aware, the ultimate objective of this Seminar is to promote economic and technical co-operation among the ESCAP developing countries in the field of agricultural machinery industry and thus to accelerate their industrial and economic development. The importance of economic and technical co-operation among developing countries has been recognized in a series of resolutions and declarations of the United Nations General Assembly and other international fora. ECDC/TCDC has emerged as a new dimension of the international co-operation for development to make optimum use of their resources and to bring

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about a New International Economic Order. There are many factors to justify ECDC/TCDC, among others I would like to underline three, namely: commonality, similarity and complementarity.

The developing countries have set a common goal of industrialization. They have a common desire to uphold their sovereignity to develop their national economy and to improve the living conditions of their people. Commonality of goal and desire brings the developing countries together and generates a political basis for economic and technical co-operation among themselves. It is obvious that most of the developing countries are newly independent. They have gone through similar routes of development and now face similar problems. They can thus easily appreciate each others difficulties and share one another's experiences. The experience of many higher industrialized countries may not be applicable to the present concern of developing countries. The most useful advice and assistance is to be available from countries which are currently facing or have recently faced similar early-stage industrialization problems, similarity of conditions among developing countries implies that many problems of industrialization may best be solved through ECDC/TCDC. Further, every developing country has its strong points and weaknesses. One country may be rich in natural resources but lack appropriate technology. Another country may have reached a certain level of technology development but requires raw materials which are not available locally. It is necessary and possible for them to complement each other.

In recent years the developing countries, particularly in the ESCAP region, have co-operated with each other at different levels and in different forms. In order to achieve maximum results in economic and technical co-operation among developing countries the following principles, namely: solidarity and mutual assistance, equality and mutual benefit, stress on practical results, diversity in forms and common development, should be observed.

/UNIDO

UNIDO has attached and attaches great importance to economic and technical co-operation among developing countries. UNIDO's programme for ECDC/TCDC activities is primarily intended to increase awareness of the developing countries of the necessity and possibility of co-operation, to stimulate developing countries to formulate their policies and to break attitudinal barriers in order to obtain maximum benefit from the co-operation and to promote specific ECDC/TCDC projects and to assist in their implementation.

UNIDO has actively organized ECDC/TCDC activities in the field of agricultural machinery. The first and second Consultation Meetings on Agricultural Machinery Industry were held in 1979 and 1983 in Stresa, Italy and Vienna, Austria, respectively. The Meeting on Exchange of Experience and Co-operation among Developing Countries in the Development of Agricultural Machinery Industry was organized in 1980 in Beijing. UNIDO is also an associate executing agency of the Regional Network for Agricultural Machinery of ESCAP. Potential for promoting and implementing ECDC/TCDC in this field is immense. It is with this understanding that the present Seminar has been organized. According to our experience there is great room for co-operation and the forms are varied. For instance; exchange of information and experience, training of personnel, expansion of trade, transfer of technology, joint research and production activities and so on. ESCAP developing countries, in particular the host country China, has accumulated rich experience in developing their agricultural machinery industry. This provides the basis for our discussions. I am firmly convinced that the participants from developing countries, as well as from the international organizations, will benefit from the discussions to take place during this Seminar. However, we should not limit ourselves only to the exchange of experience but more important to promote economic and technical co-operation among ourselves in this field.

/The emphasis

The emphasis of recent discussions on ECDC/TCDC was on functional approach, based on matching needs and capabilities of co-operating countries. The Solidarity Ministerial Meeting for Co-operation in the Industrial Development of Least Developed Countries, organized by UNIDO, and the ESCAP Intergovernmental Consultation for Formulation and Implementation of Programmes for TCDC, which was held in November 1983, are examples of this kind of approach. Based on the experience and adapting it to the specific industrial sector, it is suggested that the present Seminar and Study Tour can be viewed as an initial, but important, preparatory step for a high-level ECDC/TCDC meeting. Keeping this suggestion in mind, the participants may take this opportunity of discussions and field visits to exchange information on the needs and capabilities of economic and technical co-operation among developing countries. We hope that at the end of the field visits some concrete possibilities for co-operation will be explored between the host country and the participating countries and among the participating countries themselves. I also wish that the discussion in Shanghai, which will exchange experience and views on various topics, will focus on the concrete proposal for further co-operation in the field of agricultural machinery industry among the ESCAP developing countries. It is envisaged that in the final report some specific proposals will be adopted for further action. When our distinguished participants go back to their countries they will report to the authorities concerned and start intensive preparations for a high-level ECDC/TCDC meeting in the field of agricultural machinery industry, which is expected to reach agreements and concrete ECDC/TCDC projects for quick implementation.

I wish you all success in your visit and deliberations. Thank you for your attention.

Statement by Mr. Tao Hengxiang, Chief Engineer, MMBI
at the Opening Session on 9 May 1984

Ladies and Gentlemen, Comrades:

First of all, I would like, with your permission, on behalf of Ministry of Machine Building Industry, to congratulate the opening of ESCAP/UNIDO Seminar for Promoting Economic and Technical Co-operation among Developing Countries in Asia and the Pacific in the field of Manufacturing and Popularization of Agricultural Machinery, Tools and Equipment, held by ESCAP/UNIDO, and to extend a warm welcome for your coming here - - the Capital of our country - - in participating this Seminar. Our Ministry controls the manufacture of various kinds of civil machinery in our country, among which, the agricultural machine building industry is a very important profession industry. Since the foundation of the People's Republic of China, the agricultural machine building industry in our country has been extremely developed. It has developed itself from nothing and very small scale to a manufacturing system with more complete products specification and quite considerable technique level to meet the demands of our agriculture.

Since the Third Conference of the Eleventh Central Committee of the Communist Party of China, the guiding principle of so-called "To make the economy more flexible internal; to carry out an open policy external" as well as a whole set of reformational policies and measurements has been established and adopted by our Party and Government, and this results in a new rising of our national economy. In the countryside, it is emphasized to pursue "the responsibility system for agricultural production", and this also results in an extremely development of our agriculture so that in the countryside of our country, a very good situation with development of agriculture, forestry, animal husbandry, sideline production and fishery has appeared. It could be expected that by the end of this century, the

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total value of the output of our national industry and agriculture might be two times to those of 1980. The new development of agriculture production has put a new and higher requirement to the agricultural machine building industry. In order to follow this new situation, our guiding philosophy to develop our agricultural machine building industry is that we must produce what the farmers need. This is to say, we must produce tillage machinery in one hand, and must also produce various kinds of machinery to be used for the development of forestry, animal husbandry, sideline production and fishery as well as some kinds of transport machinery specialized for the utilization of agriculture production. All these machinery must be produced with the specification of large, medium and small sizes but mostly should be small size in specification for the time being and within a few years. It is also our principle that we must develop the production of semi-mechanization machines, besides, we also must pay our best to develop the agricultural machinery which can save energy or can make multi-utilization of energy source.

Ladies and Gentlemen:

We are all of developing countries and we all have our own experiences in developing agriculture production and agricultural machine building industry which can be used for reference from each other. Therefore, as we think, this Seminar is a very valuable opportunity, which is very seldom to have, during the Seminar, we can exchange experience with all of you, to learn from you and to raise ourselves together with you. We would also like to take this opportunity to approach the ways and forms for conducting technical co-operation with you so as to develop our mutual friendly relationship. In this field, what I would like to emphasize is that our government has consistently paid great attention to the development of "South to South Co-operation". Now as our government is carrying out the guiding principle of so-called "To make the economy more flexible internal; to carry out an open policy external", thus, we

/have

have more wide possibility to develop the technical co-operation between our country and other developing countries. It is the same situation in the field of agricultural machine building industry that we will follow such guiding principle and policy to develop the technical co-operation relationship by means of adopting all international practices and forms, such as: by licensing to acquire advanced technology from abroad or to transfer our technology to other countries; by joint-design, joint-research, co-production, technical advising, technical service and personnel training as well as by export or import of complete plant or single machines etc., so as to contribute for the development of "South to South Co-operation" and to benefit both parties being in co-operation.

Ladies and Gentlemen:

Though we have reached rather considerable achievements and experiences in developing our agricultural machine building industry, but as we think, it is still not sufficient, and it might not be suitable for your country but only for your reference. As we think, there is a lot of shortcomings in our work, during this Seminar, you will go to visit a number of factories, so you are asked to give us your valuable opinion so that we can get improvement in our works.

Wish the Seminar successful!

Wish you healthy and enjoy your staying in our country!

Thank you.

TECHNICAL REPORTS ON VISITS TO INSTITUTES/MANUFACTURING UNITS

Report of the visit to the

Chinese Academy of Agricultural Mechanization Sciences (CAAMS)

prepared by

Dr. Zia ur Rahman

Project Manager, RNAM

Date of visit: 10 May 1984

Received by: Mr. Hua Guozhu, Director
Mr. Feng Hingyuan, Vice Director

Introduction

China, like most of the other countries in Asia, is predominantly an agricultural country. Over 80 per cent of its population lives in villages and is involved, in some capacity or the other, in the production of food and other agricultural commodities, largely with the help of human and animal labour. One of the major tasks for this Government was to modernize agricultural practices. This could not be done without the extensive use of machines. However, machines made abroad, mostly in Western countries, were not suitable to the agricultural, economic and social conditions for the major part of China. Hence need was felt to carry out research in this field within the country and develop machine suitable to the unique needs of the Chinese farmers. As a result of these considerations the Government established the Research Institute of Science and Technology for Agricultural Machinery in 1956. In the following year another institute was established called "The Institute of Agricultural Machinery". These institutes functioned as two separate entities, but with almost similar objectives. In 1962 it was decided to merge them and form a single institute with the broad responsibility of carrying out research and development of all kinds of agricultural machinery in the country. Thus came into existance the Chinese Academy of Agricultural Mechanization Sciences (CAAMS).

Objectives

The main objective of the Academy is to develop appropriate machinery for use by the Chinese farmers in addition to devising new

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methods of agricultural mechanization. The main tasks of the Academy are listed below:

1. To conduct studies on the economic impact of agricultural machinery;
2. To determine priorities and sequences of mechanization;
3. Conducting research on the application of new materials and technologies for agricultural machinery manufacturing;
4. Carry out basic research on all aspects of development of agricultural machinery, i.e., research on components, structures, strength of materials, measuring equipment and techniques, and hydraulic systems;
5. Dissemination of information and provision of consultancy services;
6. Development of techniques for testing agricultural machinery and testing of products manufactured under the Ministry of Machine Building Industry (MMBI) and the Ministry of Agriculture, Forestry and Fisheries; and
7. To establish national standards for agricultural machinery.

Achievements and Activities

Since the Academy was founded, it has completed 300 research projects and has been awarded prizes for 40 of them. These 40 projects were conducted on a varieties of subjects including improvement of animal-drawn implements; rubber-tired harrows; high capacity axial flow pumps; submersible pumps; wind mills; ULV sprayers; tractor-drawn combines and reapers; plows, harrows, hydraulic components used on farm machinery, machine operation and repair techniques; measuring systems and instrumentation and structural strength test techniques.

The Academy is actively engaged not only in the design and development of agricultural machinery but also in its popularization by working in close co-operation with 35 provincial institutes.

In its effort to popularize the machine, the Academy attempts to reach engineers, technicians and farmers through its Seminars,

/special

special publications and a monthly magazine called "Agricultural Machinery" with a monthly circulation of 100,000 copies. The Academy also holds small exhibitions where new machines developed in the Academy are exhibited.

The machines developed and propagated by the Academy take into account the present needs of the farmers and the future trends and plans for mechanization in the country. Thus in the 60's emphasis was given to animal-drawn machinery. In the 70's livestocks and forestry machinery were in the forefront and currently the development of small and medium-sized machinery crop production as well as sideline occupations is being given the highest priority.

The Academy has a staff of 1,200 personnel out of whom 760 are engineers and technicians. The Academy is entitled to confer Master's and Doctor's degrees and there are 20 post-graduate engineers presently working toward these degrees at the Academy. The Academy is equipped with an excellent library consisting of 190,000 books and periodicals and keeps in touch with its counter-parts in U.S.A., England and other European countries.

Main Laboratories and Test Equipment

The Academy consists of the following laboratories:

- Tillage Machinery Laboratory
- Wind Energy Laboratory
- Hydraulic Technique Laboratory
- Harvesting Equipment Laboratory
- Pump Laboratory
- Structural Strength Laboratory
- Instrumentation Laboratory
- Test and Evaluation Laboratory
- Power Unit Test Laboratory
- Material and Technology Test Laboratory

Due to the limited time to visit the Academy, the participants were able to visit only 5 of them. The following is a brief description of visit to these laboratories:

/1. Tillage Machinery Laboratory

1. Tillage Machinery Laboratory

The tillage laboratory consists of two full-scale outdoor test soil bins for testing soil in dry-land farming conditions. These bins measure 100 meters long, 6 meters wide, and 1.5 meters deep. There are two indoor test bins which simulate dry and wet paddy field conditions and measure 50 meters long, 3 meters wide and 1 meter deep, each. There is a scaled model of a test soil bin for measuring draw-bar pull as well as the performance of scaled models of tillage implements. This bin measures 12 meters long, 0.8 meter wide, and 0.5 meter deep. There are 6 test cars to carry out different experiments. The outdoor cars are capable of up to 60 HP draw-bar pull, each consisting of 3 parts, i.e., the tractor unit, the tool carrier for mounting implements followed by a trolly for carrying instruments. The maximum speed of the car is 20 Km per hour. An additional car is used for restoring the soil to its base conditions of moisture, tilth and cone index (compaction).

The laboratory has successfully improved several tillage implements to arrive at the optimum shape of the implement. A three-dimensional measuring system is used to accurately record dimensions of implements. A shear strength testing machine is used to measure the shear strength of soils used for various experiments.

2. Wind Energy Laboratory

Consists of a low velocity wind tunnel, primarily for testing two types of wind mills propellers with output less than 10 kw. The maximum air speed in the tunnel is 24 meters per second. With the help of this wind tunnel the engineers have been able to arrive at several energy efficient propeller configurations for use on wind mills. These results have been transmitted to the Beijing Combine Plant where such wind mills are being manufactured.

3. Hydraulic Technique Laboratory

In this laboratory tests are carried out for hydro-static

/transmission

transmission, hydraulic pumps and hydraulic motors of up to 40 kw, 100 kw, and 200 kw ratings. The data is recorded and analysed by a mini-computer. The accuracy of measurements conforms to ISO B grade level. Three other test rigs in this laboratory are: hydraulic steering-gear test rig, cylinder test rig and a small hydraulic motor test rig. The data from this rigs is also recorded in a mini-computer which analyzes it to draw performance curves for these machines.

4. Harvesting Equipment Laboratory

This laboratory basically tests threshers, reapers and combine-harvesters. There are two rigs for testing the feeding rate. They consist of two conveyors: one is 30 meters long and 0.9 meter wide while the other is 50 meters long and 1.6 meters wide. The conveyor speeds can be varied from 0 to 2.5 m/sec.

There were 2 threshers in the laboratory at the time we visited it. These 2 threshers, one exclusively for wheat and the other for both wheat and rice, have a good potential for application in the countries of the Regional Network for Agricultural Machinery (RNAM) and other Asian countries. The Government of China may be requested to supply prototypes of these machines to all the countries that were listed to participate in this Seminar.

The Academy plans to set up a conveyor-belt type rig for testing the cutting efficiency of harvesting equipment. Since such rigs are much more complicated and very difficult to make, it would be sometime before the Academy acquires one.

5. Pump Laboratory

The last laboratory visited by the participants was the Pump Laboratory. This laboratory is equipped to test the following types of pumps:

- Axial flow pumps
- Mixed flow (axial & centrifugal) pumps
- Hand pumps

/ Five

Five rigs have been set up to carry out these tests. Their brief description is as follows:

(a) Submersible Pump Test Rig

This rig is capable of testing pumps with 6" to 8" impeller dia pumps which may be submerged up to 250 meters deep. The Academy has been able to develop pumps with 78 per cent efficiency which is at par with international standards. The two parameters measured with this rig are: pump efficiency and flow. At present this measuring is done manually, but very soon the Academy plans to acquire a mini-computer to store data and analyse it automatically.

(b) Horizontal Testing Rig

This rig is used for testing axial flow and mized flow pumps and has a maximum capacity of 400 litres/second. The parameters measured are: flow, efficiency and observation of cavitation. The rig can measure efficiency within a $\leq \pm 1\%$ margin of accuracy. Measurements can be controlled manually or with an interacting mini-computer.

(c) Vertical Testing Rig

The primary function of this rig is to measure efficiency and cavitation of turbines. Their composite efficiency error is also $\pm 1\%$.

(d) Energy, Efficiency and Cavitation Test Rig

This rig is employed for testing turbines, axial flow and mixed flow pumps with capacity upto 500 litres/second. The measuring error for efficiency is again less than or equal to $\pm 1\%$.

(e) Hand Pump Testing Rig

This rig is being set up with assistance from UNDP and World Bank is not complete yet. It is expected to be functional within the next two or three months. The rig will assist in arriving at an optimum design for hand pumps, which could be of great value to the rural population of the third world countries.

/The Academy

The Academy has a permanent exhibition of major tools, machinery and equipment manufactured by various factories throughout China. These machines number into hundreds. It would not be possible to list them all, however, their major categories are given below:

1. Four-wheel tractors of various horsepowers
2. Hand tractors of different horsepowers
3. Engines (diesel)
4. Tillage implements
5. Rice transplanters
6. Planters for cotton, corn, soyabean and wheat
7. Pumps
8. Chemical spraying and dusting equipment
9. Weeders
10. Harvesting equipment (reapers)
11. Threshers for wheat and rice
12. Rice mills
13. Ground nut sheller
14. Fodder cutter, and
15. Food processing equipment

There are good prospects of cooperation between the Academy and RNAM. The Network already has an established infrastructure in the eight participating countries (RNAM information dissemination extends beyond these eight countries to other ESCAP and non-ESCAP countries - India, Indonesia, Iran, Rep. of Korea, Pakistan, Philippines, Sri Lanka and Thailand) for popularizing agricultural machinery, developed within the network countries and that developed by other countries and international organizations. Thus, RNAM has already helped popularize the Chinese vertical reaper and the axial flow thresher in collaboration with IRRI. The network countries are awaiting the development of a successful paddy transplanter. Understandably, the Academy scientists will work with those at IRRI to develop this machine in the near future. This will be a major break through and RNAM will be eager to contribute in popularizing the machine.

The Academy prides itself in working on problems which touch upon the lives of the majority of the people in the country. Thus the emphasis is on finding pragmatic solutions to such problems faced by farmers in their everyday life, rather than on very basic research, which, of course, is not totally ignored. The Academy, as mentioned earlier, is having a great deal of success at this. The gap between research and its ultimate utilisation in the field is bridged through continuous interaction between the Institute, the manufacturing industry and the end users (farmers). The scientists in the Institute work hard in their laboratories, day in and day out, oblivious of the noise and clanking of heavy construction machinery on the road outside, trying to develop machines which are, slowly but surely, improving the working conditions and increasing the income of millions of Chinese farmers throughout the country.

Report of the visit to the

Huairou County Agricultural Machinery Factory

prepared by

Mr. H.S. Biswas, India

Date of visit:	10 May 1984
Received by:	Mr. Hou Re Xing, Director
	Mr. Sheng Rui Zheng, Deputy Director
	Mr. Li Ren Huan, Chief Engineer

The factory is located in the suburb of Beijing city and was established in the year 1958 covering an area of 140,000 m^2. It is one of the biggest factory for manufacture of plant protection equipment in the country, employing 840 staff members including 40 technical personnel. More than 40,000 sets of sprayers are produced in the factory each year. The products are also exported in Southeast Asia, Latin America and Africa. The main products of the factory are WFB-18A2C Knapsack Sprayer, WFY-2 Electric Sprayer and 3 WCD-5A Hand Electric Ultra-low volume sprayer. Details of these machines are as follows:

WFB-18A2C Knapsack Sprayer

This machine can be used for low volume spraying, dusting, grannular applications and ultra-low volume spraying by using the different attachments provided with the unit. The machine can also be used for pest control in agricultural land and forest plants, weed control by herbicides and for civic use for control of mosquitoes etc. Specifications of the unit are:

Weight:	14.5 kg
Overall dimensions:	360 x 555 x 680 mm
Capacity of container:	11 l

/Range

Range of application/performance:

		Micron mist spraying	Mist spraying	Powder dusting
(i)	Horizontal range	10 m	9 m	25 m
(ii)	Vertical range	7 m	7 m	15 m
(iii)	Discharge	60-180 ml/min	1.7 kg/min or more	3.7 kg/min or more
(iv)	Field capacity	3.3-6.0 ha/hr	.4-.5 ha/hr	.7-2.3 ha/hr

Air volume displaced:	0.180 m^3/sec
Air speed:	75 m/sec
Engine model:	IE40FP
Rated speed:	5000 rpm
Power:	1.6 hp
Price:	360 Yuans (local)

WFY-2 Electric Sprayer:

The electric sprayer is mainly used for disinfection of houses, farm structures, livestock sheds etc. The electric sprayers can be run from domestic power lines. Specifications of the unit are:

Weight:	16.5 kg
Capacity of container:	11 l
Power of the electric motor:	250 W (220 V)
Motor speed:	4000 rpm
Pump pressure:	2.5 - 3 kg/cm^2
Flow rate:	1.5 - 2 l/min
Price:	400 Yuans (local)

3WCD-5A Hand Electric Ultra-low Volume Sprayer:

It is a small, light weighed sprayer suitable for ultra-low volume spraying in agricultural crops. A slight air movement is essential for satisfactory spraying by this unit. The specifications of this unit are:

/Weight:

Weight:	1.2 kg
Operating voltage:	12V D.C. (8 batteries)
Power of the motor:	4 W
Motor speed:	7500 rpm
Diameter of droplets:	15-75 microns
Effective range:	3-5 m
Air movement:	1-3 m/sec
Capacity of container:	1 l
Field capacity:	0.67 ha/hr
Price:	40 Yuans (local)

In additon to the above three models, another new model of sprayer 3MF 2.3 with a 2.3 hp engine (IE 45 F) has been developed. This unit weighs 12 kg and can spray a maximum of 13 m swath covering an area of 0.67 to 0.80 ha/hr. a wind speed of about 0.2 m/sec is required for effective operation of this sprayer.

Visit to the Workshops

The different workshops of the factory was visited by the participants after the introductory meeting. The workshops included Plastic Moulding shop, Sheetmetal shop, Painting shop, Foundry shop and Assembly shop. In the Plastic Moulding shop, moulding of flexible plastic hose, container and the cap, plastic bags etd. were shown. Punching, bending and forming of sheetmetal components were shown in the sheetmetal shop. Priming and painting of the various components by automatic spray painting line were observed by the participants in the Painting shop. The participants had a round to the Foundry shop. Assembly of the sprayers, testing and packing of the sprayers were observed in the Assembly shop.

Demonstration

Demonstration of the sprayers were given for spraying and dusting operations in front of the office building of the factory. Spraying operations were shown by WFB-18A2C Knapsack Sprayer, WFY-2 Electric Sprayer and 3 WCD-5A H and Electric Ultra-low Volume Sprayer were shown. Dusting operations by the knapsack sprayer using short pipe and long tain-walled plastic hose were also shown. The demonstrations were very much interesting to the participants.

/Discussion

Discussion

After the visit to the different Workshops and the demosntration, the participants joined with the factory personnel and organizers on discussions. The various issues discussed during the period are summarized below:

(a) About the research and development activities, it was mentioned that the Design Section of the factory designs new products which are developed, tested, modified and put under production as per the market needs.

(b) A few questions on safety of the factory workers, safe cover of the moving parts of the sprayers and use of mask by operator were raised during the discussion. It was clarified that due safety considerations for the factory workers are given to avoid accidents and hazards. Providing of safe covers to moving parts of the sprayers is under consideration, specially for the new model (3MF 2.3). During operation, the operations pay due attention to direction of wind.

(c) Regarding co-operation and collaboration with outside organizations, it was mentioned that the factory has some co-operation with the Chinese Academy of Agricultural Mechanization Sciences. The factory is also studying a few products from a few developed countries for further development and collaboraltion.

(d) Regarding testing, it was mentioned that performance of the sprayers are tested regularly by drawing random samples from the assembled machines.

(e) The factory produced about 40,000 units of the Knapsack model, about 600 units of the Hand model. The capacity utilization for the Knapsack model was about 60% of the installed capacity.

(f) Regarding price fixation of the products and wages of the workers, it was mentioned that cost of material, labour cost, machine cost, overheads and profit (about 20%

/including

including taxes) are included while fixing cost of a product. Each worker gets the basic wage of 70 to 80 Yuans per month. The workers may also earn more for overtime jobs.

Report of the visit to the

Beijing Combine Harvester Plant (BCHP)

prepared by

Mr. Poh Seng Chai, Malaysia

Date of visit: 8 May 1984

Received by: Mr. Pan Yao Guan, Director
Mr. Lee, Chief Engineer
Mr. Wu, Chief Engineer

BCHP is a medium sized agricultural machinery plant under the Ministry of Engineering Industry. The two main products are combine harvesters and wind powered generating sets. At the moment, only the combine harvester Model 4LZ-2.5 is produced at a rate of 500 sets per year. The FD1.6-50 wind powered generating set has been successfully tested and will be manufactured at 4000 sets per year.

other machines currently appraised or developed include:-

i. other models of wind powered generating set

ii. self propelled and mounted green feed harvester

iii. wind powered water pumping sets

The plant has in fact two factories located 6 km apart. The total area of BCHP is 126,000 m^2 (building floor is 23,039 m^2). It has a staff of 1037, including 19 engineers.

A 50 watt television using electricity from a wind powered generating set was demonstrated.

We were taken to a visit around the North Factory. We could see the FD16-50 wind powered generating set working very well. At the press workshop, we saw mechanical presses of various sizes. Then we went to another workshop where lathe, milling, slotting, spot wedding and cutting machines were present. We then proceeded to another workshop where fabrication work was in progress. We could see the threshing drum and the straw walkers being fabricated..

Personnel of BCHP then demonstrated the 4 LZ-2.5 combine harvester.

The question of machine utilization capacity was raised. We were told that from October to June, only the combine harvester was

/manufactured

manufactured and from June to October only the wind powered generator set is produced. The percentage of machine utilization is 85%.

Amongst the new products developed are the 1000w wind powered generator set and the silage cutter harvester.

1500 man hours are required to manufacture a combine harvester.

The combine harvesters are sold to the farmers of China, none are exported.

We were told that in the harvesting of crops, 50% of the planted area has been mechanized. Out of this 50%, 2% has been mechanized using combine harvesters and 48% using power reapers.

The capacity of the combine harvester is 1 ha per hour.

The design of the combine had been done jointly between the factory and the Academy of Agricultural Mechanization Science.

In the area of product improvement, the emphasis is on improving the quality of the parts, the basic design of the combine is to remain the same. This improvement makes use of the feedback from the users and from studying foreign machines.

Comment was made on the safety aspect of the combine and its implications for export. This point was taken by the BCHP.

Excessive vibration was noticed in the demonstration. BCHP replied that vibration is not a problem in the soft soil conditions of the farms.

The price of the combine sold to the Chinese farmer is ¥26,000 and the export FOB price is about ¥10,000. A participant commented that this is a cheap price.

Report of the visit to the

Zhenjiang Thresher Factory

prepared by

Amar B. Karki, Nepal

Date of visit 14 May 1984

Received by: Mr. Cao Yang, Director

Introduction

This factory was established in 1958 with the objective of manufacturing of agricultural machinery of high quality standards. The factory has a total work force of 700 out of which 60 are technical personnel. The factory has got primarily important shops like press and punch, forging, machine, assembly (including welding), heat treatment, etc.

Product Range

Various machineries form the product range of the factory. Popular among them are threshers, seed cleaner cum grader, small marine gear box, and small size combine harvester. However, threshers are the main products which occupy the major share. At the present abour 10,000 units of various types of threshers are produced annually and marketed throughout the country. These threshers are also exported in about 20 countries which accounts for about 20 per cent of the total sales.

Product description

The mission members were taken inside the workshop where at that time mainly component parts of the TDG 400 threshers were being fabricated. Various members of the mission raised many pertinent questions and based on the answers received and also on the observations made by the mission following facts were elicited.

(a) TDG 400 Threshers

Threshing capacity:	Rice	600 - 1,000	kg/hr
	Wheat	350 - 750	kg/hr
Net weight		164	kg
Power requirement		4	kw
Price (CIF Calcutta)		464	US$

It was observed that the crop stalks to be threshed may be sheared in neat and trim order.

(b) 5TZ 100 Axial Flow Thresher

Capacity:	Rice	1,000 - 1,500 kg/hr
	Wheat	1,000 - 1,200 kg/hr
Threshing performance		more than 99%
Cleanliness of grain		more than 98%
Power requirement		7.5 - 10 kw
Price (CIF Calcutta)		1,200 US$

This thresher is a relatively new product but has proved to be very successful. The basic design is very much similar to TH8 model thresher developed by IRRI, Philippines.

Other products were at that time out of production. Therefore, the mission could not gather much information about those products.

Observation

The factory was running on semi-automation production line. Most shops were using relatively sophisticated machines in the components fabrication. However, the assembly line has not been automated at all.

The factory has 43 technical personnel engaged in the design department. Out of this, there are 16 graduate engineers working constantly on - (i) design and development of new products, (ii) improvement on the existing products. At present they are designing a thresher which can even thresh wet crops. If this becomes successful, it would be a leap forward in the field of agricultural machinery development.

Report of the visit to the

Jiangsu Institute of Technology

Prepared by

Dr. Zia ur Rahman

Project Manager, RNAM

Date of visit:	14 May 1984
Received by:	Mr. Song Ya-Xin, President (not present)
	Mr. Weng Jiachang, Vice President
	Mr. Luo Ti-qing, Dean of Study
	Mr. Liu Xingrong, Director of the Scientific Research Department
	Mr. Wang Yuen, Head of President Office
	Mr. Wang Yuefeng, Interpreter

Background

Jiangsu Institute of Technology, though a provincial institute, has developed into a centre of higher learning, not only for the Jiangsu Province, but also for the rest of China, and is beginning to gain international recognition. It was established in 1960 with faculty and equipment transferred from the Nanjing Institute of Technology. The Institute had only three specialities at that time, i.e. agricultural machinery, automative engineering and tractor engineering. In 1963 the specialities of drainage and irrigation machinery were transplanted here from Jilin Polytechnical University, and in 1970 the Department of Agricultural Mechanization was transferred to the Institute from the Nanjing Agricultural College.

Institutional Set-up

The Institute has the following eight departments:

1. Agricultural Machinery Engineering.
2. Power Machinery Engineering.
3. Machine Building Engineering

/4. Agricultural

4. Agricultural Mechanization.
5. Electrical Engineering.
6. Basic Courses Teaching.
7. Research and Development, and
8. Foreign Languages Department.

Within these departments, there are several specialities, including agricultural machinery, tractors, automobiles, internal combustion engines, hydraulic machinery, machine building technology and equipment, foundry technology and equipment, metallic materials and heat treatment, agricultural machinery repair and manufacture, management engineering for agricultural mechanization and industrial automation technology. There are 30 laboratories used for both teaching and research. A well equipped library contains 50,000 books and numerous journals and periodicals in Chinese and major foreign languages. A nearby factory is used by students to learn engineering in an applied environment.

The primary function of the Institute is to teach students to become engineers. It is empowered to confer undergraduate and graduate degrees. There are, at present, 600 faculty members and 2,500 students at the Institute. Out of these students 120 are post graduates, with 3 working toward their Ph.D. degrees. All students have to live on campus in one of the 30 dormitories provided for this purpose. A typical student, with 12 years of primary, middle and high school, takes 4 years (or 8 half-yearly terms) to earn a bachelor's degree.

The Institute has run 3 special courses for engineers from RNAM countries on manufacturing technology. In the past

/these

these courses have consisted of 3 ten-week terms as follows:

1st Term	Noise and vibrations in Tractors. Practice in nearby factory to learn production methods.
2nd Term	Design of Tractors.
3rd Term	Design of Jigs and Fixtures.

A fourth term is planned to be added for the next course which will consist of designing moulds and dies.

Laboratory Visits

In the limited time available the participants were able to visit only five of the 30 laboratories in the Institute. These are briefly described below:

1. Metallic Materials Laboratory

- This laboratory is basically meant to observe the crystallographic structure of metals. The students prepare their own specimens for observation under the standard Chinese microscope with 1:600 magnification.
- A Transmission Electronic Microscope with magnification of 1:50,000 is used for observing finer microstructures.
- In order to analyse fractures a Scanning Electronic Microscope, with 1:50,000 magnification, is used along with a CRT terminal.

- An X-ray diffraction machine is used to measure stress distribution on components under load.

2. Measurements Laboratory

This laboratory consists of mechanical and electro-mechanical devices to measure dimensions, profiles, finishes, etc. The following instruments were briefly observed.

- Gear measurements - profile and pitch measurement
- Electromechanical device to measure surface finish
- Gauges for measuring straight and round objects, i.e. inside/outside micrometers, callipers, depth gauges, etc.
- Screw profile mechanism (optical)
- Profile project for optically viewing objects.
- Roundness measuring machine (Electro-mechanical)

3. Farm Machinery Laboratory

The only noteworthy machines seen here were:

- Electronic Spraying Testing Equipment: The spray droplets are electrically charged and are evenly deposited on the crop leaves (upper and lower surfaces) due to the static field around them.
- Profilograph of Plough Bottom is used for drawing curves of mold board ploughs. The engineers have developed a plough with optimum curvature for use in paddy fields.
- Plough Bottom Soil Resistance Measuring Device: The device measures forces in three rotatations and three translations and analyses them on a mini-computer.
- Horizontal Draft Measuring Machine measures draft on the plough.

/4. Tractor

4. Tractor Testing Laboratory

One of the tests in this laboratory consists of measuring noise and vibrations on tractors. Accelerometers are suitably placed on the tractors and the data transmitted to a computer and a CRT terminal with an interactive graphic device, which draws the vibration curve and compares it with the international standard curves.

5. Irrigation Machinery Laboratory

The following irrigation equipment was displayed here:

- Pumps of various sizes
- Sprinkler heads
- Nozzles
- Bicycle pump
- Well drilling rig with a 3 H.P. motor capable of drilling a well of up to 50 meters depth in about 5 hours

The possibility of expanding cooperation between the Institute and RNAM was explored. They were asked to develop a design course for the RNAM engineers, which will be very practical in nature involving design of a machine, design of jigs and fixtures for its commerical production, possible fabrication of a prototype and its testing. RNAM, in collaboration with the counterpart national institute in the Philippines, has already drawn up syllabus for such a course and will make it available to the Institute.

Report of the visit to the
Changzhou Tractor Factory

prepared by

Mr. H.M. Tilakaratna, Sri Lanka

Date of visit:	15 May 1984
Received by:	Mr. Lin Jinwei, Chief of the Designing Deparment
	Mr. Zhong Yong, Engineer
	Madame Wang Jinwei, for reception

Location:	About 15 km from Changzhou City in Jiansu Province
Major Production:	Dongfend - 12 hp walking tractor

Introduction

This factory was established in 1956 to produce simple farming implements and spare parts of textile machines. At that time the number of employees were only 126 and the total output was about 250,000 Yuan. Today the factory has 1,376 employees including 384 females, 83 engineers and technicians, 167 administrative staff members. The factory is composed of 9 workshops, 22 departments and 83 working groups, and it occupies an area of 162,000 m^2 of which 78,000 m^2 are covered by the buildings. By the end of 1983, the fixed assets of the factory had reached 17,480,900 Yuan. In 1963 the factory has started the production of walking tractors.

Production processes

Gearbox casing, final drive, chassis and the handle of walking tractors are few of the major parts produced by the factory. Thirteen automation and semi-automatic lines and a semi-automatic painting workshop which are said to be designed by design engineers of the factory to produce nearly 35,000 walking tractors per year. Ample safety devices, ventilating, seating and lighting facilities had been provided for the working groups. The inter-connection of production lines until the end of assembly and painting has been satisfactorily done in order to save labour and time. In addition to the Dongfeng-12 they also produce other models such as Dongfeng-12k, Dongfeng-12A walking tractors and

/Dongfeng-35

Dongfeng-35 four wheeled tractors. In 1983, two new models of Dongfeng-8 and Dongfeng 6-4 walking tractors have also been developed.

Quality control

Similar to the Changzhou diesel engine factory, the individual workmen working in a line is responsible for the quality of work carried out in the production line. In addition, at the end of each production line the items are subjected to randamized check by an inspector. After completion of painting the tractor is checked for excessive heating, vibration and brakes. The Dongfeng-12 tractor has won the national gold medal in 1982 for the finest quality control. The durability of these tractors are about 10 years.

Marketing

Nearly 20% of the annual production of walking tractors are exported to 42 countries, spareparts valued as at 10% of total cost of a tractor and an after sale service through various agents appointed in individual countries are available. The 1st 1,500 hrs service is under the factory's guarantee.

In 1983, the factory has produced 30,540 units of walking tractors and the total annual output value was 66,267,700 Yuan and the profit is 8,270,000 Yuan. Since 1977 to date the factory has handled over to the state a total amount of 49,910,500 Yuan, which is said to be 4.76 times that of the value in fined assets of the factory. During this period factory's production and profit growth rate were 11.81% and 17.5% respectively, while the production costs down by 9.1%

Observations

The following facts have been contributed towards the higher productivity and improved quality of the production.

1. Automation

2. Technical innovation and transformation

3. Improved and perfected basic management system with regard to purchasing, production and marketing.

4. Incentives and facilities given for working group.

/General

General discussions

During the discussion held at the end of the visit the Director clarified the following questions as raised by the participants:

1. Question - China being a developing country, why the factor is going towards more and more automation, which considerably replaces labour?

   Answer - (i) In the province where the factory is situated labour is insufficient for factory work.

   (ii) It improved the productivity, quality, and reduced drudgery.

2. Question - The number of gears available in most of the two wheel tractor models are too much for a farmer's used. Higher number of gear makes the gearbox more completed, more expensive and more heavy. What is your opinion about it?

   Answer - The number of gears available in this factory's gearbox are 6 which is the optimum necessary number for various application in farming in China.

Report of the visit to the

Changzhou Diesel Engine Works

prepared by

Mr. H.M. Tilakaratna, Sri Lanka

Date of visit:	15 May 1984
Received by:	Mr. Wang Zhijun, Vice Director and Chief Engineer Mr. Zhao Hongwei, Interpreter

Major Production : Small size diesel engines ranging from 8-36hp, for agricultural and other purposes

Introduction

This factory was established in 1913 as a private enterprise, basically to provide technical services and maintenance for the textile industry. After the founding of the People's Republic the factory has been gradually converted to the present Changzhou Diesel Engine Works. Today the factory provides employment to 2,772 persons, including 836 females, 182 technicians and engineers, 281 administrative staff members. According to the declaration made by the Director of the factory, they have had a total amount of 23,867,200 Yuan in fixed assets, which, after depreciation amounts to 14,370,100 Yuan in net value. The total area occupied by the factory is 135,373 square meters, of which 92,037 square meters are covered by the buildings.

Production Process

The number of parts required for an engine is 360, out of which only 57 major parts like engine block, crank shaft, connecting rod and cylinder head are produced here. The production processes of various components are in semi-automatic. The diesel engine final assembly line is equiped with the purifying and air conditioning facilities. It is reported that one complete diesel engine gets off the assembly line every 70 seconds.

In 1983 the factory's annual capacity has reached to 90,000 units. The main products of the factory are "Dong-fend " brand model

/S195

S195 (12 hp) D 180 (8 hp) and model 395 (36 hp) diesel engines. These engines have 24 variations of both condensor and evaporative types and can be started by hand cranking or by means of an electric starter built with the engine.

Quality Control

Basically each operator working in the production line is responsible for the quality of various machining stages of a component. Randomized quality control is done by an inspector at the end of each production line. After the final assembly, engines are sent to laboratories for checking over heating, fuel consumption, oil consumption and for excessive vibration. In 1983, the factory has received the National Gold Medal price for fine quality control.

Marketing

The engines produced are suitable for small-sized tractors, transportation vehicles, boats, electric generators, waterpumps and agricultural processing machines. The model S195, 12 hp diesel engine is more popular in the foreign market as well as the local market. About 20% of the total output each year is exported to more than 60 countries. The price of S195, 12 hp diesel engine is US$ 348, spares valued at 10% of the total cost of the tractor is supplied along with. The aftersale service is entrusted to agents in various regions and countries by the Changzhou Agricultural machinery Import and Export Corporation.

In accordance with the information supplied by the Director of the Factory, in 1983, the total output of S195 12 hp engines was 75,754 units, which is amounting to 61,800,000 Yuan of gross income, with a profit margin of 14,042,000 Yuan. The profit marginal range had been increased in each year.

When compared to the profit received in 1980, the annual increase of profit margin since 1981 is as follows:-

in 1980/81	-	15.76%
1981/82	-	12.96%
1982/83	-	9%

/When

When compared with 1970, the production output has been increased by 623%. During the 13 years from 1970 to 1983, the profit and taxes which the factory had handed over to the State, reached 109,933,700 Yuan, which is said to be 6.67 times that invested for the factory during the period. The Director pointed out that the following techniques contributed to achieve this improvement:-

1. Correct leadership
2. Hard working of the mass employees and the full support of the brother factories
3. Development of appropriate products and improvement of quality
4. Continuous technical transformation and the promotion of the scientific management

General Discussion

The questions raised by the participants and the Director's answers, in brief, are as follows:-

1. Q Have the factory design engineers done any study to reduce the weight of total engine?

   A Yes, the engines produced at present are in optimum weight for the specific purpose.

2. Q Whether training facilities can be arranged in the factory for outsiders (especially for foreigners)?

   A Yes, for example last year a few Pakistani technicians were trained by the Factory on production of diesel engines.

3. Q Is any Patent system practiced in China?

   A No, the factory management is happy to take over more and more technical co-operation activities within the country as well as with other nations.

Report of the visit to the

Wuxi Pump Works

prepared by

Mr. Sherub Gyaltshen, Bhutan

Date of visit:	16 May 1984
Received by:	Mr. Ren Cheng Yong, Director
	Mr. Xu Han Wu, Manager
	Mr. Yu Mei Liang, Senior Engineer
	Mr. Tu Zhongliang, Interpreter

Background

Wuxi Pump Works is specialized in manufacturing pumps for industries, mines, water supply and drainage etc. It employs 1150 workers and the yearly production is about 10,000 sets of pumps. It is capable of manufacturing 135 different types of pumps suited for various requirements.

Over the past few years a few models of pumps have won many provincial and national awards for the factory. About 25% of the yearly production is exported to 20 different countries and districts. Altogether 18 different models are exported.

The factory has casting, forging, machining and assembly facilities. The Research and Development and Test Section is involved in the quality control, design and development activities.

The prices of the larger and new pumps are calculated on a negotiable basis.

Visits

1. Showroom - where various models of the pumps were displayed.
2. Machine shop - machining of various components.
3. Test section - pumps are tested for design capacities, power consumption and other component tests.

/Main

Main points of interest

1. The largest pump in China was manufactured by this factory. The pump took one year to manufacture and has been installed in Huai-an, Jiangsu.

Specifications	-	overall dimeter	- 4.5 meters
	-	motive power	- 5000 kw
	-	design head	- 1.5 ~ 10.5 meters
	-	output (discharge) 6 meter head	- 288,000 m^3/hr
	-	weight	- 150 tonnes

2. Turbine pump - still under the development stage, this was designed by the Research Institute for Turbines, Fujiyan. This pump is designed to use the kinetic energy of water to lift water to a higher level. For the pump under fabrication, as per design, supply of 3.25 m^3/sec. of water under 18.9 meters drop will produce 1450 turbine rpm and will raise 0.28 m^3/sec. of water to 150 meters high.

3. The factory is basically self contained in almost every component manufacturing, except for electric motors and a few small accessories which are procured from other factories.

Conclusion

For any country it would be considered essential to know the area of land that could be irrigated with gravity feed in order to base a factory's production programme.

For a mountainous country, like Bhutan, with numerous rivers, these turbine pumps could be very useful for lift irrigation if proven economical.

Would like to observe the developments and results very closely.

Report of the visit to the

Hangzhou Gearbox Works

prepared by

Mr. Phipath Patanaphan, Thailand

Date of visit:	18 May 1984
Received by:	Mr. Ren Wenang, Sales Director
	Mr. Xu Qin Mo, English Interpreter

Introduction

Hangzhou Gearbox Works covers 460 thousand square meters with housing of 200 thousand square meters, now this factory has specialized in manufacturing marine gearboxes, different agro-gear and sintered products. Up to now this factory have produced over 150 thousand set of marine gearboxes for nearly 20 models and 40 speed reduction ratios, also they have manufactured a great deal of agro-gears and friction plates thus serving fishing, agriculture, communication, navigating and so on, the employees are nearly 4 thousand workers and staff with 10 per cent of engineers and technicians. There are 13 workshops in the factory including casting, forging, heat-treatment, metal working and assembling, equipped and advanced manufacturing equipment and sophisticated inspection devices, there exist two institutes and a training centre namely marine gearbox institute and powder-metallurgy instute and the factory training centre. Also they have primary school and middle school to take care of the children of the employees. They have successfully self-designed and - manufactured different marine gearboxes with various speed-reduction ratios such as models 06, 16, 40, 120, 135, 240, 300. L2, 3500 etc. They have gained the licence of marine gearboxes facilities GUS and GWC from Lohmann & Stolterfort, West Germany. Their two prototypes products have been successfully approved by German Lloyd, British Lloyd and China Register of Shipping.

Working Visit - Heat treatment workshop, we have seen the high frequency furnace, ionize nitriding furnace, gas carbulizing

/Tool room

Spiral Roller Tea Leaf Cutter Model 2CJ 680

Technical Data

Diameter of roller	125 mm
Working length of roller	500 mm
Motor	1.1 kw

Quantity of tea leaf passing through 450 kg/hr - set

Tea Stalk Selecting Machine Model 6CEJ

Technical Data

Width of grooved plate	700 mm
Horizon dip of selecting bed	9^{o}
Motor	550 Watts
Productivity	30-50 kg/hr-set

Interesting point

Hangzhou Tea Making Machinery Factory is making tea processing machine that is suitable for other tea producing countries. Also the tea-making machinery research institute and testing centre are very useful for research in tea processing and the tea industry, in general.

Conclusion

The tea-making machinery research institute and testing centre which is under construction could co-operate with the other institute in research and training of foreign students from developing countries.

Report of the visit to the
Shanghai Jin Shan Agricultural Machinery Works

prepared by

Mr. Amar B. Karki, Nepal

Date of visit:	20 May 1984
Received by:	Mr. Ding Qi Rong, Deputy Director
	Mr. Lu Nanzing,
	Mr. Lu Zhihui

Introduction

This factory produced exclusively machines used in poultry farming. In the past, the factory was producing agricultural machinery. It has a total workforce of 460, out of which there are 23 engineers and technicians.

We were told that in PRC, this is the only factory which produces such varied machinery like ground breeding and case breeding, as well as equipment for breeding layers, broilers, and chicklings, to cater to the demands.

This factory could also provide technical assistance specially in the preparatory stage of project planning, conducts feasibility studies, and other engineering services such as plant layout, plant installation etc., on contract.

Product Specification

The whole set of mechanised equipments for breeding contains altogether 48 products of 9 series i.e. hatcher, brooder, case, feed conveyor and tower, drinker, dropping scrapper, egg-collector, and atmospher controller of the barn house. The mission observed most of these at the exhibition hall.

1. Poultry Incubator Fresh eggs are kept in this incubator for 18 days at 100° F. This incubator has a capacity of incubating 10, 752 eggs at a time. The egggs are kept at inclined position.

/Prior

Prior to keeping eggs in the incubator, the egg selector screens the eggs and only those which fall within the range of 55 gms to 65 gms are kept in the incubator.

2. Hatcher After eggs are incubated for 18 days they are taken out and kept in the hatcher chamber. This plant contains, incubated egg classifier, irradator for egg testing, tipper etc. It is also equipped with temperature and humidity controller, egg turner and counter, high temperature alarms, auto-ventilating cooler, etc.

3. Plant for Ground Breeding It is designed for raising chicks, young paults on ground or mess floor,and for raising boilers as well. It included devices like: metal mesh floor, electric brooder with temperature controller, waterer, feeder (chain or cable tray type), debeaker, etc.

4. Plant for Chick Egg Breeding It, equipped with four deck lapped cases, is suitable mainly to rear 40-60 days old chicks. It has auto heater and temperature controller, feed trough and water tough. One day old chicks are kept in the middle decks and as they grow older they move to other decks.

5. Plant for Layer Egg Breeding This is suitable for all types of poultry raising. It contains various devices for feeding, drinking, dropping scrapping, and egg-collecting. It is produced in two kinds to meet the requirements of raising medium or light type layers.

6. Plant for Raising Breeding Flocks on Floor It is used to raise breeding flocks. It includes the following devices: metal mesh floor, feeder (cable tray type, spring anger type or chain bunk type), barrel type feed container, bell type waterer, self propelled water dropper and trough, metal egg box, etc.

7. Plant for Raising Breeding Flocks in Cases The plant consists oftwo deck tier-type cage and cage frame, chain bunk type feeder, trough type waterer, and cable scrapper under cages. This is specially suitable for raising flocks by adopting the technique of artificial fertilisation. While raising the male and female are separated by putting one in each cage.

/8. Equipment

8. Equipment for Removing Bird Droppings It includes cable scrapper and spring anger scraper, the former for sweeping the dung under the machinery to one end of the poultry house and the later for bringing the dung out of the poultry house.

9. Equipment for Specialised Raiser It is suitable for specialised chicken raising or layer raising. It comes two types of machines; tier type and the deck lapped type. It is of simple construction having cage and cage flame, feed and water trough, and dung container.

10. Equipment for Raising Experimental Animals The factory not only manufactures equipments for poultry raising, but also manufactures some equipments suitable for raising experimental animals such as rabbits, rats and mice etc. Feeding technique adopted is that of manual feeding. It has auto watering system and devices to wash the dung. Some of the key parts are made with stainless steel.

Report of the visit to the

Shanghai Internal Combustion Engine W

prepared by

Dr. Marietta S. Adriano, Philippi

Date of visit:	21 May 1984
Received by:	Mr. Xue Yongchun, Vice Director
	Mr. Fu Fuyuan, Vice Director

Background

The Shanghai Internal Combustion Engine Works (SICEW) started as a manufacture of plant protection equipment in 1943. The factory, which now has 2,000 staff workers (including 280 engineers), produces 10,000 units annually of thin 50-hp diesel engines. In addition to the 50-hp diesel engines put into mass production in 1975, SICEW also specializes in the production of diesel engines ranging from 25 to 70 hp. with 11 models and 35 types. These are used as power units for tractors, marine (boats), welders, road rollers, fork lifts, water pumps and power sprayers.

Shop visited

1. We visited a shop for the main components of the engine. We observed two semi-automatic production lines: (a) one for the engine cylinder head, which is 50 meters long, turning out 1 unit per 6 minutes and (b) one forthe engine block, which is 138 meters long, turning out a cylinder block per 6 minutes. The group was informed that the factory did the design and machining of all the special cutting and measuring tools, and the production machines in the semi-production lines.

2. We saw an assembly plant for the whole diesel engine. There are 3 shifts per day in the plant with 45 units assembled per shift.

3. The engine testing shop tests every engine produced for 90 minutes wherein fifteen units may be tested at any one time. A control room in the testing laboratory houses the instrumentation for metering the performance of the engines being tested at different operating conditions.

Discussions

1. The rationality given for the semi-automatic production

/line

line for the cylinder head and engine block include the following:

(a) the need to increase efficiency and accuracy and at the same time reduce cost of production;

(b) the need to meet the big domestic demand for the product; and

(c) the need to save manpower for other purposes.

2. The quantity of spare parts manufactured by the factory depends on the expected life of the component or part. For example, rear axles and engine blocks manufactured for spare parts comprise only 1% of the total number of engines produced by the factory. In contrast, cylinder liners and piston rings produced by other factories but under the same main company, are manufactured at 100% of total production.

3. The 50-hp diesel engine manufactured by SICEW sells for US$ 1,700 per unit.

Report of the visit to the
Shanghai Tractor Works

prepared by

Dr. Marietta S. Adriano, Phhilippin·

Date of visit: 21 May 1984

Received by: Mr. Shi Jiamu, Vice Director
Shanghai Tractor Plant

Background

The Shanghai Tractor Works (STW) was established in 1956 for the production of simple agricultural implements. It went into the production of walking tractors in 1963-1970. Since 1973, it has been mass producing its current main product, a 50-hp 4-sheel tractor.

The STW is considered as a medium-sized enterprise under the Ministry of Machine Building Industry. It now occupies an area of 204,000 square meters and employs 2,800 workers, 208 of whom are engineers/ technicians. While it has a total productivity capacity of 10,000 tractors per year, its actual production in 1983 was 8,700 units. Almost all of the tractors it produces are for domestic use, with roughly 3% of the total production exported to Thailand, Sri Lanka, Australia, Greece, New Zealand, Colombia and the United States.

Shops visited

The STW has 6 production workshops, 2 auxiliary workshops, 16 managerial and technical departments, and 2 schools. However, we visited only their (1) forging shop, (2) two machining shops, one for large parts and a separate one for small parts, (3) assembly shop and (4) two testing shops. Emphasis was placed on the tractor testing units of the factory.

We saw a "running test" wherein the complete/assembled tractor is given its final check-up on its general performance before it is selected by the factory. This test is not directly research related. A "durability test" is also conducted by subjecting the tractor to a total of 600,000 "bumps". The tractor negotiates a complete circle with 48 bumps in 1 minute and 5 seconds.

/Discussion

Discussion

1. Implements available for the 50 hp tractor include power tillers, ploughs, harrows, ditcher (furrow openers) and combines. These are made in other factories which, like the STW, are members of the main (mother) company.

2. The tractors from STW are sold in 24 provinces of China. The factory is based in Shanghai because Shanghai is considered an important base for the supply of new technology. There are at present more than 20 similar tractor factories producing 4-wheel tractors in China, with a total capacity of 150,000 units. There is also a plan on the part of the government to build such factories in all the provinces of China.

3. Durability tests are conducted for the tractors. These tests last for 2,000 hrs for the first overhaul and 5,000 hours continuous testing "until something breaks". It was noted that the 6,000 to 8,000 hours life reported by the factory is less than the average 10,000 hours life of tractors manufactured elsewhere. It was likewise pointed out that the 600,000 bumps in the durability test may be short of the emperical recommendations for testing. However, it was explained that the research institutes (not the manufacturers) have testing as their main concern.

4. A change in the product line of a factory is a decision to be made by the concerned factory, the Bureau of Agricultural Machinery Industry, and the main (mother) company of the factory, with the help of 3 institutes, namely, the Chinese Academy of Agricultural Mechanization Sciences, the Tractor Institute at Luo Yang, and the Shanghai Internal Combustion Engine Institute. Any change is done in full consideration of the state economic plan and the domestic/international market. While it takes 2-3 years to completely change to a new tractor model, the Shanghai Tractor Works now has in the pipeline a 65 hp tractor manufactured in limited quantity for field trial testing.

5. The Shanghai-50 tractor sells for 9,000 to 10,000 Yuan.

photograph 3

Rice transplanter under experimentation at
Luodian People's Commune, Shanghai

Report of the visit to the

Luodian People's Commune

prepared by

Dr. Carlos del Rosario, Philippines

Date of visit:	21 May 1984
Received by:	Mr. Shi Mei-ting and Mr. Qian Shen, Heads of People's Government of Bao Shan County
	Mr. Shu Wen-hao, Head of Management Committee of Luodian Commune
	Mr. Wang Lu-Fu, Station Leader at Management Station Division
	Mrs. Wang Xiu-Zhen, Head of Agricultural Machinery Research Institute

The Luodian commune is one of the 18 communes in the county of Bao Shan. It has a total cultivated area of 1,533 hectares, representing about 70 per cent of its total land area.

There are 5,700 households in the commune with a total of 21,500 family members. The commune is organized into 13 brigades, each with 10 production teams. Each production teams have, on the average, 40 household. The work force of 13,000 workers is broken down into: 5,200 field workers, 7,000 commune factory workers and workers with sideline works.

The commune enjoys a level of about 4 hp/ha with 90 per cent of the production operations being mechanized. Machinery ownership is on a collective basis. The agricultural equipment owned by the commune includes:

/232 Farm tractors:

232 Farm tractors: 108, 50 hp, 4-wheel types and
124, 12 hp, 2-wheel types

32 Grain combines: rice and wheat

39 Trucks

7 Seed selector/graders

A Transplanter of improved design is under testing

4,000 Assorted implements: ploughs, sprayers, threshers, driers, etc.

The total earnings of the commune, based on the 1983 figure, amounts to about 49 million yuan with an average income of about 3,800 yuan per farm worker.

Besides farming, the commune is engaged in the production of cloth, furniture and hardware items like bolts and nuts. Some of the livestock raised in the farm includes; pigs, rabbit, sheep, ducks and chicken. Watermelons, mushroom and other cash crops are some of the sideline activities of the farm workers in the commune.

It is interesting to note that the farm workers in the commune are always striving for greater production. Available figure indicated a total grain production of 12,675 kg/ha per year.

Agricultural Machinery Field Demonstration

A good number of self-propelled and mounted type equipment were demonstrated, namely:

(a) Land preparation equipment: 6-bottom moldboard plow, rotary tillers; moldboard plow - rotary tiller combination;

(b) Seedling nursery machinery (soil pulverizer, soil fertilizer mixer, soil-plastic tray loader, and seeder) and self-propelled lowland rice transplanters;

(c) Open trenching machine (rotary types and continuous chain type) and mole plows;

(d) Crop protection machines: electrostatic ULV hand sprayers, Knapsac mist blowers, engine-powered sprayers;

(e) Irrigation machinery: floating type mixed-flow pump, portable sprinkler

(f) harvesting and threshing machinery, self-propelled head-fed rice and wheat combine, mounted type combine, motor-drivers cone type thresher, drum type thresher;

(g) Driers, Graders, Fans: Medium batch type drier, infra-red drier, Gravity precision seed-sorter, barnyard winnowing fan

(h) Farm Tractors: 50 hp 4-wheel tractor, 65 hp, 4-wheel tractor, 12 hp 2-wheel tractor

Note : for details, see attachment on list of machinery demonstrated at Luo Dian, 21 May 1984

All the machines that were demonstrated, based on short visual observation, appeared to show good field performance.

Farm Family House Visit

One of the important highlights of the afternoon's activity was a visit to a farm house in the commune. Visited was a household consisting of 8 family members (the parents, 2 sons and their wives, and 2 grand children) living in a 10,000 yuan 4-room apartment type concrete house. Appliances found in the house includes: a TV, radio, electric fan, 2 sewing machines, and 2 bicycles. The house is supplied with bio-gas for cooking from a communal digester.

The household worker is part of the plant protection team and the sideline includes raising pigs and chicken.

LIST OF FARM MACHINERY ON THE SPOT DEMONSTRATION

LUODIAN

MAY21 1984

1984·5罗店田间表演农机具一览表

1. Model 1LS-620 6-Bottom Moldboard Plow
——The Experimental Factory Attached to SAMRI
(Shanghai Agricultural Machinery Research Institute)
1LS-620型六铧犁
——上海市农业机械研究所实验厂

2. Model 1LS-625 6-Bottom Moldboard Plow
——Sheshan Farm Machinery Factory,
Songjiang County, Shanghai
1LS-625型六铧犁
——松江县佘山农业机械厂

3. Model 1G-150A Rotary Tiller
——Songjiang Farm Machinery & Implement Factory,
Songjiang County, Shanghai
1G-150A型旋耕机
——上海松江农业机具厂

4. Model 1GS-200 Rotary Tiller
——The Experimental Factory Attached to SAMRI
1GS——200型旋耕机
——上海市农业机械研究所实验厂

5. Model 1LB-100 Plow with Rotary Tiller
——The Experimental Factory Attached to SAMRI
1LB-100型耕耙犁
——上海市农业机械研究所实验厂

6. Model 1BSQ-23 Series Paddy Field Driving Harrows
——Shanghai Farm Machinery Factory, Shanghai
1BSQ-23型系列水田驱动耙
——上海市上海农业机械厂

7. Model 1BSQ-23 Series Paddy Field Driving Harrows
——Jiangxi Tractor-Drawn
Agricultural Implemet Plant, Jiangxi Province
1BSQ-23型系列水田驱动耙
——江西机引农具厂

8. Model 1MK190-4 CottonField Opener
——Songjiang Farm Machinery & Implement Factory, Songjiang County, Shanghai

1MK190-4型棉田开行机
——上海松江农业机具厂

9. Model 1K-30 Rotary Disk Trencher
——Zhangqiao Farm Machinery Factory, Chuansha County, Shanghai

1K-30型圆盘式旋转开沟机
——川沙县张桥农业机械厂

10. Model 1KM-100 Endless Chain Trencher
——The Experimental Factory Attached to SAMRI

1KM-100型链齿式开沟机
——上海市农业机械研究所实验厂

11. Model 1LA-80 Mole Plow
——Jiading County Agricultural Machinery Research Institute, Shanghai

1LA-80型暗沟犁(鼠道犁)
——嘉定县农业机械研究所

12. Model 1LA-80 Mole Plow
——Wuxi County Farm Machinery Factory, Jiaugsu Province

1LA-80型暗沟犁(鼠道犁)
江苏省无锡县农业机械厂

13. Model 1KY-40 Rotary Disk Trencher
——Shanghai County Agricultural Machinery Research Institute, Shanghai

1KY-40型圆盘式旋转开沟机
——上海县农业机械研究所

14. Model 1G-120 Wheat Seed Mulched Rotary Tiller
——Jiadiug County Agricultural Machinery Research Institute, Shanghai

1G-120型盖麦机
——嘉定县农业机械研究所

15. Model 2B-5 Wheat Seed Drill with Rotary Tiller
——Shazhou County Agricultural Machinery Research Institute, Jiangsu Province

2B-5三麦旋耕条播机
——江苏省沙洲县农业机械研究所

16. Longjiang-120 Head-feed Rice-and-Wheat Combine Harvester
——Longxi Prefecture Harvesting Machinery Factory, Fujian Province

龙江-120型半喂入稻麦联合收割机
——福建省龙溪地区收割机厂

17. Guilin-No2 Rice-and-Wheat Combine Harvestr
—Guilin Prefecture Farm Machinery Factory, Guangxi Autonomous Region

桂林-2号稻麦联合收割机
——广西桂林地区农械厂

18. Model 2ZT-7 Power Driven Soil-Stuck Rice Seedling Trasplanter
----The Experimental Factory Attached to SAMRI

2ZT-7型带土苗机动水稻插秧机
------上海市农业机械研究所实验厂

19. Model 2YS-500 Complete Set of Rice Seedling Industrial Nursing in Greenhouse
----Chongming Farm Machinery Factory, Shanghai

2YS-500型水稻工厂化育秧成套设备
——上海市崇明农业机械厂

20. Model 5TZ Rice Thresher with Cone Type Cylinder
——Changxing Farm Machinery Factory, Baoshan County, Shanghai

5TZ型锥形滚筒脱粒机
——宝山县长兴农业机械厂

21. Model Hujiao-65 Simple Rice-and-Wheat Thresher
——Luonan Farm Machinery Factory, Baoshan County, Shanghai

沪郊-65型稻麦脱粒机
——宝山县罗南农业机械厂

22. Barnyard Winnowing Fan
——Chengzhong Hardware & Machinery Factory, Wusong People's Commune, Baoshan County, Shanghai

扬谷风扇
——宝山县吴淞公社城中五金机械厂

23. Model 5TS-70 Thresher with Simplified-Seperater
——Hangzhong Prefecture Diesel Engine Factory, Shanxi Province

5TS-70型半复式脱粒机
——陕西省汉中地区柴油机厂

24. Model 5XZ-0.5 Gravity Precision Seed-Sorter
——Xiangming Machinery Factory, Shanghai

5XZ—0.5型重力式种子精选机
——上海向明机械厂

25. Model 5HY-2 Farm Use Middle-Sized Grain Drier
——Linqu County Farm Machinery Factory, Weifang Prefecture, Shandong Province

5HY-2型农用中型谷物干燥机
——山东省潍坊地区临朐县农业机械厂

26. Model 5H-0.6 Far Infrared Grain Drier

——Baoshan County Agricultural Machinery Research Institute, Shanghai

5H-0.6型远红外谷物干燥机

——宝山县农业机械研究所

27. Model Gongnong-36 Engine-Powered Sprayer

——Shanghai Agricultural Chemical Machinery Factory, Shanghai

工农-36型机动喷雾机

——上海农业药械厂

28. "Dongfanghong Brand" WFB-18AC Knapsack Mist Duster

——Huairou County Farm Machinery Factory, Beijing

WFB-18AC型背负式弥雾喷粉超低量喷雾机

——北京怀柔县农业机械厂

29. Model 3WCD-5 Hand-Operated Electrostatic Sprayer

——Mingguang Instrument & Meter Plant, Shanghai

3WCD-5型手持式电动超低量喷雾器

——上海明光仪表厂

30. Model 2.5BPZ-55 Portable Sprinkler

——Changzheng Farm Machinery Factory, Jiading County, Shanghai

25BPZ-55型移动式喷灌机

——嘉定县长征农业机械厂

31. Model 6HBD-35 Floating Type Mixed-Flow Pump

——Wuxi Taihu Pump Manufactory, Jiangsu Province

6HBD-35型浮式混流泵

——江苏无锡太湖水泵厂

• Model 165F Diesel Engine

——Nanhui Farm Machinery Factory, Shanghai

165F柴油机

——上海市南汇农业机械厂

• Model Dongfeng-12 Walking Tractor

——Changzhou Tractor Manufactory, Jiangsu

东风-12型手扶拖拉机

——江苏常州拖拉机厂

• Model Dongfeng-50 4-Wheel Driven Tractor

——Qingjiang Tractor Works, Jiansu

东风-50S型四轮驱动拖拉机

——江苏清江拖拉机厂

• Model Shanghai-50 Wheeled Tractor

上海-50型轮式拖拉机

• Model Shanghai-650 Wheeled Tractor

上海-650型轮式拖拉机

• Model Shanghai-654 4-Wheel Driven Tractor

上海-654型四轮驱动拖拉机

——Shanghai Tractor Works, Shanghai

——上海拖拉机厂

Photograph 4

Closing of the Seminar at Shanghai

BACKGROUND PAPERS

ECONOMIC AND TECHNICAL CO-OPERATION AMONG THE DEVELOPING COUNTRIES OF THE ESCAP REGION ON AGRICULTURAL MACHINERY, TOOLS AND EQUIPMENT

Note by the Secretariat

Economic and Technical Co-operation among the Developing Countries of the ESCAP region on Agricultural Machinery, Tools and Equipment

ESCAP has had a pioneering role in the promotion of Economic and Technical Co-operation among the Developing Countries in the region. More than a decade earlier than the concept of Technical Co-operation among Developing Countries (TCDC) and Economic Co-operation among Developing Countries (ECDC) was discussed in the international forums, ESCAP was actively promoting regional co-operation through its programme of work and priorities. The main thrust was to assist the developing countries to reach agreement on operational mechanisms which promoted collective self-reliance in selected sectors of economic importance. In the past two decades ESCAP has successfully forged inter-country co-operation in diverse fields of economic and social importance and some of them have even been institutionalized. In the field of industry and technology, apart from two inter-country projects of the Regional Network for Agricultural Machinery (RNAM) and the Regional Centre for Technology Transfer (RCTT), which have been successfully established, the concept of inter-country co-operation has been actively promoted in a wide range of agro- and allied industries through studies, seminars, workshops and publications. Specifically in the area of agricultural mechanization, as a part of the development programme of agro- and allied industries, ESCAP initiated studies and consultations at the request of the member countries as far back as 1969, which resulted in the establishment of the Regional Network for Agricultural Machinery, in 1977. Its operation is a demonstration of the technical and economic co-operation among the developing countries in strengthening the programme of agricultural mechanization and manufacture of machinery, equipment and tools. The programme has gone through two phases and is now at the stage of consolidation of the gains in inter-country co-operation specifically in areas of policy and strategy, design development, manufacture, popularization,

/training

training, exchange of experiences and dissemination of technical information, all under the broad programme of TCDC and ECDC.

RNAM had its origin in the former Asian Industrial Development Council (AIDC), which initiated studies in a number of sectors of industry including agricultural machinery, during the period 1968-1972. The AIDC identified the need for a regional institutional arrangement, and a series of meetings and consultations led to agreement on establishing a network of national institutes to provide closer collaboration in research and development of agricultural mechanization, to develop better testing and manufacturing technology, and to encourage exchange of research and development information. RNAM thus began its operations in 1977, with the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) as the executing agency in association with the United Nations Industrial Development Organization (UNIDO) and the Food and Agriculture Organization of the United Nations (FAO). The technical collaboration of the International Rice Research Institute (IRRI) was also enlisted. The association of UNDP with the project has been regarded as a promoter of technical programmes and not only as a source of funds. UNDP is also responsible for programming of work and proper evaluation of the performance of the project. In addition to UNDP, the Governments of Japan, Australia, the Netherlands and the participating countries have contributed to the funds. The regional headquarters of RNAM is located at the University of the Philippines, Los Banos, Philippines.

There are now eight participating countries viz. India, Indonesia, Iran, Pakistan, Philippines, Republic of Korea, Sri Lanka and Thailand. The national institute of each country organizes and implements programmes of research, development, manufacture and popularization of appropriate and improved agricultural tools, implements, machines and equipment for crop production and post-harvest technology, using manual, animal, mechanical, and electrical power and also renewable sources of energy, compatible with local agro-ecological and socio-economic conditions. As the UNDP Review Mission has observed,

/RNAM

RNAM is a development institution and not a promoter of mechanization *per se*, except within the overall development context. Essentially its programme seeks to support the achievement of goals set out in the national development plans.

China has been actively interested in the RNAM programme since 1978, and has provided training facilities in manufacture and extension, and has supplied prototypes of cereal harvesters to five RNAM countries. A team of Chinese experts have visited these countries and have demonstrated their use, repair and maintenance etc. These machines are now being produced on a commercial scale in the RNAM countries.

The Network's main objective is the identification, development, testing, manufacture and use of appropriate agricultural tools and equipment so as to enable small farmers to attain higher levels of productivity and increased incomes. During the first phase of its operations from 1978 to 1981, RNAM systematically evaluated different methods of mechanization in cropping systems, and surveys in the participating countries, identified bottlenecks in the mechanization and local manufacture of selected agricultural machinery. The Network has strengthened the capabilities of the national institutes in design development, testing, evaluation and fabrication of agricultural machinery through training and study tour programmes, exchange of prototypes, workshops and by the provision of technical expertise. One of the useful outputs has been the RNAM Newsletter and the technical publications which are widely distributed. Specifically, catalogues and technical bulletins on agricultural implements, rice transplanters, power tillers and farm power units have been published. During 1984 an audio-visual presentation has been prepared with the assistance of the Government of the Netherlands. This presentation encompasses the background, origin, objectives, impact and more particularly the operational aspects of the programme. A video film presentation of the programme is also available, which has been prepared as a part of the presentation of ESCAP programme at the 40th session of the Commission at Tokyo in April 1984.

/The

The institutional framework of RNAM is a network of participating countries in the region with a nucleus office located at the RNAM Project Office at Los Banos, Philippines. The Governing Body which makes policy decisions, consists of one representative from each participating and member country designated by the Government concerned, a representative of IRRI, and a nominee each from ESCAP, FAO, UNIDO and UNDP, and the Project Manager. The Technical Advisory Committee is composed of Directors/senior professional engineers from the national institutes of the network nominated by their Governments, technical representatives of UNDP, UNIDO, FAO, ESCAP and IRRI, and the Project Manager. It formulates the work programme, evaluates progress of network activities and advises on all technical matters. The work programme is executed through the national bodies designated by the participating Governments as the national institutes in the network, while the formulation of farm mechanization policies at the national level is handled by the National Farm Mechanization Committees of the member countries.

A practical approach based on self-reliance and TCDC provides the framework for RNAM activities. A pragmatic, need-based, time-bound, result-oriented action programme has been evolved on the basis of a set of priority areas identified as of immediate concern in mechanizing agriculture in the participating countries. These relate to the development of machinery and equipment suitable for use by small farmers under local conditions, strengthening of agricultural machinery research and development institutions, provision of training and technical advisory services, promotion of local and improvement of institutional arrangements of more effective formulation and implementation of agricultural mechanization policies and programmes.

The main purpose of RNAM is to promote appropriate agricultural mechanization through selection, development, adaptation and use of suitable agricultural machinery and equipment, with conscious and deliberate efforts to promote their local manufacture.

/The

The immediate objectives are to:

(a) Identify bottlenecks in mechanization and manufacture of agricultural machinery and equipment as the basis of developing suitable guidelines to meet the needs of the participating countries;

(b) Strengthen capabilities of national institutions in testing, evaluation, design and development, and fabrication of prototype equipment to meet local manufacturing conditions, and establish qualified testing and evaluation methods through regional co-operation;

(c) Select, evaluate and supply suitable designs and prototypes of appropriate machinery, tools and implements to national institutes for further testing, product performance analysis, adaptive research and development of machinery that could be manufactured locally;

(d) Promote local manufacture of appropriate agricultural machinery, tools and equipment in co-operation with national institutes and manufacturers in the developing and industrialized countries; and

(e) Set up a clearing house to generate exchange of information on farm mechanization programmes and relevant technological developments in the field of documentation and reference services at the national institutes.

During the first phase (1978-1981), RNAM project has achieved the following:

(a) Produced new technical knowledge to the professional engineers and experts and has thus strengthened the capacities of the national institutes;

(b) Organized workshops, seminars, meetings, study tours, fellowships, information dissemination activities, which have stimulated the exchange of experience among engineers and widened their knowledge and horizon;

(c) Supported the exchange of prototypes among member countries for testing, modification and adaptation;

/(d) Organized

(d) Organized short-term training programmes for engineers to develop their technical expertise;

(e) Assisted in establishing National Farm Mechanization Committees (NFMCs) at the national level to formulate mechanization policies;

(f) Provided financial assistance for the fellowship programme and for the purchase of technical books and instruments by national institutes;

(g) Published technical information to broaden the perspective of engineering workers;

(h) Arranged consultancy services to provide technical assistance manufacturers in improving their manufacturing technology;

(i) Organized several activities that bridged the gap between research development and manufacture;

(j) Fostered co-operation and self-reliance among participating countries through various activities.

The implementation of the programme during the second phase (1982-1984) has produced the following tangible results:

(a) Strengthened the national networks by developing linkages and effective co-ordination between institutions involved in the execution of mechanization programmes and assisted in establishing/strengthening NFMCs responsible for formulating action-oriented mechanization policies and strategies and to review their implementation;

(b) Provided assistance in the testing, evaluation, modification, design, and manufacturing technology of seeders, transplanters, weeders, harvesting machines, threshers and other equipment;

(c) Promoted batch level production of identified machinery through selected manufacturers in different countries, and assisted in the popularization of machinery through field demonstrations and extension programmes;

/(d) Provided

(d) Provided through its fellowship programme training in activities such as design and development, industrial extension, testing, evaluation, modification and standardization;

(e) Organized six regional workshops on a variety of subjects namely, co-operation among small-scale manufacturers of farm machinery; review of progress on testing, evaluation and modification of selected prototypes; on standardization of agricultural machinery and equipment; review of policies and strategies on agricultural mechanization; and popularization of machinery;

(f) Published newsletters, a technical report on weeders, a farm machinery design manual, a report on training, a bulletin on agricultural mechanization statistics, two reports on testing and evaluation, and a report on survey of farm machinery manufacturing industries in eight countries;

(g) Supported the national institutes in training engineers in design of farm machinery, manufacturing, quality control and standardization; and farmers' and manufacturers' days, workshops and seminars at the national level;

(h) Assisted in training of several hundred artisans in the production of simple hand tools and implements; and

(i) Has continued to create awareness of benefits of mechanization, influenced and motivated the people concerned with a view to strengthening the spirit of co-operation and collective self-reliance among participating countries.

The RNAM programme, during the second phase, has been divided into six subprogrammes:

(a) Establishment and Strengthening of National Networks

- The RNAM has continued to provide guidelines for the establishment of national networks in most of the countries participating in RNAM;

- National Farm Mechanization Committees for the formulation of policies have been established;
- The national network is conceptually an integration of agricultural mechanization activities in the country as a whole, so as to include the professional associations of agricultural engineers, manufacturers, farmers and other professional bodies;
- Under this activity socio-economic aspects of mechanization and the manufacture of appropriate machinery are to be undertaken;
- The RNAM has provided assistance both at the national and regional level in the formulation of national agricultural mechanization policies and strategies. It has also organized a regional workshop on planning, policies and strategies of agricultural mechanization.

(b) Strengthening of Design Capabilities of National Institutes

- In the strengthening of design capability of the national institutes, RNAM has generously assisted in providing fellowships for training;
- Assisted the national training programmes for graduate engineers in design and production engineering;
- Has strengthened the equipment and facilities at the national institutes.

(c) Testing, Evaluation and Modification of Farm Implements and Prototypes

- In the testing, evaluation and modification of farm implements and protytypes assistance has been provided in the fabrication, a modification of protytypes and for the commercialization of successful machinery;
- Promoted mutual exchange of prototypes and/or technical drawings;

/ - Organized

- Organized regional workshop on testing, evaluation and modification of prototypes.

(d) Promotion of Local Manufacture of Agricultural Machinery

- In the promotion of local manufacture of agricultural machinery, the activities have varied depending on the requirements of individual countries and have largely included standardization and quality control, training and extension services;

- RNAM has organized a regional workshop on farm machinery manufacturers to provide opportunities to exchange experiences and also another regional workshop on standardization of agricultural machinery components and equipment.

(e) Popularization of Improved Implements and Machinery

- The popularization of improved implements and machinery has been an activity of high priority. RNAM has assisted in the selection of successful agricultural machinery, tools and implements. Their demonstration in the field and promotion of their use.

(f) Information Dissemination

- The information dissemination service has been found to be useful. Through Newsletters and technical digests information on technological developments, innovations etc. are disseminated. In addition, technical publications on a variety of agricultural machinery and tools such as rice transplanters, cereal harvesters, weeders, and test codes have been published.

With a view to maintaining the momentum generated by the RNAM programme and more specifically to accelerate the mechanization and manufacturing programmes the six clearly defined subprogrammes are proposed to be continued through the remainder of the current programming cycle of 1982-1986. The evaluation of the project activities from time to time at the expert, intergovernmental, legislative and commission levels has established beyond doubt its evergrowing impact and usefulness at the national level. In essence, the opportunity to work collectively to find solutions to common problems in a crucial field of agricultural mechanization has had a profound impact and therefore, there is an ever increasing desire among the participating countries to consolidate the gains of the project and to further strengthen their bonds of friendship. With this end in view the work programme for 1985 and 1986 has been formulated.

The major policy issues considered by NFMCs are given below:

(a) Sources of power for operation of farm machinery.

(b) Identification of areas/regions suitable for mechanization. Selection of machines to accomplish this with and the means to make these machines popular with farmers.

(c) Import policy for agricultural machines and equipment to protect national farm machinery industry.

(d) Research and development programmes concerning appropriate agricultural mechanization.

(e) Production and supply of quality implements and machines.

(f) Establishment of National Farm Mechanization Institutes in Indonesia and Sri Lanka.

The future activities would encompass the following:

(a) As the NFMCs have been established and institutions in the National Network identified, organizing meetings, reviewing, monitoring and planning for mechanization could be vigorously pursued at the national level of each country. Recommendations pertaining to regional co-operation will be followed up at the Regional Office.

(b) Reports of the National Workshops on Planning, Policies and Strategies as and when received would be examined and the findings and recommendations disseminated.

In strengthening design capabilities the following action is proposed:

(a) The development of designs of agricultural tools and equipment will be encouraged by offering incentives such as prizes for the best production-oriented design of agricultural implement or machine by any individual or an organization in each participating country.

(b) Professional training at national level would be expanded.

(c) Another regional training programme for design of machines would be undertaken.

In strengthening the local manufacture of agricultural machinery the following steps are proposed:

(a) Industrial Extension Units have been set up and their engineers given special training. They will now organize training programmes at the national level. However, in future, training in some selected production operations such as heat treatment, foundry practice, workshop layout, etc. would be very useful.

(b) Socio-economic studies with respect to mechanization would be intensified. In order to encourage such studies in each country, an honorarium suitable incentives will be devised for local economists or specialists to carry out such studies in addition to their normal duties.

(c) Mechanization Research such as (i) impact of existing machinery, (ii) machinery demand for different farming situations, farmers' and manufacturers' survey would be expanded. Also agronomic studies from the mechanization angle would receive attention.

/(d) In

(d) In co-operation with Agricultural Machinery Manufacturers' Associations (AMMA), the Industrial Extension Unit (IEU)/ National Institutes (NI) should forge close linkages with manufacturers, farmers, financial institutions and Government agencies concerned. Manufacturers' problems should be reviewed constantly and they should be assisted to overcome bottlenecks and delays particularly with regard to loans and raw materials.

(e) Rural artisans who are assisting farmers have to be trained to produce several types of low cost implements. This programme has to be expanded through training courses to be organized by the National Institutes. The Philippines' programme may be taken as a model.

As this subprogramme forms the foundation for a strong mechanization programme in the countries, assistance of international experts should be made available.

In the popularization of improved implements and machinery it is proposed to carry out the following activities:

(a) The various information material listed above will be expanded. Actual field demonstrations of machines will be intensified. This activity will be undertaken in co-operation with the manufacturers. Farmers' and manufacturers' days will also be given priority attention. Production of video films and film strips focussing attention on the usefulness of individual implements should be intensified.

(b) In many countries, the extension set up and methodology for popularizing farm implements and machines are very weak or non-existing. The National Institutes should appoint local communication specialists to strengthen this activity in all countries.

The information dissemination service of issuing newsletters, technical publications, information brochure etc, will be intensified both at the regional and national levels. The following activities will receive particular attention:

(a) The newsletters will be issued on a quarterly basis. Technical publications tentatively proposed are: (i) Agri-Mechanization Planning, Policies and Strategies; (ii) Socio-economic studies; (iii) Design manual; (iv) Testing of Agricultural Implements and Machinery; and (v) Technical abstracts.

(b) Strengthening the Information and Documentation Section of National Institutes would also be continued through supply of technical books, technical abstracts, etc.

(c) Audio-visual programmes will be given a new thrust.

It is envisaged that with the establishment of a viable regional institutional mechanism, logically the programme will have to be extended to post-harvest equipment and accessories which will include handling, drying, transport, packaging and storage.

The following measures would merit consideration:

(a) Suitable institutional arrangements in each country to deal exclusively with post-harvest technology problems and to facilitate the effective co-operation of all related activities generally dispersed in a number of official and non-official agencies. Additionally, a separate R and D institute could be established, depending on the actual needs. Among other functions, such an institute should study the problem of post-harvest losses of food grains at the various stages of threshing, handling, drying and storage, with a view to taking remedial measures to reduce such losses and to undertaking cost-benefit studies on various alternative technologies for the levels of storage required within the country;

(b) The dissemination of information on technology development, application and adoption, and technical support to extension services, would be other important functions of the institute. When required, it could either undertake R and D activities within its own competence or subcontract problems to known institutes within the country to solve specific problems identified in the field and develop suitable post-harvest equipment;

(c) National research institutes, agricultural universities, extension services and the like could provide further institutional support for improving the technologies used in food-grain storage and other post-harvest operations such as drying and for the integration of transport with storage;

(d) Establishment of mobile demonstration units with a view to demonstrating the use of a package of post-harvest technologies tailored to the needs of small farmers may be an effective instrument of propagating improved storage methods. Assistance could also be provided in undertaking the local manufacture of post-harvest equipment;

(e) Existing traditional and indigenous storage structures and practices should be modified in a way that would reduce the losses and still be within the financial means and other resources of the farmers to adopt the improvements;

(f) Bulk centralized storage of food grains should be resorted to only for exceptional purposes, such as export or for holding large buffer stocks for periods of three to five years in areas where there is a shortage. Pre-processing storage of grain would also call for bulk-storage facilities. Under special circumstances where the bulk storage of food grains is required, vertical silos might not be advisable because of their high capital and operational costs. Alternative flat bulk-storage structures could be equally effective with less capital investment;

(g) A suitable financing mechanism would need to be established to assist the farmers, especially the small and medium-scale farmers, to adopt improved, appropriate technologies for storage and other post-harvest operations. Such a measure would call for suitable policy decisions to provide credit facilities. Equal importance would have to be given to other infrastructural requirements such as marketing and transport facilities;

/(h) The

(h) The national institutes to be established should actively seek the farmers' participation so as to make their activities effective and also to ensure the acceptance of the techniques developed and their practical application by the farmers;

(i) The extension services should have close links with R and D institutes and should be managed wherever possible by farmers' co-operatives or associations. The extension agent should not be a specialist but should rather be a generalist who would be able to assist the farmers in the entire range of farm activities. Facilities should be provided to update the knowledge of the extension agent from time to time.

On a more practical basis the mechanization programme would need to be reoriented with a view to strengthening the machine building capability for a wide range of agro- and allied industries in the developing countries of the region. At the primary processing level machinery and equipment will have to be redesigned, developed, manufactured and popularized. At the secondary processing the selection of machinery would require careful consideration. There is an urgent need for modernization of machinery already in use and to introduce recent technological developments to reduce energy consumption, improve productivity, and the quality of the products. In view of the conditions prevailing in a large number of developing countries in metal processing and engineering industries there is every justification for a ECDC-TCDC programme to develop the machine building capability. While it is readily recognized that the requirements of such capital goods would be country-specific, consideration may be given for a long-term development programme for machinery such as for rice mills, flour mills, feed mills, sugar mills, oil mills, and also for maize and cassava processing of starch and starch based products; equipment for processing essential oils and extracts from medicinal herbs; textiles (cotton, woollen, silk and hard fibres such as jute, kenaf) etc. In fact, there is an urgent need to

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inculcate an engineering and technological temper in the processing of agricultural raw materials in the developing countries of the region, one of the effective means by which this could be implemented is to have a sustained programme of mechanization. With the growth and development of the infrastructure particularly for metal processing industries the developing countries should concentrate on strengthening their machine building capability which includes repair and maintenance, engineering and design, consultative services etc. TCDC/ECDC programmes would be invaluable in achieving this goal.

The level of industrial processing in the developing countries cannot progress rapidly without an indigenous repair and maintenance capability, spare parts production, and eventually the manufacture of capital goods. We are only considering these requirements for the basic sector of agricultural and rural development. In order to provide a fillip to the process of development, suitable mechanisms as may be relevant to individual industrial sector will have to be considered for sharing the available technological developments, know-how and operating capabilities with due emphasis on the programme of TCDC and ECDC which takes into account the reciprocity of capabilities of the participating countries.

CONSTRAINTS IN FARM MECHANIZATION AND THE ROLE OF REGIONAL NETWORK FOR AGRICULTURAL MACHINERY (RNAM)

Prepared by

Regional Network for Agricultural Machinery (RNAM)

INTRODUCTION

The eight countries of the Regional Network for Agricultural Machinery are at different stages of development. Over the last decade these countries have reached a stage of socio-economic development where farm mechanization is becoming not just important, but absolutely essential to achieve the overall national development goals. Due to the impact of oil boom in the Middle East and the changing domestic economic scene, where industrialization is taking place rapidly, the rural population is migrating to countries abroad or to cities and the farm labour is no longer abundant. Mechanization is also becoming essential in order to handle new varieties and to cope with more modern agricultural practices. The region is, therefore, going through the beginning of an industrial revolution. There are many factors that make it difficult to introduce mechanized farming in these countries, not the least of which is that each country is a unique entity by itself, and has its own distinctive climatic, agricultural, social and political characteristics. The solutions obtained for one country are not necessarily applicable to another. However, despite these diversities there do exist some commonalities as well.

The Regional Network for Agricultural Machinery encourages the member countries to share experiences and technologies to avoid duplication of efforts and to avoid re-inventing the wheel, so to speak.

The basic question is that of economics. If the farmers find it profitable to use machines, it has been found that they will accept them readily, especially if the economic advantage over manual methods is significant and realizable within a reasonable period of time. The following factors have been found to be most influential in impeding the progress of mechanization in the RNAM countries.

CONSTRAINTS AND RNAM'S ROLE

1. Policies

The national policies, drawn up during the planning stages, have a great influence on whether or not farm mechanization will be successful. The implementation of these policies and plans are

/again

again of crucial importance. The following factors in this category are considered important:

(a) Definition of mechanization priorities

In countries where the priorities are clearly laid down, the task of mechanization is relatively easy. However, in countries where these priorities are not clearly defined and implemented, the task is very arduous. In general, most countries have tried to mechanize only those operations which are labour intensive, time consuming and which involve excessive drudgery. Priorities may be dictated by other factors such as climatic conditions, soil conditions and cultural practices, in addition to social and political considerations.

(b) Imports versus local manufactures

The import policies of some of the countries, wittingly or unwittingly, discourage the local manufacture of farm machinery. The import duties on imported finished products and on raw materials for manufacturing the same products are tiered in such a way that they create unfair competition between the imports and local manufacture. Thus, the manufacturers are compelled to either produce goods of much lower quality or not get into such business at all.

(c) Incentives for local manufacture

In countries where incentives for local manufacture are provided by the governments, the process of mechanization is proceeding at a much faster rate than in those where incentives are not provided. These incentives can be in the form of any of the following:

(i) Provision of raw materials - If the raw materials are easily available, preferably indigenous materials, the manufacturers are saved from spending time and efforts in acquiring these raw materials. Some countries have set up raw materials depots at the county levels, from where the smallest manufacture (at the village level) can buy raw materials. In countries where no such facilities exist, the manufacturers face hardships in obtaining good quality standard materials for manufacturing the products. One of the recommendations of the Manufacturers'

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Workshop held in Lahore in 1982 under RNAM sponsorship, was that each country should set up a network for providing raw materials to manufacturers. This recommendation is being implemented to varying degrees in the participating countries.

(ii) Duty concessions - Some of the RNAM countries give duty concessions to manufacturers for importing raw materials and components to manufacture products locally. These concessions are either outright deletion of import duty, or reimbursement of all or a portion of duty upon giving the proof of utilizing the raw materials for manufacturing agricultural products. This incentive was also recommended by the Manufacturers' Workshop held at Lahore.

(iii) Tax incentives - Reduction of tax on profits realized from the sale of agricultural products indigenously manufactured is practiced by several countries. This encourages local production and promotes mechanization.

(iv) Streamlining bureaucracies - In some of the countries of this region, it is extremely hard to start a manufacturing plant and is comparatively much easier to embark on a business of imports. The bureaucratic procedures in setting up manufacturing plants are so complicated and involve such lengthy procedures that ordinary mortals are sometimes discouraged to start local manufacturing industries. Some countries have consciously tried to streamline these procedures to encourage indigenous production with noticeably successful results.

(d) RNAM is helping the participating countries in overcoming the constraints by continuously urging the countries to adopt appropriate mechanization policies by arranging workshops on the subject of planning and policies. This was recommended at the Regional Workshop on Mechanization Planning, Policies, and Strategies held in the Republic of Korea in August 1983. The network is proposing to hold a course for senior government officials of the participating countries involved in planning, to benefit from the Korean experiences where they have been able to mechanize agriculture within a relatively short period.

/2. Trained

2. Trained Manpower

The lack of trained manpower in almost all the RNAM countries is perhaps one of the most insidious problems facing them. Whether they are engineers for design and development, testing and evaluation, industrial extension, or technicians for manufacturing or agricultural extension, the countries are facing severe shortage of such manpower.

(a) Design/development, testing and evaluation

There is a severe shortage of design and development engineers in all the RNAM countries. The fact that these countries are engaged in very little original design work makes it very hard to train them within the country. It takes anywhere from 5 to 10 years to train a design engineer who already has well developed mechanical aptitude and has a penchant for creative work. Training test and evaluation engineers is relatively easy, but problems arise when these engineers are called upon to do adaptive design work after testing.

RNAM has conducted several courses in design development and testing. Please see Annex I. In order to facilitate the design and adaptation efforts, the network has encouraged the countries to share designs for different machinery during the first phase of the RNAM Project. Prototypes of three machines (harvesters, rice transplanters and weeders) were provided to all the participating countries. Please see Annex II. Of all these machines the vertical reaper supplied by the People's Republic of China has proven to be most successful, especially in Pakistan and India where this year 2165 and 150 units, respectively, were fabricated.

During the second phase, the countries have been encouraged to share prototypes and drawings of machinery amongst themselves. Thus, by the end of the second phase in December 1984, close to four dozen machines will have been exchanged between the eight participating countries. Please see Annex III.

/(b) Manufacturing

(b) Manufacturing technologies

There is a severe shortage of well-trained engineers in this very important category and there is a dire need for training manpower in such areas as plant management, production and quality control, metallurgy and selection of appropriate materials, heat treatment, and special processes such as brazing, automatic welding, chemical plating and finishing.

RNAM is striving to train as many engineers from the participating countries as possible, however, due to limited resources and lack of institutions where engineers can be given such training in a practical environment, the Project is having limited success. So far, a total of 23 engineers have been trained in the field of manufacturing technology.

Until very recently, the agricultural machinery research institutions in different countries were engaged in either basic research or in the development of machines without regard to their practical application. Consequently, such institutions are full of these machines, developed by them, but which never found their way either to the manufacturers or to the farmers. It is now been realized that without the industrial extension component, the design development, testing and evaluation efforts are largely wasted. Thus, a greater emphasis is being placed on industrial extension.

(c) Technicians

There is a severe shortage of trained technicians in the agricultural engineering field. Most of the well-trained technicians from the farming areas have moved, either to the urban industrial centres or to the Middleast for more lucrative jobs, thus creating shortage of manpower for agriculture in the rural areas.

RNAM is urging the National Institutes to start major training programmes of their own to train engineers, technicians and farmers, with manpower already trained abroad through RNAM-sponsored courses. This, however, is a slow process and is likely to take a considerable amount of time.

(d) Agricultural extension

As mentioned earlier, the linkage between the National Institutes, where machines are developed, and the manufacturers has not been traditionally very strong. The linkage between the institutes and the farmers to popularize machines, normally accomplished through agricultural extension departments, is even weaker. The reason perhaps is that the agricultural extension personnel are, as yet, hesitant to work with machines. There is a strong need to train the agricultural extension personnel in handling and demonstrating mechanical equipment. Until such manpower can be trained, the task of demonstration and popularization of agricultural machines will have to be carried out by the research institutions themselves.

3. Information dissemination

Since farm mechanization involves more than machines and methods, the importance of conveying the right type of information to engineers, manufacturers and farmers cannot be overemphasized. Most of the RNAM countries do not possess adequate resources to effectively carry out information dissemination. RNAM is helping the countries in bridging the information gap by issuing newsletters, technical publications, test codes for individual implements and other technical circulars. Please see Annex IV.

One of the most effective means of information dissemination is the television media. The Project is assisting the National Institutes, through catalytic funding, in developing capability for producing their own audio-visual presentations for popularization of farm machinery and equipment.

RECOMMENDATIONS

As discussed in the preceeding pages, most serious constraints in the mechanization of farming in the RNAM countries are lack of appropriate policies, trained manpower, and information dissemination. In view of these constraints, the following recommendations are made:

1) The countries should establish mechanization priorities, keeping in view their own socio-economic and agro-climatic conditions. Priorities for development of machines, for specific farming operations to be mechanized, must be clearly defined;

2) In order to encourage local manufacture of farm machinery, the imports must either be totally banned or at least limited. In order to avoid unfair competitions between imports and local machines, the imports must be levied higher level of duties, or at least the same amount, than those on the raw materials imported for local manufacture;

3) The manufacturers must be given other incentives in order to produce more machines within the country. These incentives may be in the form of: tax incentives, import duty concessions on raw materials and components, setting up of raw materials depots and streamlining bureaucratic procedures for establishing manufacturing plants;

4) With the manpower already trained abroad, through various RNAM programmes, the countries must undertake, on a large-scale, the training of engineers in the fields of design and development, testing and evaluation, manufacturing technology and industrial extension. Local training of technicians, agricultural extension workers and farmers should be given the same priority;

5) In order to keep engineers, manufacturers, and farmers abreast with the latest developments in the field of agricultural mechanization, they must be continuously supplied with information through television, radio, newspaper, and special publications. The National Institutes must devote a sizeable portion of their resources and efforts in these various activities.

TRAINING PROGRAMMES ORGANIZED BY REGIONAL OFFICE

Number of fellowships, host country/institute 1978-1984

Host Institute & Country	Design & Development	Testing & Evaluation	Mfg. Technology	Industrial Extension	Total
Egyptian International Centre for Agriculture, Egypt	1				1
University of Hohenheim, Germany	2				2
Tamil Nadu Agric. University, Coimbatore, India		1	2		3
Tractor Training & Testing Centre, Budni, India		1			1
Institute of Agricultural Machinery, Omiya, Japan	4	10			14
Agricultural Machinery Industry, Japan		3			3
Agricultural Univ. Wageningen, The Netherlands	8				8
International Rice Research Institute, Los Baños, Phils.	3			2	5
Zhenjiang Institute of Agric. Machinery, People's Rep. of China			4	4	8
National Institute of Agric. Engg. Silsoe, U.K.		3			3
International Centre for Advanced Tech. & Voc. Training, ILO, Turin, Italy & Punjab Agric. Univ. India	12				12
Indian Standards Institution, New Delhi, India			11		11
TOTAL	30	18	17	6	71

Number of fellowships by country and subject 1978-1984

Country	Design & Development	Testing & Evaluation	Mfg. Technology	Industrial Extension	Study Tours	Total
India	3	1	3	1	3	9
Indonesia	3	6	3	1	1	12
Iran	2	1	-	-	-	3
Pakistan	5	2	3	-	1	9
Philippines	3	3	3	1	2	10
Rep. of Korea	5	1	-	1	2	9
Sri Lanka	5	1	2	1	1	9
Thailand	4	3	3	1	2	11
TOTAL	30	18	17	6	12	83

PROTOTYPES SUPPLIED BY REGIONAL OFFICE

Rice Transplanters

Country	Annapurna 77	Mametora TA-2	Tang-Hong 2S	IRRI-RT
India	-	x	x	x
Indonesia	x	x	-	x*
Iran	x	x	x	-
Pakistan	x	x	-	x*
Philippines	-	x	x	x
Republic of Korea	x	-	x	x
Sri Lanka	x	x	-	x
Total	5	6	4	6
Grand Total				21

*Supplied under IRRI programme.

Cereal Harvesters

Country	Mametora reaper	TNAU reaper	Satoh reaper	Iseki reaper	Vertical conveyor reaper
India	x		x	-	1.9 m (tractor)*
Indonesia	x	x	-	-	1.6 m (power tiller)*
Iran	x	x	-	-	-
Pakistan	x	x	-	-	2.2 m (bilateral)
Philippines	x	x	-	-	1.6 m (power tiller)
Republic of Korea	-	x	-	x	-
Sri Lanka	-	-	-	-	1.6 m (power tiller)
Thailand	x	x	-	-	1.6 m (power tiller)
Total	6	6	1	1	6
Grand Total					20

*(tractor) = tractor drawn: (power tiller) = power tiller drawn

PROGRESS OF MUTUAL EXCHANGE OF PROTOTYPES

PROTOTYPES	Requesting Country	Status
FROM INDIA:		
1. Bullock-drawn disc harrow	Sri Lanka & Indonesia	(T) (R)
2. Two-wheel tool carrier	Thailand & Indonesia	(T) (T)
3. Helical blade puddler	Philippines	(T)
4. Paddy husk stove	Indonesia	(T)
5. Semi-automatic sugarcane planter	Pakistan	(E)
6. Groundnut digger-shaker windrower	Pakistan	(T)
7. Multi-crop seed drill	Sri Lanka	(D)
8. Two-row seed drill	Thailand	(P)
9. Chaff cutter	Philippines	(E)
10. Potato-digger cum planter[1/]	Pakistan	(P)
11. Seed-drill cum planter with fertilizer attachment[1/]	Pakistan	(P)
12. Potato planter[1/]	Pakistan	(P)
FROM INDONESIA:		
1. Cassava slicer	India	(P)
2. Single pass rice mill	India	(X)
3. Sprayer	Philippines & Thailand	(P) (P)
4. Weeder fertilizer applicator	Sri Lanka & Thailand	(X) (X)
FROM PAKISTAN:		
1. Bullock-drawn cultivator	Indonesia & Thailand	(T) (T)
2. Bullock-drawn disc harrow	Indonesia & Thailand	(R) (T)
3. Bullock-drawn groundnut digger	Sri Lanka	(R)
4. Corn sheller	Sri Lanka	(T)
5. Reaper windrower FMI-RW 22[1/]	India	(T)
6. Ridger cum-cotton planter[1/]	India	(R)
FROM PHILIPPINES:		
1. IRRI portable axial-flow pump	Pakistan & India	(T) (T)
2. UPLB peanut sheller	Sri Lanka, Indonesia & Thailand	(R) (D) (R)
3. Animal-drawn corn planter	Sri Lanka & Thailand	(T) (D)
FROM REPUBLIC OF KOREA:		
1. Grain dryer	India	(X)
2. Rotary seeder	India & Thailand	(X) (X)
3. Automatic thresher	India, Pakistan & Thailand	(T) (E) (T)
4. Combine harvester TC 1710 three-row[2/]	India	(X)
5. Rice transplanter NS 400-3[2/]	India	(P)
6. Power sprayer	India	(P)
FROM SRI LANKA:		
1. Pedal pump	Indonesia	(D)
2. Single-row hand seeder	Indonesia	(D)
3. Blade hoe	India	(T)
4. Two-row hand seeder	India & Thailand	(T) (T)
5. Three-row seeder for walking tractor	Philippines	(P)
6. Animal-drawn cultivator	Thailand	(P)
FROM THAILAND:		
1. Direct hand seeder	Indonesia & Philippines	(D) (T)
2. Hand-operated winnower	Sri Lanka	(T)
3. Propeller pump	Philippines	(X)

[1/] Additional request

[2/] Request in place of Nos. 1 and 2

(R) - Received - 6

(T) - Undergoing tests - 21

(D) - Despatched - 6

(P) - Pending - 11

(X) - Inability to supply - 8

(E) - Extension & popularization - 3

Total = 55

Annex IV

LIST OF RNAM PUBLICATIONS

1. Newsletters

Issue 1	April 1978	Issue 13	April 1982
2	October	14	August
3	December	15	December
4	April 1979	16	April 1983
5	September	17	August
6	December	18	December
7	April 1980	19	April 1984
8	August	20	August
9	December	21	December
10	April 1981		
11	August		
12	December		

II. Technical Publications

1. RNAM - Regional Network for Agricultural Machinery (Pocket Brochure)1978
2. Thailand's Harvest - Man or Machine?" by Jack Makeham, Consultant, February 1979
3. RNAM - Digest 1 Rice Transplanter, April 1979
4. Lack of Agricultural Mechanization: Causes and Effects" by Ghulam Kibria, October 1979
5. Aspects of Appropriate Agricultural Mechanization Development and Priorities by Adrianus G. Rijk, Consultant, November 1979
6. Regional Catalogue of Agricultural Implements, January, 1980
7. A Reaper for Thailand? by Jack Makeham, Consultant, May 1980
8. Regional Network for Agricultural Machinery Progress Review, June 1980
9. Report of the UNDP Review Mission - Regional Network for Agricultural Machinery by Charles J. Moss and David W. Gaiser, August 1980
10. Guidelines for Agricultural Mechanization Strategy in Development by R. C. Gifford and A. G. Rijk, October 1980
11. RNAM Digest 2 Power Tiller, Design, Development, Manufacture and Marketing, December 1980
12. RNAM Digest 3 Power Unit, May 1981
13. Regional Network for Agricultural Machinery - (Information Brochure) 1982
14. Testing, Evaluation and Modification of Weeders, 1983
15. RNAM Test Codes and Procedures for Farm Machinery, 1983 (with 15 individual test codes)
16. Testing, Evaluation and Modification of Rice Transplanters, 1983
17. Testing, Evaluation and Modification of Cereal Harvesters, 1983
18. Technical Circulars (Total-43)

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

Prepared by:

Mr. Wang Wanjun, Chief Engineer, Chinese Academy of Agricultural Mechanization Science, Ministry of Machine Building, UNIDO consultant.

CONTENTS

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CONTENTS

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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 Meetings on the Agricultural Machinery Industry, held in 1979 and 1983 respectively; First Regional Consultation Meeting on Agricultural Machinery Industry in Africa, 1982; Meeting on Exchange of Experiences and Co-operation Among Developing Countries in the Development of Agricultural Machinery Industry, 1980, in Beijing, and lots of other bilateral and multilateral 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 and activities, is the strengthening of international co-operation for accelerating the agricultural machinery industry with the purpose of expediating 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 possess some special characteristics or merits which other forms of international co-operation do not have. The developing countries have similar economic conditions and technical levels, and face the similar kind of tasks in building-up industries for promoting agricultural production. More often 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 their problems. So, the co-operation among the developing countries would be most direct, practical and acceptable to both sides.

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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 unit) 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 efficient development and continuous upgrading 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 tens of agricultural machinery plants manufacturing tools and implements, and repairing tractors and automobiles.

So, China has the capacity and will continue to participate in ECDC/TCDC activities, with the purpose of promoting agricultural machinery industry, on the principle of "equality and mutual benefit, stress on actual results, variety of forms and common development".

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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 readiest way to obtain the materials which are valuable to the interest institutions.

Exchange of experience will suggest some designs which may be applied directly and 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 the Regional Network of Agricultural Machinery (RNAM) on the new reaper designed by the Chinese Academy of Agricultural Mechanization Sciences (CAAMS) and adapted in co-operation with the International Rice Research Institute (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. An other reason might be the lack of a competent international co-ordinator to organize the job. Experience revealed that organized exchange of information in a specific field will be more systematic and well oriented. 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, and repair techniques.

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2. "Tractor Operator" - monthly, on the correct operation of different tractors, knowledge on repairing.

3. "Internal Combustion Engineering" - monthly, research and development of various international combustion engines.

4. "Tractors" - monthly, research and development of tractors.

5. "Pumps for Irrigation and Drainage" - monthly.

6. "Animal Husbandry Machinery" - monthly, etc.

Besides, each province in China 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 also some agricultural machinery information of foreign countries.

If there are sufficient funds for editing, translating, printing and circulating the information, the serving area will be much enlarged and the technical people benefited will be much multiplied.

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 related to agriculture production, 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) feasibility study for establishing multi-purpose agricultural plant;

(2) the management of a multi-purpose agricultural plant;

(3) experience and lessons on international co-operation for establishing plants;

(4) the basic research and development facilties, logical but practical sequence of the research and development of agricultural machinery;

(5) appropriate technology;

(6) technical problems about implement design, 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 Jiangsu 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 on research and development of specific machines.

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

- Research and development of intermediate and sophisticated implements - Chinese Academy of Agricultural Mechanization Sciences;
- Research and development of tractors - Luoyang Tractor Institute;
- Research and development of internal combustion engines - Shanghai Internal Combustion Engine Institute;

- Animal production machines and equipment - Inner Mongolia Animal Husbandry Machine Institute;

- Chicken farm and dairy farm equipment - Chinese Academy of Agricultural Machinery Sciences;

- Technologies for manufacturing agricultural machines - Chinese Academy of Agricultural Mechanization Sciences, Tianjin and Luoyang Institutes of Plant Design and Technology Research.

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.

2.2.3 Training of trainers 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 upgrading of technical men.

Agricultural Machinery Colleges of China may be commissioned for:

(a) training of trainers;

(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 features 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 2.2.1 may also be commissioned for designing and fabricating the prototype and sending it to the country concerned for testing and evaluation. It could save time and money as it will not involve too much international travelling and it is practicable as long as the specific and detailed requirements for designing the implement could be submitted beforehand, and communication and mutual understanding could be achieved promptly and correctly.

2.3.2 Despatch of experts and/or machines: Despatch of experts, bringing along the implement deemed 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 co-operatively by experts of both sides.

It is also practicable to 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.

2.3.3 Despatch of prototype for test and evaluation in Chinese institutes: Despatch the prototype of the implement to appropriate Chinese institute for testing and evaluation is also feasible. Power unit, such as internal combustion engines, not much related with soil and farming conditions, could be tested and analysed with reliable results.

2.4 Production co-operation

2.4.1 Range of products and service for 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

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these tools and machines, could be arranged for production co-operation:

1. Simple hand tools and manual operated implements: hoses, spades, axes, knives, sickles, sprayers, dusters, hand pumps, pedal-type threshers (the tools and implements are applicable to tropical and temperate 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 (up to 9 tons) 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 meter 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 meters.

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 larger 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.

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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.

2.4.2 Feasibility study for building plants: If an agreement of establishing agricultural machinery plant, or some other project related to agricultural machinery industry, is preliminarily arrived at, the supply 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.

2.4.3 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 Tianjin Institute of Plant Design is specialized in the planning and designing of agricultural implements plants, and the Luoyang Institute of Plant Design is specialized in the planning and designing of tractor plants.

2.4.4 Supply of production equipment and facilities: According to the contract agreed upon, the supply side will be responsible 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.

2.4.5 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

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components to expediate the fabrication of machines. In this context, standardization is very important. It is requested to adopt the International Standards (SI) to facilitate international co-operation.

2.4.6 Building of 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), but 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.

2.4.7 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 the factory 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 industry and agriculture.

Country	Project	Time	Scale and Products
Zaire	Farm Tool Factory	1976.4-1979.2	Hand tools 1,946 tons/year (hoes, spades, machetes, sickles), building area 7,600 sq.m., 273 men, principal equipment 132 units.
Mali	Agricultural Machinery Repair Shop	1975.3-1976.3	Repair of tractors 150 units, 1,815 sq.m., 40 men, equipment 80 units.
Guinea	Farm Tool Factory	1972.4-1973.6	Hand tools and animal traction implements 1,300 tons per year, 7,000 sq.m., 290 men, equipment 210 units.
Tanzania	Farm Implement Factory	1967.9-1969.9	Hand tools and animal traction implements 1,013 tons/year, 5,170 sq.m., 223 men.
	Farm Implement Factory (extension)	1978.3-1980.5	Hand tools and tractor spare-parts 2,700 tons/year, 6,781 sq.m., 240 men, equipment 55 units.
	Agricultural Machinery Repair Shop	1967.8-1968.3	Tractors repaired 50 units/year, 1,850 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 3,000 units, rice hoes 500 units.

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Country	Project	Time	Scale and Products
Albania	Tractor Spare Part Factory	1963.5-1966.10	Spare parts for 6,000 tractors (standard units), cast steel 2,500 tons, 23,965 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 1,500 tons, 14,200 sq.m., 980 men, principal equipment 1,550 units.
Vietnam	Agricultural Sprayer Factory	1974-1975	Knapsack sprayers 10,000 units, 4,690 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	

<u>Some experience on building such plants</u>

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 careful survey and investigation. In planning, allowance for extension must be provided in case more demand in the near future is certain. Possible channels and economical factors of purchasing materials and parts must be considered.

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 possible, to locate the plant in a place with good infrastructure, especially the transportation facilities.

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c. It is encouraged to use advanced but simple and reliable technology, to 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 well contrived. Experience has shown that stopage in production due to shortage of material or delay in supplying is not rare at plants 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 with "Multi-purpose". As a rule, the more universal the plant, the higher the technical requirement for the workers.

4. Right from the very start, up to the finish of the project, the active and responsible participation of the "receiving" 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 transfer 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 the project. In certain cases, "turn-key" is not the appropriate form. After the plant 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 agricultural machines 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.

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 help in designing a rice transplanter suitable for countries in south-east Asia.

3.4 Exchange of experience

In 1980, the Meeting on Exchange of Experience and Co-operation Among Developing Countries in the Development of Agricultural Machinery Industry was held in Beijing, China. Before and after that meeting, for every year, at least two or three seminars or meetings on exchange of experience of agricultural machinery with specialists from different countries were organized. Right now, China's relevant institutions, among which the Chinese Academy of Agricultural Mechanization Sciences is an active responsible unit, are preparing for three international exchange of experience meetings to be held in 1984: (1) Seminar for Promoting Economic and Technical Co-operation among Developing Countries in Asia and the Pacific Region in the field of Manufacture and Popularization of Agricultural Machinery, Tools and Equipment in China, 8-25 May 1984, sponsored by ESCAP and UNIDO; (2) Seminar on exchange of experience on developing hand pumps, sponsored by WHO, UNDP and World Bank; (3) Seminar on research and development of water pump and water turbine, sponsored by Chinese and Japanese Societies of hydraulic machineries.

3.5 Training activities

The Jiangsu College of Technology, commissioned by ESCAP and UNIDO, has opened training courses for trainees from the Philippines, Thailand, Pakistan, India, Sri Lanka, Burma, Bangladesh, Nepal, Egypt, Somalia, Uganda, Tanzania and Ethiopia. Each course lasted for three months. Not only the basic knowledge on the construction of tractors, internal combustion engines and agricultural implements were taught, but also the manufacturing technologies such as foundry, pressing and heattreatment were lectured. After the classroom work was over, they spent about one month to visit factories making diesel engines, tractors and implements. Thanks to the ample preparation by the lecturers and the good background of the trainees, the training courses have achieved good results and got favourable comments from the trainees.

Besides, a lot of factories, manufacturing and repairing various farm machines, have had the experience of training experts and mechanics in the plant and on-the-job. For example, the Shanghai Diesel Engine Factory has organized training courses on diesel enigne maintenance, the Luoyang Tractor Factory has organized training courses on tractor maintenance, and the Jiamusi Agricultural Machinery Factory, on the manufacturing, operation and maintenance of threshing machines.

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 carried out on the basis of equality, mutual benefit 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 authorities to give their full support to ensure its successful operation.

2. Feasible forms of ECDC/TCDC, as mentioned before, are many and will be varied according to the needs and capacities and relevant conditions of the partners. In order to promote the activities effectively and to assist the countries concerned to develop the agricultural machinery industry, a focal point or an International Centre is necessary to be established.

At the beginning, the centre will start with the activities, as its first phase of operation, which are comparatively easy to perform and yet interesting and important to all. Such as exchange of information, exchange of experience and training of technical personnel, compiling books or monographs for some specific subjects interesting to agricultural machinery technical personnel in developing countries.

As time goes on, the centre will manage to handle other co-operation activities, as its second phase of operation, such as joint research and development,despatch of prototype of machines and specialists to the needing country, and promoting various forms of production co-operation.

3. In this connection, it would be desirable to reconsider the project programme of "International Centre" proposed in 1981, to be established in Beijing, China. The project was suspended due to lack of funds. Not long after that, the Chinese Government approved a project for

expanding and consolidating the Chinese Academy of Agricultural Mechanization Sciences (wherein the proposed "International Centre" was planned to be located), as the National Centre of Research and Development of Agricultural Machinery and Mechanization of China.

One of the objectives of expanding the Academy is to promote the international activities on agricultural machinery and mechanization. The Academy (national centre) will be equipped with conference rooms, training rooms, field demonstration and testing facilities, machinery exhibition hall, information and library equipment. All these will be well fitted, not only for domestic purposes, but also for international activities. The centre will be better equipped for proceeding with more international activities, if United Nations could provide some necessary input.

4. In order to push for the realization of the proposed, but suspended project, the "International Centre" could be established through co-operation between UNIDO and China, by commissioning the role of the International Centre to the Chinese Academy of Agricultural Mechanization Science (CAAMS). Within the framework of CAAMS, a division will be set up exclusively engaged in the activities of the International Centre. At the beginning, UNIDO or UNDP will finance the approved activities (mainly the activities of the first phase), as well as the personnel and facilities involved.

If this recommendation is accepted by relevant authorities a detailed draft project will be elaborated by committed specialists.

SUGGESTED AREAS AND MEASURES FOR CO-OPERATION AMONG DEVELOPING COUNTRIES IN THE DEVELOPMENT OF AGRICULTURAL MACHINERY INDUSTRY

Prepared by:

ECDC Section, UNIDO

CONTENTS

INTRODUCTION

1. The ultimate objective of the Seminar is to promote economic and technical co-operation among the ESCAP developing countries, in the field of agricultural machinery industry and thus to accelerate their industrial and economic development.

2. UNIDO has submitted a comprehensive document entitled "Economic and Technical Co-operation among Developing Countries for Promoting Agricultural Machinery Industry", which was prepared by a consultant on the basis of China's practice and experience. This document has been distributed to the participants for discussion.

3. This paper deals only with some general issues and suggestions on areas and measures to promote economic and technical co-operation among developing countries in this field.

ECDC/TCDC AS A NEW DIMENSION AND UNIDO'S ACTIVITIES

4. The importance of economic and technical co-operation among developing countries (ECDC/TCDC) has been recognized in a series of resolutions and declarations of the United Nations General Assembly and other international organizations. ECDC/TCDC has emerged as a new dimension of the international co-operation for development, which gives expression to the developing countries' determination to achieve national and collective self-reliance, to make optimum use of their human and other resources and to bring about the New International Economic Order.

5. ECDC/TCDC is one of the important means for developing countries to accelerate their industrial development and to achieve self-reliance. There are many reasons why this is so. Among others, the following three elements should be underlined:

6. Commonality - The developing countries have set a common goal of industrialization. They have a common desire to uphold their state of sovereignty, to develop their national economy and to improve the living conditions of their people. They undertake common tasks to break the old

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international economic order and establish a new one. Commonality of goal and desire brings the developing countries together and generates a political basis for technical co-operation among developing countries.

7. Similarity - Most of the developing countries are newly independent. They have gone through similar roads of development and now face similar problems. They can thus easily appreciate each others' difficulties and share one anothers' experience. The experience of many highly industrialized countries may not be applicable to the present concerns of developing countries. Problems which the advanced developed countries are most concerned with often have little relevance to the developing countries because of the large technological gap between them. Most useful advice and assistance is to be available from countries which are currently facing or have recently faced the similar early-stage industrialization problems. Similarity of conditions among developing countries implies that many problems of industrialization may best be solved through TCDC.

8. Complementarity - Every developing country has its strong points and weaknesses. One country may be rich in natural resources but lacks appropriate technology. An other country may have reached a certain level of technology development but requires raw materials which are not available locally. It is obviously necessary and quite possible for them to complement each other. If the developing countries move toward industrial complementarity, such advantages as diversification of production and expansion of markets would ensure broader possibilities for further development of industrial technology and increase in employment opportunities. Complementarity would further contribute to a more efficient sharing of available resources and technology. It would not only result in pooling and sharing of human and raw material resources, but also enhance collective industrial planning based on mutual benefit and practical consideration of existing needs and resources. It would, moreover, improve the bargaining position of the developing countries vis-à-vis the developed countries.

9. In recent years the developing countries have co-operated with each other at different levels and in different forms. In order to achieve

maximum results in economic and technical co-operation among developing countries, the following principle guidelines should be observed:

10. Solidarity and mutual assistance - The developing countries have a common desire to develop their national economy and to improve the living conditions of their people. They undertake common tasks to establish the New International Economic Order. Co-operation should be guided by the spirit of solidarity among the developing countries. The co-operating countries should appreciate each others' needs and difficulties and try to help each other as much as possible.

11. Equality and mutual benefit - The co-operation will be based on equality and mutual benefit. This means that all the co-operating partners are equal and the co-operation activities should be beneficial to all. The co-operation should not be simply "give and take" but rather each party could benefit from the co-operation technically and/or financially. There are no simple donor countries and recipient countries. Each one will give something to others and at the same time it will get something from others as well. If they co-operate commercially, the terms of the deal could be better than that with the developed countries.

12. Stress on practical results - The co-operation should be arranged on the real needs and capabilities of the co-operating countries. The co-operation should directly promote the development of the selected industrial sectors and bring practical results.

13. Diversity in forms - The forms of co-operation should be very flexible. They could be exchange of experience, expertise and training opportunities, joint research and design, joint venture and multinational production enterprises among developing countries etc. The diversity of conditions determines the different forms of co-operation. The form can be developed from simple to complex and from individual to comprehensive, depending on the wishes and conditions of the co-operating countries.

14. Common development - To achieve common development is the ultimate objective of economic and technical co-operation. One should measure the

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success or failure from the industrial development which has been achieved through co-operation. Special attention should be paid to the development of each of the co-operating parties in order to reach a balanced and common development.

15. UNIDO has attached and attaches great importance to economic and technical co-operation among developing countries. UNIDO's programme for ECDC/TCDC activities is primarily intended:

(a) to increase the awareness of the developing countries of the necessity and possibility of TCDC;

(b) to stimulate governments of developing countries to reorient their policies and to break attitudinal barriers in order to obtain maximum benefit from TCDC;

(c) to promote specific TCDC projects and to assist in their implementation.

16. The programme has five mutual supporting components, namely, organization of Solidarity Ministerial Meetings in least developed countries, follow-up of decisions and agreements reached at Solidarity Ministerial Meetings, development of joint programmes for specific industrial sectors, implementation of conclusions and recommendations relating to TCDC reached at Consultation Meetings, promotion of the establishment of multinational production enterprises, enterprise-to-enterprise co-operation among developing countries and other ECDC/TCDC activities.

17. UNIDO has actively participated in and contributed to the ECDC activities in the field of agricultural machinery industry. The first and second Consultation Meetings on Agricultural Machinery Industry were held in 1979 and 1983 in Stresa, Italy and in Vienna, Austria respectively. The First Regional Consultation Meeting on Agricultural Machinery Industry in Africa was also organized by UNIDO in 1982. The Meeting on Exchange of Experience and Co-operation among Developing Countries in the Development of Agricultural Machinery Industry was organized in 1980, in Beijing. UNIDO is also an associate executing agency of the Regional Network for Agricultural Machinery of the ESCAP region.

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POSSIBLE AREAS FOR CO-OPERATION

18. The diversity of conditions determines the different areas and forms of the economic and technical co-operation among developing countries. The potentialities of co-operation are immense. The following are some possible areas of co-operation:

Exchange of information and experience

19. Exchange of experience is the first step of co-operation. ECDC/TCDC may start from this initial and simple form. A lot can be developed through the establishment of meaningful contacts, technical visits, study tours, seminars and expert group meetings which have been proven very useful. These activities which can usually be organized with relatively little cost and effort represent the essential preliminary reconnaissance required to establish a sound foundation for further co-operation. More than 100 projects of this kind have been implemented by UNIDO during the past ten years and a number of concrete co-operation programmes have resulted from these exchanges. Exchange of information should be gradually carried out in a systematic way. A useful programme could be the preparation of comprehensive studies of available technologies and technological needs in the field of agricultural machinery of developing countries. It would be important to collect and disseminate this information as widely as possible. Such studies could be undertaken by the developing countries themselves and could also be commissioned by UN agencies. It would be necessary to up-date the information and to develop a broad prospective of technological needs and capabilities of developing countries.

20. The Regional Network for Agricultural Machinery of the ESCAP region has done a lot of work in the collection and dissemination of information among developing countries. The contents and scope could be further enlarged and extended to meet the needs of the developing countries. The present Seminar may serve as an example of exchange of experience at a regional level, on general topics. Seminars or workshops on selected specific topics

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are also necessary. Such specific topics may include: manufacture of hand tools and implements, design of low-cost tractors and engines, quality control and standards, repair and maintenance, design and manfuacture of specialised equipment and so on.

Training of personnel

21. Training of technical personnel at different levels is an urgent need of developing countries for industrial development. It constitutes an important element in the development of agricultural machinery industry. There are several advantages of co-operation among developing countries in the field of training. The pattern of industrial development in developed countries do not always meet the specific needs of the developing countries. Therefore, training in other developing countries is often more appropriate. The developing countries have faced and overcome similar social, economic and technical problems more recently and they can show other developing countries what works, what does not and under what conditions. Social, economic and industrial infrastructure of the developing countries are more similar. These factors could facilitate the transfer of knowledge. Moreover, the costs of training in developing countries are likely to be substantially less than that in developed countries.

22. There is much room for co-operation among developing countries in training personnel in the field of agricultural machinery industry. The personnel to be trained may include local craftsmen, agricultural technicians, production personnel, supervisors and managers of enterprises. The contents of training programmes could include one or more topics of the following: design and research of agricultural machinery, production technology and operational methods, repair and maintenance of tools, implements and agricultural machinery.

23. The programmes of the co-operation among developing countries in the training of personnel for agricultural machinery industry already exist. For instance, China has conducted training courses on diesel engines and agricultural machinery in co-operation with UNIDO. A training centre has been established in the Jiangsu Institute of Technology. Technicians from

tens of developing countries have taken part in these courses. The Regional Network for Agricultural Machinery has also organized a number of training courses in many institutions in developing countries.

24. Under the Centre of Excellence programme, UNIDO sought to identify existing training institutions, assess their capabilities and potential and develop technical co-operation projects to permit such centres to serve both national needs and those of other developing countries. The programme offers one of the most promising ways of strengthening ECDC/TCDC in training. Special emphasis was placed on identifying qualitative and quantitative needs for training in various branches of agricultural machinery industry, focusing on existing and plant training institutions. The aim has been to strengthen existing industrial capacities and capabilities to develop a network for improving co-operation among industrial training institutions and to exchange information on programmes developed to meet the needs of developing countries. It has been confirmed that a number of training institutions were equipped with facilities which, if strengthened, could better meet identified training needs of their own countries and other developing countries. In carrying out this programme further, more funds are necessary to strengthen the selected institutions and to make them real "Centres of Excellence".

25. The participants of this Seminar may take this opportunity to know the demands and the facilities available for training in each other's countries and may also discuss and agree on some bilateral and/or multilateral co-operation training programmes.

Expansion of trade

26. The share of trade among developing countries, in agricultural machinery as in other industrial sectors, is very limited in comparison with the total world trade. It should be increased rapidly. In fact, the agricultural machinery and tools produced in some developing countries may be more suitable for other developing countries. They are generally small and medium in size, simple in structure, easy to operate, maintain and repair and also low in price.

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27. Trade among developing countries can be expanded on the basis of mutual benefit. After exchange of information they can easily find many aspects of mutual interest for increasing the trade and agricultural machinery products. They may offer better business terms to each other, which may lead to the increase of trade among themselves.

28. Most of the developing countries usually cannot afford the purchase of agricultural machinery due to the lack of convertible currency. The developing countries can agree on some payment arrangements bilaterally or multi-laterally on the barter trade of goods. This would rapidly promote trade among themselves.

29. In order to expand the export of agricultural machinery, the developing countries should increase the quantity, improve the quality and pledge to provide spare parts and service for their exported agricultural machinery implements and tools.

30. The participants may wish to discuss what kind of agricultural machinery they need and what they can supply. Through the exchange of information and views some trade possibilities could be explored and negotiation may be initiated between interested parties.

Transfer of technology

31. Transfer of technology constitutes an other important area of co-operation. As mentioned before, the technology locally developed in developing countries may be more appropriate than that in the developed countries. The fact is that in agricultural machinery industry the technology which is needed but not always available in the developed countries, because relatively low-cost and abundance of labour are required rather than most automated technology.

32. In order to promote the transfer of technology among developing countries it is imperative to identify the industrial technology already available in the developing countries, including expertise, technical know-how and skills, machinery and equipment, design, consultancy and construction capacities.

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33. Some developing countries, especially those in this region, are ready to provide experienced engineers and technicians for rendering services and teaching techniques necessary for the manufacture, operation, management and maintenance of agricultural machinery and repair of special machine parts. The transfer of technology can be combined with the expansion of trade. The suppliers may despatch experts to the countries concerned to help their consumers to master the technologies for operation and maintenance.

34. Transfer of technology may also include supply of complete sets of agricultural machinery plants such as medium or small size tractor plants, diesel engine plants, farm implement plants, factory for manufacturing spare parts of tractors and other agricultural machinery.

35. Flow of technology among developing countries could be arranged commercially on the basis of mutual benefit. Conditions of south-south flow of technology could be conceived as follows: provision of information, incentives and reduction of barriers; preferential treatment of south-south flow of technology vis-à-vis north-south flow; no restrictive, monopolistic or exploitative practices; transfer of technology accommodated by indigenous efforts to develop its own technological capacity on the recipients part and by offers of support facilities on the suppliers part.

Joint research and production activities

36. There is a large scope for joint research and development activities among developing countries. It could be arranged in accordance with the practical conditions and the features of the co-operating countries. The research institutes of the developing countries may exchange research personnel to learn from each other. They may also choose the common topics to be studied together. The prototype of the machine or implement must be tested and evaluated at the country where they are expected to be used.

37. There are various forms of joint production in agricultural machinery and implements: co-operation based on complete unit complimentary or part exchange; production process complimentary - one country is responsible for supplying spare parts and an other for machine assembly.

38. Positive results have been gained in enterprise-to-enterprise co-operation which includes joint ventures, co-operation in production through mutual delivery of spare parts, co-operation in marketing of products etc. There is also a possibility in joint activities to combine the various aspects of technical co-operation, namely training, transfer of technology, management and consultancy, joint research and development into one well planned comprehensive co-operation programme.

39. The participants may wish to exchange experience on joint research and production activities in the field of agricultural machinery industry and explore the possibilities for further development of joint activities on bilateral and/or multi-lateral basis.

PRACTICAL MEASURES FOR PROMOTING ECDC/TCDC

40. The emphasis of recent discussions on economic and technical co-operation among developing countries in global and regional fora was on functional approaches based on the matching of needs and capacities of co-operating countries. The Solidarity Ministerial Meeting for Co-operation in the Industrial Development of selected least developed countries, organized by UNIDO, and the ESCAP Intergovernmental Consultations for TCDC are examples of these kind of approaches.

41. Both undertakings have resulted in concrete co-operation projects. The experience of these undertakings could be summarized as follows:

(a) a pre-identification of ECDC/TCDC needs and capacities is absolutely necessary. Before the meeting is held a detailed and specific inventory of TCDC needs and capacities should be made and every efforts given to match the needs and capacities.

(b) the meeting should be attended by high level policy makers who can be duly empowered by their governments to enter into co-operative arrangements with the co-operating countries.

(c) the meeting should discuss concrete project proposals on the basis of matching needs and capacities and which has to be submitted

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to the participating countries before the holding of the meeting for necessary preparation.

(d) a period of six months to one year is required to make the inventory and match the needs and capacities, to prepare the documentation and make the physical arrangements.

42. Based on the above experience and adopting them to the specific industrial sector, it is suggested that a high level meeting for promoting ECDC/TCDC in agricultural machinery industry be held in 1985 in China. The present Seminar and Study Tour can be viewed as an initial but important preparatory step for the proposed high level ECDC/TCDC meeting.

43. Keeping this suggestion in mind the participants may take the opportunity of the discussion and field visits to exchange information and views on the needs and capacities of economic and technical co-operation among developing countries. It is hoped that at the end of the field visits some concrete possibilities for co-operation will be explored between the host country and participating countries and among the participating countries themselves.

44. The discussion in Shanghai, while exchanging experience and views on various topics, will focus on the concrete proposals for further co-operation in the field of agricultural machinery industry. It is envisaged that in the final report of this Seminar some specific proposals will be adopted for further action. When the participants of this Seminar go back to their country they will report to the authorities concerned and start intensive preparation for the high level ECDC/TCDC meeting on agricultural machinery which is expected to reach agreement on ECDC/TCDC projects for quick implementation.

INTRODUCTION ON POPULARIZATION OF AGRICULTURAL MACHINERY IN JIANGSU PROVINCE

Prepared by:

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INTRODUCTION ON POPULARIZATION OF AGRICULTURAL MACHINERY AND IMPLEMENTS IN JIANGSU PROVINCE

I. Continuous improvement and perfection

The Jiangsu province, one of the main bases of the agricultural machine building industries in China, has the appropriate technical capability. At present, it forms a complete industrial system with various business lines and enterprises. Many types of products are designed. There are 13 business lines such as tractor, engine; plowing, plant protecting, harvesting, fields construction, drainage and irrigation, transportation machines; and machines for processing agricultural products and its by-products, and various machines for husbandry, forestry, fishery, etc. There are 26 kinds covering more than 1000 varieties of products. There are more than 200 well established and experienced manufacturers, fully equipped with testing, inspection and production equipments. The quality of their products stands stable, and performance reliable. Among these products some are very famous, both at home and abroad, such as small power diesel engine, portable tractor, and fundamental components such as water pumps in big-, medium-, small-size and oil pumps, nozzles, cylinders, pistons, gears and etc. which are sold to about more than 20 provinces, cities autoregions at home and more than 50 countries and areas all over the five continents. The Jiangsu province has a leading position in China with regard to export of agricultural machinery and implements.

In the course of developing and continuous improving products, we look upon the 800 million of peasants as master for agricultural mechanization, and strive to meet the demands of customers at home and abroad. We concentrate in thorough study and investigations on the home and international market, so as to keep ahead on the situation of the market demand both at home and abroad. For instance, when the Changzhow Diesel Engine Manufacturing Plant knew the market demands from South Asian countries, they changed the S195 type 12 h.p. diesel engine from hand starter to electric starter and at the same time develop a lot of new varieties as well, so the demands of the customers could be met. The Danyang Diesel Engine Manufacturing Plant, in view of the present development in rural area in China try to design and

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produce a small type portable tractor "Phoenix 4" to meet the requirements that "Every family can buy, every couple can carry". As it is just as the peasants desired it, many orders are coming in for the Phoenix 4; Wuxi Water Pump Manufacturing Plant in accordance with their principle: "customer first" produces not only medium- and small-type water pumps, but also an extraordinatry 4.5 M type water pump. And now almost one third of its products are exported, but it still falls short of the market demands. When 95 series small type diesel engine was popularly required on the market, Wujin Diesel Engine Manufacturing Plant, Jianghua Power Machinery Manufacturing Plant, following the production policy "we should have while others have none, ours become qualified while others have, when others have qualified products, we should have plenty of it, when others have plenty of qualified products, ours become cheap". Tried successfully to produce a S1100 type 15 HP diesel engine, the fuel consumption of which is much lower than that of 12 HP S 195 diesel engine, and design is advanced and reasonable with compact structure, better rigidity, light, good outlooking and easy start. Products are often improved, great demands kept constant. Since Wujin Diesel Engine Manufacturing Plant put this product into lot production, it gradually became the supplier of various big and medium-size enterprises such as Luyang, Zhangchen, Yunchen, Baotau tractor manufacturing plants and Beijing portable tractor manufacturing plant for their matching components. The sale area covered has increased from 3 provinces before 1980, to 21 provinces and cities, now. Its sales prospect are very promising.

II. To better quality and develop market.

The quality is the foundation where an enterprise stands. The value of the use (economic efficiency) of agricultural machinery can only be judged by its quality -- applicability, reliability and economic as a lever. Therefore the principle "quality first" should be strictly followed, in order to gain the faith from the customers. In recent years, through the adjustment of the enterprises and the reinforcement of the quality control, the agricultural machinery in this province has made great progress. In fact, 63 varieties have been rewarded with "gold medal" "silver medal" by the state and "super quality prize" by the ministry and province authorities respectively. A lot of products were developed, which won their reputations with their own excellent quality. The exports of agricultural machinery represents a great proportion of the total sales.

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The fuel consumption of both diesel engines S195 12HP and 170F 4HP produced by Changzhow, Wuxi and Jintan diesel engine manufacturing plants, is much lower than the consumption rate stipulated by the state. Three leakages of engine (oil, water and air) are fundamentally controlled. And the outlook of the engine is excellent.

Within one year only, 8 important improvements were made in the product structure designing and 10 main measures were adopted on the manufacturing process in Changzhow tractor manufacturing plant. Though production cost was increased a little, the working durability of the machine is much extended. These plants became not only famous within small type diesel engine and tractor line at home, but their products also intrude into the leading position among the same kind of products abroad. Many customers come from afar and across the sea to order the products produced by these plants.

The fundamental components, such as oil pump, nozzle starter and etc. are the basic elements of a machine. The performance of the machine depends on the quality of the spare parts. Through technical innovation, introduction of main item and perfection of the key equipment, the quality of its products has got much improved, especially the products produced by the Wuxi, Nanjing oil pump and nozzle manufacturing plants and Wujin motor manufacturing plant, has built up its reputation both at home and abroad. A lot of customers stated clearly on the contract when they order diesel engines from China that the products they required should be made by Wuxi oil pump and nozzle manufacturing plant. In order to improve the quality of the starter for the agrimotor produced by the Nanjing Car manufacturing plant, Wujin motor manufacturing plant introduced a key equipment -- cold intruder and changed the process from welding into entire drawing. The quality is improved, and their supply falls short of demand.

III. <u>For better service and building up good reputations</u>

Guided by the thought in operation "there should be no sales without service, and there should be no production without sales", we maintained that the service should be provided even better when the demand exceeds supply.

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1. Combining technical service with training

   Four forms were adopted:

   (a) The manufacturer of the main machine sets up a "three undertakings" service station (undertaking to repair, to replace the unqualified parts, and to get the whole machine back if it is unworkable) in cities and countries where its products are greatly gathered.

   (b) Agency system: Agency is appointed to deal with on manufacturer's behalf. The supplier should send the wearing parts and technical data to the agency and bear certain expenses arising from "three undertakings".

   (c) To send workers to tour the area for repairing, maintenance and technical service periodically every year.

   (d) To start a technical service training class attended by the working staffs from customers and agricultural machine firms or departments, let them get better systematic understandings on the manufacturing positions, technologies and processes, testing inspection measures, and get further impressions on the structure, performance, principle of the products, and gain more experiences to remove the obstacles from the product so as to raise their operating abilities, and make full use of the agricultural machinery. Several times we dispatch some of our personnel to visit customers outside of this country, collect feed-back informations and to render technical service. We shall do our best to serve the customers at home and abroad.

2. Stress on the production of the replacement parts and the agro-machinery repairing.

The output of the replacement parts of the tractor and engine in this province held the first place in the whole country, in 1983. There are 47 main factories specially for producing replacement

/parts,

parts, among them, especially the oil pump, nozzle, cylinder, piston, valve, bushing, oil-transmission pump, generator, starting motor, instruments and gears have got a very good market both at home and abroad, that provides not only this province with its repairing and replacement service but also the principal enterprises and departments concerned all over the country. The main machine body manufacturing factories follow the policy to put the stress on the production both of main body and replacement parts, e.g. Changzhou Tractor Manufacturing Plant supplied more than 30 thousand pieces of the replacement parts for repairing last year. Many main machine-body manufacturing factories maintain that the repairing should serve the peasants, e.g. Wujin Diesel Engine Manufacturing Plant has a workshop specially for repairing, the workers are sent to tour the rural area during the busy season for repairing. In two years, they repaired more than 3 thousands diesel engines and tractors. The workshop is equipped with crank grinding and valve grinding machines, so the cranks and the valves can be repaired there, what saves the peasants extra expenses.

3. On-the-spot performance followed by the service

Due to the full development in the fields of agriculture, forestry, husbandry and fishery, a string of the new small type, multi-purpose, super-quality cheap farm machinery and implements appears. On-the-spot performance takes the role as a mediator and a bridge between the manufacturers and the customers. For example, during the meeting held by the foodstuff department, we held an exhibition of the machine set for processing mixed feedstuffs, and the on-the-spot performance was shown on the exhibition, which resulted that all the samples of the machine set were sold out, a good market was thus open for it. During wheat harvest Zhenjiang thresher manufacturing factory sent its TDG 400 thresher to Haiman County for exhibition and on-the spot performance and got rather favourable comments from the local peasants. They sold more than 500 sets of thresher in 1982, and 800 sets in 1983, so they got a very good market.

4. Stress practical results and the applicability of the product

Our country has a vast territory, with many different weather conditions. The farming system is different too. The agromachinery should meet these different farming requirements. Only in this way, the market can be obtained. Our policy on agro-machinery industry development follows the principle that the production should be according to the demand, i.e., we should produce what the peasants (customers) required, not otherwise. For example, with the development of the feedstuffs industry, we decrease step by step the production of the simple feedstuffs processing machinery-crusher, and start to produce the machine set for processing mixed feedstuffs. As there are plenty pine woods in Lianyungang city, we have designed a pine-needle powder feedstuffs processing machinery; following the establishment of the Plant Protective Corp. We developed various auto-sprayers instead of the hand-operated sprayer; in order to keep the straw for by-products in some rural area, we also increase the production of TDG 400 thresher for rice and wheat. In addition we also accepted the processing in accordance with the drawings and samples supplied by customers from South America, North America, Asia and Africa.

We are willing to study and process the agro-machinery in accordance with the practical requirements of the local agriculture of various countries all over the world, and to devote ourselves to our common cause in agriculture development.

Comments and suggestions to the above introduction are welcome.

ON THE AGRICULTURAL MACHINERY INDUSTRY OF THE PEOPLE'S REPUBLIC OF CHINA

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On the Agricultural Machinery Industry of the People's Republic of China

China is a country with vast territory, big population, and various natural conditions. The cultivation systems are different from area to area. The financial foundation of the nation is poor yet. The urgent task has been to promote the rural economy as fast as we can, in order to provide the peasants enough food, clothing, and higher income. Following the government's directions and policies concerning rural development, we carried out farm mechanization to meet diverse local conditions. The agricultural machinery industry in China grew along with the agricultural mechanization in the course of mutual adaptation.

In 1949, the year of the founding of the People's Republic of China, there were only 36 agricultural machinery factories with 4,000 employees, and the output value was 2,700 thousand Yuan. The main products of that period were animal drawn implements. In the fifties,the main task in the field of economic reconstruction was to promote the production effort. In 1956, the government's decision was to spend 25 years to achieve the target of farm mechanization nationwide. Then, many efforts have been made to promote farm mechanization. A great deal of agricultural machinery factories were set up in all provinces, cities or some districts (except Tibet), by means of investments mainly provided by the State, and partly by the local authorities, communes, and production brigades. Originally most of these factories were engaged in repair work, and making miscellaneous parts or utility machineries. Their capacities were small. Owing to the rapid development in farm mechanization, these factories soon specialized in manufacturing a single type of agricultural machinery. Around 1959, there were 2,000 factories, with 580 thousand employees, and the output value of 2,000 millions approximately. There were lot-producing factories, and even mass producing, tractors, engines, diesel generating sets, tillage

/machineries

machineries, equipments for crop protection, grain harvesting machineries, some crops and sideline products processing machineries, animal husbandry machineries, irrigation equipments, transport machineries, and also factories for maintenance and repair. Other factories manufacture manual or animal drawn plows, harrows, drills, cultivators, crop protection machineries, reapers, and threshers. Although these factories possessed certain capacity to provide fair enough kinds of farm machineries to the farmers, there were some defects in this industry, such as, scattered low capacity factories, production in small quantity, and so forth.

In the early sixties, severe natural calamities occurred in our country. During that period, the agricultural machinery market dwindled. Readjustment in the agricultural machinery industry was carried out. The total number of factories decreased from 2,000 to 1,300, and output value decreased to 1,000 millions. In 1964, it began to recover. During the years 1966 to 1975, the government still allocated funds, investments, and granted credits to help the communes and production brigades to purchase agricultural machinery, striving for the realization of farm mechanization in 1980. Accordingly, the production volume of agricultural machinery increased year by year.

In 1976, a new phase began to take place all over the country. In 1979, there were 2,200 and more agricultural machinery factories, about one million employees, and the output value was nearly 8,500 million Yuan. The quantity of big and medium sized tractors produced in that year was 125 thousand units; small tractors, 317 thousand units (we take the tractor above 60 h.p. as big, 25 to 60 h.p. as medium and 20 h.p. and below as small size); and engines, 22.7 millions h.p. That was the highest output for agricultural machinery production since the founding of the new nation.

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Since 1979, our government was determined to follow a national policy of readjustment, consolidation, reformation, and development more in accordance with the national features of having vast territory, big population, a poor economic foundation to start with, and still being a developing country. In the past, the nationwide practice was: the government granted funds or credits to peasants for purchasing agricultural machinery without direct relation to the benefit of individual farmers; machinery products were allocated by government departments which were in charge of farm mechanization; and, factories manufactured products according to the volume of production stipulated by the government. All what the factory manager was concerned with was to make enough quantity of machines disregarding the quality of it or its suitability to the demand. At the same time, the prices of agricultural machinery laid down by the government were quite low. The factories could only make a quite limited profit. Therefore, in 1979 the needed readjustment in organization and management were carried out in this industry.

At about the same time, in the rural areas, a new policy - the personal contract system-came into practice. In this new system the individual farmer or his family is responsible for the field yield and their income is linked proportionally to the crops. Thus the enthusiasm of peasant was stimulated to a great extent. Peasants' income increased. They began to spend their money, first, to improve the conditions of food, clothing, and housing - trying to raise their living standards. For a short period, demands in the agricultural machinery market decreased. In 1980 and 1981, the output value of agricultural machinery production decreased a great deal. However, in 1982, farmers turned to buying a lot of machineries which were suitable for individual farming, mostly small types of machineries. Thus, the agricultural machinery production began to rise again. But the types of machinery were different. The output value reached 7,000 million Yuan. In 1983, the output value rose to 8,588 million Yuan, surpassing that of the record year 1979. More than thousand

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units of big and medium sized tractors, 470 thousand units of small tractors, and 23 million h.p. of engines were produced in 1983. The variety of products also increased a lot. At present, there are more than 2,200 agricultural machinery factories and 2,200 repair works in this industry, producing over 2,300 types of agricultural machineries.

We now have a fairly complete set of research organizations for our industry. There are 40 and more research institutes. Among them are some national institutes, such as, China Academy of Agricultural Machinery Sciences, which is a comprehensive research organization. The others are the National Research Institute of Tractors, Internal Combustion Engines, Animal Husbandry, Fuel Injection Equipments. There is in nearly each province or city, one agricultural machinery research institute. Some of these institutes specialize in fields such as tea processing machinery, peanut machinery, machinery for subtropic crops, hill-side machineries and so forth. There are also three Plant Design Institutes for the agricultural machinery industry, taking care of renovation of the manufacturing technology in plants, including civil engineering. We also have universities like Jilin University, Anhui Institute, Luoyang Institute, and Jiangsu Institute for the education of students in agricultural machinery specialization. At present, the technical force and manufacturing capacity in our industry are considerable. At the moment, the product variety on the industry is in the increase and can meet the present rural demands. And a lot of products specially required in the market are being produced in those factories. Thus, more profits can be made. In addition, lots of special machines and equipments for textile and light industry and some other machines are also being manufactured in these factories, with a value of nearly 1,000 million Yuan. This indicates that the result of industrial readjustment is good. Yet, some factories earn only quite limited profit, still some factories lose and need to be subsidized by the government. Whether the factory can exist or not, it depends on types and quality of the products they produced. However, to solve the problem of factory's existence, the factories should try to add new models, improve the product quality, expand after-sale service, or form joint venture enterprises with other factories.

About four years after starting the reform of the agricultural production system in 1979, great achievements in agriculture were obtained. Bumper harvests of grains and cotton had been gathered in. The rural economy grew rapidly. Nowadays, the rural economy is not only limited to cereal crops, but includes cash crops and keeps expanding into a diversified economy, including agriculture, forestry, animal husbandry, fishery and sideline products. This year, the government calls to release the labour force by using the above-mentioned small machines bought. Through processing the primary products, they are turned into higher grade product-commodity for sale. Thus a lot of handicraft, semi-mechanized or mechanized enterprises can be established. This new situation requires that the industry responds adequately. All the industrial organizations and enterprises need to expand their range of services in order to meet the demand from the countryside.

A. To expand the range of services. This means not only providing enough machinery for grains, cotton, and oil crops production and so on, but also to attend to the various aspects of rural reconstruction, production and circulation of commodities, improvements of peasants' living as well as the development of the agricultural machinery industry. In brief, all the agricultural machineries produced in our country can be grouped as follows: (1) conventional agricultural machinery for grains, cotton, and oil crops; (2) machineries for forestry, animal husbandry, poultry farming, fruit, medical plants and mountain products; (3) machineries for processing, packing, storage and shipping of agricultural products; (4) machineries and equipments for popularizing advanced techniques and keeping ecological equilibrium; (5) machineries for construction, transport and energy sources; (6) equipments and implements for improving farmers' living. Machineries of groups 1 and 2, small generating sets, wind energy machines, and methane installations have been produced for many years and are being modified now and then. The present task is to concentrate on designing and manufacturing new varieties, by means of: (a) adopting advanced techniques in designing energy-saving models; (b) developing new models to meet the demand for product varieties; (c) producing new substituting series, to catch up with the world level.

B. To stress the production of key products. At the moment, the majority of the agricultural machineries products are cultivating, harvesting and feeding machineries for agricultural and animal husbandry farms, but the so-called "the pre-crop machinery" for preparation works and "the post-harvest machinery" for processing, packing, storage and shipments, in models and in quantity, are few. The government calls the rural area to speed up in producing more agro-commodities to supply the market. Because, by doing so, farmers' income could be increased promptly, the products can be processed and packed in the local area without any loss, and plenty of labour force can be utilized. Thus, farmers can accumulate more funds to buy more machineries. This is an effective way to mobilize the masses of peasants to fulfil the farm mechanization by themselves, so as to lighten the financial burden on the State. Therefore, at the moment, the key point of the industry is the stress on the production of "pre-crop machinery" amd "post-harvest machinery", but especially the latter one.

/C. Readjustment

C. Readjustment of enterprises. In our country, the agricultural machinery factories are scattered in almost every country. Such factories are small- or medium-sized enterprises, either with one hundred, two hundred, or a few hundred workers. Tractors, engines, combine harvesters, and large and medium size implements are being manufactured in some big factories, but other medium- and small-size machineries are manufactured in these medium- and small-sized factories. In fact, there are too many agricultural machinery factories for the present machinery products. However, they do exist, so we have to keep them running and ask them to manufacture appropriate models to supply various rural areas, after some readjustments. At the same time, measures to formulate a global long-term production plan and arranging appropriate locations of factories should be adopted. In recent years, some factories have changed their line of production to meet the changing demand in the domestic market. For example, some factories for big and medium-size tractors are now manufacturing small tractors, some engine factories are also producing feed processing machineries, and others, animal husbandry machineries, dairy farm sets, or wind driven generating sets.

The government has granted funds to some promising enterprises to carry out technological innovations. These factories are going to be the key enterprises in the industry. By improving its technical level, product quality and developing new products, such factories will lead the whole industry to prosperity. In this way, the surplus factories and surplus capacity can be fully utilized and developed. The task of enterprise readjustment is quite important and arduous. It will take considerable time to fulfil the job.

D. A clear guiding principle of development. At present, in this industry, though there are enough capacity and many kinds of products to produce, some problems still exist. Certain number of factories are faced with unsatisfactory quality and product

/varieties,

varieties, low rate technology and low profits. With such defects, the production of agricultural machinery cannot meet the demands of the rural economic development. In order to solve these problems good management of these enterprises is required. Attention should be paid to improve the product quality, to add varieties, to earn more profit, that is, not to concentrate on quantity and production speed alone.

As demand grows rapidly, some factories are entirely absorbed in the increase of product quantity, neglecting the quality. Therefore, the interests of farmers are overlooked. For instance, a certain factory manufactured threshers in a rough and slipshod way to meet the great demand in harvesting season. Many accidents happened during the threshing operation. Now, to follow strictly the quality control system in production becomes an important task to be fulfilled in this industry. Factories are required to improve their management, to implement a Total Quality Control System. Factories are also required to adopt ISO standard as much as possible in their manufacturing. Recently, nearly all of the agricultural machinery factories are keen to participate in the appraisal and award activities.

The economic-technical level of the staff and workers in our industry has to be upgraded. Therefore, different training courses are being given to them.

The rural economy in our country has poor conditions to start with. Though the farmers' income has increased in the recent years, their financial resources are still limited. For the time being, the farmers need machines of small sizes, of high quality, and low cost. These small machineries should be capable of versatile applications, and be adequate to match with the farmers' income level. Power ranges of these machineries are as follows: tractors and implements, under 20 h.p.; engines, under 20 h.p.; powered stationary machineries, under 7 KW. There

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is also a great demand of manual or animal drawn machineries and implements. In the last three years, about over five hundred new products, of small power range, were produced. The output value of this small power ranged machineries was 27.9 per cent of total, in 1979; 30.6 per cent, in 1980; 35.8 per cent, in 1981; 38.5 per cent, in 1982; and 43.4 per cent, in 1983. If counting its proportion to the quantity of all size machines excluding the spare parts thereof and the machines for light industry, the figure is more than 60 per cent. As the farming scale of special farmers will expand gradually and the farming system is progressing to form joint-farms or connected field operations, rural demand of medium-power machineries will increase accordingly. In our estimation, the production of the medium-power machineries will increase gradually. Therefore, we should not relax our attention to the improvement of medium machineries, while we are trying to produce more and better small machineries. The main points are to produce more varieties, to lower the fuel consumption, and to design and produce new series.

The number of various "specialized" farms are increasing rapidly day by day. These farms specialize in one or two specific fields, such as, grains, poultry, fishery, cattle, sheep, fruits, afforestation, sideline products processing, and machinery renting or repair; commodity production is developing further. Also the production scale is expanding. All these farms need to purchase complete sets of machineries for the whole process so that the commodities produced can be of high quality, and production efficiency can be raised. Several years ago, factories producing complete sets of machineries began to be arranged and organized. Among these, those for grains, oil crops, tea processing, potato processing and animal husbandry are growing more rapidly than others.

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China is a member of the big family of developing countries. The agricultural machinery industry in China is not old enough. In this industry, at the moment, we still have some weak points. It is necessary to update the technology to catch up with the level in advanced countries of the world, so that China can make greater contributions to the development of farm mechanization, especially in the developing countries. We shall continue learning advanced techniques and experiences from foreign countries. We shall also make every effort to establish international collaboration with other countries in the world, especially to foster co-operation among developing countries. During this Seminar, if some projects of co-operation can be studied and discussed, or some business agreements can be made with friendly countries, we will be honoured.

THE DEVELOPMENT OF AGRICULTURAL MECHANIZATION IN CHINA

Prepared by:

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The Development of Agricultural
Mechanization in China

The People's Republic of China has a population of one billion, and 80 per cent of them are peasants. There are only about 100 million ha of cultivated land, so per-capita cultivated land in our country is merely 0.1 ha. This makes it clear that China is one of the countries in the world that has the smallest area of farm land per capita. Moreover, the levels of our productive forces are low and the commodity economy is not well developed. Therefore, it is a very difficult and important task to solve the problem of supplying one billion people with food and to modernize agriculture.

Since the establishment of New China, we have made land reforms and built on this basis mutual-aid teams, co-operatives and people's communes. In a word, we have put agricultural production into collective management. At the same time a number of state farms have been established. In the past 30 years considerable advances have been made in agricultural production as a result of our efforts. Although the population of our country has grown quickly in this period of time, we have succeeded in meeting people's basic needs for food and clothing through our hard work.

The mono-collective economy in agricultural production, however, has a few shortcomings such as over-centralization of management. This system doesn't stimulate peasants to work hard enough to develop full production. Since 1979, we have introduced a series of essential reforms in agriculture. The most important step taken is the introduction of a contract responsibility system for agricultural production which links output with household earnings. Under the guidance of the state economy and the unified control of the collective economy, a peasant household can contract to manage a given area of farmland, forestry, grassland or waters, etc., engaging in agriculture, forestry, animal husbandry, sideline occupations and fishery on the condition that the means of production such as land, and the like remain as public ownership. According to the national policy, land contracts are drawn for 15 years or more. A peasant household is allowed to engage in as many activities as it can manage well. The work a household cannot undertake may be

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arranged and run at the collective level under the unified leadership. This approach has greatly stimulated enthusiasm of both collective communities and private households. At the same time, it has promoted the all-round development of agricultural production. In 1983 the output of grain in China was over 387 million ton, and the output of cotton exceeded 4.6 million ton. At present various forms of contract responsibility system, such as "household farm" are also being practiced experimentally on some state farms.

I

Along with the development of agricultural production, considerable advances have been made in agricultural mechanization in the past 30 years.

The development of agricultural mechanization in China has undergone three stages:

1. In the 1950s and 1960s, it was a period when the mechanization of agriculture was managed by the State. In 1948, we started to build state mechanized farms and since then a great number of state farms has been set up. These state farms have played an experimental and demonstration role in agricultural mechanization. Later, in 1952, while continuing to develop state farms, we established the first tractor stations and began to extend agricultural mechanization in vast rural areas. With farm machinery imported from foreign countries, agricultural mechanization in our country was still in the experimental stage during those years. Since the late 1950s, when we built our own agricultural machinery industry, agricultural mechanization has developed at a quick pace. By 1965 there were 2,062 state farms, 1,624 state tractor stations and 811 commune tractor stations in China. The total number of tractors reached over 76,000. The level of mechanization on state farms was higher, while in the vast countryside agricultural machinery was mainly used for tillage, irrigation and drainage of farmland. The tractor-ploughed area accounted for 15 per cent of the total cultivated land, and the area irrigated and drained by mechanical and electrical power took up 24.5 per cent of the total irrigated area.

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2. In the 1970s it was a period when people's communes, production brigades and teams managed the affairs of agricultural mechanization. Following the development of the collective economy, the state-owned agricultural machinery and tractor stations were gradually put under communal management. The number of machines bought by communes and production brigades and teams increased rapidly. By 1978 the total power of agricultural machinery throughout the country was 160 million horsepower. The number of large and medium-sized tractors was 557,000. There were 1.37 million small tractors with less than 20 hp. The tractor-ploughed area accounted for 40.9 per cent of the total cultivated land. The area irrigated by mechanical and electrical power took up 55.4 per cent of the irrigated area. Machines used for plant protection, threshing, transporting and agricultural products processing also increased rapidly.

In this period mechanization of agriculture was carried out by the administrative measures and through agricultural loans from the state and collective funds. The peasants had little freedom to choose farm machines for themselves. Some farm machines, even though of low quality, were sold at a high price. Agricultural mechanization in certain regions gave poor economic results.

3. Since 1980, we have entered a new period of agricultural mechanization with diversified forms of management. The outstanding characteristic is that the peasants perform agricultural mechanization on their own.

After the contract responsibility system has been adopted in rural areas, agricultural machines have become commodities which peasants choose and purchase at will and which are managed in different ways. First of all, it is the peasant household that manages farm machinery. This form of management has now developed rapidly. By the end of 1983, the number of tractors owned managed by peasant households and collectively-owned but

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contracted to peasant households reached 3 million, accounting for 80 per cent of the total number of tractors. Most of the households that have farm machines also do contract work for neighbouring peasants. These households are considered as specializing in the management of agricultural machines. Some households having farm machines and using the machines only for themselves, are called households specialized in mechanized production, for instance, in grain production and in raising poultry, etc. Among the collective-owned agricultural machinery stations, some perform mechanical operations for the peasants by contracts, and others, besides these operations, do maintenance and repair work, ensure supply of machines and spare parts and engage in personnel training for the farm machine household, as well. These are called farm machinery service stations. Where higher level of agricultural mechanization has been achieved, the agricultural machinery stations (or teams) directly sign contracts to take charge of agricultural production. Such stations (or teams) are known as mechanized production teams.

Through readjusting and reforming, a remarkable improvement of economic results has been attained in agricultural machinery management in the past few years. According to statistics from 26 provinces and municipalities in 1982, more than 80 per cent of the 23,600 commune-run farm machinery (service) stations made a profit, the income of 174,000 farm machinery specializing households exceeded the average household level.

With the development of commodity production and the rural economy, mechanization has been moving towards diversified management. Now the peasants not only purchase a great quantity of machinery for field and transport use, such as tractors, but also need a variety of machines such as irrigation and drainage

machines,

machines, animal husbandry machines and forestry and fishery machines that are suited to the family production scale. Some models of these machines still cannot be furnished to peasants by the industry. There were fewer sales of farm machines during the early period of the adoption of the responsibility system in agriculture, but since 1982 the volume of sales of farm machines has increased. In 1983 the total output value of farm machinery industrial production reached 8.588 billion yuan, the highest ever recorded. Agricultural mechanization is being promoted steadily.

II

For more than thirty years agriculture in China has been equipped with a great quantity of farm machines. Up to 1983, the total power of farm machinery throughout the country reached about 245 million h.p. including 3.59 million tractors, 275,000 farm trucks and many irrigation and drainage machines the horsepower of which amounted to 78.49 million. The tractor-ploughed acreage amounted to 35.82 million ha., which is 36.3 per cent of total acreage under cultivation. The machine-sown acreage reached 11.95 million ha. The acreage in which plant protection was done by machines reached 7.23 million ha. Mechanization of processing of grain, cotton, oil-bearing crops and forage has been mostly realized. Mechanical power is becoming an important component of agricultural productive forces.

Farm machines play an important part in agricultural production. First of all, farm machines make it possible to shorten farming time and for plants to accumulate more heat. In the area where much field work is done by machines the busy farming time for rushing planting and harvesting has been reduced to about half as compared with the 1950s. This prolongs 10-15 days for the plant growing period. The head accumulated by plants during these days amounts to 200° - 300°C. As a result the grain output may increase on average 750-1,125 kg per ha. In the struggle against natural disasters, irrigation and drainage machines have become an important means. Only mechanical and electrical power irrigation throughout the country can increase grain output by about 1,125 kg per ha on an average. Mechanized plant protection helps to

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reduce grain loss in approximately 188 kg per ha. Mechanization has also enabled us to raise the level of scientific farming and to give full play to biological technology. For example, factory growing and machine transplanting rice seedlings can increase paddy rice output by 375 - 1,500 kg. per ha. Other techniques such as deep ploughing, precision seeding, contribute to higher yields in agriculture. Mechanization makes it possible to save manpower for the development of a diversified economy in rural areas, which promotes the development of the commodity economy and helps peasants increase their income.

In the past 30 years, we have had both successes and failures in our work.

We have come to recognize that we cannot copy indiscriminately the experience of other countries to mechanize our agriculture; we must keep in mind the concrete conditions of China and take our own way.

China has a huge population and a limited amount of cultivated land. Her material and technical foundation remains rather weak. Mechanization is restricted by many factors, such as the consideration for rural labour forces, funds, energy resources, levels of industry and science and technology in general. At present, when our economy is not well developed, we should not strive blindly for a high level of mechanization. It is still necessary to combine manpower and animals with machinery.

Centering our attention on the improvement of economic results, we must develop mechanization steadily. The operations to mechanize must be chosen carefully. Practice has shown that farm activities in drainage and irrigation, transportation, processing, threshing, plant protection and ploughing can be mechanized rapidly and on a wide scale. This has been achieved because mechanization gives good economic results. Some mechanized operations such as combine harvesting are very popular in certain regions, while they are not appropriate for others. It depends not only on the local natural conditions, but also on the economic results of applying these machines. Therefore, all measures we take must be suited to local conditions, and investigation of social and economic implications are considered when we promote farm mechanization.

The development of mechanization must be combined with promoting the development of a diversified economy. According to our national

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conditions, great numbers of the peasant population cannot be permitted to move into cities. It is just in a diversified economy that the labour forces saved as a result of farm mechanization can be absorbed in. This enables part of the peasants to transfer from crop growing section to other production sections, services and trades, "leaving ploughed land, but not leaving native places", that is, doing non-farm work in the village. Agricultural mechanization helps to diversify the economy and to increase peasants' income as well, so that the peasants can choose and purchase more machines. Thus, the circle of mechanization for wealth and wealth for mechanization is created. The peasants are getting wealthy with mechanization. The wealthier they are, the higher level of mechanization they will attain.

Farm machines must be dealt with as commodities under the guidance of the national plan. Peasants are able to choose, purchase, use and manage the machines on their own. This policy enables us to take measures suitable to local conditions, emphasize practical results and arouse enthusiasm of the peasants for realizing mechanization. Only by carrying out the policy can the peasants accumulate funds to steadily develop mechanization.

III

At present, agricultural mechanization in our country is steadily developing with excellent economic results. Farm machines have been transformed from the centralized management into the present-day decentralized management in a variety of forms. Millions of farm households have got farm machines; different kinds of electro-mechanical equipment have increased rapidly; the technical services are continuously expanding, and the shortage of technological skills and scientific knowledge is quite glaring at the present time. Therefore, in order to manage and make good use of farm machines so as to rapidly develop the agricultural mechanization under the new situation, we are now paying close attention to public service and development.

1. To promote the development of service trades concerned with farm machines and establish a sound service system.

At the present products and fittings of farm machines are managed and sold by the farm machine supply companies at two levels: provincial and county. Factories must guarantee to repair and exchange any returned product that is not up to standard. In the areas which

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are under the leadership of counties all kinds of farm machine service stations are combined with each other to maintain, service and repair farm machines and provide required parts and fittings for users in the villages.

Various forms of technical personnel training have been adopted. There are 1,800 county-level agricultural mechanization schools and special training classes throughout the country. These schools and training classes are permanent training organizations. Drivers, maintenance-repair workers and operators of all kinds of farm machines are mainly trained here. Admissions to these schools and classes total about two million per year. Factories give users technical guidance according to products. Technical advice stations run short-term training classes to teach special new techniques. Farm machinery service stations also give farm machinery households technical guidance in the form of short term courses or apprentice training.

Farm machinery service stations do maintenance and repair of household-run machines or instruct farm machinery households to do this kind of work by themselves. Apart from general overhaul, country-run agricultural machine manufacturing and repair factories mainly take the task of assembly adjustment and test and machine parts repair with their advanced equipment. Some household-run repair shops and co-op repair shops for farm machines can also be found in China. They play a supplementary role in repairing farm machines.

Some country-run agricultural mechanization research institutes have set up advisory stations as an experiment to provide technical information for peasant households.

2. To promote technological development and extension of agricultural mechanization.

In recent years, the government has made great efforts to manage scientific research on agricultural mechanization. So far, there are 2 agricultural mechanization research institutes at national level - one is in Beijing, the other is in Nanjing; 3 specialized institutes - one is for research on agricultural mechanization in mountain areas, the other is for research on mechanization of animal husbandry and the third is for research on farm machine repair; 17 provincial level research institutes of agricultural mechanization

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and 218 prefectural level institutes. Being assistants of the industrial sector in the development of part of the new products, these institutes centre their efforts on studying the relationship between natural conditions, agricultural production features and agricultural mechanization. They are also exploring the inherent laws of equipping agriculture with machines and studying applied technology so as to achieve best results.

Any new products of farm machines, quality control of which is carried out by national industrial departments, can be sold and extended only after they have been appraised and given an extension licence by central and provincial level farm machinery appraisal stations under the Agricultural Mechanization Administrative Bureau.

China has preliminarily set up a system for extension of agricultural mechanization technology with organizations at different levels. The county agricultural mechanization research institutes serve as primary organizations for popularizing agricultural mechanization technology, providing guidance to all kinds of farm machinery service stations and farm machinery households in adopting new products and new techniques of agricultural mechanization in order to turn them into productive forces.

Since 1982, the government has chosen a number of important technical items to be extended in rural areas each year. Special funds for these activities are allocated. Honourable rewards and badges are given to the workers who have engaged in the extension of agricultural mechanization technology for a long time.

In the popularization, a technical contract responsibility system is also being tried out - when the user adopts a certain new technique and gets good economic results under the guidance of the technical popularizer, the latter will be offered a reward; if the technical guidance fails, the popularizer has to compensate for the loss.

In the immediate future, we will further study and analyze the feasibility of the mechanization of key production areas in the countryside, in order to provide a scientific basis for making the programme of agricultural mechanization development, establishing the system of agricultural machines in different areas and extending new technical items for agricultural mechanization.

3. To strengthen the administration of the agricultural mechanization.

Now we are making reforms in the administration system. At present, the Agricultural Mechanization Administrative Bureau of the Ministry of Agriculture, Animal Husbandry and Fishery and the appropriate organizations of the provinces and counties are responsible for the agricultural mechanization in the rural areas. Facing the new situation we can no longer rely on the administrative decree, we must strengthen administration by laws and regulations; help the central authorities draw up policies and laws concerned with agricultural mechanization and issue relevant rules and measures; further make plans for realizing agricultural mechanization in different areas throughout the country on the basis of agricultural mechanization regionalization; organize a satisfactory service system of agricultural mechanization and the scientific and technological management; train cadres and peasants; supervise the safety in applying agricultural machines and make appropriate distribution of oil for mechanization of agriculture.

China is a developing country. Though our country has her own distinct features, she also has much in common with other developing countries. While seeking our own way of agricultural mechanization we should also study and incorporate the advanced experience and techniques of other countries. We hope to strengthen international exchanges and cooperation. We welcome advice and criticism from the experts who are present here.

RESEARCH AND DEVELOPMENT OF THE AGRICULTURAL MACHINERY INDUSTRY IN CHINA

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Along with the development of agricultural machinery industry, a fairly comprehensive organization and operation system for research and development has been set up. In co-operation with manufacturers and universities, the agricultural machinery research institutes, at different levels and with different specialities, have designed and produced thousands of models of machines, covering most of the ranges of farming power units, implements and equipment.

The appropriate application of these farming tools, integrating with biological and chemical measures, has exerted great influence on the increasing of agricultural production. Within the last two decades, thanks to the increasing mechanical power and other input, the production of grain has been increased by 100 per cent and cotton by 110 per cent. These facts have fully convinced people that for the realization of agricultural modernization and the achievement of the agricultural output target by 2000, agricultural mechanization is one of the indispensable key measures deserving great attention.

The R & D work is the foundation for the development of agricultural machinery industry. With the purpose of exchanging with you and upgrading our capability in this respect, I present the following highlights of the experience and practice of R & D of agricultural machinery gained in China in the past decades.

1. Developing agricultural machines according to regional conditions and following the way of selective mechanization to increase yield and income.

There are numerous factors to be considered in developing agricultural machinery but the primary one is that regional conditions and local demands are to be considered. Agricultural production is closely related to natural and soil conditions, crops, cropping systems, social and economical conditions as well. All these conditions vary with localities. Consequently it is necessary to develop agricultural machinery according to local conditions in order to get successful results.

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The span of China's territory is 5,200 km from east to west and 5,500 km from north to south. It covers 8 temperature zones from tropical to cold temperature. In the southeast, where the humid and semi-humid regions are located, the precipitation ranges from 2,400 to 400 mm. In the northwest - semi-arid and arid regions - the precipitation ranges from 400 down to 50 mm. About two thirds of the territory is mountainous and hilly, the valley area only accounts for one third. All these conditions lead to the growing of different crops and different cropping systems.

On the basis of the natural and agricultural conditions, a regionalization map for agricultural mechanization has been drafted to serve as a guide for developing agricultural machinery, setting up factories and relevant institutions.

There are 9 regions at first level:

(a) Northeast agriculture and forestry region;

(b) North agriculture region;

(c) Southeast agriculture region;

(d) Southwest agricultural and forestry region;

(e) Loess plateau agricultural forestry and animal husbandry region;

(f) Northwest agricultural region;

(g) Inner Mongolia-Xinjiang animal husbandry and agricultural region;

(h) Qinghai-Tibet plateau animal husbandry region;

(i) Sea and ocean fishery region;

Under the 9 regions at first level, there are 38 regions at second level and many regions at third level, with more specific features and detailed requirements for developing agricultural machines and mechanization.

/Owing

Owing to technical, economic and social reasons, it is impossible and impractical to realize complete mechanization in any region at the present moment or even in the near future. For developing machines, we must only select those items which are urgently needed for increasing agricultural production and which will mostly benefit the farmers.

So the research institutes in different regions are requested, at the very beginning, to identify the needs of the region and put the urgent ones on the first priority for research and development.

2. Developing equipment for diversified economy along with machines for crop production.

The average cultivated land per capita of China is only 1/10 hectare, which accounts for only 27 per cent of the world average. However, we must consider the fact that the cultivated land of China is only 10 per cent of the land of the whole country. We have tremendous, vast grassland, land fit for afforestation, water areas and virgin land to be reclaimed. Even in the thickly populated and intensively cultivated regions, we still have plenty of resources to be developed.

To date, we have designed and produced numerous tractors and implements which contribute to the remarkable boost of the production of grain and cotton and many other industrial crops. Hereafter, we will continue to develop crop cultivation machines to further agricultural production. However, it is quite inadequate for developing our national economy if we limit our mechanization efforts to the field crop production, we must widen our scope of activity. We must develop the machines, equipment and tools to facilitate the utilization of local resources to create more wealth, such as aquatic product cultivation, afforestation, chicken, hogs and various domestic animal production, agricultural product and food processing, fruit processing and preservation, storage and transportation, etc. There is a great variety of machines and equipment to be developed for the promotion of diversified economy.

There are at least three benefits worthwhile mentioning: (a) local resources could be better utilized, and more wealth will be created; (b) the agricultural labor force, replaced by mechanization could be better re-allocated in the countryside without rushing them into big cities. The policy "leave the field, but not leave the countryside" is a very important and significant policy in considering the issue of Chinese big population; (c) once the farmers get well-off, they will buy more agricultural machines and capital goods to further improve their production capabilities. Evidence has already shown that a favourable cycle between the farmers' well-being and farm mechanization is emerging in the countryside.

After the implementation of the responsibility system, not only the crop production has reached an unprecedented record, but also the income from sideline occupations has increased tremendously. The sales volume of farming machines is going upward, and the demand of some categories already exceed the capacity of the factories.

Some social scientists sum up such agricultural development as a "+" agriculture. The horizontal stroke represents the various sectors of agriculture and diversified economy. The vertical stroke represents the production activities, before, in and after production. This new concept of agriculture has made a breakthrough in the realm of agriculture in the narrow sense. The agricultural machinery industry must serve the "+" agriculture and develop agricultural machines to meet the requirements of the "+" agriculture.

/3. Developing

3. Developing manual operated, animal drawn and motorized machines simultaneously, emphasizing the small- and medium-sized categories.

With the exception of irrigation, plant protection and some product processing, the general level of mechanization of China is rather low. According to the survey of 1983, the land plowed by tractors is about 36 per cent of the total cultivated land, tractor planted area, only around 12 per cent, and machine harvested area only around 4 per cent. It is evident that most of the field operations are performed by man labour or animal force. Such structure of farming power will not be altered radically in the near future. From a practical point of view, we must pay more attention to the improvement of the existing tools and the development of small and medium-sized implements needed by the majority of farmers.

However, the size of land owned per capita or per household varies considerably between different regions. By and large the farmers in the southeast and southwest need small sized power units (say under 20 h.p.), and those in the northeast and northwest need bigger power units (say over 60 h.p.) especially in the state farms and for land reclamation. Besides, there is a tendency for the farmers to organize themselves to form some kind of specialized production units which have the capacity and also the need to use equipment with bigger power and more sophisticated construction. The engineers are watching closely the new development and new demands from the farmers.

4. The principles and procedures for developing agricultural machines.

We put the emphasis on developing agricultural machines according to local conditions, but it does not imply that the farmers in different regions have to use different machines. As a matter of fact, there are many common features or identities in

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the construction of the machines and tools used in different parts of a country and among the machines used in different countries as well. For the purpose of saving time and labour, we stress the importance of learning and adapting the experience and products from different regions or countries to the local needs.

On the basis of past experience we have adopted "adaptation, designing and invention" as the proper sequence in developing agricultural machinery. Firstly, we collect the machines available to test and find out whether they suit the local conditions. If so, use the machines directly or make some necessary adaptation. Secondly, if we could not solve the problem by adaptation, we make use of the suitable mechanism, construction and parameters to make new designs. Thirdly, if for some new demands or some new farming operations, there is no available machines or mechanism, we try to invent a new machine. We encourage invention to solve new problems, but we discourage the so-called inventions which could be solved by adaptation and designing through the help of the existing machines, at less cost and in a shorter period of time. In the early stage, 1950s and 1960s, we adopted "adaptation" as a major method of developing machines. Thence, "designing" was the major method. Now we have invented some machines, like rice transplanter and head-in-feed combine, boat-type tractor, reaper with starwheel lifter, etc.

In developing agricultural machines, we ask our engineers to follow the following procedures strictly to guarantee smooth and successful operations:

(a) Subject deciding - The first step to develop agricultural machines is to choose and decide the research project properly. For every subject, it is necessary to make an economico-technical feasibility study through the joint effort of agricultural engineer, agronomist and economist. The feasibility study must include such items as the purpose and scope of service of the machine, the conditions and requirements to be met by the machine, the expected

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volume of production, proposed scheme and construction of the machine, technical and economic analysis of the machine, the state-of-art of the machine available either in the domestic market or in foreign countries. The feasibility study must be discussed in depth by relevant specialists especially the specialists from the end-users. Practice have shown that to decide a project in a rushed manner make it liable to fail and to be abandoned half way.

(b) Prototype designing and fabricating - In this stage of developing machine, the chain "Adaptation, design and invention" must be followed. Appropriate technology and proper materials must be considered.

(c) Testing and modification - The design of a new machine could seldom be accomplished in one move. It has to be tested and modified over and over again. Owing to the limitation of seasonal field operation, we encourage to carry out rig test before the season is due or after the season is over in order to have more chance to expose the defects and make modifications. The strength and durability of the critical parts or components could be and should be checked by rig test.

As a rule, this stage will take longer than any other stages.

(d) Evaluation - National Centre of Agricultural Machinery Test and Evaluation or an evaluation committee commissioned by government is authorized to test and evaluate a new machine and make recommendation for production or otherwise.

(e) Extension - Every researcher or designer must actively participate in the work of extension to help the factories to manufacture the machine and the farmers to use the machine. It is very crucial for the researcher or designer to obtain first-hand information about the performance and the economic effect of the new

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machine through the channel of extension, yet so far it has not received due attention. Now we put performance of extension as one of the criteria for assessing the work of a researcher or designer.

5. Attaching great importance to standardization.

The Ministry of Machine Building Industry of China has attached great importance to standardization and has stipulated the introduction of international standards (IS) within a fixed time. Standardizaiton for agricultural machinery possess particular significance. As they are numerous in categories, sizes and often produced in many factories, and as they are distributed to every corner of the country, standardization is one of the effective measures to guarantee the quality, to provide the possibility of specialized mass production, to ensure interchangeability of parts and components. Interchangeability is essential for supplying spare parts for timely machine repairing to guarantee seasonal farming operations.

According to the scope of application of the agricultural machines, we have national standards, ministerial standards and enterprise standards. For every category of machines, we have standards of (a) configurations and parameters; (b) technical requirements (for quality and performance); (c) test procedures; (d) labelling, packing, storing and transportation.

At the present moment, there are 367 standards for tractors, power units and implements.

The standards are drafted by specialized groups with the participation of research institutes, factories and universities, under the guidance and co-ordination of commissioned institutes. The draft is discussed by specialists, including the specialists from the end-users. Then it will be approved and issued by the National Standard Bureau or the Ministry of Machine Building.

/6. Setting

6. Setting up and consolidating research institutions.

The technical institutions related to the research and development of agricultural machine/mechanization are organized in four sectors: the research institutes, the factories, the schools and the testing and evaluation centres. Among all these sectors, the research institutes are the mainstay.

The agricultural machinery research and development institutes, according to the administrations to which they are subordinate, are at four levels, i.e. ministerial, provincial, prefectural, and county. The institutes under ministry are mainly engaged in: (1) the basic research of agricultural machinery/mechanization; (2) developing important and sophisticated products; (3) formulating national/ministerial standards; (4) assimilation and dissemination of information; (5) testing and evaluating of important products; (6) participation in drafting the short- and long-term product developing project. The provincial and prefectural institutes are engaged in the development of machines for the localities. The county institutes are mainly engaged in the work of extension of the agricultural machines and techniques suitable for the counties. There is no direct leading and subordinate relationship between the institutes at different levels. The institute will receive technical instructions from the institute at the upper level and will participate in the research project organized by the institute at the upper level. Such arrangement will enable the local institutes to be fully responsible for the solution of the local agricultural machinery problems, and also address some technical issues of common concern through joint effort.

There are 8 institutes with different specialities under the Ministry of Machine Building, 35 provincial institutes, and more than 2,000 prefectural and county institutes.

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In the course of developing agricultural machine/mechanization, universities and colleges have played important roles in two respects: (1) participating in R & D of agricultural machines; (2) training agricultural machine experts. Now we have 10 universities and colleges major in agricultural machine design and manufacture and 58 having departments or specialities major in agricultural machine/mechanization, with a total enrollment of more than 25,000. Practice has shown that adequate and qualified technical personnel are essential for developing agricultural machine and mechanization.

7. Encouraging the joining of efforts in research and development.

We encourage the joining of efforts as an appropriate form for developing agricultural machines. Generally, the experienced engineer from the research institute will serve as the leader of the group with the participants from factories and universities and sometimes from the end-users. Such practice has proved fruitful, especially for the sophisticated machines like combines and tractors, and complete set of machines and equipment, and also good for those machines having many series and specifications.

The advantages of this joint effort are:

(a) The participation of individuals with different specialities and different positions, will make the design better in relevant respects and also will shorten the period of developing. It is an effective measure to pool the wisdom of the masses.

(b) It is advantageous for the implementation of standardization.

(c) It is beneficial to those factories which do not have enough qualified engineers to develop new machines, especially the sophisticated ones by themselves.

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As time goes on, the technical level of factories will grow up. The forms of organizing and the ways of operation of the joint effort will vary accordingly. Except for highly sophisticated machines, we encourage the factories, under the guidance and control of the national standard, to develop machines by themselves. The research institutes and relevant parties will assist the factories by providing new construction methods and new technologies. This will bring the initiatives of the factories into full play in developing diversified machines to meet the various need of the farmers.

8. On the basis of self-reliance, stressing on international exchange and technical co-operation.

It is apparent that the issues of agricultural mechanization and development of agricultural machinery of a country like China could only be solved through our own effort. However, self-reliance does not conflict with international exchange and technical co-operation. On the contrary, transfer of technology on the basis of mutual benefit, will not only provide the receiving side with the facilities and technique of producing new machines at higher level, but also will upgrade the engineers' skill and enhance the capability of self-reliance. Just recently, with the purpose of speeding up the development of diesel engines of medium power, tractors and combines of meidum and large power, we have co-operated with firms in England, the Federal Republic of Germany and America and bought "know-how" from them.

We stress "nationalized production" through the help of the introduced technique. By "nationalized production", we mean that we must master the technique and shall be able to develop new machines on the basis of the introduced technique. Another implication of "nationalized production" is to make use of the basic working principle of the introduced technique and with necessary modifications of parts or materials to suit the local

/conditions

conditions so that we could produce the equipment at lower cost yet serve the same purpose. Jilin Province introduced the rice seedling nursery technique from Japan, but found it too expensive, the farmers could not afford buying the equipment. After careful investigation and repeated tests, they have successfully made modifications in the constructions and materials, and reduced the cost to one half of the original. The nursery equipment was then widely accepted and contributed to the increase of yield by 27 per cent of rice per mo in the province.

For the purpose of international exchange, we hold seminars on agricultural machine/mechanization almost every year and invite foreign specialists to attend or give lectures on special subjects of interest to our engineers.

In the past years, we have had quite a few co-operation projects with countries in Asia and Africa in the fields of training of experts, designing of implements and building of agricultural machinery plants.

To conclude my presentation, I would like to point out that China's agriculture has entered a new stage of development ushered by the implementation of various responsibility systems. The agricultural machinery industry must provide more diversified implements and machines to meet the demand of the new stage. We, R & D personnel, must summarize and consolidate our own experience and also learn from foreign experience so as to upgrade our R & D capability to accept the new challenge. Further, we would like to co-operate with the counterpart institutions of foreign countries in the area of R & D of agricultural machines for the purpose of common progress.

Annex

The Map of Agricultural Mechanization Regionalization of China

1. Northeast agriculture and forestry region
2. North agriculture region
3. Southeast agriculture region
4. Southwest agricultural and forestry region
5. Loess plateau agricultural forestry and animal husbandry region
6. Northwest agricultural region
7. Inner Mongolia-Xinjiang animal husbandry and agricultural region
8. Qinghai-Tibet plateau animal husbandry region
9. Sea and ocean fishery region

ON THE DEVELOPMENT OF THE AGRICULTURAL MACHINE-BUILDING INDUSTRY IN CHANGZHOU

Prepared by:

Mr. Qian Zhixing, Deputy-Director of Chanzhou Agricultural Machinery Research Institute, and

Mr. Shu Bainian, Chief Secretary of Changzhou Tractor Corporation

The city of Changzhou lies in the middle section of Shanghai-Nanjing Railway and is a medium-sized one. In the early period of the People's Republic, which was founded in 1949, the industry in Changzhou was in a very poor condition. Particularly, the machine-building industry, which was equipped with outdated facilities and backward technology, could not produce a decent product. It mainly provided maintenance and repairing services for the textiles machinery and diesel water pumps. At that time, Changzhou had 83 factories and workshops, large and small. Only two of these had over 100 employees, while all the others were small workshops and cottage industries. The people employed in the machine-building industry were about 1,500 and they produced an annual output of no more than 1,600,000 Yuan.

During the 1950s, these scattered and backward small factories and workshops were combined into 15 larger factories in an effort to pool together the existing technical forces and strengthening the machine-building capability. By 1957, specialized production of agricultural machinery had been underway in two factories, which, manned by 1613 workers and staff members, and backed by 2,060,000 Yuan fixed assets, produced an annual output that reached 2,590,000 Yuan. These were the bases for the development of the agricultural machinery industry in Changzhou.

In 1962, readjustment and reform were carried out on the industrial enterprises in Changzhou. As a result, the production of agricultural machinery has expanded considerably, with one more factory added. Now the total labor force employed by these factories reaches 2,260 persons, while their fixed assets went up to 11,020,000 Yuan. However, due to the lack of proven products, the lack of production orientation as well as the low level of productivity, the economic results of the three factories were still very poor. This fact is well illustrated by the following statistics: the total annual output value of the three factories was but 16,010,000 Yuan.

In 1983, in view of the pressing demand from the mass rural population, we started and succeeded in the development of the 195 diesel engine and the walking tractor. After two more years of hard work industrial production of these two machines became possible.

During the past twenty years, especially since 1979, when the

/Changzhou

Changzhou Tractor Corporation was established, we have set up as our objective "To strive for famous products with distinctive characteristics, raise productivity and improve the economic results". We have achieved fast growth and high economic results with relatively small input by the State.

Currently, Changzhou Tractor Corporation has under its control 10 manufacturing factories, 1 agricultural machinery research institute and 2 subsidiaries i.e. Changzhou Agricultural Machinery Import and Export Corporation and Changzhou Agricultural Machinery Sales and Service Corporation (for domestic market). It employs 7,449 of which 427 are engineers and technicians and has 69,690,000 Yuan in fixed assets. Equipped with 2,117 sets of major production facilities, the corporation mainly manufactures 12 kinds of agricultural machinery such as Model S195, 395, D180 diesel engine and Model Dongfeng-12 walking tractor, simply-constructed tractors, Model 130 130 reaper, 1-ton trailer, as well as other accessory equipment.

In 1983, the whole corporation had realized a total output value of 1,700,700,000 Yuan, which is 41.7 times that of 1962, averaging an annual increase of 19.44 per cent; derived a profit 28,732,200 Yuan, 213 times that of 1962, an average annual increase of 29.08 per cent; increased the annual output value per capita to 21,996 yuan, 13.2 times that of 1962, an average annual increase of 13.03 per cent. In that year, it had turned out Model S195 diesel engine: 75,254 units, which is 28.2 times that of 1965, averaging an annual increase of 24.06 per cent. The quality of these products has been improved steadily. As a result, both Model S195 diesel engine and Model Dongfeng-12 walking tractor have won National Gold Medal for their superior quality, while their major fitting parts of gears and valve springs, which are also made by the factories under the control of the corporation, were awarded with first class prize by the concerned authorities of Jiangsu Province. At present, products of fine quality account for as many as 79.4 per cent of all the products made by the corporation.

From 1965 to 1983, the State had invested a total amount of 26,066,400 Yuan in the agricultural machine-building industry of the city. However, during the same period, we have returned profit,

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taxes and equipment depreciation that valued 2,635,000,000 Yuan, which is 10.11 times that of the State input, and equals four times the current fixed assets possessed by the corporation. It was also during this period that the corporation has provided the State with 244,175 walking tractors, 599,454 diesel engines, not only for the domestic market in 29 provinces, autonomous regions and cities, but also 95,461 units diesel engines, 19,003 units of walking tractors and 4,344 rural trailers were already exported to over 50 countries and regions, worldwide.

I. Adopt the correct production orientation in view of the market demand.

An enterprise or an industry, no matter what it is, can achieve vigorous development only after it has decided to adopt a correct production orientation, as to adequately determine the market suitability of the products has a strong bearing on the development of the enterprise.

Taking our case as an example, during the period prior to 1962, although the industry of agricultural machinery in Changzhou, had made some initial progress, we could not make up our mind as how to define the production orientation owing to our insufficient knowledge of advanced management, and disregard of economic results and the market demands. Consequently we were caught in a very passive situation. For example, in the same period, the Changzhou Diesel Engine Works had successively started to produce as many as 20 different models of diesel engines but none of them turned out to be successful: they all proved to be short-lived; nor could the factory start industrial production of these models. Another example, the Changzhou Tractor Plant at that time unrealistically attempted to produce medium-sized tractors, but had to stop half-way and turned to the production of water pumps and valves. This caused the employees of the factory, which totalled 696, to find it hard to survive, as their annual output value dropped to no more than 1,010,000 Yuan with an average annual loss of as much as 480,000 Yuan.

In view of our previous bitter experience, we began in 1963 to realize the importance of selecting a correct production orientation. After a thorough fact-finding in the market and with the support of the higher authorities, we had started by actively developing the

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walking tractors as well as its diesel engine. Trial operations of these new products in rural areas met with immediate favorable responses from the peasants, which confirmed that this orientation was correct. The walking tractors and the diesel engines, ever since they were industrially produced in 1965, have been enjoying an assured market,which does not show any sign of weakening.

Through practice we have come to realize that a product, like a human being, has a life pattern, growing older with each passing day. Especially with the intensifying competition in the market both at home and abroad, an enterprise can face up the coming challenges and survive only when it has developed the capability to continuously put into the market new items. Accordingly, in recent years, we have given full play to the initiative of the technical personnel and made efforts to diversify the existing products and develop new ones so that we not only have the suitable products for the present market, but will also be ready to provide the future market. As a result, today our diesel engines are being manufactured in 24 types under 3 models and their accessory equipment in 8 types. A number of new products are being trial-produced and among them are model S1100, A0160 diesel engines, model Dongfeng-12, Dongfeng-8 and Dongfeng-6-4 walking tractors; to effectively strengthen our market position.

II. Organize the production following the principle of coordinated specialized production.

To organize the production according to the principle of coordinated specialized production is not only the objective demand of the social production, but also an important means by which the economic results may be improved. In 1963, following our readjustment of production orientation, we encounter many problems to start industrial production of the walking tractor as we were short of suitable factory buildings, facilities and technical power and could not expect the State to make large-scale investments. However, under the unified plan of the Municipal Government, and according to the quantity requirements and technical specifications of each kind of the tractor parts and components, we adopted distribution of production and signed long-term contracts with those chosen factories for a guaranteed supply of finished products, and it was under such production arrangement that

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the production of the walking tractor in small quantities gradually become possible. Afterwards, based on this, we took steps to further organize the concerned factories together so as to ensure a steady development of the coordinated specialized production by breaking down the three barriers that were existing between industries, between the city and the countryside and between State ownership and collective ownership. Now the coordinated specialized production of the walking tractor involves 33 units of which 11 are under the control of the Corporation including the diesel engine factory and the tractor factory, while the rest provide the Corporation with finished parts and components on the basis of long-term cooperation.

With this kind of production arrangement, we make full use of the existing resources and tap the internal potential of the Corporation. From 1963, we began to build necessary facilities, which took us a little more than two years and cost us only 2,480,000 Yuan. Yet by the year of 1965, with basically the same labor force, the Corporation had developed such a capability that it could turn out 3000 units of walking tractors and 6000 units of diesel engines per year.

Now that the coordinated specialized production has changed the previous situation when even a small factory had to be "self-contained", each factory can concentrate on the production of a few selected products which facilitates its management and permits continuous increase of productivity through deeper specialization.

For instance, the production of both gears for the tractor and diesel engines was previously carried out by the tractor plant and the engine factory respectively, which hindered both the production and quality of the gears. In 1965, we combined the gear-making workshops along with all their facilities and personnel into the previous agricultural machinery maintenance factory to establish a specialized gear-making outfit. Compared with 1965, the gear production in 1983 rose by 36 times with 10 times as many products, while the production cost dropped by two thirds. Gear manufactured by this factory have been selected as first class product in Jiangsu Province and the industrial and economic indexes of the gears are all in the leading place of gear-making in China.

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The coordinated specialized production has also promoted the development of the agricultural machinery industry as a whole. With one main product, an assortment of parts and accessories have come into specialized production.

III. Vigorously improve the quality of the products so as to enhance their competitiveness.

The quality of a product is reflected by its competitiveness and thus plays a key role in opening the home market as well as the foreign market. During the period from the founding of the People's Republic to the early 1960s, we could not develop the capability for industrial production as the quality of the products was not good enough to win the confidence from the users. In view of this fact, we committed ourselves to the continued improvement of the quality of the walking tractor and the diesel engine by carefully listening to the users' opinions and comments. We concentrated in making the necessary modifications to increase its usefulness.

In 1963, we started to make Model Gongnu-7 walking tractor and 195-7 h.p. diesel engine, copying Kubota machines made in the 1940s; in 1965, we improved the original design and produced Model Gongnu-7A walking tractor and 195B-8 h.p. diesel engine; and in 1967, we ourselves had successfully designed and manufactured Model Dongfeng-12 walking tractor and Model S195 diesel engine (12 h.p.), which in view of their light weight, compact construction, were well received by the mass users, and since 1970, are gradually gaining the international market.

Since 1979, in order to further upgrade their quality to catch up with and surpass the world advanced levels, we have actively promoted total quality control and adopted international standards. In the meantime, we have also imported a number of sample machines of different types so as to test their performances and the properties of the materials used in their construction. Information thus collected would then be compared with that of our products. For example, after comparing the S195 diesel engine with similar foreign ones, we have found out that the engine has to be improved in six aspects from the structural designing, properties of the materials, to the engine outlook. The improvement on the designs of 16 essential parts, including the piston, the fuel nozzle and the combustion chamber has been made and we have thus

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implemented 25 technological innovations. As a result, the overall performance and the realiability of the engine has been effectively strengthened; its service life has increased from 5000 hours to 7000 hours; its specific fuel consumption has decreased from 185 to 180 g/h h.p. hr. Currently, the technical indexes of the engine, excluding that of the noise level and the painting quality all have already caught up with an surpassed the world advanced levels of the similar type of engines.

In the meantime, we have also made 8 significant improvements on the structural designing of Model Dongfeng-12 walking tractor and taken 10 measures of innovation of the production technology. As a result, new breakthrough has been brought about in the quality of the tractor, as its service life rose from 1,500 hours to 2,500 hours and the technical indexes of the tractor, except for the painting quality, have also reached the world advanced levels. In 1982, both Model S195 diesel engine and Model Dongfeng-12 walking tractor were awarded National Gold Medal. In 1983, Changzhou Diesel Engine Works again won the National Prize for Quality Control.

Because we have insisted on placing priority on the products quality control, the popularity of our diesel engines and tractors is growing steadily. Even in 1981, when most agricultural machinery produced in China suffered a 20 per cent setback due to the temporary stagnation of sales in the domestic market, our products sold well and the demand kept growing at a certain rate.

IV. Actively carry out technical transformation so as to rise the technological level of production.

Although in 1965, we had already developed the capability to start industrial production of the small-sized diesel engines and walking tractors through the implementaiton of coordinated specialized production and production distribution measures, it was not possible to do so due to the low technological level of production and backward facilities of the other factories involved in agricultural machine-building in Changzhou.

During the past decade, however, with the development of production and the progress of science and technology and technical innovations, our corporation has made gradual transformations towards technological

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progress in four stages: (1) from small-scale adjustment to complete restructuring the production technology; (2) from transforming the general purpose machine tools to self-designing and manufacturing highly efficient specialized equipment; (3) from innovating individual machine tools to setting up production lines and finally (4) from production lines to semi-automatic and automatic production lines. As a result, now Changzhou Tractor Corporation boasts of 574 pieces of various self-produced special equipment, 41 production lines, semi-automatic and automatic lines. The backwardness of the production technology has begun to disappear.

For instance, the technical transformation has brought about great changes in the foundry shop of Changzhou Diesel Engine Works. In the past, the production in the shop was mainly hand-operated and could not produce even 2,000 tons of castings a year. Today, the sand preparing, molding, pouring and fettling operations in the shop has been mechanized with automated lines.

This has not only reduced the labor intensity, but also tremendously increased the productivity with an annual output of 16,000 tons of castings, 8 times greater than before.

In expanding its production, Changzhou Tractor Plant has also adopted a series of advanced technology. In the past, the tractors were hand-painted piece by piece. Although this involved more than 60 persons, the annual output could not reach 2,000 units of tractors. After technical transformation, however, the capacity of the painting workshop has gone up to such a level that an annual output of 15,000 units of tractors became possible with the number of operators reduced to about 20.

In order to meet the needs of production expansion, an automatic painting workshop with TV controlling system was also designed and set up in 1979. Equipped with such advanced technology of electroshareses-coating and electrostatic surface painting, chain operation of 14 processes including pre-preparing, painting and drying would become available. The workshop was put into operation in 1981. It has helped to upgrade the painting quality of the tractors, and also raised the working efficiency. Manned by only 7 persons per shift, the annual output of the workshop today can reach 30,000 units of tractors.

Thanks to the continued efforts in restructuring and technical transformation and innovation focusing on products, the production of

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agricultural machinery in Changzhou has grown steadily with remarkable achievements, despite its poor foundation. However, we should double our efforts to earnestly learn the advanced experiences from home and abroad, consolidate our technical cooperation, actively introduce foreign advanced technology so as to promote the technological progress, step up the technical transformation and reach the world levels of the 1970s and the early 1980s.

TRAINING MORE SENIOR TECHNICIANS IN MANUFACTURING AND REPAIRING AGRICULTURAL MACHINERY FOR VARIOUS COUNTRIES TO DEVELOP COOPERATIVE RELATIONSHIP AMONG NATIONS IN ASIA AND AFRICA

Prepared by:

Mr. Liu Xing-rong, Director of Scientific Research Department
and Associate Professor, Jiangsu Institute of Technology

The original name of Jiangsu Institute of Technology was Zhenjiang Institute of Agricultural Machinery. It is one of the key machine-building and electrical engineering institutes of high learning in China with particular emphasis on agricultural machinery. The institute was founded in 1960 with teachers and equipment from the Nanjing Institute of Technology to teach agricultural machinery, automobile and tractor manufacturing technology. In 1963 the speciality of drainage and irrigation machinery, and its research staff, of Jilin Polytechnical University were transferred to Jiangsu Institute of Technology. In 1970 the Agricultural Mechanization Branch School of Nanjing Agricultural College merged with Jiangsu Institute of Technology. In the past 24 years we have achieved remarkable successes. Now the campus occupies 50 hectares with building area of nearly 120,000 square meters. The scope of our Institute is also growing. The Jiangsu Institute of Technology consists now of Departments of Agricultural Machinery Engineering, Power Machinery Engineering, Machine-building Engineering, Agricultural Mechanization, Electrical Engineering, Mechanical Engineering, Management Engineering and Computer, and Basic Courses Teaching-and-Research Department. Within these Departments the specialities are agricultural machinery, tractor, automobile, internal combustion engine, hydraulic machinery, machine-building technology and equipment, foundry technology and equipment, metallic materials and heat treatment, agricultural machinery repair and manufacture, management engineering for agricultural mechanization, industrial electrical automation, mechanical engineering, electrical engineering, etc. Up to now we have established more than 30 teaching-and-research sections, about 30 laboratories and an affiliated factory. We have also built the Research Department of Drainage and Irrigation Machinery, established Research Sections for Measurement and Testing Technology of Agricultural Machinery, Farm Products Processing, Engineering Mechanics, Engineering Thermo-Physics. The facilities in electronic computer room and in electrical audio-visual aids are being perfected. Now there are in all about 600 teachers and scientific researchers, among them there are more than 70 professors and associate professors, and more than 300 lecturers and engineers. Among these teachers there are not only a number of famous old experts in the field of agricultural machinery engineering, but also a number of middle-age scholars trained in our country who had advanced studies in foreign countries.

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At present, the agricultural machinery course is 4 years. During the first 3 years students study general basic courses and technical basic courses, such as higher mathematics, physics, theoretical mechanics, strength of materials, machine design, tolerance and measurement, metallography and heat treatment, electro-technics, electronics, computer, etc. In the fourth-year students study specialized courses including construction principles, design and manufacture of farm machines, experimentation on farm machines, etc. During this period, students must practice in some farms and farm machinery plants. Students have to sum up what they have learned and put it into practice by preparing and implementing graduation projects, three months before graduating. Thus, after graduating students have gained the capability to be engaged in design and manufacture of farm machines.

In order to train more senior technicans in agricultural machinery, we have recruited doctor's and master's candidates in the specialities of agricultural machinery, agricultural mechanization, etc. The postgraduates courses are two and three years respectively. In the first year post-graduate students study basic subjects in depth the last year they complete independent research projects and prepare graduation thesis. Most of post-graduate students will take a scientific research job in research institute of agricultural machinery or college after graduating.

Since the founding of Jiangsu Institute of Technology, we have trained more than 5,000 graduates and more than 100 postgraduates. In recent years we have held more than 50 training courses and classes for advanced studies in various specialities. In total we have trained about 3,000 participants. Now our graduates are all over the country. They are performing an active role in big and medium size enterprises, research units, colleges and government departments in the field of agricultural machinery, tractor, automobile, or internal combustion engine. Many of them have become key members of the technical profession. Some have been leaders in their departments and units.

In order to further friendship and co-operation between our country and developing countries, and to promote the development of manufacture of farm machines in developing countries, we have organized

3 terms of training courses in the field of manufacturing agricultural machinery of small and medium size since 1980 sponsored by PNAM and UNIDO. We have trained 24 senior technicains in agricultural machinery for 13 countries, namely Bangladesh, Burma, Egypt, Ethiopia, India, Nepal, Pakistan, Philippines, Somalia, Sri Lanka, Tanzania, Thailand, and Uganda. A vice-president was assigned to organize these training courses. Some staff members were chosen to set a training office. We got capable teachers from the departments to act as teachers and tutors and compiled teaching materials in English for 9 specialities and instructions for experiments and practices. Some young teachers who can speak English well were chosen to be oral interpreters in lab experiments, workshop practices and daily life.

Each training course took 3 months. In the first month, we arranged the theoretical teaching and lab experiment; nine lectures were offered, such as farm machines (including plow, harvester, rice transplanter), small-size tractor (mainly power tiller or walking tractor), diesel engine, fundamentals of machining process (including tolerance and prcision measurement), heat treatment, foundry, stamping, forging and welding, equipment for irrigation and drainage, etc. These courses permitted participants to master the construction. performance and design essentials of small and medium size farm machines and to familiarize themselves with the manufacturing procedure of various farm machines. Each course includes some experiments designed to give participants practical knowledge and technical ability. Through these experiments, all the participants can perform tests of various farm machines, as well as analysis of the materials used. Therefore, we arranged plant practice in our Affiliated Factory and in nearby small and medium size factories. The main factories selected for practical training were Zhenjiang Thresher Plant, Danyang Diesel Engine Works, Changzhou Tractor Plant, etc. Through these plants' practice, all the participants learned the production processes of various farm machines, products inspection and test, and new technology and techniques. During practice all the participants assembled and disassembled some products, such as diesel engine, walking tractor, thresher, drainage and irrigation machines, etc. At the same time demonstration of products' operations were arranged. We also arranged visits to some machine parts factories producing piston, gear, spring, etc.

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In the last half month we arranged jig and fixture design, review, examination and writing sum-up report.

Jiangsu Institute of Technology is located in the south part of China, where paddy fields occupy a large percentage of the reclaimable land. The climatic condition, crops distribution and the development of farm machines are similar to many countries in Asia and Africa. All the participants said the 3-month training courses were successful as they allowed them the opportunity to not only learn some useful farm machines production technologies, but also extended the scope of technical exchange in the field of design and manufacture of farm machines. At the same time it promoted friendship and co-operation between developing countries in the third world.

The Jiangsu Institute of Technology can undertake four kinds of training courses in agricultural machinery, as follows:

1. Training course for test and research in small and medium size agricultural machinery.

   This course can help the participants to master the techniques of test and research in agricultural machinery, and acquire ability to improve the quality of agricultural machinery products.

2. Training course for design of small-size agricultural machinery.

   This course can help the participants master fundamental principles in designing walking tractors and agricultural implements, as well as design essentials.

3. Training course for manufacturing engineering of small- and medium-size agricultural machinery.

   This course can help the participants master production techniques in agricultural machinery.

4. Training course for design of small-size internal combustion engine for agricultural machinery.

   Mainly help the participants master design of small-size, single-cylinder internal combustion engine widely used in China.

/Moreover,

Moreover, Jiangsu Institute of Technology also possesses the ability of sending a certain number of professors and experts to developing countries to give short-term lectures or conduct various kinds of training courses in agricultural machinery; the ability of offering to developing countries various sorts of testing, technical appraisal or technical cooperation in the field of agricultural machinery; and is willing to jointly engage in the design and manufacture, or in scientific research relevant to small- and medium-size agricultural machinery.

OUTLINE OF THE EXPORT OF CHINESE AGRICULTURAL MACHINERY

Prepared by:

Mr. Jiang Zhaorong, Deputy Director, Department of China National Machinery Import and Export Corporation

Our agricultural machines were exported to over 60 countries and regions in the period 1957 to 1983 and in recent years to export volume has been gradually increasing. Taking the volume in 1979 as 100, it would be 141 in 1980, 218 in 1981 and 223 in 1982. Even in 1983, we still got more orders from many countries and regions.

Our major markets are in Southeast Asian countries such as Thailand, Singapore, Malaysia and Philippines. Also in Pakistan and Hong Kong. Our export to some developed countries, for instance, the United States, Canada, Australia, and countries in the South and Central America and Africa, is also going up.

Our agricultural machines are made in a great variety of models and most of them are medium and small-sized with simple structure, with durability, ease of operation and maintenance, and lower price in mind. Thus, our machines can meet the technical requirements of agriculture in developing countries. Taking our rice and wheat harvester, light type, as an example, it was well evaluated at the Harvester Conference sponsored by Asia and Pacific Agricultural Machinery Network in July 1980. The harvester was demonstrated and developed afterwards in Thailand, India, Pakistan, Philippines, etc. Besides the above-mentioned products, the developing countries are also interested in other machines, such as small-sized tractor, walking tractor, boat tractor, diesel engines (including marine engines), diesel generating set, milling machine, drier, water pump, turbine pump, transplanter, processing machine for agricultural products, crop plant protection machine.

China National Agricultural Machinery Import and Export Corporation (CAMC) which is a specialized foreign-trade corporation combining manufacture with trade, was established on 1 January 1982, with the government's approval. It unifies, coordinates and administrates China's agricultural machinery import and export. CAMC is cooperating with the manufacturers as a "Community of Manufacture and Trade" that is in favor of making products fitting the market, performing contracts, improving product and providing better service. In the last two years, CAMC dispatched over 20 technical service groups to over 10 countries and regions to maintain the machines, give them demonstrations and technical lectures, listen to their comments for improving and upgrading our products. Our customers are very much

/satisfied

satisfied with it.

CAMC is flexible in its business practice, i.e. it deals by international tender, co-production, export of complete set equipment, manufacture as per buyer's sample etc. Since last year, CAMC has been involved in several big international tenders and succeeded, such as Heilongjiang Land Reclamation Project financed with proceeds of the World Bank Loan/Credit, Generating Set Project of WAPIA (Pakistan Water and Power Development Authority) and Emergency Electric Generating Sets Project Great Wall Hotel, a joint venture of China and the United States. For all the above projects, CAMC is responsible for contacting the factories to supply the equipment, negotiations and entering into contracts and ensuring that the contract will be performed, so that all the parties concerned with those projects are satisfied.

At present, CAMC is trying, with industrial department, to upgrade agricultural machinery and manufacture of medium-sized and small-sized agricultural machines for some overseas markets. It intends to develop and expand its markets not only in Asia but also in Africa, Latin America, North America and the Middle East.

CAMC's branches are located in the following provinces and municipalities: Guangdong, Guangxi, Hunan, Hubei, Yunnan, Guizhou, Sichuan, Jiangxi, Fujian, Shanghai, Jiangsu, Zhejiang, Shandong, Tienjin,Beijing, Liaoning, Heilongjiang, Hebei, Changzhou. CAMC's representatives are: China Resources Machinery and Equipment Co., Ltd. Department of Machinery & Instrument, Hong Kong; Sino-American Machinery Corp. Fort Lee, New Jersey, USA: Representative Office, Lahore, Pakistan.

To supply spare parts to both domestic and overseas customers, CAMC has established service centres, as follows:

China Engine Spare Parts Co., Ltd., Hong Kong, and China Engine Spare Parts Supply Centre, Tianjin.

THE STATUS OF FARM MECHANIZATION AND THE AGRICULTURAL MACHINERY IN BHUTAN

Prepared by:

Mr. Sherub Gyaltshen, Deputy Agricultural Engineer, Agricultural Department of Bhutan

TABLE OF CONTENTS

I. INTRODUCTION

Present agricultural practices in the country are labour intensive. This combined with the acute shortage of labour (unlike in other developing countries) poses a severe constraint for achieving increases in agricultural productivity.

Mechanization of farm practices is therefore essential for Bhutan for achieving the ambitious production targets set in the Fifth Plan.

The farm mechanization programme of the Department of Agriculture is aimed at making labour-saving machinery available to farmers.

The programme is being accorded very high priority in the Fifth Plan period. The programme coverage and resources allocated has been accordingly expanded considerably.

The sales of machinery and equipment are now encouraged so as to commercialize farming operations and only if mechanization is economic in the long run, even without government financial support.

The key basis for farm mechanization is private ownership of machinery and equipment by farmers. The government will be responsible for the provision of spare parts, maintenance and advisory services on a fully commercial basis.

II. CATEOGRY OF TOOLS, EQUIPMENT AND MACHINERY

All the items of tools, equipment and machinery, which are essential to the present level of development activities and applicable to the Bhutanese condition, are categorized as follows (for further details see Appendix):

/CATEGORY I.

CATEGORY I. HAND TOOLS: Consisting mainly of very basic and traditional hand tools;

CATEGORY II. IMPROVED TOOLS: Which are most essential for improving present agricultural practices. By the application of these improved tools appreciable labour productivity increases can be achieved;

CATEGORY III. LIGHT MACHINERY: These types of machinery can be easily operated by farmers and can contribute greatly in saving farm labour requirements. Also, small scale rice/flour/ oil mill (off-farm income creating) can be set up by the farmers;

CATEGORY IV. MEDIUM SIZED MACHINERY: These machineries will assist farmers to carry out private hire service of machinery and establish small scale village industries (off-farm income creating) as well as encourage the setting up of private water pumping etc.

III. SUBSIDY AND SALES POLICY

The Government encourages farmers to buy more quantities of useful and improved tools, equipment and machinery. Towards this, the Government subsidizes transport costs up to District Headquarters. In addition, the following subsidies on the cost price are made available to individual farmers.

The machinery supplied are registered at the Centre and the District and the agreement between the Government and the owner is made (for details see Chapter V).

The Subsidy Grant

CATEGORY I. - transport cost up to District Headquarters (i.e. at the cost price);

CATEGORY II. - transport cost up to District Headquarters plus 20 per cent of the cost price;

CATEGORY III. - transport cost up to District Headquarters plus 20 per cent of the cost price;

CATEGORY IV. - transport cost up to District Headquarters plus 30 per cent of the cost price, and instalment payment plan, without interest. Consisting of 50 per cent payment on supply, balance payment in after two years from supply;

CATEGORY V. - the hire service charges separately prepared applies for heavy equipment.

To encourage the sales of the most important tools and equipment under Category II, the Government has decided to give 20 per cent of the subsidy on the cost price on all items under Category II, in addition to the subsidy on transport costs. Because, at present, the majority of farmers depend on these types of tools for effecting labour-saving and improving yield, this subsidy is expected to have the most widespread impact. Eventually, with the widespread application of these important tools and equipment, farmers will gain confidence in the mechanization programme and naturally adopt more labour-saving devices and methods.

IV. PURCHASE AND DISTRIBUTION PROCEDURES

Standardization of tools, equipment and machinery

The Government standardizes the item, model and make of tools, equipment and machinery, as far as possible, for easy maintenance and training, and also for ready stock and supply of spare parts.

The procurement of these items is centralized, by either the AMC* of the Department of Agriculture, observing existing Government rules and regulations.

* Agricultural Mechanization Centre

/However,

However, the Districts are allowed to procure directly and the items under Cateogry I from the market, in line with AMC policy and the refund is made from the central budget to the District. Especially, urgent requirements of the District are met with through this arrangement.

The Districts send their requirement (yearly and time-to-time requirement) to the Department of Agriculture. The Department of Agriculture keeps a reasonable size of stocks for the ready-stock supply, as far as possible.

The District makes a payment to the central body after the sales of these items, either by cash or through rural credit loans. To avoid excessive tying up of funds unnecessary stocks, the Districts are persuaded to make payment as soon as possible, within 6 months of receiving the consignment at the latest.

V. SUPPORTING ARRANGEMENT FOR THE SMOOTH FUNCTIONING OF THE FARM MECHANIZATION PROGRAMME

To support Farm Mechanization, the Department of Agriculture has instituted the Agricultural Mechanization Centre which is responsible for the whole operation and co-ordination of the Farm Mechanization Programme.

The Agricultural Mechanization Centre (AMC) is established in the following arrangements for the smooth running of the programme:

(a) Supply Depots - Bondey and Phuntsholing.

(b) Spare Parts Centre - Bondey.

(c) Training Centre - Later at Chhundu-Dinkha, Paro main workshop at Bondey.

/(d) Workshop

(d) Workshop - Regional Workshop at Tashigang, Bhur, Wangdiphodrang and (Bhumthang). One mobile workshop unit.

(e) Hire Service (National) - Based at Bondey.

(f) R & D and Manufacturing Unit - Bondey.

The Training Programme at the AMC, Bondey, consists of the training of mechanics and operators, in-service training and farmers (buyers) training at Bondey, Paro. By the end of 1984, a complete Training Centre will be set up at Chundu-Dinkha, Ucho, Paro, after which proper training facilities and better standards will be available.

Farmers (buyers of machinery) will be paid a stipend of Nu.10.- per day for the duration of their training period as well as accommodation and food.

Workshops

The main workshop for agricultural machinery is at Bondey, Paro and one mobile-workshop unit will be established (by September 1984). Three or four regional workshops will be set up at Tashigang, Bhur, Wangdiphodrang and (Bhumthang) to look after the regional requirements of farm mechanization. Since the technical and disciplined personnel are scarce, the expansion of regional workshops will be possible only after one or two years when this constraint is relaxed.

Also, the requirement of regional workshops is subject to the local requirement and the progress of mechanization in the regions.

National level hire service

National level hire service of heavy machinery is an undergoing programme. All the unserviceable earthmoving equipment is

/being

being collected and repair work is in progress. The hire service of heavy machinery will be expanded soon. After successful operation of hire service, the major labour consuming activity, such as; feeder road construction, site development for schools, hospitals and field protection etc. will be supported by this programme.

Manufacturing unit (plus R & D activity)

A small unit for manufacturing and fabrication of tools, implements and equipment has been set up as an attachment to the workshop at Bondey and is currently engaged in the trial and manufacturing of paddy-cultivation related tools and equipment. The activity will be enlarged for the trial production of a wider range of improved tools and equipment on small irrigation and processing etc. for application nationwide.

Assistance from IFAD and ADB is also expected for the supply of equipment and facilities for the manufacturing unit.

Case studies

The AMC selects cases for encouraging contract farming and studies the economics of them in detail, to provide a basis for a policy on contract farming in the Sixth Plan if it appears economically viable.

VI. HIRE SERVICE CHARGES OF LIGHT AND MEDIUM SIZE MACHINERY

The amount of hire service charge of agricultural machinery and equipment cannot be discussed without considering the following:

(a) labour availability;

(b) labour wages for agricultural operations;

(c) yield potentiality of the area;

/(d) cash

(d) cash income (through cash crop cultivation) of farmers in the area;

(e) intensity of cultivation;

(f) efficiency of the machinery used.

The present hire rates recommended by the AMC are based on the commercial operation of the machinery, and the charges are used as a guide for fixing the hire charge for particular areas. The farmers who carry out the hire service can decide on their own charges according to the conditions mentioned above.

Sale of agricultural equipment

For the efficient operation of hire service the agricultural machinery, private hire services are encouraged, and the machinery owned by the Districts have been sold to the private party.

Hire service for public works

Since the hire service of agricultural machinery is aimed at cutting down the labour requirements of farmers on feeder road construction, site development for schools and hospitals etc., the District authority is advised to make maximum use of available hire services of tractor etc., for these purposes. The payment for these works are met from the budgetary allocations or from absentee fees. This is expected to facilitate the commercial hire service of machinery as well as save a lot of labour.

Especially, transport of stone, timber and other construction materials are encouraged to be done by the machinery and not by the scarce labour.

VII. THE PURCHASE AND REGISTRATION AGREEMENT

The tools, equipment and machinery supplied with the grant of the Government subsidy is registered at both the District and the Centre. The agreement between the Government and the machinery owner is signed to ensure the ownership, and obligations of both parties.

The printed form of agreement and registration is filled out by both parties in triplicate. One copy of each is kept at the Centre, District and with the owner. This facilitates timely collection of payments, ensures proper post sale services and better monitoring of programme impact.

Appendix

Categories and Sales Policies for Tools, Equipment and Machineries

Category of Tools, Equipment and Machinery		Sales Policy Subsidy and Instalment Plan	Remarks
Category I. (hand tools)	Axe Saw (Domtchi) Garden fork Crafting knife Pick axe Plough share Pruning knife Pruning saw Pruning secateur Soil sleve Spade Tree pruner Watering can Weeding hoe Hammer Shovel Balance (pan type) Balance (beam type)	Cost price	Very basic hand tools
Category II. (improved tools)	Drip irrigation system Dryer Duster Garden water-pipe Hand pump Hoist pulley Hot frame Improved plough Maize sheller Pedal thresher	20 per cent subsidy on cost price	Efficient tools and machinery with potential to create substantial impact on labour savings and productivity increases

/Planting

Cateogry of Tools, Equipment and Machinery		Sales Policy Subsidy and Instalment Plan	Remarks
	Planting rope set Rotary weeder Seed drill Sprayer Wheelbarrow Winnower Nursery box Pedal spinning Potato plough		
Category III. (light machinery)	Dryer Flour mill Electric hand tools Hand pump (deep well) Maize sheller Potato plough Power thresher Rice huller Rice polisher Water pumping set (small) Water turbine Oil expeller Power sprayer Primemover electric motor (Petrol or diesel engine)	20 per cent subsidy on cost price	Will help in labour and time saving & productivity increase. Will help in expansion of oil seed and winter crop cultivation. For villagers hire service. Resale of machinery in this category is subject to Government approval.
Category IV. (medium machinery)	Belt hammer (powered) Combined unit for post harvest and village cottage industry	30 per cent subsidy on cost price and payment in instalment. 50 per cent of subsidized cost at delivery.	For villagers hire service.

/4 wheel

Category of Tools, Equipment and Machinery		Sales Policy Subsidy and Instalment Plan	Remarks
	4 wheel tractor	(more than) 30,000	
	Oil expeller (big)		
	Power tiller (big)		
	Power thresher		
	Power sprayer (big)		
	Reaper		
	Water turbine (big)		
	Water pumping set (big)		
Category V. (heavy machinery)	Air compressor		For national level hire services for labour savings.
	Buck hoe		
	Carryer		
	Swamp dozer		
	Bulldozer		
	Excavator		
	Road roller (small)		

STATUS OF FARM MACHINERY MANUFACTURE AND POPULARIZATION IN INDIA - THE PROBLEM AND PROSPECTS AND THE EFFORTS MADE BY CIAE.

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STATUS OF FARM MACHINERY MANUFACTURE AND POPULARIZATION IN INDIA - THE PROBLEM AND PROSPECTS AND THE EFFORTS MADE BY CIAE.

by

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INTRODUCTION

Agriculture is the major industry in India. Out of the total geographical area of 328,759 thousand hectares a total area of about 138,334 thousand hectares is cultivated. An area of 66,850 thousand hectares is under forest and 4,000 thousand hectares is under permanent crop. Production of major cereals in the country has been 53 million tonne (m.t.) rice, 31.3 m.t. wheat, 11.8 m.t. sorghum, 4.7 m.t. pearl millet and 5.9 m.t. maize. The foodgrains have been sufficient for the population above 648 million. With the increase in population, the foodgrain production has to be increased steadily. The scope to increase the cultivated area is limited. The increased demand of foodgrains can be met by increasing productivity of the land. Introduction of improved varieties of seed, fertilizer, irrigation water and plant protection chemicals have increased the productivity considerably during the past but further impact of these inputs are becoming limiting. Utilization of improved farm implements and machinery have been quite low in the country except for a few states. The input of improved farm machinery may increase the productivity considerably at this stage by timeliness of operation, better utilization of other inputs, decreasing losses at harvest and post harvest levels and by reducing the cost of operations. But production and introduction of improved farm machinery is not a simple task. During the last decade, a large number of improved farm machinery have been developed by the various research organizations, agricultural universities,

/government

government organizations and private firms, however, most of these machinery did not reach the farmers. There are many reasons for this, but the most important factors are the problems of manufacture and popularization.

MANUFACTURE OF AGRICULTURAL MACHINERY

The major problem of manufacture of agricultural machinery is the varied designs, specifications and types of agricultural machinery in use. Due to the bulk size, transportation of the machinery involves high cost. The majority of the small farmers depend upon the village artisans who fabricate traditional tools, implements and a few simple improved machinery. There are more than a million village artisans in the country who fabricate country plough, sowing devices, hand hoes, sickles, blade harrows and hoes, bullock carts etc., constituting about 80 per cent farm machinery requirement of the country.

The simple agricultural machinery e.g. ploughs, harrows, seed drills, cultivators, power threshers, levellers etc., are manufactured by small scale manufacturers numbering more than 8,000 who are located in cities and small towns. Most of the simple improved agricultural implements are produced by these manufacturers. In addition to the small scale manufacturers, there are a large number of unregistered workshops located in towns and rural areas whose number are not known but estimated to be about 3,000. These workshops undertake repairs, maintenance and fabrication of seed drills, threshers, cultivators, tractor trailers etc.

The large and medium scale manufacturers numbering about 1,474, manufacture tractors, power tillers, diesel engines, irrigation equipment, plant protection machinery, land development equipment, post harvest machinery and dairy equipment, electric motors etc.

/The major

The major problem of manufacture of agricultural machinery are faced for the manual and animal drawn implements which are mostly fabricated by the small scale manufacturers, village artisans and small workshops. Since these are manufactured/fabricated in small numbers, the specifications vary from one manufacturer to another. Many of these implements are not based on improved designs. Since the demand of most of the small farmers are met by the small workshops and village artisans, the improved agricultural implements do not reach the small farmers adequately.

POPULARIZATION OF AGRICULTURAL MACHINERY

The Department of Agriculture and Co-operation, Ministry of Agriculture co-ordinates the farm machinery production and popularization and programmes of the State Governments. The various State Agro-Industrial Development Corporations undertake the production of farm machinery. The State Extension Departments of Directorate of Agriculture undertake the demonstration and popularization of improved machinery at Block-levels.

The Agricultural Universities located in the various states, through their extension wings, popularize the improved implements and machines to a limited extent.

The Ministry of Rural Development finances majority of the development programmes related to farmers, village artisans and rural youths through various government, private and voluntary organizations. A large number of rural engineering and rural technology centres sponsored by the Department of Science and Technology, Ministry of Industries, Ministry of Rural Development, Khadi and Village Industries Commission, private industrial houses, charitable trusts, voluntary organizations and religious institutions have established training centres for upgrading the skills of the rural people.

/The Indian

The Indian Council of Agricultural Research (ICAR), through its various research institutes develop improved machinery and technology for crop, animal and fish production. ICAR has also established Farm Science Centres (Krishi Vigyan Kendras) and Trainers' Training Centres for transfer of improved technology to the farmers and users. ICAR during the past few years has launched a Lab to Land Programme for rapid transfer of the proven technology to the farmers' fields. There are a few All India Co-ordinated Schemes on Farm Implements and Machinery, Post Harvest Technology, Renewable Sources of Energy, Power Tillers etc., established by ICAR which work for adaptive research, development, evaluation and popularization of improved agricultural machinery and technology.

In spite of the efforts made through the above infrastructure, the adoption of the improved farm machinery and technology has been quite low. The main reasons for this are considered to be (i) Compared to the large number of small farmers spread over the vast area and remote places, the infrastructure is inadequate; (ii) Non-availability of large number of simple and improved implements and machinery due to low production; (iii) Difficulty of transport of the implements to the remote areas; (iv) Low investment capacity of the farmers; (v) Lack of training and exposure of the farmers to the improved technology.

MANUFACTURING PROMOTION AND TECHNOLOGY TRANSFER ACTIVITIES AT CIAE

Village artisans play key role for manufacture and popularization of simple agricultural tools and implements. So regular training courses on production of simple improved implements have been initiated by the Institute. Most of the village artisans who have been trained by the Institute are producing the simple improved implements in the village. Some of the village artisans have procured welding and drilling machines through bank loans and taken up production of seed fertilizer drills, weeders, storage bins etc., along with repairs of farm machinery.

/The Institute

The Institute has established liaison with the small scale manufacturers for manufacturing promotion of improved machinery in the state of Madhya Pradesh. The Institute scientists pay regular visits to the manufacturers, studies the products, the manufacturing processes and suggest improvement. Improved designs of machines are made available to the manufacturers. Regular in-plant training courses for product improvement and production of improved machinery are organized by the Institute. Manufacturing drawings of the improved machinery are also supplied to the manufacturers at nominal costs.

Under the All India Co-ordinated Scheme on Farm Implements and Machinery, the Institute has established a Prototype Manufacturing Workshop for production of improved research prototypes. In all 8 Prototypes Manufacturing Workshops have been established throughout the country of which CIAE, Bhopal is the Co-ordinating Centre. Improved prototypes are being manufactured by these Workshops for intensive testing and popularization. It is expected that the production capacity of these workshops shall gradually increase.

The technology transfer activity of the Institute is looked after by the Trainers' Training Centre (TTC) and Krishi Vigyan Kendra (KVK). Under TTC, regular training courses are organized for Subject Matter Specialists, Agricultural Extension Officers and other in-service personnel. Under KVK, regular training courses are organized for farmers, farm-women, rural youths, village artisans etc. The Lab to Land Programme is also executed by KVK. Under this programme, about 400 farm families were selected at a time and improved package of practices were provided with some critical inputs. Each farm family is adopted for a period of two years during which each family learns about the improved crop production technology, use of improved farm machinery and post harvest

/practices.

practices. Some of the improved tools and implements have been provided to the adopted families as critical inputs under this programme. There have been good impact of these programmes for popularization of improved machinery and demand for the improved machinery are increasing tremendously.

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2. Agricultural Engineering Directory, 1983, Indian Society of Agricultural Engineers.

3. Agricultural Statistics, 1980, Directorate of Agriculture, M.P.

Table 1. Status of farm machinery manufacturers in India

. Agricultural tractors	...	15
. Power tillers	...	7
. Agricultural hand tools, implements and machinery	...	6981
. Combines	...	4
. Tractor parts accessories of agricultural machinery	...	546
. Earth moving machinery and parts	...	188
. Diesel oil engines	...	524
. Irrigation pumps	...	193
. Bullock cart, push cart, hand carts etc.	...	962
. Tractor trailor	...	126
. Village artisans	...	More than 1 million

Source: Development Commissioner, Ministry of Industries, Government of India, 1972.

Table 2. Tractor Population in India

Year	Indigenous Production	Import	Total
1961-66	14,314	12,271	26,585
1966-71	73,875	35,133	109,008
1971-76	127,667	23,632	151,299
1976-77	33,146	2,920	36,066
1977-78	40,946	-	40,946
1978-79	56,450	-	56,450
1979-80	64,100	-	64,100
1980-81	80,564	-	80,564
1981-82	68,037	-	68,037
Total	5,59,099	73,956	6,33,055

Source: Agri.Engg. Today, Vol 4 No.3, May June 1980

Table 3. Power Tiller Production

Year	Indigenous Production	Import	Total
1970-71	1,387	70	1,457
1971-72	1,081	1,583	2,664
1972-73	1,199	112	1,311
1973-74	1,526	147	1,673
1974-75	2,142	Nil	2,142
1975-76	2,540	Nil	2,540
1976-77	1,758	Nil	1,758
1977-78	1,596	Nil	1,596
1978-79	2,336	Nil	2,336
1979-80	2,535	Nil	2,535
1980-81	2,125	Nil	2,125
1981-82	2,352	Nil	2,352
1982-83	2,241	Nil	2,241
Total	24,818	1,912	26,730

Table 4. All India Agricultural Machinery and Implements (In Thousands)

Sl. No.	Items	1961	1966	1972	1977
1.	2.	3.	4.	5.	6.
1.	Bullock and manually operated implements				
a.	Wooden plough	38372	39923	39294	40766
b.	Iron plough	2298	3523	5359	6258
c.	Blade harrow or bakhar			11738	11497
d.	Wet land puddler	N.A.	2724	1694	2056
e.	Earth levellers or scrapers			3731	8728
f.	Seed drills/sowing device	N.A.	1135	4049	4822
g.	Carts (animal drawn)	12072	12697	12960	12742
h.	Maize shellers	N.A.	N .A.	175	226
2.	Sugarcane crushers				
a.	Worked by power	33	45	87	987
b.	Worked by bullocks	590	650	681	673
3.	Sprayers and dusters	NA	211	448	559
4.	Pumpsets used for irrigation and persian wheels				
a.	Oil engines with pumpsets	230	471	1557	2162
b.	Electric pumpsets	160	415	1618	2313
c.	Persian wheels	600	680	638	621
5.	Tractor operated implements				
a.	Mould board plough and disc plough	N.A.	N.A.	57	81
b.	Disc harrow	N.A.	N.A.	56	105
c.	Cultivators or tillers	N.A.	N.A.	81	149
d.	Levellers or scrapers	N.A.	N.A.	49	96
e.	Seed-cum-fertilizer drills	N.A.	N.A.	25	36
f.	Seed planter	N.A.	N.A.	9	16

1.	2.	3.	4.	5.	6.
g.	Rotavator	N.A.	N.A.	6	9
h.	Trailer	N.A.	N.A.	55	117
i.	Other tractor operated implements	N.A.	N.A.	18	21
6.	<u>Power driven machines and miscellaneous equipments</u>				
a.	Wheat threshers	N.A.	349	183	350
b.	Paddy threshers	N.A.		14	17
c.	Threshers for other crops	N.A.		10	10
d.	Maize shellers	N.A.	N.A.	16	17.2
e.	Harvester combines	N.A.	N.A.	N.A.	1268
f.	Power chaff cutters	N.A.	N.A.	142	200
g.	Other power operated equipment	N.A.	N.A.	34	38

N.A. = Not available

Source: 1. Indian Agriculture in Brief, Sixteenth Edition; Directorate of Economics and Statistics, Ministry of Agriculture.

2. Machinery Division, Ministry of Agriculture, Department of Agriculture and Cooperation, New Delhi.

Table 5. Cultivated area of major crops, production and yield

Sl. No.	Crop	Total area (x 1000 ha)	Production x 1000 t	Yield Kg/ha
1.	Rice	40,001.4	52,676.5	1,317.0
2.	Wheat	21,203.3	31,327.8	1,477.0
3.	Sorghum	16,273.0	11,818.3	726.9
4.	Pearl millet	11,035.1	4,710.8	427.0
5.	Maize	5,699.6	5,946.7	1,043.0
6.	Bengal gram	8,256.6	5,451.0	661.0
7.	Potato	664.4	8,153.2	12,272.0
8.	Sugarcane	3,219.5	181,627.9	56,415.0

THE STATUS OF FARM MECHANIZATION AND THE AGRICULTURAL MACHINERY INDUSTRY IN PENINSULAR MALAYSIA

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1. THE AGRICULTURAL SECTOR

Malaysia has an estimated 3.6 million hectares of cultivated land of which rubber accounts for 1.7 million ha, palm oil 0.9 million ha and padi 0.55 million ha. The crops grown can be differentiated into two categories ; export and food crops. Export crops include rubber, palm oil and to a lesser extent coconut, tea and cocoa whereas food crops encompass paddy vegetables, fruits, groundnuts, maize etc.

Table 1 summarizes the hectareage and production of several major crops in Malaysia in the recent years. Both palm oil and cocoa have shown significant increases in planted hectareage and output. Padi, coconut and rubber have stagnated in terms of production and area expansion.

Three types of farm organization can be identified, namely :-

(a) estates ; generally covering thousands of acres, well managed, producing high yields and growing mainly export orientated crops.

(b) Smallholdings ; generally farms of less than 100 acres.

(c) Land Schemes; operated by government agencies.

Rubber, palm oil and cocoa are found in all three farm organizations. Land Schemes are becoming increasing important with the opening of new land areas for export crops. Coconuts are grown mainly by smallholders; only a few estates grow coconut. Food crops are exclusive to the smallholders. Padi farms in Malaysia are essentially miniscule smallholdings of approximately 1 ha in size.

The agricultural sector employs about 40% of the total working population.

Table 1 : Planted Hectareage and Production of Major Crops In Malaysia

Crops	1977		1978		1979		1980		1981	
	Total Planted Area ('000ha)	Total Production (tonne)	Total Planted Area ('000na)	Total Production (Tonne)	Total Planted Area ('000ha)	Total Production (Tonne)	Total Planted Area ('000ha)	Total Production (Tonne)	Total Planted Area ('000ha)	Total Production (Tonne)
1. Paddy (i)	567.0	1,620,108	445.6	1,220,345	561.7	1,787,916	529.8	1,752,234	522.9	1,737,926
2. Rubber	1,684	na	1,699	1,506,000	1,703	1,497,000	1,698	1,463,900	1,696	1,456,600
3. Palm Oil (ii)	692	na	756	1,640,000	831	2,032,900	907	2,396,700	983	2,645,200
4. Coconut (iii)	242	na	243	93,557	243	105,178	245	97,246	249	100,059
5. Cocoa (iv)	58	16,708	57	21,963	61	31,592	65	32,800	118	45,000

Source : Monthly Statistical Bulletin, Department of Statistics (February 1984) excep cocoa

(i) Production of wet padi in Paninsular Malaysia

(ii) Production of crude palm oil

(iii) Production of copra (produced by millers)

(iv) Production of dry cocoa (Source : Economic Reports, Ministry of Finance, Malaysia)

1.1. Background of Agricultural Development

Table 2 shows the status of agriculture in Malaysia in 1980 as compared to the situation 10 years before. For the decade as a whole, the sector grew by 4.3% per annum. However, the importance of agriculture to the national economy has diminised as evidenced by the fact that in 1970 the sector's share of the GDP was 30.8% but this had declined to 22.2% in 1980. As a result of the government's diversification policy, there was rapid growth in the oil palm industry and to a lesser extent the cocoa industry at the expense of rubber as a monocrop. In 1980, both oil palm and cocoa contribute one-quarter each of the total agriculture sector output. In the padi-sector, the government's efforts were directed towards providing and upgrading drainage and irrigation facilities. By 1980, 56% of the paddy area was under double cropping. Paddy production was about 1.75 million tonnes to achieve about 85% self sufficiency. Paddy yield per unit area has also improved.

Although, the agricltural sector continues to be the largest employer of labour, its relative importance to other sectors has declined. In 1980, it employs 40.6% of the labour force as compared to 50.5 in 1980. Over the decade, agricultural labour registers an annual growth rate of 1.9% compared to 7.6% for manufacturing and 6.8% for construction. However, those households which remain in agriculture continue to face the highest incidence of poverty (relative poverty as defined by the Government of Malaysia). In 1980, 443,700 households or 46.1% of the total number of households in the agriculture sector was estimated to be in the poverty group. (cf 29.2 for the total population).

Table 2 : Key Statistics on the Agricultural Sector (1970 & 1980)

	1970	1980
Agricultural Sector's share of GDP (%)	30.8	22.2
Per Capita income (at current prices)	M$1,142	M$ 3,675
Area planted in rubber (estates only) (ha)	647,200	507,100
Rubber's share of Agriculture output (%)	34.3	24.9
Area planted under oil palm (ha)	308,800	890,000
Palm oil's share of Agriculture output (%)	9.6	25
Area under padi (ha)	533,400	595,600
Padi production (tonne)	1,434,600	1,752,234 (i)
Padi yeild (main season) (tonne/ha)	2.7	3.2
Padi yeild (off season) (tonne/ha)	3.2	3.4
Agriculture's share in total Employment (%)	50.5	40.6
Percentage of poverty in Agriculture sector (%)	68.3	46.1

Source : Fourth Malaysia Plan (1981 - 1985)

(i) Source from Month Statistical Bulletin, kept by Statistics (February 1984)

1.2. Agricultural Policies and Strategies

The agricultural policy in the Fourth Malaysia Plan took into account two important factors, the continuing importance of agriculture in the economy and secondly the high incidence of poverty in the sector. Its expressed objectives are to maximise farm productivity and to create greater employment opportunities. Two documents recently released by the Government of Malaysia shed light on the new thinking and direction of the government on the future development of the agricultural sector. The National Agricultural Policy (NAP) states as its primary objective the maximization of income from agriculture through efficient use of resources and strengthening the contribution of the agricultural sector to the economy of the country. More specifically, the NAP stresses the greater use of machinery to counter the farm labour shortage situation.

The Mid Term Review of the Fourth Malaysia Plan unveils a new approach towards solving the persistent poverty in the paddy areas. Paddy farmers would merge their land holdings with adjacent plots to form centrally manages 'estates'. Landowners of these 'estates' will hold shares proportionate to the size of their holdings. This 'pooling' of uneconomic holdings will pave the way for greater mechanization of farming operations and attainment of higher productivity of land and labour. Agro-based industries would be developed to absorb the labour released by the greater mechanization. Self sufficiency in rice is to be achieved at 85% level.

The strategies outlined in the National Agricultural Policy are :-

* Opening of new land
* In-site development
* Strengthening of technical support services
* Social and institutional development.

2. FARM MECHANIZATION IN MALAYSIA

2.1. The Need to Mechanize

The government's policy objective for agriculture is maximization of farm productivity and income. Mechanization can contribute to this by lowering production costs and increasing labour and land productivity. The agriculture sector has also been encouraged to become modernized and further commercialized.

The country's labour situation is markedly different from other developing countries. Wages even that in the agriculture sector are relatively high. The population engaged in agriculture has declined and is expected to decline further. The rapid development of the Manufacturing and Construction industry has witnessed a burgeoning of urban migration with a subsequent depletion of agricultural labour. Farm work is perceived as a drudgery and unattractive to the people.

However, the government is currently faced with a problem of alienated agriculture land left idle. A ministry of Agriculture, 1980 study has estimated about 880,000 ha of such abandoned land. Mechanization will have to be employed to bring these land into productivity.

The introduction of double cropping in padi has also accelarated the mechanization progress to achieve timeliness of farm operations and relieve seasonal labour peaks.

2.2. Mechanization of Plantation Crops

Land tillage, crop spraying and haulage are just about the major operations being mechanised. The Machinery employed includes the :-

(a) Use of bulldozers or tractors mounted with front end dozers or buckets for land clearing, levelling and contouring.

(b) Use of tractors with mounted disc or rotovator for land cultivation.

(c) Use of tractor mounted, motorised and knapsack sprayers for application of weedicides and fertilizers.

(d) Use of tractor pulled trailers for infield transportation.

(e) Use of P.T.O. driven rotorslasher for clearing bushes and grass.

(f) Use of P.T.O. mulchers to pulverise fallen palm oil branches.

For short term crops, machinery is utilized for :-

(a) Land cultivation and ridging.

(b) Spraying of fertilizer and weedicides

(c) Seeding

The responsibility of developing mechanization for plantation crops notably rubber and palm oil lies even more heavily on the hands of local researches in view of Malaysia being the world's foremost producers of the two crops. Recently, a battery operated tapping knife has been developed. Yanmar (Japan) has recently unveiled a prototype palm oil harvester.

2.3. Paddy Mechanization

The level of mechanization is increasing at a steady rate (Table 3). There is an increase in the population of 4-wheel tractors and water pumps whereas the number of pedestrian tractors show a marked drop.

Custom Hire Services

A salient feature of farm mechanization in this country (as highlighted in Table 3) is the unique role and importance of the custom hire services. These services are provided by private contractors, cooperatives and government departments. In 1982, the private contractors account for 35% of the total population of 4-wheel tractors in the non-plantation sector. Although data is not available, private contractors play an even more prominent role in padi combine harvesting services, especially in the MADA and other double cropping areas. The Farmers Organization Authority is the government agency entrusted to expand the provision of agricultural machinery services to the paddy farmers. FOA has established 12 Farm Mechanization Service Centres in 1982 and plans to establish a total of 35 such centres by 1985 under an Asian Development Bank financed project.

Government Agencies

A total of five agencies are mandated for involvement on various aspects of padi mechanization in this country. The Farmer's Organization Authority (FOA) provides machinery services to the farmers via the Farmer's Cooperatives, Department of Agriculture (DOA) provides training and agricultural extension work, the Malaysian Agricultural Research and Development Institute (MARDI) conducts research and development of indigeneous agricultural machinery, the National Padi and Rice Board (LPN) runs large processing complexes to dry and mill padi and the Agricultural Bank is the principal lending authority for agriculture machinery

Table 3 : Agricultural Machinery Population and Ownership in the Non-Plantation Sector, Peninsula Malaysia

(A) 4 - Wheel Tractor

	1978	1979	1980	1981	1982
Agriculture Dept.,	482	507	464	468	478
Contractors	1366	1305	1267	1565	1549
Farmers	704	690	737	966	1872
Farmers Cooperative	304	275	443	508	615
TOTAL	2856	2777	2911	3507	4514

(B) Pedestrian Tractors

	1978	1979	1980	1981	1982
Agriculture Dept.,	149	386	163	136	140
Contractors	773	809	610	675	697
Farmers	3677	3679	3407	3328	2255
Farmers Cooperative	203	237	339	363	368
TOTAL	4802	5111	4519	4502	3460

(C) Thresher

	1978	1979	1980	1981	1982
Agriculture Dept.,	33	35	32	14	16
Contractors	10	10	1	-	-
Farmers	9	6	2	-	3
Farmers Cooperative	-	-	-	6	5
TOTAL	52	51	35	20	24

(D) Water Pump

	1978	1979	1980	1981	1982
Agriculture Dept.,	135	374	449	574	686
Contractors	507	535	282	310	321
Farmers	1239	1316	1351	1571	1611
Farmers Cooperative	165	223	329	283	295
TOTAL	2046	2448	2411	2738	2913

(E) Sprayers

	1978	1979	1980	1981	1982
Agriculture Dept.,	247	323	350	382	477
Contractors	38	2	9	11	23
Farmers	628	629	980	987	999
Farmers Cooperative	94	202	241	196	286
TOTAL	2082	1156	1580	1576	1785

Source : Annual Report, Extension Branch, Department of Agriculture - 1978, 1979, 1980, 1981 & 1982 purchases. (In the perenniel crop sector, the Rubber Research Institute of Malaysia (RRI) and the Palm Oil Research Institute (PORIM) undertake research in mechanization for rubber and palm oil respectively).

Paddy Land Preparation

Padi land preparation is mainly done by rotary tillage using pedestrian tractors or 4-wheeled tractors as prime-movers. There is a general decline in pedestrian tractor usage due to low productivity and high repair costs.

The extent of mechanical cultivation in four paddy areas is shown in Table (4).

It is estimated that a population of approximately 3,500 units of pedestrian tractors and 18,000 units of 4-wheel tractors are in use in this country. The pedestrian tractors are solely used by smallholders. Out of the 18,000 4-wheel tractors. about 5,000 are used in the paddy sub-sector, the rest being taken up by the plantation sub-sector and construction and mining sectors (In Malaysia, agricultural tractors are used in the tin mines, construction sites and civil engineering works).

Initially when 4-wheel tractors were introduced into the Muda Area, the bigger horsepower tractors around 60-70 hp were used. This situation continued until 1973 when there was a change to smaller horsepower tractors. The reasons were the availability of smaller Japanese tractors and the destruction of the hard pan by combine harvesters. The situation now is preference for 31-40hp tractors (Shigyo M, 1981)

According to a study of tractor use by Len (1968), pedestrian tractor are worked over 28 ha per year and 4-wheel tractors work 240 ha per year. In another study of tractor operations by Chancellor (1970), the pedestrian tractor covered

Table 4 : Extend of Mechanical Land Tillage in major Padi Areas.

Area	Approximate Area (ha)	Percentage Tilled Mechanically
MUDA	96,000	90 %
Tg Karang	4,600	98 %
KADA	57,000	40 %
P. Wellesley	11,000	29 %

Source : Sukra, et al, 1980

400 hours of operation per year while the 4-wheel tractor averaged 1,040 hours of operation. This was based on an average 7-12 working hours per day for each machine over a period of 3½ - 4 months per year.

Paddy Combine Harvesting

Both the 14 feet European combines and the 4-row Japanese Combines are used in this country. The big European combines have caused field damage and hard pan destruction. The small Japanese combines are less durable and have low rate of work.

Information collected from dealers indicate that there are about 360 large European combines and about 60 over Japanese combines in the country. In the Muda Scheme itself (MADA, 1981), there is an estimated population of 350 European combines and 33 units of Japanese combines.

Private Contractors using European combines operate 12 hours per day or average 755 hours per year or 370 ha/year (Rayarappan & Taylor, 1980). On a daily basis, they harvest about 6 - 8.8. ha (Shigyo, 1981).

The Muda area which is 80% combine harvested has the largest concentration of European combines, mainly owned by private Contractors. Combines are also used in other double cropped areas to varying success. Only recently, hire services of the Japanese combines are made available through FOA.

Paddy Transplanting

The Japanese rice transplanter is not adopted by the local farmers due to :-

(1) Unevenness of padi land
(2) Absence of drainage facilities (poor water control)
(3) Difficulty in raising the seedlings.

A divergent development has is fact taken place with the increasing popularity accorded to the direct seeding of rice. The methods used include manual broadcasting, broadcasting using mistblower and using locally manufactured mechanical seeders. It is estimated that 4,185 ha in the Muda area and 1,855 ha in Sekinchan, Tanjung Karang are direct seeded (Working committe on Evaluating New Method of Padi Planting, Agriculture Department, 1982(Unpublished)).

3 . THE AGRICULTURAL MACHINERY IDUSTRY

3.1. Policies

In line with the government's wish to promote industralization and improve the balance of payments, the manufacturing of agricultural machinery and equipment has been listed as one of the priority industries and enjoys the incentives accorded such industries (Federal Industrial Development Authority, 1977). However, the government offers no protection against the competition of imports. The rationale is to enable farmers to mechanize at a lower cost, thus promoting mechanization. The policy had had an adverse effect on local manufacturers. Price and quality wise, they cannot successfully compete with imported products because of their lower technology used, low turnover, high labour content, low productivity and absence of economies of scale. The situation is made worse by the devaluation of certain currencies, making imported machinery even cheaper.

3.2. Current Status

Malaysia has an open economy. The industry is dominated by importers - companies which hold franchises from foreign manufacturers to import and distribute their products. The array of brands in the market is numerous . At the moment, there exists about 20 tractor distributors vying with each other to sell about 20 different brands of tractors from about 10 different countries (Table 5).

Table 5: Brands of Agricultural 4 - Wheel Tractors found in Peninsula Malaysia.

No.	Brands	1970	1975	1976	1977	1978	1984
1.	Ford	X	X	X	X	X	X
2.	Massey Ferguson	X	X	X	X	X	X
3.	Nuffield/Leyland/ Marshall	X	X	X	X	X	X
4.	I Harvester	X	X	X	X	X	X
5.	David Brown	X	X	X	X	X	X
6.	Fiat		X	X	X	X	X
7.	Same		X	X	X	X	X
8.	Ursus		X	X	X	X	X
9.	Deutz		X	X	X	X	X
10.	John Deere			X	X	X	X
11.	Universal			X	X	X	
12.	Belarus					X	X
13.	Ebro					X	X
14.	Kubota				X	X	X
15.	Mitsubishi				X	X	X
16.	Iseki				X	X	
17.	Suzue				X	X	
18.	Hinomoto				X	X	X
19.	Shibaura				X	X	X
20.	Swaraj						X
21.	Case						X
22.	Zetor						X
23.	Yanmar						X
24.	China						X

Source : Years 1970 - 1978 ------ Miller, J.H. 1979
Year 1984 ------ Author's Own Survey

There are 3 make of Japanese and one make of Chinese pedestrian tractor in the market. The European combines consist of 5 different makes from 4 countries and the Japanese combines consist of 2 different makes.

Dividing equally the projected annual sales of 4-wheel tractors amongst the distributors, Miller, J.H.(7) calculated that each distributor would sell only 60 units per annum. On a turnover this size, an effecient business with supporting services, parts enginering, distribution, training and management is not possible.

The market demand for agricultural tractors, machinery and implements is very small (Table 6 shows total annual sales of 4-wheel tractors, Table 7 shows the annual import of agricultural machinery into Peninsular Malaysia). It is estimated that 4-wheel tractor demand in the near future will remain between 1,500 - 2,000 units per annum. The combine harvester market is saturated in the Muda Area, future sales will only be for replacement purposes.

Many problems are faced by the Malaysian consumers of imported agricultural machinery . Because sales are small for the majority of distributers, they do not hold complete inventories of spare parts stock. Most do not have extensive network of service dealers. The net result is that spare parts are not readily available immediately and frequently very high in price.

Some imported machines are not completely suitable to the local conditions. Others have features so complex and technically sophisticated (eg. power steering for low horsepower prime movers, 30 or more gear changes, advance hydraulic systems) they are really not necessary for our purposes. Instead, it only makes repair more difficult and costly when the machine breaks down.

TABLE 6 : SALES OF AGRICULTURAL TRACTORS IN PENINSULA MALAYSIA BY HORSEPOWER

TOTAL MARKET	1970	1971	1972	1973	1974	1975	1976
BELOW 50	175	143	98	111	131	79	74
51 - 60	32	8	9	80	52	31	17
61 - 70	405	286	284	367	261	328	212
71 - 80	471	397	540	576	842	663	461
81 - 90	-	-	-	-	-	-	20
91 - ABOVE	-	1	15	11	63	34	21
TOTAL	1083	835	946	1145	1349	1135	805

Source : Ujang, A.B, 1979

TOTAL MARKET	1977	1978	1979	1980	1981
BELOW 40 hp	300	130	100	247	183
41 - 60 hp	129	132	108	217	156
61 - 70 hp	331	396	399	624	566
ABOVER - 71 hp ABOVE	650	710	653	733	800
TOTAL	1410	1368	1260	1821	1705

Source : Dept., of Agriculture, Informal Survey

Table 7 : Imports of Agricltural Machinery in Malaysia

Items	SITC Code	1978		1979		1980		1981	
		Quantity	Value M$'000	Quantity	Value M$'000	Quantity	Value M$'000	Quantity	Value M$'000
1. Ploughs	72111000	326	562.0	442	862.2	557	722.5	646	1,125.2
2. Seed planters, fertilizer and annual spreaders.	72112000	99	293.0	269	348.4	272	777.2	344	633.0
3. Cultivators, weeders, hoes and harrows	72113000	533	1,058.3	1,257	2,704.6	532	1,390.1	821	1,767.7
4. Other agricultural and horticultural machinery for soil preparation.	72118000	430	1,188.8	260	619.8	488	1,081.9	652	1,473.5
5. Combine harvesters	7212200	35	2,649.1	127	11,435.2	79	7,265.6	170	8,351.5
6. Other harvesting or threshing machinery or fodder presses	7212300	83	1,037.4	433	737.8	570	1,446.3	632	1,103.2
7. Tractors for agricultural use,pedestrian controlled	7224110	397	1,241.7	431	1,332.5	124	328.1	57	207.5
8. Tractors for agricultural use, non-pedestrian controlled	72241900	2,238	33,865.6	2,259	39,030.7	2,704	54,578.2	2,311	53,821.4

Source : Agriculture Ministry, 1979, 1980, 1981. Import and Export Trade in Food and Agriculture Products.

3.3. Local Manufacturing

The agricultural machinery manufacturing industry is very poorly developed.

To date, there is only one concern which can be realistically called an agricultural machinery manufacturer. This is an Australian-Malaysian joint venture sited in Kuala Lumpur. This company manufactures rotary tillers, rotary slashers, farm machinery and farm implements.

Certain engineering workshops have specialized in the manufacture of manual sprayers,bush cutters, mechanical seeders, water pumps and lawn mowers. None of them have however expanded beyond their original scope and capacity of business.

Skid tanks, trailers, cage wheels and other fabrications are within the capacity of most engineering workshops.

Traditional hand tools (hoe, spade, rake, sickle etc.) are made by local blacksmiths (even these products in the agriculture areas have to compete with imported versions)

There is only one diesel engine manufacturer. (The government has announced the setting up of one more joint venture project to manufacture engines). All other prime mowers from engines to combines are imported.

4. PRODUCT DESIGN, DEVELOPMENT, ADAPTION AND INDUSTRIAL LIAISON

The Agricultural Engineering Branch of the Malaysian Agricultural Research and Development Institute (MARDI) undertakes research and development in various aspects of crop mechanization. Its activities consists of three different types :-

(i) Design and development of indigenious machinery and accessories.

(ii) Modification and adaption of foreign technology

(iii) Studies and evaluation of foreign technology.

Current research is directed towards :-

(i) Evaluation of technologies suitable for reaping and threshing padi in areas where big combines are not able to operate.

(ii) Evaluation of foreign transplanters

(iii) Evaluation of foreign and indigenious direct seeders

(iv) Design and development of tractor traction aids.

(v) Evaluation of suitable technologies for peat soil

(vi) Design and development of groundnut thresher

(vii) Design and development of rotary cultivator cum ridger for tobacco.

(viii) Design and development of coconut dehusker.

Industrial liaison activities have been minimal. This area of work will be strengthened in future, MARDI plans to make available some successful machinery that has been developed to local manufacturers. Selected manufacturers will be closely supervised and assisted.

5. POPULARIZATION OF AGRICULTURAL MACHINERY

This is the function of the Farm Mechanization Branch of the Department of Agriculture.

This activity is carried out in two ways :-

(1) Formal training in the Farm Mechanization Training Centres. There are 10 such centres in Peninsular Malaysia and a wide variety of agricultural mechanization courses are taught.

(2) Field training to groups of farmers via the T & V (Training and Visit) extension system.

6. ACKNOWLEDGEMENT

This paper is prepared by S.C. Poh. Contributions were made by Encik Ishak Haji Ibrahim, Deputy Director of Farm Mechanization Branch and Encik Stephen Khaw, Senior Agricultural Officer of the same Branch. Typing was done by Cik Sharifah Nazilah. Thanks to all concern.

The views and interpretations in this paper are those of the author and not necessarily those of the Department of Agriculture or the Government of Malaysia.

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THE STATUS OF FARM MECHANIZATION IN NEPAL

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THE STATUS OF FARM MECHANIZATION

Background

Agriculture is the mainstay of Nepalese people. Over 60 per cent of the GDP accrues from agricultural, and about 95 per cent of the economically active population is engaged in farming. Major portion of the population lives on small private land which averages at 1.2 ha. The farm labour is provided by unpaid family workers, by the farm owner himself and by his minor children. As children earn their subsistence by providing useful work, they are an asset to the farmer. The drawback is that, becuase of the inhertance system in which all sons receive equal shares, the land holdings are progressively fragmented over the generations.

The country can be divided into three geographical regions.

(a) The mountaineous north portion of the country. This is sparsely populated,and the inhabitants derive their livelihood mostly from livestock raising.

(b) The middle hilly portion of the kingdom. The population lives by agriculture. The density of the population is largest in this region. Because of the hilly terrain, the major portion of the area is unsuitable for cultivation, but the little that remains on the banks of the numerous rivulets is highly fertile. The pressure of population and the scarcity of suitable land, have driven land prices in this region to unrealistic heights. This has resulted in a steady flow of the population to the third region of the country.

(c) The third region of the nation lies in the foothills of the Himalayan mountains. The region is level with a small gradual slop towards the south. The area is called the Terai, and now forms the breadbasket of the country. There are a number of small steams all flowing roughly in a southern direction. A primitive system of earthen dykes and canals for irrigation purpose is in extensive use in the region. A substantial portion of this terai region is under double cropping and the trend is on the increase. It is expected that most of the future agricultural development of the nation will take place in this region and therefore subsequent discussion is confined to the terai only.

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The Status of Farm Mechanization in Nepal:-

The road to economic development has to be suited to the individual nation. Japan and other development nations have sizeable industrial population, so that machinery is cheap, while agricultural labour being expensive has led to a higher price of cereal grains. The low prices of agricultural produces in our country as compared to other nations has made the use of power operated machinery uneconomic.

Nepal has large population of draught animals. And it is felt that for the foreseeable future most of the farming work will continue to be performed by bullocks. Cultivation of land requirements large energy inputs. Irrespective of the source, however, whether by diesel engines or by farm animals, as long as the seed bed cultivation is properly done, the crop yields will be good. Farm animals do not have the strength to till soil to the depth achieved by tractors. Generally animal drawn plough can till soil to a depth of 50 mm only for which the energy required for a single cultivation of 1 ha is estimated at 45 HP,hr. However, the top soil in our country is also about 50 mm in depth. Therefore decrease in the depth of cultivation only marginally affects the crop yield. Table 1 shows the availability of farm power in the various countries of Asia. It will be seen that although Nepal ranks last among the nations as regards concentration of mechanical power per ha, it ranks fourth as regards the availability of total power. Hence the emphasis in our country is towards the development of animal powered agricultural tools.

Government Policies for Farm Mechanization

The agricultural sector has been accorded topmost priority in terms of development plan outlay and annual budgets. Nevertheless, the government's attitude towards farm mechanization, based on plan documents and policy statement can be best summarized as selective mechanization of farming with emphasis on labour-intensive technology. There is a general feeling among policy makers that mechanization conflicts with employment objectives. But in my view, this only a conjecture, as there are no empirical evidences to support the view. Emphasis is heavily placed on the modernization of agriculture through the use of HYVs, fertilizer, pesticides and irrigation. As far as

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farm mechanization is concerned, Government's concern is to introduce those machinery that will help increase production without displacing labour.

In relation to engineering research and development two organisations are worth mentioning: the Agricultural Engineering Section, Department of Agriculture and the Council for Science and Technology. The former concentrates on aspects of agricultural engineering like designing appropriate farm mechanization schemes, efficiency study of farm machinery, training farmers on farm machinery use, etc. The Council for Science and Technology was established recently to design appropriate technology that can be productively applied to farming among other considerations.

Until recently there was no quantitative control on the importation of farm machinery. Starting with the fiscal year 1980/81 the Government restricted imports of wheel tractors in consideration of the emphasis given to intermediate technology in the Sixth Plan. Importing agencies import the required number of farm machinery on the basis of demand assessment. Import duty is only one per cent. Nevertheless, the number of farm machinery in use in Nepal is very small, mainly due to economic and structural constraints. Nepal has no separate organisational setup for promoting extension, training and other advisory service on mechanized farming. The government has established agricultural extension offices in all the 75 districts of the country that provide necessary advice to farmers on mechanized farming as a part of their broad role.

The Agricultural Development Bank of Nepal (ADB/N) is the biggest Government agency that provides credit to farmers for purchasing farm machinery, e.g., tractors and pumsets. Other commercial banks too provide credit for farm machineries but their share is negligible. The ADB/N provides loans to farmers for machinery imported by the Bank as well as other sources, like the National Trading Limited and private dealers. Credit on farm machinery and pumpsets are considered medium term credit.

The ADB/N charges 14 per cent interest on credit for farm machinery. This rate is relatively cheaper than the interest rate prevailing in the private sector. As a result, it is observed that willing and able farmers have expressed favourable attitude towards the acquisition of farm machinery.

/Problems

Problems and Prospects of Farm Mechanization

Most of the country's development indicators are increasing at a low rate, farm mechanization included.

Agriculture is wholly traditional and is at a subsistence level. As only one per cent of all farmers operate farm greater than 10 ha, farm mechanization has remained at a low level.

Food crops still dominate the scene, with more or less stagnant yield over the years. The total index of agricultural productions is hardly improving. The non-agricultural sector has yet to expand. Consequently increasing labour force has to be absorbed in the agriculture sector. This has resulted in the further fragmentation of land holdings because of inheritance law.

The ceiling of land holdings in the Tarai, the only feasible area for mechanization, has been fixed at 17 ha only. Any further land distribution measure, in the present state of growing inequality, would not be towards increasing the ceiling.

Agronomic practices in rice production have not undergone significant changes over time. Due to a low rate of literacy, the farmer's skill in handling farm machinery is poor. There is dearth of good and well equipped engineering and repair services. At best, the Government's attitude towards mechanization is rather neutral. In village, local blacksmiths continue to supply and repair most agricultural tools and implements.

Of the various constraints farm mechanization may encounter in poor countries, i.e., economic, social, institutional, and technical, economic constraints top the list in the case of Nepal. This is evident from the existing condition of agriculture and farm mechanization in the country. Once the economic constraints are removed other constraint is the disparity between growth of resources and population, giving rise to small and fragmented holding. Consequently, small income and purchasing power prevail.

Therefore, the purchasing power of the people has to increase significantly and that changes in factor price have to favour machine rather than labour. These pre-conditions are imperative if farm mechanization must improve although they are not likely to emerge in the near future.

The main objective of development in Nepal is growth with equity. The current Sixth Plan has intended to provide minimum basic needs to all the people. In this regard, provision of employment is considered to be one important basic need. Past trends show that agriculture has to provide employment to most of the labour force. Another important objective in agricultural development is to achieve maximum possible production. So, in essence, the desired course of development is Nepal would be agricultural development with higher production employment.

Conclusions

There is no such thing as the optimum design of a farm machinery. Performance of a farm machinery varies widely from place to place. Given this fact, a machine, very successful in China, may not prove to be as good in Nepal or vice-versa. Therefore there is nothing like one hundred per cent copying the design of agricultural machineries. However, a venue like this, should give ample opportunities to the participants to gain first hand informations in the field of development of farm mechanization.

Therefore, besides agreeing along broader terms in respect of economic co-operation, such meeting as this, should be arranged from time to time to enhance technical co-operation among participating countries.

The ESCAP-backed RNAM project has been proving very fruitful in helping member countries join hands together. Unfortunately though Nepal has yet to be member of this organisation, I, personally feel strongly, that more activities along what RNAM is doing, should be performed in future to further promote farm mechanization in Asian region.

COUNTRY PAPER

PHILIPPINES

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Country Paper (PHILIPPINES) for the ESCAP/UNIDO Seminar for Promoting Economic and Technical Co-operating among Developing Countries in Asia and the Pacific in the field of Manufacture and Popularization of Agricultural Machinery, Tools and Equipment, China, 8-24 May 1984

The thrust of economic policy in the Philippines for the coming years is in the evolution of a balanced agro-industrial development in the country. Two thirds of Filipinos live in the country-side. They are in agriculture, forestry and fishery. With an increase in the productivity of the entire Philippine economy as an ultimate goal, there is a need to raise farm productivity. The importance of higher farm incomes lies in its subsequent contributions to the stabilization of food prices, higher generation of savings and the creation of a domestic market for industrial goods. More competitive industries are envisioned to develop in this process of a balanced agro-industrial development.

An objective of the agriculture and agrarian reform sector, as indicated in the Philippine Development Plan for 1983-1987, is to stimulate the growth of food production. Included as production strategies are the utilization of modern and effective farm implements, improved soil preparation techniques such as deep placement of fertilizers, and the construction of postharvest facilities such as dryers, terminal silos and food handling facilities. We hope to find in this seminar fruitful discussions on these agricultural machines and equipment.

Agricultural Mechanization Program

The Philippines is now in the process of creating a body that would manage the agricultural mechanization program of the country. This proposed Committee on Agricultural Mechanization shall formulate agricultural mechanization policies and strategies related to:

(a) The research, design and development, manufacture and popularization of agricultural machines and tools;

(b) The need for short and long range strategies/programs in the implementation of the country's agricultural mechanization program; and

(c) The need to coordinate, integrate and evaluate all policies, strategies, programs and activities for

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the modernization of agriculture through the appropriate blending of chemical, mechanical and bio-technologies.

There are several government offices/programs on agricultural mechanization. The brief profiles of the more important ones are as follows:

Regional Network for Agricultural Machinery (RNAM)

The Regional Network for Agricultural Machinery began operations in 1977 with the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) as the executing agency. Sources of finance have been the United Nations Development Programme and contributions of the Government of Japan, Australia, the Netherlands and the eight participating countries, namely: India, Indonesia, Iran, Pakistan, Philippines, Republic of Korea, Sri Lanka, and Thailand.

RNAM aims to promote appropriate agricultural mechanization through the selection, development, adaption and use of suitable agricultural machinery and equipment with conscious and deliberate efforts to encourage their local manufacture. Essentially, its programmes seek to support the achievement of goals set out in the development plans of the participating countries. The national institute of each member-country organizes and implements programmes on research, development, manufacture and popularization of appropriate agricultural machines.

The regional headquarters of RNAM is located at the University of the Philippines at Los Banos, Laguna.

Agricultural Mechanization Development Program (AMDP)

The Agricultural Mechanization Development Program is the national institute or the Philippine counterpart to RNAM. AMDP was established at the University of the Philippines at Los Banos in 1979. The main objective of AMDP is to raise the level of agricultural productivity and production through appropriate agricultural mechanization. AMDP establishes linkages with various government agencies, the private sector, and farmers in carrying out its various activities, which includes:

1. Acting as catalyst in the government in the formulation of policies and strategies on agricultural mechanization;

2. Conducting researches on the socio-economic aspects of agricultural mechanization;

3. Designing, developing and promoting agricultural machinery for local use;

4. Providing technical assistance in the manufacture of farm machinery; and

5. Disseminating information of agricultural mechanization.

Agricultural Machinery Testing and Evaluation Center (AMTEC)

In recognition of the importance of agricultural machinery as an input in food production and the need to maintain a certain level of quality in the design and workmanship of agricultural machines/implements, the Agricultural Machinery Testing and Evaluation Center was established in 1977 through a Memorandum of Agreement between the Ministry of Agriculture and the University of the Philippines at Los Banos.

AMTEC is the official testing agency for agricultural machinery sold in the country whether local or foreign-made. It sets quality standards and conducts performance tests for agricultural machinery used under Philippine field conditions. It also sets standards in evaluating spare parts and after sales service capabilities of firms engaged in the sale/distribution of agricultural machinery and equipment in the Philippines. Tests results are published in bulletins to guide the financing institutions, farmers, as well as the manufacturers.

Agricultural Machinery Distributors/Manufacturers Accreditation Committee (AMDAC)

The Agricultural Machinery Distributors/Manufacturers Accreditation Committee was organized in 1978, composed of representatives from the bank/lending institutions and the Ministry of Agriculture. Its main objective is to accredit reliable agricultural machinery manufacturers and distributors who will do business with government financing agencies extending loans for agricultural machinery. AMDAC's policies cover company, product and price accreditation for both imported and locally made agricultural machines.

National Science and Technology Authority (NSTA)

The National Science and Technology Authority is involved with the comprehensive national plan for science and technology including specific goals, plans, programs and projects. Research and development related to agricultural mechanization is undertaken through the Philippine Council for Agriculture and Resources Research and Development (PCARRD) and the Philippine Inventions Development Institute (PIDI), both of which are under the NSTA.

PCARRD is a national research system composed of national, regional and cooperating research centers. Included in the network are academic institutions, commodity research institutes and government line agencies/bureaus of the Ministries of Agriculture and Natural Resources. The research stations may conduct basic and applied research, as well as verification of packages of technology, including among others those specific to agricultural machine design and development.

The PIDI was specifically established to provide various forms of assistance and incentives to Philippine inventors, innovators and creative researchers in order to help them develop, patent, fabricate and promote their inventions or discoveries. To promote and encourage Philippine inventions and their manufacture, technical, legal, financial and promotional assistance/incentives are given to inventors.

Interface Between Research/Development and Manufacture/Popularization

The Ministry of Agriculture (MA) and the International Rice Research Institute (IRRI) initiated in September 1981, a collaborative effort to promote the development and extension of agricultural equipment which is appropriate for small farms and may be produced in the Philippines. The objective of the MA-IRRI Industrial Extension Program for Small Farm Equipment is to institutionalize the Program within the Ministry and related organizations.

As of May 1983, 161 manufacturers located throughout the Philippines have become cooperators in the MA-IRRI Program. They range in size from small blacksmith and metalcraft shops to large-scale industries. The Program provides them with designs of agricultural equipment, training and technical assistance. The cooperators in turn, provide annual production statistics and agree to sell units only after testing and authorization by MA-IRRI.

Some of the machines the MA-IRRI Program promotes are the following:

1. Reaper - It harvests paddy with a capacity of 2.4 hectares per day using a 5-hp gasoline engine with a

1.2 meter width of cut. The fuel consumption is approximately 1 liter per hour.

2. Axial Flow Pump - The pump is used for low water lifts up to 4 meters and is appropriate for irrigation and fish ponds. It has a capacity up to 3000 liters per minute for a total lift up to 4 meters, using a 5-hp gasoline engine. Its fuel consumption is 1.2 liters per hour.

3. Seed and Fertilizer Applicator - In a single operation, this unit makes a furrow and applies fertilizer, seeds and soil covering over the seeds. It is an animal drawn seeder and depending on the operator and endurance of the animal, it can plant about 0.25 ha/day.

4. Thresher

   - IRRI portable thresher has a capacity of 300-600 kg/hr of threshed paddy depending on crop conditions. It utilizes 2-3 men to feed, thresh and bag the grains. It is powered by a 5-hp gasoline engine. Its fuel consumption is about 1 liter/hour.

   - IRRI TH7 axial flow thresher has a capacity up to one-half ton per hour when threshing paddy. It utilizes a 7-hp engine and it can be carried by 4 men.

   - IRRI TH8 axial flow thresher has a capacity of up to one ton per hour when threshing paddy and using a 10-hp engine. It needs 3-4 men to feed, thresh and bag the grains. It can be pulled by a power tiller, a light truck, or by a carabao.

5. Cassava Chipping Machine - The machine is used in cutting cassava tubers or other root crops into chips for easy drying and storage. It can be manually operated for a 300 kg/hr capacity or powered by a 3-hp gasoline engine for a 1300 kg/hr capacity.

/6. Transplanter

6. Transplanter - The rice transplanter is operated by a single person and has a capacity of 0.25 ha/day. It plants 6 rows in one passing and its labor requirement per hectare is 30-35 man-hours for seedling preparation and 30-35 man-hours for the actual transplanting operation.

Although relatively recent, the MA-IRRI project is considered significant because of its efforts in bridging the gap between research and actual utilization of agricultural machines in the farms.

Problems and Recommendations From Local Agricultural Machinery Manufacturers

Based on the summary proceedings of the First workshop on the Manufacture of Agricultural Machinery in October, 1982, the problems and recommendations as articulated by the local manufacturers are as follows:

Problems

1. Low quality materials and components;
2. Product standards are not strictly implemented;
3. High prices;
4. Undersized specifications due to metrification; and
5. Basic facilities for the agricultural machinery industry are dispersed, inadequate and of poor quality.

Recommendations

1. Adapt quality and safety standards for various agricultural machinery and components;
2. Standardize testing procedures;
3. Establish accreditation procedures and standards;
4. Conduct training programs on technological processes to upgrade manpower skills for improved productivity;
5. Provide consultancy services;
6. Impose minimal tariff duties and taxes for imported raw materials and components;

/7.

7. Make available to manufacturers specifications of raw materials and components and require suppliers/subcontractors to follow specifications;

8. Organize companies to manufacture components needed by agricltural machinery manufacturers;

9. Grant incentives for the upgrade/establishment of basic facilities, which agricultural manufacturers may avail of.

The problems and recommendations presented above give an overview of the state of the local manufacturing industry in our country. The Agricultural Machinery Testing and Evaluation Center (AMTEC), the Products Standards Agency (PSA) and the Metal Industry Research and Development Center (MIRDC) are working together in finding solutions to the problems of our local manufacturers. However, much still remains to be done.

Proposed Policies for the Rationalization of the Agricultural Machinery Industry

A sub-committee on Manufacturing in the envisioned National Committee on Agricultural Mechanization has proposed for adoption the following policies for the manufacturing industry in the country:

1. Promote the manufacture of appropriate agricultural machinery which would be economically viable in line with the following objectives:

   (a) Realize foreign exchange savings for the country through import-substitution of complete equipment or components.

   (b) Earn foreign exchange for the country through export to other countries.

   (c) Create manufacturing activities in various enterprises.

2. Promote the export of domestically produced agricultural machinery and components.

3. Promote the setting up of rural industries, especially small and medium scale.

4. Allow the importation of agricultural machinery or components which are not economically viable for manufacturing

/and

and which are in consonance with the national agricultural mechanization program.

Some Identified General Issues on Agricultural Mechanization

1. There is a need to forge a smooth interface between research and development on one hand, and the manufacturing and popularization aspects of agricultural machines/equipment on the other hand. Researchers in the academe must look at the development process beyond the production of the working prototypes. A packaged/integrated scheme must address the issue on how our small farmers can make full use of the products of research. The equity question related to the direct beneficiaries of research efforts becomes more meaningful when we consider the extent to which such researches are funded with public funds.

2. It is imperative that a functional interdisciplinary linkage among the engineer-designers, the social scientists (sociologists/economists) and the farmer-end-users be assured throughout the development process of an agricultural machine/equipment. The related issues on timeliness in field operations, displacement or replacement of labor, and income distribution consequences of agricultural mechanization can not be considered separate from the total process of development. Furthermore, no single discipline can aptly handle all these issues.

3. Two possible effects of mechanization which we need to address are labor displacement and income re-distribution. Alternative employment through other activities either as on-farm, off-farm or non-farm labor must be explored. Studies show that the displacement effects of mechanization tend to affect family labor more than wage or hired labor. Farm household incomes, therefore, are likely to change with mechanization. In general, the rent or payment to a factor of production goes to the owner of the factor. Income redistribution can be expected to occur in, for example, the shift from manual transplanting

/and

and threshing to the use of mechanical transplanters and threshers, since the owners of the machines are expected to receive the payment for their use. Government policies and strategies which allow better access to agricultural credit and a steps toward the local manufacture of more affordable agricultural machines and implements will give the farmer the opportunity to be a machine owner-operator as well.

4. Lastly, we believe that the multi-dimensional process in the Technical Cooperation Among Development Countries (TCDC) can offer immense apportunities to developing countries in the development and adaptation of selected agricultural machinery. Prototypes of specific agricultural machines found to be successful in a country like China and in other countries, if introduced and found to be adaptable in other developing countries like the Philippines, can hasten the development process in the modernization of our agriculture.

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DESIGN, DEVELOPMENT AND ADAPTATION OF AGRICULTURAL MACHINERY IN SRI LANKA

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1. Introduction

Sri Lanka is traditionally an agricultural country, where over 70% of the population depend on agriculture. In recent years considerable progress has been made in crop production, particularly in rice and few of the upland crops. In the profession of agriculture, the major problem that the farmers are facing is the rising cost of production, due partly to the high cost of energy and increasing cost of operations based on machinery. It is a well known fact that the income level of many of our farmers are quite low. This results in their inability to purchase or hire-out vital equipment, which could enhance their productivity efficiency and income. Hence identification of constraints and problems of mechanization had become a vital necessity.

Design, development, manufacture and use of appropriate agricultural tools, implements, machines and equipment using manual, animal, mechanical and electrical power, as well as renewable source of energy is considered as a major part of mechanization. Increase of service life and convenience of use of existing machines through intensive training and extension activities is also an important aspect.

2. The Farm Mechanization Research Centre (FMRC), Maha Illuppallama, Sri Lanka.

This research centre is the one and only institution of it's nature in Sri Lanka and has been set-up by the Department of Agriculture with the view to achieving an economically, technically and socially suitable mechanization of agriculture in Sri Lanka. The prime task of FMRC are:

- identify constraints and problems of mechanization
- draw-up criteria for determining suitable implements for various regions and spheres of Sri Lankan agriculture
- select and test promising implements with regard to their construction, function, organizational integration and economical and sociological consequences

- adapt equipment to local conditions
- advise industry on selecting and producing agricultural implements
- engage in agricultural extension to diseminate information on improved mechanization technology to the farming community by means of demonstrations, exhibitions, publications, training courses etc.
- furnish test reports on implements tested

In order to carry-out the above long list of activities, FMRC has been sub-divided into three main sections.

- Research & Development section
- Testing & Evaluation section
- Extension section

3. Research & Development activities of FMRC

The Design & Drawing office and the Workshop are coming under this section and is headed by an Agricultural Engineer. Since the staff capacity of this section is insufficient to carry-out all on-going design and development activities, project members from other sections of the institution have been appointed for each of such implements under research. The team members of a particular project are responsible for design development, adaptation and testing of the particular implement. At present FMRC is carrying-out 4 such research and development projects, namely:

- Manual rice transplanter
- Manual highland seeder
- Manual lowland seeder
- New animal drawn tool carrier

3.1 Manual rice transplanter

In Sri Lanka during the Maha season (October to March), about 35% of total area cultivated for rice is transplanted, while in the Yala season (April to August) it is about 24%. Random transplanting is the most commonly employed method and only 10% of the total area transplanted employ row transplanting. Mechanized row transplanting brings the following benefits according to Sri Lankan conditions:

i. Timeliness - solution for water scarcity problem
- facilitates pest & desease control
- facilitates 2 or 3 seasonal cultivation
- minimises harvesting losses, especially from climatic variations

ii. Cheaper weed control - (Average cost for mechanical weeding is Rs.400/- per ha., whereas average cost for chemical weeding is Rs.900/- per ha.)

The labour scarcity during the season in many parts of the country is the main reason for not employing the method of row transplanting.

The manually operated IRRI Transplanter which has given satisfactory performance at the research stage and passed FMRC tests, was given to 4 manufacturers for large scale production. Ten units were produced at the Department of Agriculture operated Agricultural Implements Factory at Welisara.

The field tests on these transplanters at FMRC's lowland fields revealed that the performance was not satisfactory, with a missing hill percentage of above 20%. This short-coming, along with the new and costly method of seedling raising technique, made the FMRC to decide to stop extension activities and to look into possible improvements.

Firstly, to avoid the costly and complicated seedling raising technique with double frames, a number of research work was carried-out. Seedlings raised on a polythene mat or on plantain leaves in the farmers field itself have proved to be a better solution. The bed raised and levelled on the plot itself is then laid with a sheet of polythene. A thin layer of soil (mud) about 15 to 20 mm. thick s then laid over the polythene. Pregerminated seed paddy is then sown over the mud layer. Uniformity in the density of the seed paddy on the mud layer is important in order to obtain minimum number of missing hills.

A simple wooden frame made to the size of the transplanter tray facilitates cutting the seedling mat to the correct tray dimensions with the help of a knife.

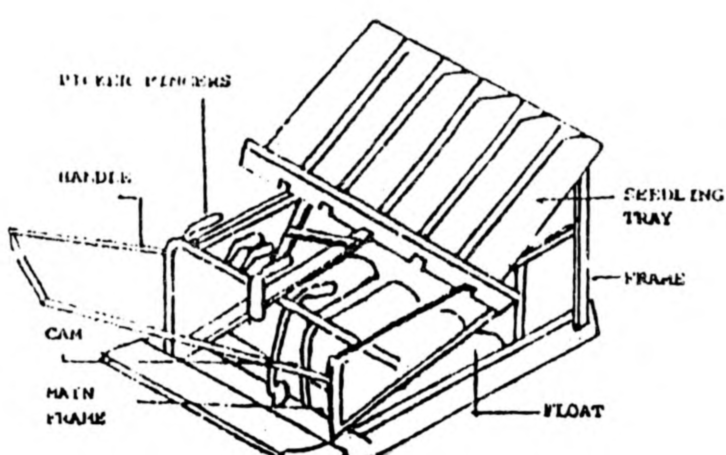
This seedling raising technique has the following advantages when compared to single or double frame system.

- cost is neglible, when compared to frame method
- it is not completely new for most of the farmers, although the method slightly deviates from the well known Dapog system
- easy to transport. No special trays are necessary. Can be carried as a roller or as cut pieces

(Details of transplanter is given on page 5)

IRRI RICE TRANSPLANTER

1. Function	To transplant 15 to 25 day old rice seedlings in puddled lowland.
2. Specifications	
Make	Agricultural Implements Factory, Welisara
Type	Manually operated
Power	One Man
Dimensions	L x W x H 1200 x 1160 x 650 mm
Spacing	20 cm row to row spacing
Weight	25 Kg.
3. Developed at	IRRI
4. Test results	
Suitable for	planting paddy
No. of rows	5
Capacity	0.25 ha/day
5. Cost	
Sale price	Rs.2,700/= (approximately
6. Development Stage	research stage



3.2 Manual highland seeder

The necessity of a multiple highland seeder for almost all types of upland grain varieties had been emphasized, especially in the regional Technical Working Group meetings (RTWG). In order to select and to do modifications, if necessary, FMRC has conducted a series of comparative studies on 5 numbers of existing upland seeders on repeated trials with Soyabean, Cowpea, Blackgram, Greengram, Ground nut, Maize and Paddy seed. The evaluation of the performance showed that there are too many weak points in each seeder to justify extension activities.

Adapting the attractive characteristics of all seeders, FMRC has developed a multiple upland seeder, which has given encouraging results on the trials carried-out with bigger grain varieties other than Kurakkan and Gingerly.

This Highland seeder consists of the following components:

- square shape handle made of 1/2" GI tube
- 2 numbers traction wheels
- wooden metering rollers with provision for moving along the axle in a key way
- hoppers made of 1 mm. GI sheets
- separating brushes with provision for adjustment from outside the hoppers
- floating type furrow openers fitted at the end of grain discharge tube. (Grain discharge tube is a longitudenal section of 1¼" GI pipe)
- floating type furrow closers
- containers to add weight to regulate the depth of furrow

The hoppers with all connected components (metering rollers, grain discharge tubes, furrow openers, furrow closers etc.) can be moved along the axle in order to adjust the distance between rows. For different grain varieties different sizes of metering rollers have to be used. However, this seeder still needs attention with regard to the possibility of seeding smaller size grain varieties.

(Details given on page 7)

2 ROW HIGHLAND SEEDER

1. Function	Row seeding of highland crops
2. Specifications	
Make	FMRC
Type	Manually operated pull type
Power	One man
Spacing	Adjustable
Weight	20 Kg.
3. Developed at	FMRC
4. Test Results	
Suitable	Seeding highland crops in rows
Capacity	0.05 ha/hr. (1 to 1.5 acres/day)
Seed rate	Adjustable
5. Cost	Rs.800/=
6. Development stage	Research stage

3 Manual lowland Seeder

Row sowing is presently practised only by a few farmers in the country. They use a simple and locally developed seeder called the "Johnpulle" seeder. In view of the advantages associated with raising a crop in rows, emphasis is given to encourage the farmers to row sow rather than broadcast. As in the case of the Upland seeder, four lowland rice row seeders have been tested repeatedly at FMRC fields, i.e. the Johnpulle seeder, FMRC seeder, Wickramasekera seeder and the IRRI seeder. Although there are advantages and disadvantages in every seeder, the IRRI seeder resulted with the best seed rate uniformity.

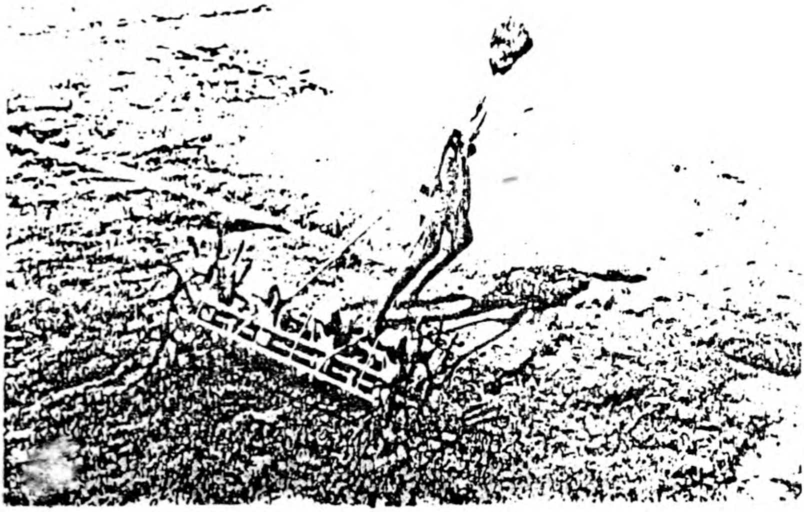
The big handicap with the IRRI seeder obviously is it's cost, which has been estimated at approximately Rs.800/=, while the Johnpulle seeder costs only Rs.106/=. Another disadvantage is it's fixed seed rate for a particular grain size. Paddy grain size of length and breadth of 7.7 mm and 3 mm respectively or 39,500 grains per kg. with 10 mm. sprout length resulted in the correct and required seed rate of 75 kg./ha. Paddy soaked for 36 hours and incubated for 48 hours gave the required sprout length of 10 mm. Specifically farmers have no need to learn this soaking procedure, since this is the usual soaking and incubating time practiced by them. If the row spacing is 8", traction wheels which have slightly bigger diameters control the seed rate. During the last Maha season (October to March 83/84) several trial plots have been laid, maintaining 8" and 10" spacing. The mechanical weeder (Japanese 2 row) had been used twice in each plot at the age limit of 14 and 25 days after seeding. Weed counts, plant counts and growth rate etc. in comparison to chemically weeded broadcasted crops of the same age have been recorded.

The average yeild received from all replicated trials of 8" spacing, 10" spacing and broadcasted were 4,250 kg/ha., 3,750 kg/ha. and 3,000 kg/ha. respectively.

(Details of Lowland seeder are given on page 9)

4 ROW LOWLAND SEEDER

1. Function	for row seeding of pregerminated paddy in puddle soil
2. Specifications	
Make	IRRI
Type	Manually operated seeder
Power	One man
Spacing	20 or 25 cm row to row spacing, variable
Weight	18 Kg.
3. Developed at	IRRI
4. Test results	
Suitable for	sowing pregerminated paddy in rows
Capacity	0.05 ha/h (1 to 1.5 acres per day)
Draft	9 Kg.
Seed rate	1.5 to 2.5 bu/per acre (depends on variety)
5. Cost	
Sale price	approx. Rs.800/=
6. Development stage	ready for extension activities mid 1984



JOHN PULLE LOWLAND SEEDER

1. Function — Row seeding of pregerminated paddy on mudland

2. Specification

Make	Agricultural Implements Factory, Welisara
Type	Manual, pull type
Power	One man
Dimensions	L x W x H 300 x 700 x 900 mm
Weight	5 Kg.
No. of rows	4
Working width	80 cm

3. Developed by — John Pulle

4. Test results

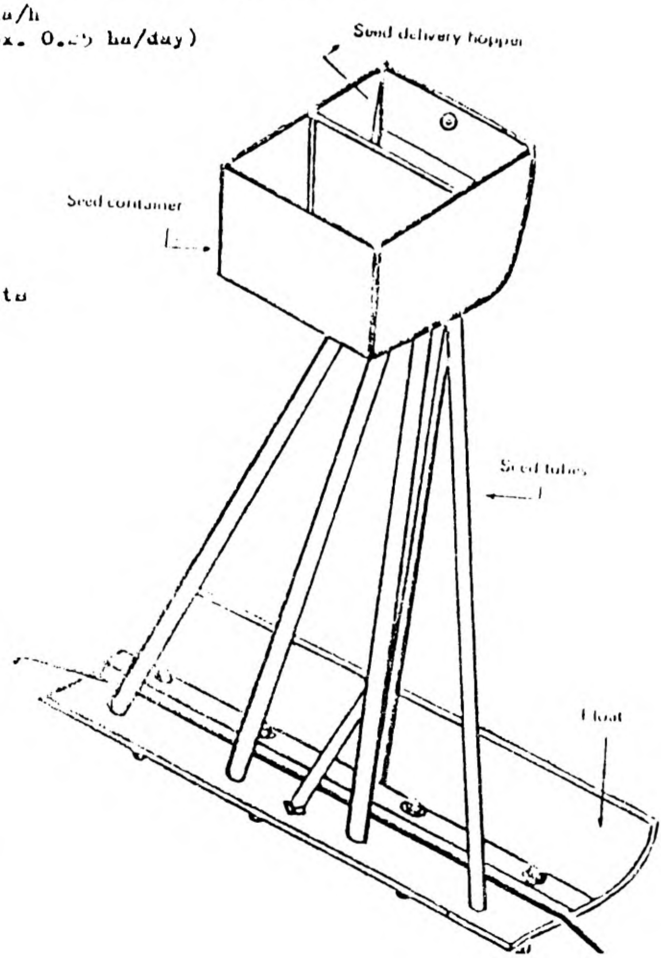
Suitable for	pregerminated paddy and puddled soil
Capacity	0.03 ha/h (Approx. 0.[illegible] ha/day)

5. Cost

Sale price

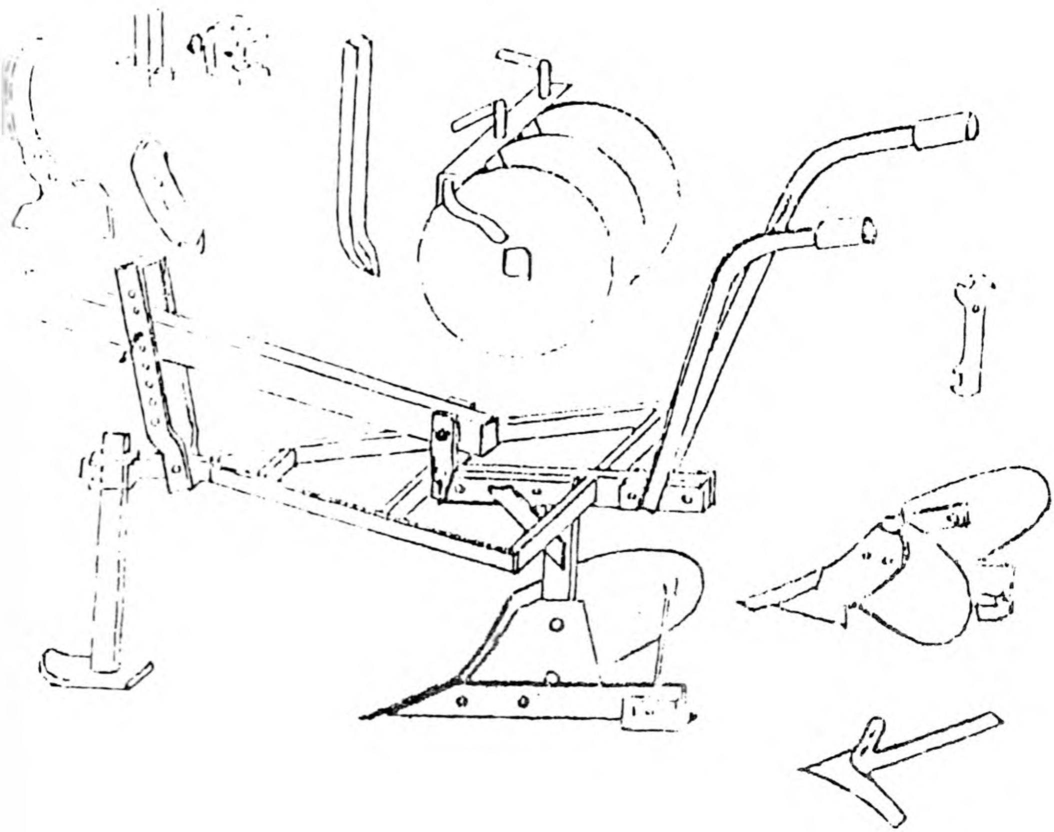
6. Development Stage

Commercially available at Agricultural Implements Factory, Welisara



NEW ANIMAL DRAWN TOOL CARIER

1. Function	Can be used for wide variety of cultural and field operations
2. Specifications	
Make	FMRC, Maha Illuppallama
Type	Animal drawn tool carrier
Power	A pair of animals and one man
Dimensions	L x W x H 850 x 600 x 800 mm
Weight	15 Kg. without tools
3. Developed at	FMRC, Maha Illuppallama
4. Test results	
Suitable for	mounting different types of soil working implements i.e., disc harrow, plough, ridger, tines etc.
Capacity	0.08 to 0.12 ha/h.
Draft	60 to 100 Kg. depending on attachments used and soil conditions
5. Development stage	Ready for industrial & agricultural extension



4 Implements which are at the Extension stage

4.1 Weeders

Single row rotary weeder is already a popular implement among farmers who practice row sowing and row transplanting. This implement is being manufactured in large quantities by the state owned Agricultural Implements Factory and also by a private manufacturer.

For upland weeding the Swiss hoe, Chopping hoe, 3 tyne cultivator and the V-blade hoe were found to be successful implements. Though Government farms and institutions willingly adapted these tools, the village farmer is not being readily attracted. The mammoty or the spade hoe is the implement commonly used by the farmers for weeding. Every farmer possesses one or more of this mammoty, as it is a multi-purpose basic tool, which is indispensable to him. A worn-out mammoty not usable for other purposes becomes his ideal tool for weeding. But the mammoty with its short handle and higher weight is less efficient than the recommended weeding tools. However, many farmers show reluctance to invest some money on special tools for weeding, while having the mammoties with them and their financial difficulties especially influence this line of thinking. The farmers have to be gradually convinced about the advantages of using improved weeding tools and efforts are being continued in this direction.

4.2 Reapers

In many rice growing areas the harvesting operation imposes a distinct bottleneck characterised by high harvesting costs, severe labour shortage, and high shattering losses, if the operation is delayed. As a preliminary effort of mechanizing at least part of the harvesting operation, FMRC has carried-out extensive testing on the 1.6 m Chinese Harvester received on RNAM programme and 1 m CAAMS/IRRI Reaper received from Philippines. Considering the prevailing agronomic, economic and social conditions, it has been concluded that the CAAMS/IRRI 1 m Reaper is the most suited for typical Sri Lankan conditions.

The major limitation in the use of harvesters in some districts of Sri Lanka is the small size of the plots. Manoeuvring of the Chinese harvester in wet fields imposed some problems. The CAAMS/IRRI Harvester had also an advantage in the relatively smaller plots.

Districts which have a higher potential for mechanical harvesters have been identified and promotional activities are concentrated here.

The harvesting costs in areas where an introduction looks promising vary from Rs.200/- to Rs.600/- per acre. An economic evaluation of the reaper revealed that, if it is used to capacity (68 days or 80 ha. per year), farmers having total harvesting costs of above Rs.200/- can operate the reaper economically. Of all the new implements introduced in recent times, the harvester has been the most attractive to the Sri Lankan farmer.

Six local manufacturers have obtained drawing of the CAAMS/IRRI harvester. One manufacturer has already produced four power tiller units. Five numbers reaper heads have been manufactured at the Farm Mechanization Training Centre (FMTC) Workshop, Anuradhapura. Training courses have been arranged at FMTC, Anuradhapura to train operators and officers on the reaper. Operator manuals have been translated into Sinhala and Tamil. Training material and hand-outs have been prepared.

(Details of CAAMS/IRRI Reaper given on page 13)

4.3 Axial flow thresher

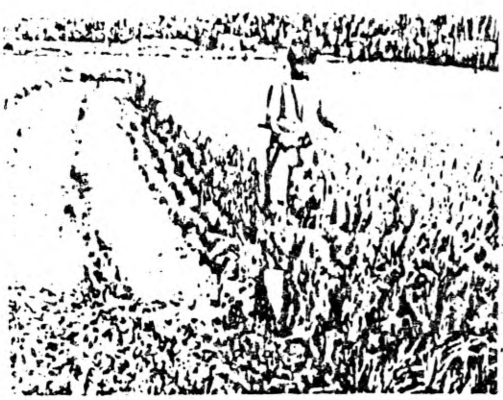
The IRRI Axial flow thresher is being manufactured and marketed by two private companies in Sri Lanka with slight modifications. One IRRI designed rice thresher with some modifications by a Philippines' workshop has under gone field tests at FMRC. Apart from it's weight the overall performance is superior to any machine FMRC has tested before. Farmers do not consider threshing as a priority for mechanization. The present widely spread practice of threshing is by a 4 wheel or 2 wheel tractor. The tractor is driven over the cut crop until the paddy is separated from the crop. Unlike in the case of reaping, threshing can be delayed for some time till a tractor and labour is available, if the crop is properly stacked. But, from an economic point of view this practice cannot be recommended.

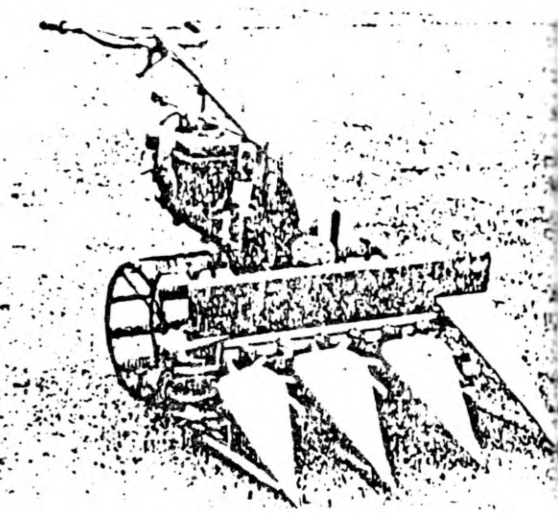
A third manufacturer has adopted the IRRI version of the Axial flow thresher on drawings and prototypes supplied by FMRC.

(Details of the Axial flow thresher are given on page 14)

1 Metre CAAMS/IRRI Reaper(Paddy harvester)

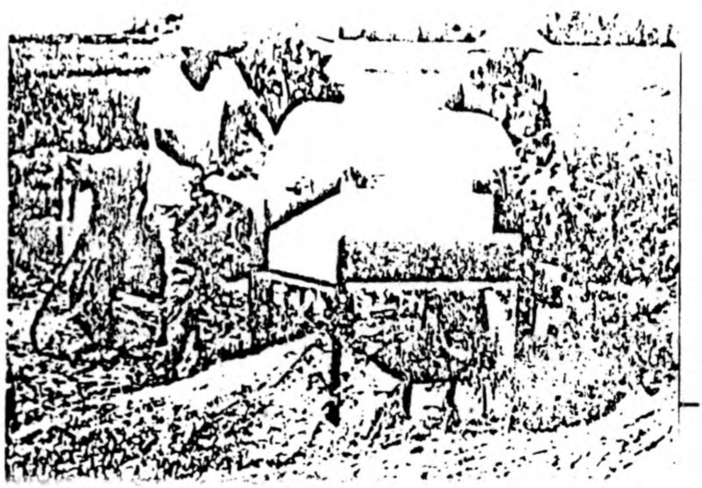
1. Function	Cuts paddy and leaves it in parallel swaths on the field, reaper can be detached and power tiller used for other operations
2. Specifications	
Make	IRRI
Type	2 wheel tractor, fronted mounted reaper assembly with vertical conveyor belts which gather and transport paddy crop to right hand side
Power	5 hp kerosene engine, 2 operators, helper
Dimensions	L x W x H 2180 mm, 1170 mm, 900 mm
Weight	135 kg.
3. Developed at	IRRI in cooperation with CAAMS, Peoples Republic of China
4. Test results	
Suitable for	harvesting paddy
Capacity	0.25 ha/h on average
Field losses	Less than 1% at optimum ripening stage
Fuel consumption	approx. 1 litre/h
5. Cost	
Sale price	approx. Rs.30,000/=
Operating	Rs.150/= per acre (including labour and preparatory, cutting if 200 acres harvested annually)
6. Development stage	Ready for industrial & agricultural extension





PORTABLE AXIAL FLOW THRESHER

1. Function	To thresh paddy
2. Specifications	
Make	IRRI
Type	Throw-in axial flow thresher with air winnowing
Power	6 hp engine & 2 to 3 men to feed, thresh and bag grain
Dimensions	L x W x H 950 mm, 760 mm, 1380 mm
Weight	135 kg. with engine
3. Developed at	IRRI
4. Test results	
Suitable for	Paddy
Capacity	300 - 600 kg/h depending on crop condition
Separation Recovery	98%
Grain purity	87%
Grain damage	less than 2%
Fuel consumption	approx. 2 litre/h
5. Cost	
Sale price	Rs.22,000/= approx. with engine
Operating	Rs.17/= per 100 kg. (including labour)
6. Development Stage	ready for industrial & agricultural extension



THAILAND FARM MACHINERY INDUSTRY

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Farm Machinery Industry

1. Introduction

About 77 per cent of the total 50 million Thailand's population or about 65 per cent of Thai families are directly engaged in farming, and most of them leave upcountry. Approximately 43 per cent of the total land 514,000 square kilometers are cultivated area. The agriculture sector accounts for around 30 per cent of the Gross Domestic Product and it has 4 to 5 per cent average growth rate.

Most people in the agricultural sector are farmers grow rice. The rice is grown everywhere and the Central Plain with the Chao Phraya River is the one of the world's richest rice growing area. The plain also provides endless quantities of maizes, tapioca, sugar, beans, jute and vegetable. The mountainous regions of the Northern and some of the North Eastern parts have great tracts of the teak and other valuable timbers. Their slopes are also good for tobacco cultivation, or the growing of tea, vegetable, tapioca and jute. The humid zone in the Southern and Eastern parts are excellent for growing rubber trees, palm and coconut cultivation.

In the cultivated land, there are six crops namely rice, maize, cassava, kenaf, rubber and sugar-cane account for 88 per cent of the total area. However, of these crops, rice is by the most dominant being approximately 60 per cent of the total crop land. Nowadays Thai farmers accept new technology and different kinds of machine to improve their per acre yield.

Although the cultivation in Thailand, the farms are not fully mechanized but Thai farmers utilize more and more machinery to increase their production. Many farm machinery and accessories are produced locally.

Hence this paper presents mostly the facts and some information dealing with the country's demand and supply of Thailand's farm machinery mostly for those are utilized in rice farming which is the major activity in the country's agricultural sector. Small part of the paper gives some information of the Government's policy.

/2. Demand

2. Demand for the farm machinry and implements

As introduced that Thai farmers accept and utilize much more machinery and implements to increase their production per land area, but not only reason causes the increment of the demand for those machinery and implements. It is reported that each year the forest and some uncultivated land are destroyed and turned to develop to grow some plants at the average 4 per cent. The increment of the cultivated land implies the increment of the amount of the various machines and implements too. The diversification of crops and multiple croping those are other main Government policy stated in the Fifth National Economic and Social Plans are also the significant factors increase the demand of the machinery in the national agriculture sector.

During the past decade, the statistic shown sharp increment on the numbers of the different farm machinery and implements used in Thailand i.e. 30 per cent for farm tractors, 16 per cent for small farm tractors, 22 per cent for power tillers (two-wheel tractors), 23 per cent for water pumps, 79 per cent for rice threshers, and 14 per cent for win-nowers etc.

However many Thai farmers still use animal draught power because of their economic constraint and their own belief that the old traditional animal equipments and animals give them less cost of production than use the farm tractor. The statistic shown Thais use the farm tractors only 1.7 units per 1.0 square kilometre of cultivated land, and only 10 per cent of farmers own farm tractors.

Table 1 shows the statistic recorded by the office of the Agriculture Economics, the Ministry of Agriculture during the year 1977 to 1981, that indicates the amounts of the main farm machinery existed in the years.

3. Imports

The existing agricultural machinery and implements distributed in the local market come from both the importers and the local manufacturers. To fullfil the annual demand of the agricultural sector, Thailand imported big amount of the different kinds of machinery and implements. Table 2. shows the import statistic of the farm tractors

/(power

(power tillers included) and the agricultural machines during the year 1979 to 1982, while Table 3 gives the similar statistic of the various implements for the same period.

Table 1

Amount of Farm Machinery in Thailand

Description	1977	1978	1979	1980	1981
Farm tractors (45 hp and up)	22,826	28,987	33,285	37,177	50,044
Small tractors (less than 45 hp)	23,942	26,984	31,158	36,158	39,158
Power tillers	151,504	192,004	230,591	280,591	284,351
Water pumps	317,328	359,308	473,975	517,975	603,548
Rice threshers	4,962	5,557	6,224	18,934	20,601
Win nowers	53,114	59,488	66,806	74,782	83,801

Source Paper "policy and Implementation Measures for Farm Mechanization in Thailand" by Mr. Praphunth Sawetanunthn

/Table 2

Table 2

Import Statistics of Agricultural Machines

*Qty - Kg
Qty - Unit
Value - CIF.(1,000M)
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Year / Description	1979		1980		1981		1982	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value
Farm tractors	3,348	261,406.704	3,892	369,832.61	15,840	755,441.70	13,438	371,539.18
Lawn and sports ground rollers complete sets	98	374.17	-	-	6	665.19	5	397.86
Parts of lawn ground rollers*	37	3.61	-	-	-	-	325	46.58
Ploughs	12,570	4,651.68	11,711	4,312.48	47,643	14,194.65	18,516	9,714.88
Harrows hoes	1,636	4,690.33	595	685.18	246	1,480.88	265	1,032.98
Cultivators	16	266.60	14	215.07	292	2,687.48	68	953.91
Distributors seeders planters transplanters	69	684.10	66	169.28	139	4,884.79	17	742.60
Other Agriculture horticulture machine for soil preparation or Cultivation	506	2,609.76	332	5,305.43	2,449	18,709.00	744	6,641.66
Parts & Accersories for Agriculture horticulture machinery*	1,443,657	31,694.99	3,147,062	72,061.87	3,219,324	82,097.69	2,993,137	74,639.83
Grass mowers	2,885	16,401.52	4,622	8,876.90	8,525	13,542.61	6,835	11,120.33
Parts of grass mowers*	2,842	315.37	6,594	254.95	2,306	284.87	2,065	422.11
Havesting machines	13	401.18	18	4,176.76	356	12,547.17	78	1,182.83
Threshing machines	2	13.98	2	54.17	401	3,126.98	1	5.21

Table 2 (Cont.)

Description / Year	1979 Qty	1979 Value	1980 Qty	1980 Value	1981 Qty	1981 Value	1982 Qty	1982 Value
Combined havester threshers	3	132.01	19	645.63	112	4,545.34	46	1,923.80
Winnowing & Similars cleaning machines	10	1,896.36	4	661.73	8	110.07	2	1,232.97
Straw fodder presses winnow of other cleaning machines for seed etc grading machines	89	17,087.12	153	5,471.22	3,515	18,410.61	272	22,388.33
Parts & accessories for straw fodder presses cleaning machines for seed grain etc & grading machines*	9,965	423.88	13,374	993.20	24,442	993.00	67,282	2,676.71
Poultry incubators brooders	2,138	55,262.92	204	28,819.76	400	19,385.53	1,367	2,929.15
Poultry-keeping machines	23,636	8,670.06	15,932	7,737.54	5,429	3,987.20	10,015	1,190.98
Other agriculture horticulture bee-keeping machinery germination plant	10,659	6,449.23	3,494	8,029.66	11,492	9,424.27	2,123	2,584.54
Parts & Accessories for other agriculture horticulture poultry-keeping bee-keeping machinery etc*	3,153	381.61	168	53.88	4,022	568.18	2,145	257.96

Source : Department of Custom

Table 3

Import Statistics Of Agricultural Implements

Qty - kg
Value - CIF. (1,000$)

Year / Description	1979		1980		1981		1982	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value
Spades shovels	315,530	8,416.70	171,506	5,103.81	143,443	5,021.92	80,187	2,913.89
Changols hoes	396,386	8,660.39	273,719	10,233.82	128,840	3,363.89	31,675	890.53
Picks forks rakes	220,919	3,835.64	31,795	577.69	28,495	562.93	65,361	1,175.73
Bill hooks hewing tools	16,432	469.72	4,397	381.67	1,930	214.26	3,018	259.91
Scythes sickles hay knives	4,000	135.36	7,200	228.59	1,403	136.75	15,000	570.97
Axes of any kind	72,293	3,109.46	70,828	2,484.91	95,971	4,774.33	59,774	3,335.89
Other hand tools nes used in Agriculture horticul or Forestry	83,244	4,312.62	104,545	4,815.80	124,196	8,181.42	57,750	4,575.48

Source Department of Custom

4. Exports

Many kinds of the agricultural machinery and implements can be produced locally and some of them are over the domestic demand so that they can be exported. Table 4&5 show the exports of different kinds of the agricultural machinery and implements. The Table 4 may be considered with the Table 2 that there are some items under the same description can be both imported and exported in the same year. They happened because of many commodities were designed and modified and improved in Thailand for the local circumstances and fortunately they were appropriate to the neighbourhood countries too, and many of imported commodities are not exactly the same as those exported. For example Thailand imports a lot of the farm tractors especially the advanced four wheel (bigger than 45 hp.) and two wheel tractors (power tillers) at the same time she produces a lot of the small four wheel tractors (less than 23 hp.) and the well modified two wheel tractors, then the tractors to be exported are all local products.

/Table 4

Table 4

Export Statistics of Agricultural Machines

*Qty - Kg
Qty - Unit
Value - CIF.(1,000M)

Year / Description	1979		1980		1981		1982	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value
- Farm Tractors	60	1,508.56	884	7,933.27	18	2,767.45	28	8,124.70
- Lawn & sports ground rollers complete sets	-	-	200	354.26	-	-	-	-
- Ploughs	618	412.96	586	1,521.54	274	1,459.26	491	3,498.60
- Harrows hoes	6,885	275.73	162,430	9,224.45	7	246.88	240	3.30
- Distributors seeders planters transplanters	-	-	6	514.08	3	369.13	3	165.25
- Other agriculture horticulture machinery for soil preparation or cultivation	-	-	1,231	2,259.19	10	271.76	29	1,412.06
- Parts & accessories for agriculture horticulture machinery*	6,130	53.97	113,323	1,941.80	16,870	614.11	234,097	3,188.62
- Grass mowers	5	4.68	2	0.70	6	25.15	391	462.75
- Parts of grass mowers*	60	1.40	-	-	-	-	1,693	131.32
- Threshing machines	-	-	4	57.50	-	-	15	659.96
- Havesting machines	-	-	-	-	2	125.38	-	-
- Straw fodder presses winnow other cleaning machines for seed grain etc. grading machine	11	8,384.40	3	33.95	-	-	-	-
- Parts & accessories for straw fodder presses cleaning machines for seed grain etc. & grading machines*	2,423	270.50	786	142.34	1,906	3,586.29	151,118	10,067.18

Table 4 (Cont.)

Description \ Year	1979		1980		1981		1982	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value
- Poultry incubators brooders	-	-	484	411.08	762	1,529.52	455	1,257.11
- Poultry-keeping machines	115	80.45	17,753	1,702.98	12	6,209.23	-	-
- Other agriculture horticulture bee-keeping machinery germination plant	1,210	236.82	33,361	6,624.04	3,072	760.03	1,168	1,856.18
- Parts & accessories for other agriculture horticulture poultry-keeping bee-keeping machinery etc.	6,163	326.76	38,985	2,124.84	45,548	1,668.11	262,597	6,205.52

Source : Department of Custom

Table 5

Export Statistics Of Agricultural Implements

Qty - kg

Value - CIF. (1,000 ₩)

Description \ Year	1979		1980		1981		1982	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value
Spades shovels	196,385	3,845.42	399,810	8,250.92	444,786	9,073.89	331,279	5,764.21
Changols hoes	659,788	21,369.39	1,167,465	40,872.94	754,947	33,310.55	1,016,525	43,421.18
Picks forks rakes	150	3.82	33,137	263.69	9,921	332.50	31,130	1,094.04
Scythers hay knives	-	-	-	-	21,015	781.89	4,100	204.02
Axes of any kind	1,913	32.11	24,652	806.30	14,744	447.21	23,276	787.45
Other hand tools nes used in agriculture hor ticulture or forestry	380	13.10	35,873	2,167.77	512	40.07	26,208	1,238.73

Source Department of custom

5. Production

The agricultural machinery and implements produced domestically show the growth both horizontal and vertical. development. However, the historic growth of Thailand's agricultural mechanization has been horizontal rather than vertical. The farmers prefered increasing their productivity by expanding the land area rather than by applying fertilizers and improving land quality to get better yield per land area. So that the production of the agricultural machines and implements were just to serve the need of the agricultural mechanization and developed horizontally as same as the mechanization. Major agricultural machines are well produced and popular among the farmers in Thailand namely, large four wheel tractors, small four wheel tractors, two wheel tractors or power -tillers, plough discs and blades, water pumps, rice threshers, seeders, millers, and corn shellers. However, there are many kinds of the farm transportation means such as farm motor vehicles and tailers, these are popular and locally modified and domestically manufactured too.

Table 6 provides the amount of manufacturers and their capacities and also the production records during the year 1980-1982 for the said agricultural machines.

The driven engines for the agricultural machines are the Diesel engines and electric motors. There are three government promoted engine assembly plants with total annual capacity 187,400 units of the Diesel engines whose power range between 5 to 22 hp. And there are five motor assembly plants with total annual capacity of 277,500 units of A.C. electric motors whose power range between 1/4 to 10 hp.

46% of the agricultural machines and implements manufacturing factories are located in and around Bangkok the city of the country, 29% in the North East, 17% in the North and 8% in the South. The Manufacturing employment besides those of the government promoted Diesel plants, mainly found in cottage type of workshops. There are around 18% of the total number of the manufactures are large and employing 31 and more workers, while the medium size enterprises account for about 38% and employing 10-30 workers, the small size workshops emplying less than 10 workers, the small size workshops employing less than 10 workers and account for about 44%.

/Table 6

Table 6

Local Farm machinery and Implements Factories and Production/Assembly.

Products	Production 1980	Production 1981	Production 1982	Annual Capacity	Unit	Numb of fact
Rice millers	3,412	3,087	3,238	4,510	unit	58
Threshers	1,968	3,371	1,949	3,820	unit	38
farm motor vehicles	553	609	501	1,170	car	9
Plough discs (cast)	215,600	220,000	475,200	528,000	unit	22
Plough blades	13,043	32,723	35,335	54,320	set	24
Plough tails	78,400	91,840	117,920	133,440	unit	32
husker-shellers	1,066	1,328	1,550	1,730	unit	18
Seeders	340	375	390	630	unit	13
Tractor blades	556	1,011	1,015	1,410	set	7
Water pumps	21,023	25,423	17,419	40,000	unit	17
Diesel engines (5-22 Hp.)	21,901	103,130	61,025	187,400	unit	3
Farm tractors (47-75 Hp.)	2,784	1,853	1,105	6,500	unit	3
Small farm tractors	4,069	6,597	5,748	10,000*	unit	7
Power tillers (2 wheels)	50,075	66,750	33,659	100,000*	unit	4C

Note * Estimated

Sources : 1. Paper "Policy & Implementation Measure for farm mechanization in Thailand."

2. Industrial Economics & Planning Division Ministry of Industry.

Since Thailand has no iron and steel plant that can produce steel sheets and bars or other structural frame for making any agricultural machinery and implements so that it may say that all of the steel components and parts of the local made agricultural machinery are imports. However, there are few factories own some scrap remelting furnaces, then they can make some parts by casting and shaping themsleves. Naturally a factory produce many kinds of products.

The power-tillers and the small four wheel tractors are mostly local modified from the original imported models and they are very appropriate to the local circumstances and cheaper than the imports too. Hence most of the existing power-tillers are local made. At the same time almost all of the large four wheel tractors are imports. The domestic tractor assembly plants now are running at about 30% of their capacities.

6. Government Policy

The Ministry of Industry supports the promotion of any kinds of the small farm machinery manufacturing to be the industrial size of scale for reaching the national targets of the National Economic Plans especially to serve the nation agricultural production plans. The Board of Investment would promote all kinds of the agricultural machinery industry. The Government by the Ministry of Agriculture machinery in 1979. This is the high level advisory body for policy making. The Committee comprised of senior representatives from Ministries/Departments of Agriculture, Industry, Board of Investment, Bank for Agriculture and Agriculture Co-operatives, besides the representative of the Asian Institute of Technology Thailand Industry Association, manufactures and universities. The Committee is responsible for advising the government on important policy matter such as promotion of appropriate farm mechanization, development and manufacture of the agricultural machines, credit, training, repair and maintenance. The Committee is now preparing the national policy to implement in the next national five year plans. The objectives of the proposed National - Agricultural Policy are:

6.1 The farmers can have the agricultural machinery adequately and cheaply.

6.2 The agricultural machinery and implements to be supplied in the country must be good quality with the reasonable prices and maintenance costs.

/6.3

6.3 The agricultural machinery must be appropriate to the nature of Thailand.

To protect the local manufacturers, the Government given a quota with a limited amount small four wheel tractors and power-tillers to be imported since August 10,1979. And the same for the small Diesel engines (331 - 1,100 c.c.) the quota for import was also given at a reasonable amount since 1978.

To strengthen the national agriculture mechanization Thai Government also stressed the policy to cooperate with other nations in the various international organizations dealing with the development of the agricultural mechanization. Thailand now is a participating country in the following international organizations/associations (besides the various main UN bodies i.e. UNIDO, FAO, ESCAP, etc.) namely:

- Regional Network for Agricultural Machinery (RNAM)
- International Rice Research Institute (IRRI)
- Association of South East Asian Nation (ASEAN)

7. Conclusion

Thailand needs the agricultural mechanization to increase the national agricultural products and provide better living for the farmers. The present and future machinery requirements are for the major crops and just for the basic operations such as land leveling, ploughing, seeding, weeding, transplanting, ridging, cultivating, threshing and shelling. There are many kinds of the agricultural malchinery and implement can be produced locally and some of them are over the domestic demand so they are exported. The Government set up the policy and implementation measures for development of the farm machinery and implement industry and for the agricultural mechanization.