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The Status and Prospect of Agricultural Machinery Industry in China

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China has been building its own agricultural machinery industry since the 1950's. In the beginning, it was limited in imitation of foreign horse-drawn implements, tractor-drawn five-furrow plows, pull-type grain harvesters and so forth. Later China began to form its own education and scientific research system. In the 1960's and 1970's China's agricultural machinery industry achieved a rapid development. A number of emphasis enterprises, scientific research institutes and higher education institutions were built. Agricultural machinery plants and research institutes were established in all counties. Up to 2,200 such plants, 2,100 such institutes and 68 higher education units with agricultural machinery speciality were counted in early 80's. In fact, that expansion exceeded objective needs.

1. Outline of the Agricultural Machinery Industry in China

Agriculture is the base of China's national economy. China's land area covers about 960,000,000 hectares, out of which the cultivated land is approximately 0.1 billion hectares and the prairie is nearly 0.22 billion hectares. The population is 1.17 billion, out of which 0.9 billion is in the rural area. The total yield of grain is 0.44258 billion tons or 402kg of grain per person on average. China feeds up to 22% of the world population with 7% of the world's cultivated land. In the 1990's China's agriculture faces a transition from a traditional system to one with high yield, excellent quality and high efficiency.

Research has shown that the development of agricultural machinery has reached a higher level on the east coast of China than in the inner regions[2]. That is evidence for the conclusion that China's agricultural machinery industry will certainly develop together with the economy.

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It is shown in table 1 that the preservation of agricultural machinery in China had increased rapidly during the 11 years from 1980 to 1991. The annual increase of machinery power was 6.4%, of which tractors comprised was 10.8% (large and medium types—0.46%, small type—13.16%), harvesting combines comprised 4.42%, irrigation machines comprised 4.28%. The total power in agri-machinery of China is 0.302 billion kw[1]with a increase of 2.6%, compared to the previous year. The number of large and medium type tractors is 758,000 with a 3.3% decrease, compared to the previous year, and small type tractors is 7,423,000 representing a increase of 1.6%.

The agri-machinery industry in China has a history of 40 years and has formed a certain output capacity. There are 16 varieties of products with more than 3,200 models. There were 2,513 agri-machinery enterprises in 1990. The average number of workers in these enterprise was 505. The output value of the agri-machinery industry comprises the following: tractors of all types 23.9%, internal combustgion engines 20.2%, harvesting machines 9.7%, agricultural transport and handling machines 9.5%(tables 2 and 3). Therefore, the output values of tractors, internal combustion engines, transport and handling machines, irrigation machines and their spare parts take a big part of the total .

The total value of output of the agri-machinery industry in 1992 was 42 billion RMB with an increase of 26%, compared to the previous year. The increases of grain combines, agricultural transportation vehicles, internal combustion generators, rice transplanters and equipment for crop protection are 79.04%, 66.07%, 54.59%, 209.9%, 33.79% respectively. However, the output values of tractor-operated plows, harrows, wagons of agricultural use, mills and seeders decreased to some extent.

The sales income of agri-machinery products in 1992 increased by approximately 19% and profit increased by 50%. The average rate between profit and output value in the machinery building industry in 1992 was 6.24%, and that of the agri-machinery industry was 3.85%. The sales rate of products of large and medium enterprises in China's machine industry in 1992 was 99.46% and in agricultural machinery it was 98.73%.

China's agri-machinery is exported in a small amount. The export value was $25 million in 1980, $0.11 billion in 1989, and $0.15 billion in 1992. The last was 4% of the output value in that year. Chian's exported machines feature

small or medium capacity, low price and ease of operation, and are suitable for small plots of land, horticulture, and small engineering projects. They are medium and small capacity tractors, walking tractors, small capacity internal combustion engines and machines for paddy fields. The importing countires are basically developing countries ssuch as Peru, Indonesia, Bengladesh, Pakistan, and Venezula. Countries of the former Soviet Union and East Europe have also purchased Chineses mini-tractors and implements in recent years.

2. Enterprises of Agricultural Machinery in China

The more than 2,500 agricultural machinery enterprises in China are basically State-owned invested in by State and local governments. In the planning economic system they were highly specialized with a limited variety of products. For example, the seeder manufacturing enterprise produced a few models of seeders only. Since the 1980's with the transition of the State to a marketing economy system, those enterprises have begun to expand a variety of products to survive and develop while maintaining the former specialized production. The State has been following a low-price policy for agri-machinery products. Further more, the cost of raw materials keeps in-

creasing, so the profit rate is rather low at present.

1) Supervision system of enterprises in the Agri-machinery Building.

There is a Construction Machine and Agricultural Machine Supervision Bureau in Ministry of Machine-building Industry of China for the general supervision of planning, production, scientific research and training in agricultural machinery. There is an Agricultural Mechanization Bereau in Ministry of Agriculture which is responsible for the general supervision of extension and operation of agricultural machinery. Most State-owned agri-machinery manufacturing plants are supervised by the Department of Machine-building in the provincial goverment, while repairing plants or small capacity manufacuring plants of agri-machinery, local research institutes and schools of agricultural mechanization are supervised by departments of agricultural mechanization in local governments. The departments are responsible for the determination of contract targets such as targets in product quality, sales income, profit and taxes, wages, increase of fixed assets and so forth, and for selection of directors or general managers of enterprises. The directors of enterprises sign general contracts concerning responsibilities, rights and interests with authority to manage the

enterprises independently, being subject to laws and responsible for profit and loss.

2) Engineering and Technical Personnel in the Agri-machinery Enterprises.

According to statistics at the end of 1990 there were 84,557 engineering and technical persons in those enterprises which comprise 6. 66% of total staff and workers. They work mostly in technology and production management. In a few large plants engineers work independently in development of new products. Most of the medium and small enterprises develop their products with the help of research institutes and high education institutions or by introducing new technology and techniques from foreign countries.

3) Some agri- machinery enterprises are introduced as follows inorder to understand China agricultural machinery industry briefly.

First Tractor Plant is located in Loyang, Henan provincde. It is the centralr enterprise of China's First Tractor and Construction Machinery Company. It was founded in 1955 and started production in 1959. Now it is a first rank enterprise of State level. It covers 483ha and has a production area of 103ha, 37,000 staff and worker, of which 8,400 are engineering and managing staff. There are 17,000 sets of equipment, out of which 1,600 have been introduced from abroad. They form more than 150 mechanized or automative production lines.

Yearly production capacity: catepillar tractor or bulldozer is 25,000 units, wheel-type tractors are 60,000 units, diesel engine series 100 is 1500 units, the mini-pumps are 40,000 units, road surface rollers are 1,500 units, trucks are 500 units, bycicles model BMX are 30,000 units. Sum of the output value in 1992 was 1. 68 billion. The rate bewteen profit and output value was 11. 9%, and it occupics the first place in agri-machinery enterprises of China.

The Changchun Tractor Plant is located in Changchun, Jilin province, and is one of the major backbone enterprises in the agri-machinery industry. It was built in 1958, and now has 6,600 staff and workers. Technical staff (900) comprises 13. 6% of total staff and workers. Its products include 4 series of medium and small size wheel-type tractors and construction machines. They are CT-12 (8. 82kw), CT-15, CT-30, CT-40, JD-940, JD-114 etc, and two wheel road surface roller 2YJ8/10, bulldozer TY100, frozen soil drill DZL50A.

Beijing General Internal Combustion Engine Works, set up in 1949, is a key enterprise administered by the Ministry of Machine Building Industry. It has a strong contingent of technical personnel with over 10,000 workers and staff members, and

is equipped with nearly 3, 500 units of modern facilities and 49 mechanized production lines. In this works there is an affiliated internal combustion engine research institute. The principal products are: model 4115T diesel engine and 10 other varieties (water-cooled, 33-62. 5kw, 48-73. 5kw), models E6L912 and F6L913 diesel engines and their varieties (air-cooled, 37-118kw), petrol engines: model 4920 and two other varieties of model 6V920 (water-cooled 51-88kw). The former has been one of the principal products of the plant for years and appraised as a high-quality product by the Ministry of Machine Building Industry. Both of these are principally used on various jeeps, trucks, sedan cars, station wagons, and construction and handling machinery. There is also a product of model 30GF diesel generating set of 30 kw.

Jiamusi Combine Harvester Factory is in Jiamusi, Helongjiang province. It was set up in 1946. It covers an area of 40 hectares in which 120,000 sq. m. is under roof. There are 4,000 employees in the factory all together. It is well equipped with advanced production means and testing instruments. It is one of first rank enterprises at State level. Its products have been exported to more than 10 foreign countries and regions. The products include plows, seeders, pumps, threshers and combines.

In 1981, the know-how and licence for producing 1000 series combines was introduced from John Deere Company of United States, at the same time large-scale technical reformation was started. At present, the main products in the factory are 28 model of 5 kinds of machines, namely, harvesting combines, threshers, seed cleaners, rice seedling transplanters. FS-3. 0A, JL-30,JL-35,JL-3060, JL-3060W grain harvesting combines are designed and developed by technical personnel of the factory.

Siping Harvesting Combine Plant, produces 2 series of combines, namely " Dongfeng" and SE514. Know-how of the latter have been introduced from Germany. The production capability of the factory is 2,000 combines annually.

Baoding Farm Machinery Manufacturer is located in Baoding, Hebei province, and produces medium type mounted plows. There are three standard types of mounted medium-duty plow IL series: IL-230, IL-330 and IL-430. , which are equipped on wheel tractor of 22-45kw with three point hitch. They are suitable for light or medium texture soils with specific resistance below 0. 7kg/cm^2. The plows of the IL series can be matched with 3 types of the disk smoothing furrow-filler for double operation.

Yanji Rice Transplanter Plant, located in Yanji, Jilin province, is the only factory designated by the Ministry of Machine-building Industy to produce soil-bearing rice seedling transplanters. The main product of Yanji Rice Transplanter Plant is the Model 2ZT-9356. In 1983, Model 2ZT-9356 Power-operated rice transplanter was issued the certificate of the outstanding new product by the State Economic Commission.

Haerbin Agricultural Machinery Plant, is situated in Haerbin, Helongjiang province. It is a key producer of seeders and planters.

Its principal products:

a. Fertilizer-seeders 2BF series trailed grain seeders including all sized drills of 7 specifications ranging from 6-row to 48—row, and 2BY series press grain drills.

b. Large air-conditioning equipment JW series large horizontal industrial air-conditioners of 10 specifications with the rated air quantity ranging from 10km^3/h to 200km^3/h.

c. Various heat exchanging equipment.

3. The Education and Scientific Research of Agricultural Machinery in China.

A group of senior experts in the field of agricultural machinery were for the most part trained by agricultural engineering departments of universities in U. S. A in 1940's and in the former Soviet Union in the 1950's. They are very limited in number. In the 50's New China began to build its own education system in agri-machinery including middle and high level education. A agricultural mechanization school of middle level was established in each province throughout the country, and districts of some provinces had their own middle schools or schools of agricultural mechanization for training technicians in the operation and management of agri-machinery.

Engineering and technical personnel of high level are trained in higher education institutions. In the 1950's, following the education system of the former Soviet Union, specialized colleges of agri- machinery and colleges of agricultural mechanization were established. Departments of agri-machinery were established in some polytechnical colleges and colleges of agriculture. Engineering and technical personnel were trained in directions of design and building as well as of mechanization . By the early 80's there were up to 68 departments of 4-5 year undergraduate programs. In the early 60's graduate schools started in a few

universities such as Jilin University of Technology and Beijing University of Agricultural Engineering. With the development of industry and agriculture and because of the influence of market mechanism on personnel training, some specialized colleges of agri-machinery have grown into polytechnical colleges and some colleges of agricultural mechanization into universities of agricultural engineering. Their departments of agri-machinery have grown into departments of agricultural engineering or colleges of agri-machinery. They began to admit graduates for masters degrees in 1978 and graduates for PH. D. in 1981. Now Jilin University of Technology, Beijing University of Agricultural Engineering and Chinese Academy of Agricultural Mechanization S cienes have the right to award the title of Ph. D. in the speciality of agri-machinery design and building (tractor and implements). The speciality of agri-machinery in Jilin University of Technology is an emphasized one of State level and possesses moving post-doctorial research stations. The North-east College of Agriculture has the right to award the title of Ph. D. in the speciality of mechanization of agriculture. Beijin University of Agricultural Engineering is also an emphasized institution of the same speciality.

Recently, the State Academic Title Committee has renewed the catalog of specialities for graduate schools and ranked speciality of agricultural engineering as one of first level with 8 sub-specialities for graduate enrollment—agri-machinery, mechanization of agriculture, electrification and automation of agriculture, livestock environment and architecture of agriculture, utilization of water resourcse in agriculture, agricultural energy source engineering, processing engineering of agri-products, agricultural system and management engineering. Now about 40 higher education institutions have specialities of agricultural engineering including more than 20 locations awarding master title and 8 locations awarding Ph. D. The alumni of above mentioned specialities from polytechnical colleges mostly work in industry and the alumni from agricultural colleges mostly work in agriculture.

Higher education in China is undergoing reform. A transition from those students studying free of charge and subject to distribution by the State after graduation to those that they are self-financed and choose their jobs independently is currently taking place. In some universities and colleges nearly 20% of students enrolled in 1993 will be self-financed. At present in expanded teaching program of fundamental subjects is emphasized, training in practice and hi-tech is strengthened, and speciality coverage is extended.

Specialities in agricultural engineering are facing a problem of lack in admitting students as the working conditions and wages in agriculture are not as favorable as those in other fields.

More than 2,000 research institutes at ministry level, province level, district level and county level were established in the 50's and 60's. Now the county level institutes have changed into extension units. Chinese Academy of Agricultural Mechanization Sciences, Loyang Research Institute of Tractor, and Shanghai Research Institute of Internal Combustion Engine are key institutions under the Ministry of Machine-building. They are fitted with excellent modern apparatus for research and possess high level technical personnel. They are responsible for key State projects. Local research institutes saftisty projects raised from local agri-machine industry and agriculture. There are also some research institutes with full-time researchers in a few colleges and universities.

Reform of the scientific research system began in the early 80's. Instead of entire subsidization by the State, research institutes have been granted construction funds by local government. They are subsidized if they fulfill State or enterprise projects.

Sources for research funds of agri-machinery are:

a. Technical Development Funds of the Ministry of Machine-building which mainly supports the development of key products and common technology for State agri-machinery industry;

b. Research Funds of the Scientific and Technological Commission in local governments which mainly supports State and local key projects of science and technology;

c. Funds From the State Planning Commission, which supports key State projects;

d. State Funds of Natural Sciences which supports research projects in related fundamental theories and in the fundamentals of applied sciences.

Finance of agri-machinery research institutes comes from commitments assigned by enterprises. Those institutes have expanded the circle of their customers since the reform started. They offer services not only to their own field but also in all fields of national economy, fulfilling research and development commitments. They provide all kinds of services with their own surplus of staff. A self-developing and self-restraining operation mechnaism is being formed.

4. The Prospect of Agricultural Machinery in China

1)Requirements of agricultural mechanization to agri-machinery industry:

In 1991, tractor-cultivated area was 50 million ha, tractor-seeded area 24,667 million ha, and machine-harvested area 11, 667 million ha. Mechanization levels were 57%, 23%, and 10% respectively. Machine- protected crops area was 17,067 million ha and machine-threshed grain was 0. 225 billion tons. 60% of the transportation volume in rural areas is mechanized. Primary processing of grain, cotton and oil seeds is basically mechanized. Now in China approximately 40% of total labour volume in agricultural production is fulfilled by machines [2]. The sum of fixed assets of agri-machinery accounts for about 100 billion RMB, 80% of which belongs to the peasants. It is expected that rural township enterprises will admit 50-60 million people from the rural labour force by the year 2,000. In the meantime, the same number in the labour force will be added to because of population growth. Labour force in agriculture will remain at about 0. 35 billion, i. e. 0. 286 ha cultivated land per each labour force on average.

In China with a large population and not enough land is there any necessity of mechanization for agriculture? The answer is positive, because:

a. With progress of agri-techniques some highly tech-contained operations such as deep tillage, precision planting, spray irrigation, trickle irrigation, extra-low volume mist spraying for crop protection, drying, and combine harvesting are not able to be completed by manual labour but by machines.

b. Agricultural production features seasons. In busy seasons a shortage of labour causes township enterprises production to stop. There is school closing to have land seeded or to have grain harvested in time.

c. The agricutural labour force is distributed unevenly over the country. In provinces such as Guangtong, Fujian, Zhejiang, the average cultivated land per person is merely 0. 04ha, while there is 1. 9ha in Heilongjiang, 1. 15 ha in Xinjiang and 1. 04ha in Inner Mohgolia. Mechanization of agriculture in these areas is obviously necessary.

d. Relative surplus of agricultural labour force is an evidence of low level in development of agricultural production. In the suburbs of big cities such as Beijing, Shanghai and in regions of the east and south coasts of China where rural township enterprises and forestry, animal husbandary, subsidiary occupations and fishery have rapidly developed and absorb much labour force and accumulate much fund

mechanization of agriculture has developed well inspite of a large population and not enough land.

In short, China's agri-machinery industry will develop further and rapidly with the development of economy. It is expected that during 1992-1995 the total power of agri-machinery will grow from 0. 294 billion kw to reach 0. 357 billion kw, tractors will grow from 8. 08 million units to reach 9. 05 million units, grain combines from 40 thousand to 70 thousand units, truck from 610 thousand to 1 million units, irrigation power from 7. 2 million kw to 7. 8 million kw, hay harvesting equipment from 20 thousand to 35 thousand units, breeding equipment and equipment for keeping food fresh from 120 thousand units and sets to 330 thousands units and sets[2,3].

The target for agricultural mechanization in China is not simply to replace labour force, but to stress efficiency, completion of agricultural operations on time, profound opening and comprehensive utilization of resources, raising yields and quality of agri-products and more economic benefits. The concept of agricultural mechanization will be extended from the mechanization of field operations to services for pre-, post-as well as during agricultural production, services for deep expansion of agricultural resources, high yield, excellent quality and expanded processing of agri-products. Mechanization of agriculture should make great contributions to comprehensive development of rural economy in the future.

Mechanization of agriculture in China will be a relatively long process. For a period of time from now, the strategic emphases of developing mechanization of agriculture will be as follows:

a. Put stress on all-sided raising of the level of mechanization in crop growing. The entire process of growing grain, namely, wheat, rice and corn, should be mechanized. Main operations in growing industrial crops such as cotton, hemp, sugar beet, tobacco, and oil-bearing crops should be mechanized. In the struggle against drought and flood the emphasis is to strengthen management, maintainance and reconstruction of existing mechanical and electrical irrigation equipment. According to plans, a number of new types of irrigation equipment or installations can be constructed.

b. Put stress on silviculture and comprehensive utilization of timber in forestry mechanization.

c. Put stress of animal husbandry mechanization on development of prairie and

pastures, hay harvesting, feed processing, epidemic prevention and processing of products in animal husbandry.

d. Put stress of fishery mechanization on the development of breeding, raising the yield and quality of aquatic products, mainly, oxygenation, fishing, refrigeration, transportation, and bait processing.

e. Put stress of industry and subsidiary occupations mechanization on the development of feed, food, construction material industries, construction and other area closely related with appreciation of agri-products and improvement of rural productive and living conditions. Mechanization should make contributions to the development of the market economy in rural area.

2)Problems Faced by Agri-machinery in China at Present.

For many years under the planned economy system the State strictly limited prices of agricultural production means such as agricultural machines, chemical fertilizers, herbicides and pesticides, and supported agricrltural production with low sale prices. The State also provided a series of favored policies to the agri-machinery industry such as a low tax policy(taxation was lower than othr machinery products by 40%), price subsidy policy (subsidy equal to 30%-50% of price upon leaving factory was given to factory), marketing subsidy policy and favored price policy for diesel fuel of agricultural use (cheaper than that in market by 20%). All that promoted development of agricultural mechanization and the agri- machinery industry.

Since the 80's with the transition from planned economy system to a social market economy, system, the State eliminated successively the above mentioned favored policies. The agricultural machinery industry faces some problems:

a. Low prices of products accounts for a low rate between profit and output value, which is unfavorable for the development of agri-machinery enterprises.

b. It is hard for peasants to afford agri-machines on their own. In recent years, peasants have invested 10 billion RMB each year to purchase machines. In the suburbs of some large cities and main production bases of commercial grain, governments provide subsidization. For example, local government subsidizes peasants with 4,000 RMB for each grain combine in Beijing. In Heilongjiang province the government invests in purchasing agri-machines with a rate 1:1:2 (i. e. out of the price of agri-machine, government's subsidy 25%, government's loan 25%, fund of the peasants 50%). In Jilin province the rate is 2 : 3 : 5.

c. Peasants are eager to update varieties and models of agri- machinery, however, enterprises can not manage to adjust the structure of their product series. Under the system of united production and family contract in rural areas, the accounting units have changed from villages to families, which requires more medium and small size agri-machines, transportation means and processing equipments.

3)The Prospect of Agricultural Machinery.

Agriculture in China should take the crop growing as a basis, and simultaneously develop forestry, livestock husbandry, fishery, subsidiary occupations and rural township enterprises to bring about a prosperous rural economy, to transfer the agricultural labour force and open up a wide market. The agri-machinery must fit inot the system of the social market economy, orient itself to the market, and make products, and make products according to the requirements of its customers.

It is necessary to deepen the reform of agri- machinery enterprises in management, transfer the operating mechanism, diversify the accounting unit, build up sub- enterprise management systems, simplify administration, diversify rights, push sub- enterprises (workshops) to market, stimulate the initiative of staff and workers. The rights to operate production, determine product prices, market products, purchase materials, distribute profits and wages, manage the labour force should be granted to sub-enterprises which contract with the major enterprise on sum of profit handed in. It is beneficial for enterprises to form an association with specialization and coordination, and to obtain the benefit of operation with large production programs. It is also necessary to introduce qualified personnel and updated technology to raise the quality and capability of enterprises in market competition.

Agri-machinery enterprises ought to widen their circle of operation, expand their variety of their products, optimize the structure of their product series, provide rural area and township enterprises with power and machinery, as well as provide industry and communication with relevant equipment. Products should be good in quality, low in cost, and cover a wide range of varieties.

According to Prediction of Construction Machinery and Agricultural Macninery Bureau, by 1995 the output value of agri-machinery industry in China will reach 42 billion RMB[4]. The yearly output of tractors of large and medium capacities will be 100 thousand units, mini-tractors-1. 1 million units, internal combustion engines-

51.47 million kw, combine harvesters-10 thousand units, large and medium tractor-operated tillage machines-160 thousands units, trucks of agricultural use (load capacity less than 1.5 ton and operation speed less than 50 km/hr)-150 thousand units, equipment for livestock husbandry-500 thousand sets, equipment for process subsidiary products of agriculture-100 thousand sets, aquatic breeding, fishing eguipment and equipment for keeping food fresh, processing equipment-220thousand sets, and spare parts of tractors and engines 5.5 billion RMB[3].

Planned new products to be developed comprise the following:

a. whole sets of equipment for grain crop production and technique;

b. whole sets of equipment for seed processing and technique;

c. whole sets of equipment for line production in agriculture and live stock husbandry and technique;

d. whole sets of equipment for hay (feed) production and processing and technique;

e. energy-saving and water-saving type irrigation equipment and technique;

f. whole sets of equipment for processing agricultural products and subsidiary agricultural products and technique;

g. energy-saving style internal combustion engines and a whole sets of equipment for development and utilization of reproductive energy sources and technique.

The needed new products to be urgently developed in the near future are:

Paddy tractor of capacity 18.4-29.4kw, energy-saving, material-saving, high-speed, small-type one cylider diesel engine; rice combine of 22-44kw; corn combine with strippers; sugar beet planter and harvester; power-operated high-speed rice transplanter; Planter for sprouted rice seeds; precision planter with laying plastic films; seeding and deep-side-fertilizing combine; Pond mud excavator; general use excavator; cotton stripper; Entire set of equipment for small seed processing; medium and small capacity low head axial-flow pump; large and medium capacity electric diving pump; entire sets of equipment for processing composite feed of 50,000ton; grass seed harvester and thresher; stalk handling machine, hay baler; animal protein extractor; poultry manure handling machine; whole set of equipment for cotton seed deep processing; multi-use agricultural truck; medium-type wind driven generator; whole sets of equipment for line production of vegetables; excavator for lotus roots etc.

International cooperation is important for the development of China agricultural machinery industry. In the 50's when the industry started, China was supported by the former Soviet Union and the countries of East Europe. In the last over ten years, China has built up economic cooperative relations with some international organizations and more than 100 nations. To introduce advanced and adaptive technology and equipment is one of the directions in international cooperation of China agricultural machinery industry. Since 1978, 99 kinds of products and techniques have been successively introduced with regard to tractor, internal combustion engines, combines, pumps, tea processing equipment, feed processing equipment, machines for crop protection, wind driven generator etc. They are from developed countries such as Germany, United States, Italy, Japan and others. China has a large market and a rich resource of labour force. Doing import and export business or investing in China would be very beneficial and prosperous, especially in China's growing agricultural machinery buisiness.

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Table 1 Statistics of China's Agricultural Mechanization in 1980 and 1991

	1980	1991	annual increase(%)
Total power of agri-machinery(thousand kw)	147,360	294,180	6.4
Preservation of tractors(thousand units)	2,620	8,080	10.8
Tractors of large & medium capacity(thousand units)	745	784	0.46
Tractors of small capacity(thousand units)	1,874	7,302	13.16
Preservation of irrigation machines(thousand units)	5,630	8,930	4.28
Preservation of harvesting combines(units)	27,045	43,549	4.42
Tractor cultivated area(thousand ha)	42,090	50,170	1.61
Tractor planted area(thousand ha)	15,552	24,629	4.27
Combined harvested area(thousand ha)	4,355	11,639	9.35
Machine irrigated area(thousand ha)	25,315	27,149*	0.7
Machine protected area for crops(thousand ha)	11,948**	17,067	4.0

*-1990, **-1982

Table 2 Enterprises of Agri-machinery Industry in China(1990)

NO.	Field	Number of enterprises	Number of staffs and workers (1000 persons)	Percentage in total output value of agri-machinery industry(%)
1	Tractors of large and medium capacities	13	193	9.9
2	Tractors of small capacity	92	107	14.0
3	Internal combustion engines	135	217	20.2
4	Tractor-operated tillage machines	84	40	2.5
5	Tractor-operated equipment for crop protection	84	40	2.5
6	Harvesting machines	33	21	9.7
7	Machines for threshing field	79	20	1.0
8	Processing machines of agricultural products & byproducts	145	37	2.0
9	Transporting machines of agricultural use	201	82	9.5
10	Irrigation machines	184	69	5.3
11	Equipment for livestock husbandry	54	19	1.1
12	Samll implements	238	60	3.3
13	Spare parts of tractors and internal combustion engines	679	343	20.4
	Sum	2513	1269	100

Table 3 Output of Main Products in Agri-machinery Industry

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Tractor(unit)	97,162	49,584	40,208	36,794	39,325	44,962	32,609	44,162	56,123	45,424	42,167
Small capacity tractors(unit)	217,890	198,902	298,300	497,700	688,637	795,430	754,373	1,066,967	1,292,842	1,077,582	1,067,949
Internal combustion engines (thousand KW)	18,674	14,739	16,887	21,322	29,957	39,915	35,252	34,760	48,365	48,282	44,553.7
Tractor-operated implements (thousand units)	123	96	82	72	90	50	43		61		57
Tractor-operated seeders and planters (unit)	34,592	15,227	9,600	7,190	12,803	35,659	9,230	13,784	20,734	11,305	19,011
Harvesting combines(unit)	5,979	6,005	4,630	1,953	1,999	1,603	2,030	2,961	4,432	4,207	5,082
Tractor operated threshers(thousand units)	194	257	261	399	434	210	202	175	192		
Wagons of agricultural use (thousand units)	73	40	41	53	90	110	112	151	96	74	63