

# Agricultural Mechanization Promotion in China—Current Situation and Future

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China is a big agricultural country. The agriculture in China achieved marvelous success after 20 years of reformation and opening to the outside world. With 8% of the world farmland, China has succeeded in sustaining 23% of the world population. The total output of main agro-products jumped to the first place in the world, the relations of supply and demand for main agro-products changed from long-term shortage to basic balance and has surplus in good harvest years. Along with the rapid growth of national economy, the agricultural mechanization in China entered the fast development orbit and has become an important component of the world agricultural mechanization development. Nevertheless the agricultural mechanization in China, which still in the elementary stage with great market and developing potential, will provide the rare opportunity for world agricultural mechanization development.

## **1. Background**

The agricultural mechanization cause in China started from the beginning of 50s' of last century with running state-owned mechanization farms and tractors stations. Over 50 years, Chinese government has been taken the mechanization of agricultural production as one of its vital strategic targets for building modernized agriculture. After endless exploring and developing, we now formed a more appropriate way out for the development of agricultural mechanization in China. Reviewing the development history of agricultural mechanization in China, it can roughly be divided into three phases, administrative promotion phase, system

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reform and market-oriented phase, and internationalized phase.

### 1) Administrative Promotion Phase (1949 –1980)

Under the high concentration of planned economy system, agriculture developed in the collective operation mode of the people's communes. Being the important means of agricultural production, agricultural machinery were invested, owned and managed by the state and collectivity. The plan for agricultural machinery manufacturing was worked out by the government, products were allocated in the centralized way, and the prices for agro-machinery and agricultural mechanization service charge were all fixed by the government. Central government set up more than 2100 organizations for agro-machinery development and extension at the provincial, municipal and county levels by way of administrative orders and various preferential policies to push forward the development of the large-medium sized agro-machineries that suited for people's communes. While in the same time the animal-draft machines coexisted.

### 2) System Reform and Market Oriented Phase (1980 – 2000)

Chinese government endowed the right of use and management of the farmland to the farmers in 1978. The overall implementation of the system of household contract responsibility with remuneration linked with output was adopted in 1980 and agriculture entered into the stage of small-scale family farms as the main mode. The control and management of our government for agro-machinery industry loosened gradually and farmers were allowed to purchase and use agricultural machines on their own will, so the small-scale agricultural machinery, such as small-sized tractors, low-speed rural transport vehicles for farmers developed rapidly.

Under the guidance of concerned regulations and laws of our government, the main bodies of investment fundamentally changed. At the beginning of this century, the investment resources for agricultural machinery were national financial oriented investment that took 2.0%, collective farm organizations taking 1.9%, and rural families covering 96.1%. Farmers were the main investment bodies while contract household and rural enterprises coexisted. The process of marketing for agricultural mechanization speeded up and the agricultural machinery operation services of plough and harvest agents appeared, while at the same time the possessing capacity and grain production mechanization level fast increased.

### 3) Internationalized Phase (2000 – Present)

After China entered WTO, the opening of domestic agro-products market and the increasing of international trade of agro-products made plantation, animal husbandry, and fishery production

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develop from simply seeking for the quantity to the direction of standardization and high quality. Our government constituted the agricultural production development strategy of food security, food safety and ecology safety. Based on the regulations of WTO, our government provided the subsidies for agricultural machinery purchasing and implemented supporting policies for promoting the extension of new tech on agricultural mechanization so as to put forward the sustainable development of grain processing mechanization and the start of mechanization on forage production, livestock raising, seed processing, vegetable and fruit and horticultural machinery; the agricultural service industry included seed, fertilizer, pesticide supplying and agricultural machinery operation services progressively formed. Among it, there are 270 thousand service organizations engaged in professional agricultural machinery operation. The establishment of domestic capital market, the policy of multi-investment bodies and the opening policy accelerated the fast development of the corporations at the stock market, private enterprise, the sole investment and joint-ventures of agricultural machinery manufacturing.

Figures 1- 4 reflect the basic history of agricultural mechanization in China, portrays the great changes in the last 30 years.

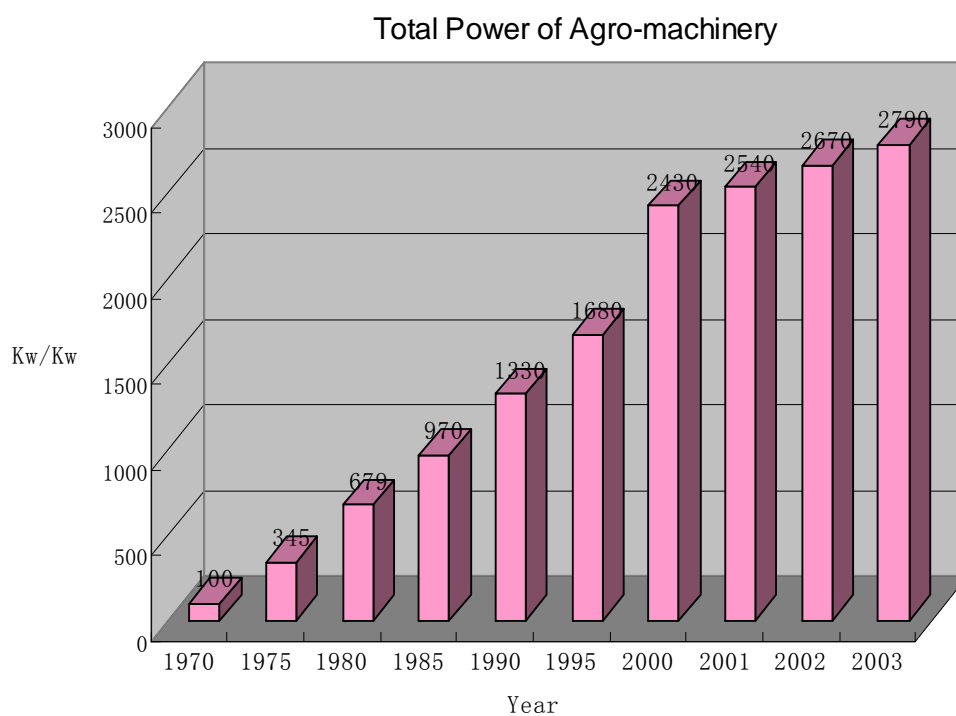


Figure 1. Relative Change of Process Quantity of Total Power of Agro-machinery in China from 1970 – 2003 (Year of 1970=100)

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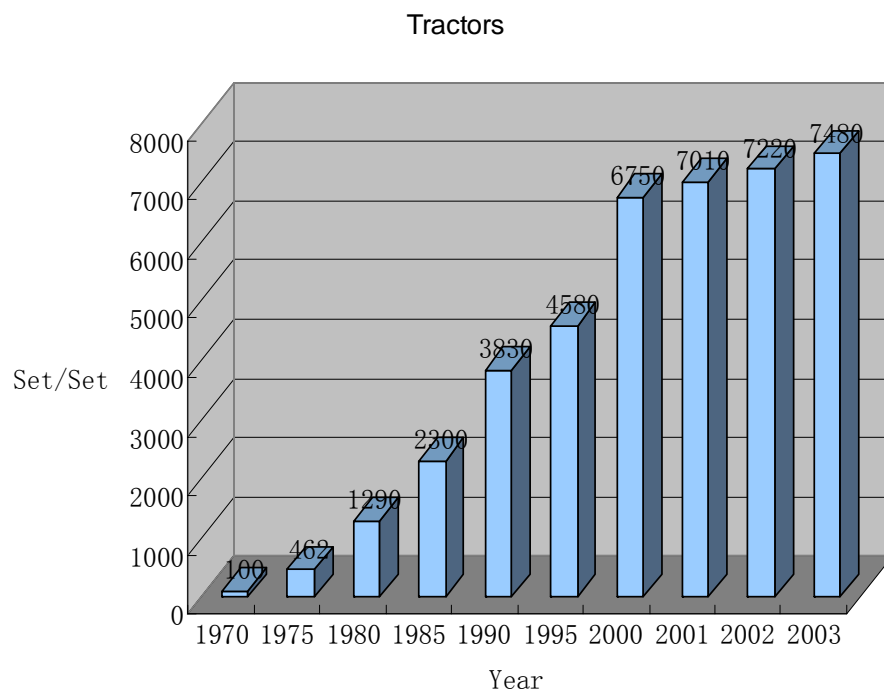


Figure 2. Relative Change of Process Quantity of Tractors in China from 1970 – 2003 (Year of 1970=100)

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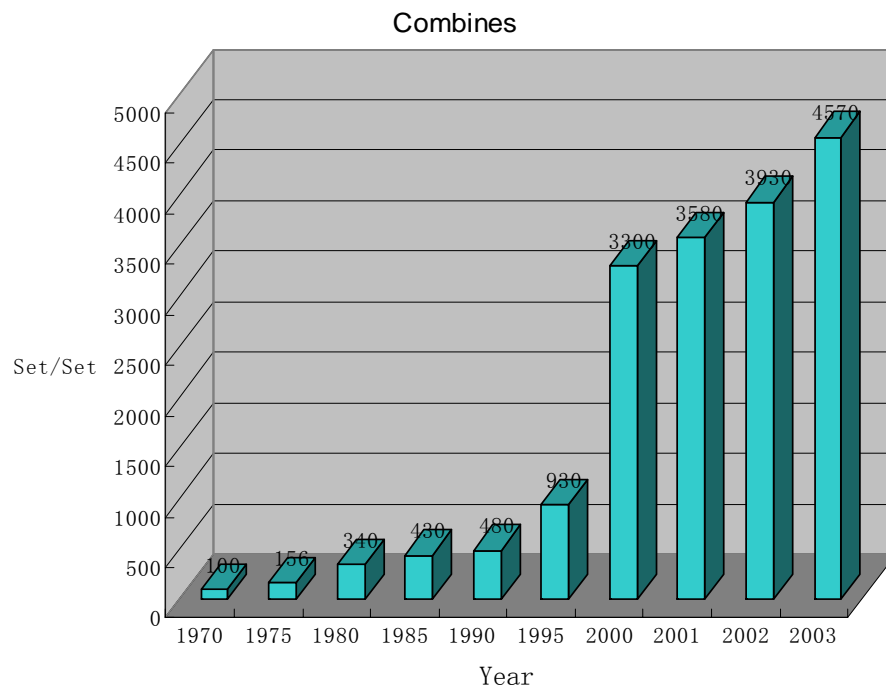


Figure 3. Relative Change of Process Quantity of Combines in China from 1970 – 2003 (Year of 1970=100)

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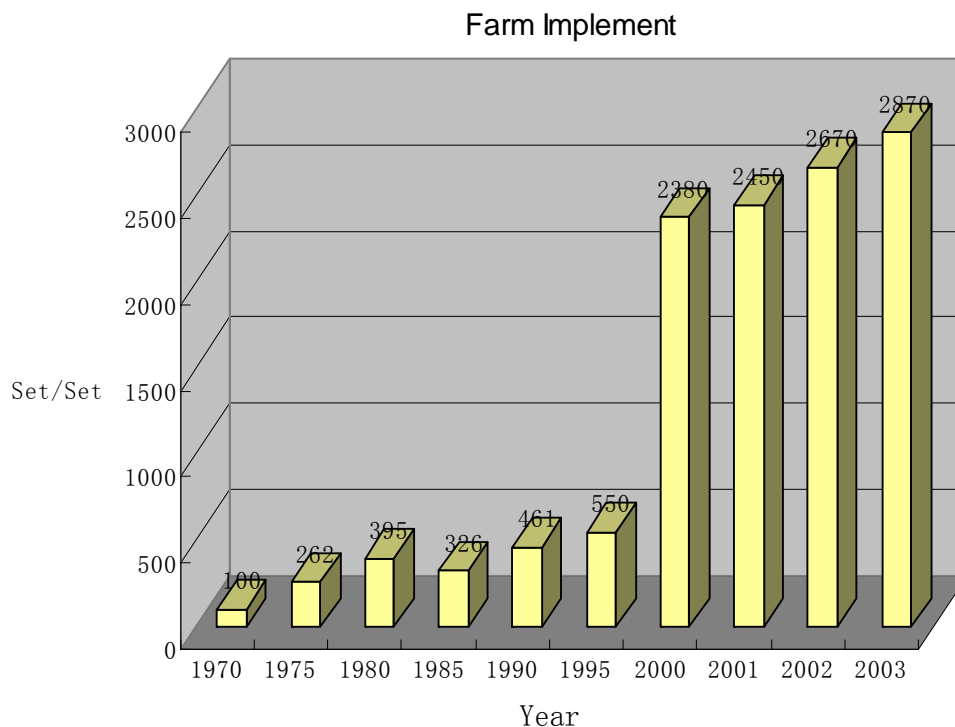


Figure 4. Relative Change of Process Quantity of Farm Implement in China from 1970 – 2003 (Year of 1970=100)

Compared with 1970, the total power of agro-machinery increased by 26.9 times, tractors increased by 73.8 times, combines increased by 44.7 times and farm implements increased by 27.7 times.

## 2. The Present Situation of Agricultural Mechanization Development in China

After unremitting efforts of over 50 years, China primarily established the agricultural mechanization R & D system with the combination of scientific research units; colleges and universities and enterprises; the agricultural machinery industry system of industrialized production and multi-investments; the demonstration and trans-regional operation service system with the combination of manufacturing enterprises and agricultural machinery extension offices; the objects of agricultural machinery products service cover agriculture, forestry, animal husbandry, fishery and agro-product processing industry; the mechanization levels of tractor plowing, seeding and harvesting respectively reached 47%, 27% and 20%. Field operation for wheat basically realized mechanization. The imports and exports of agro-machinery products are continuously going up.

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## 1) The Development of Agricultural Machinery Technology

### 1)1. The Technologies of Agro-products Safe Production and Agricultural Sustainable Development

In recent dozens years, we developed research work on the key technology that focused on major links of grain crops production mechanization and achieved great progress. The area of new technology application in mechanization covering mechanical film covering; deep tillage; precision seeding; straw chopping and returning to field; water, fertilizer and pesticide precision spraying rapidly enlarged and wheat basically realized mechanization production. In whole process mechanization of rice production, the technologies of industrialized rice raise seedling, high-speed transplanting and head-feed combines are gradually extended; the technologies of corn combine harvesting, cost-saving and high efficiency of dry land farming are at the stage of demonstration and extension.

Dry-land farming area takes 52% of the cultivated land in China. Moldboard plowing for years caused serious soil erosion; it is also the main reason for dust storms in recent years. So our government paid much more attention to the R & D for technology and equipment of agricultural environmental protection. A key Laboratory of conservation tillage technology was established in China mainly does the research work on soil corrosion and erosion, migrating mechanism under the normal farming system as well as the control measures. Farming and Planting Branch Center of National Technology Research Center of Agricultural Machinery Engineering established, focused its research work on seeding and fertilizing under the condition of lowing soil moving and tillage and with crop straws covering. It developed the technologies of crop straw returned to field in dry-land areas, wheat subsoil seeding and fertilizing, corn subsoil seeding and fertilizing, grassland subsurface tillage, forage and the related operation tools.

China is a country with abundant varieties of agro-products. The harvesting technology for some products is full of challenging apart from the one for some cereal. We concentrated the main energy on the two directions when doing harvesting technology research in recent years. First of all, solve the harvesting technology that not yet being done for industrial crops with comparative advantages in the world. We accomplished R & D for cotton-picker, potato combine, rapeseed combine, sugarcane combine, tomato harvesting, Grape harvesting for wine, oil seed and bulbs harvesting and it is in the stage of manufacturing and testing. Secondly, we did the research on early stage technology mechanism for special variety of fruit and vegetable harvesting and installed the testing devices. The agro-products that came into our consideration are tomato, grape for wine, oil seed and bulbs.

For the purpose of upgrading the agro-products quality and raising the comprehensive benefits of agriculture, in the field of technology for safe production of agro-products, for resources

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saving and effectively controlling the negative effect to the crops quality caused by improper use of fertilizer, pesticide and water, on the present foundation, CAAMS researched and developed the technology and equipment of variable rate treatment of seed, fertilizer, pesticide and irrigation water based on 3S system. In demonstration farm, we used the combine equipped with measuring (weight of grain and water) devices, the variable-volume grain seeder and fertilizing machine that operates according to the comprehensive prescription of water content rate in the soil, soil fertility and field output data, the variable-volume pesticide sprayer and large-scale linear irrigation system that operates according to low altitude remote sensing index and the prescription of agricultural expert system. CAAMS also developed R & D of detecting technology and equipment for grain outside and inside quality with near infrared, provided technological support for quality control of the whole process grain production as well as during the period of storage and transportation.

### 1)2 The Technologies of High Utilization of Water Resources and Protected Agriculture

China is one of the countries that lacks of water resources. Water resource per capita is only 2300m<sup>3</sup>, roughly taking 25% of the world per capita. The total water use in agriculture irrigation in China is 350 billion m<sup>3</sup>, taking 67% of the water in whole China. The annual average water shortage for agriculture irrigation is more than 30 billion m<sup>3</sup>, plus the fast development of protected agriculture of vegetable and orchard that need more water, water shortage has become main factor that restrained agricultural development and long stable growth of food production in particular. Realizing the high efficiency utilization of agriculture irrigation water is a long and hard strategic task of our country.

The area that controlled by mechanical water-saving irrigation reached 83 million ha. in grain, fruit, vegetable and cotton production, use the main market products of center-pivot irrigation system, large-scale linear irrigation sprinklers, small-scale movable irrigation system that we developed in the mid of 1980's. In late 1990's, we successfully developed combined operating technology of cotton planting, film covering drip irrigation system installed under film in Xinjiang cotton area, we successfully developed the technology of long distance sprinkler and variable-volume sprinkler. Now the technologies and equipment system of sprinkler for grain production, micro-sprinkler and dripping for fruit and vegetable production and dripping for cotton production have been formed.

Protected agriculture is an important measure for agro-product processing with "high efficiency, good quality and high yield" and realizing balanced and safe production. The planting area of protected agriculture in China is 2,067 million hm<sup>2</sup>, listed the first place in the world. Since 1998, Water-saving Irrigation Engineering Technology Center has been monitoring the organisms' behavior and physiology of plants and made the systematic research with the technology of nutrition adjusting at proper time, developed the sensors to monitor the

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stem flow, evaporation of leaves and growing of fruit; at present, it developed greenhouse mass control irrigation system with the combination of the requirement of reasonable use of water, fertilizer and pesticide of agricultural expert system. From the year of 2000, it researched on the technology of desalination of sea-water (bitter and salty water) with solar energy, developed relevant soil-less cultivation irrigation system and built vegetable demonstration production base.

### 1)3 The Technologies of Livestock Mechanical Raising and Forage Production

For a quite long time, the livestock raising in China focused on pig, egg chicken and meat chicken. By way of adjusting the structure of animal husbandry production in recent years, the scale of meat cattle, cow and sheep raising in pen has been enlarged, standardized feeding developed rapidly, that greatly stimulated the demand from feed production industry and forage planting industry for the related equipment and technology. We made a series of technological research and the products development: developed and manufactured grass non-tillage fertilizing seeder, forage baler; silage corn combine; forage and grass seeds of legume harvesting and processing equipment, and storage equipment; the application technology and equipment of crop straw fodder; TMR Mixer/feeder for meat and dairy cattle; technology of individual cattle recognizing and milk yield accounting, technology and equipment of multi-position milk collecting, milk yield of individual cow and automatic feeding and controlling.

Intensive Livestock raising needs more strict standard for disease control technology and equipment. In recent two years, CAAMS emphasized on researching the technology of cooked fodder and developed feed extruder so as to raise the hygiene standard in feed production: researching on the technology of individual animal water and feed supply and successfully developed inlay touch drinker and fast simultaneous feeding system so as to control the infection rate between animals while drinking and eating.

### 1)4 The Technology of Agro-products Processing

For a long time, Chinese government has attached great importance to rely on science and technology progress to accelerate the development of agro-product processing industry. Technology research and development for agro-product processing was identified as the important content in our National Development Program for Main Agro-product Processing Industry and Food Industry. Science and technology investment has been continuously increasing and brought active results.

First we mainly developed the complete technologies and equipments of small-scale oil pressers, rice grinding machine, fodder and carbonated beverage. We solved the problem of basic living demands.

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Secondly we mainly developed the complete technologies and medium sized equipments for refinery oil, grade rice, flour processing, formulated fodder, poultry slaughtering, meat processing, beer and fruit juice beverage. We solved the problem of the preliminary processing.

In the middle and late of 90s' , the research and industrialized demonstration focused on the key technologies of agro-products further processing and equipment, food safety and milk industry speeded up the steps of agro-product processing field to link up with the world, realized the transition from the elementary processing to precise and further processing with reasonable utilization of the resources. Technologies of vacuum freeze drying, microwave sterilization, membrane separation, supercritical extraction, micro-capsule, super-fine grinding have been applied gradually, in particular, the application and extension of new hi-tech of biological technology, information technology, flexible and green manufacturing technology laid a solid technological foundation for technology and equipment renewal of agro-product processing in our country and upgrading the overall level of the industrialization in China.

#### 1)5 Digital Agriculture Technology

We now emphasis on researching on the technology and equipment for the fast information gathering of water content, nutrition content, crop growing, yield, quality and plant diseases, insect pests and wild grass in the fields, build up the system of agriculture digital accounting; develop technology and equipment for precise production with quantum adjusting operation and online measurement, set up the precise agriculture production technological system with quantum decision, precise fixing and quantum adjusting operation; research and develop biological information of plant production, environmental information and intelligent control system, build digital information platform for plant production.

For the purpose of upgrading the agro-product quality and saving resources, we researched and developed the technology and equipment of variable rate treatment of seed, fertilizer, pesticide and irrigation water based on 3S system; the combine yield mapping system; detecting technology and equipment for grain quality with near infrared.

#### 2) The Present Situation of Agricultural Machinery Industry

##### 2)1 The Service Object of Agricultural Machinery Covers the Whole Agricultural Field.

The service object of agricultural machinery includes agriculture, forestry, animal husbandry, sideline production and fishery. Owing to the vast territory in China, the natural condition and economic situation is varies among different regions, the categories of agricultural machinery are also complicated with many types. At present, Chinese enterprises can manufacture 3,000 kinds of agricultural machinery under 95-small-type and 14-big-category. The output of main

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agricultural machinery in China in 2003 and in the first half of 2004 is as following (see Table 1).

Table 1: The Output of Main Agro-machinery Products

Product Name	Unit	The output in 2003	The output in the half of 2004
Big-mid-size tractor	set	48,544	48,822
Small-size tractor	set	1,864,540	867,878
Engine	10,000Kw	33,010.50	21,695.70
Harvesting machinery	set	193,265	119,091
Field operating machinery	set	137,955	63,162
Farm transportation machinery	set	2,581,952	1,117,246
Grain processing machinery	set	664,645	378,184
Feed processing machinery	set	130,873	60,736
Tobacco processing machinery	set	4,534	3,291
Cotton processing machinery	set	12,746	10,231
Pump	set	22,638,779	12,681,069

## 2)2 Multi-Investment Bodies and private Enterprises Have Grown up Rapidly

There are about 8,000 agricultural machinery manufacturers in China, which is a bigger one in machinery industry. According to the statistics in 2003 by National Bureau of Statistics of P.R. China, there were 1,469 scale enterprises with the annual sale income of over 5 million RMB Yuan, excluding the enterprises of farm diesel engine and irrigation and drainage machinery, there were only 4 enterprises with the annual sale income of over 2 billion RMB Yuan. There were 181 tractor manufacturers with the annual sale income of over 5 million RMB Yuan, the total sales was 16.4 billion RMB Yuan, the average sale income was 90 million RMB Yuan for each one.

Before the reform and opening up in China, the agricultural machinery manufacturers were all state-owned and collective-owned, with the stress on the former. However, along with the reform and opening up in China, the nongovernmental enterprises have developed rapidly and become a very important part in Chinese agricultural machinery industry. According to the statistics in 2003 by National Bureau of Statistics of P.R. China, there were 920 private enterprises among 1,469 scale enterprises with the annual sale income of over 5 million RMB Yuan, covering 62.6% of the total, its assets 43.6% and sale income 63%. The number, assets and sale income of state-owned or state-owned holding enterprises, private enterprises and joint ventures, cooperative business and exclusively foreign-owned enterprises in China are as

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following (see Table 2).

Table 2: The Structure of Agro-machinery Industry Enterprises and Their Products Sales

Enterprise type	Number	The total assets		Sale income	
		Assets value (100 million Yuan)	Ratio (%)	Income value (100 million Yuan)	Ratio(%)
Scale enterprises	1469	659	100	695.9	100
State-owned or state-owned holding enterprises	481	328.3	49.8	218.6	31.4
private enterprises	918	287.4	43.6	438.6	63
Joint venture, cooperative business and exclusively foreign-owned enterprises	70	43.3	6.6	38.7	5.6

### 2)3 The International Trade for Agricultural Machinery is Increasing

Due to the practicality and lower price, the exports for Chinese agricultural machinery have risen rapidly in recent years. According to the statistics of Chinese customs, the main exported agricultural machinery, including diesel engine and irrigation and drainage machinery, were mid-small-power diesel engine, farm irrigation and drainage machinery, tractor and spare parts in the past three years. Meanwhile the imports of agricultural machinery have also increased greatly on account of the adjustment of agricultural structure in China. The main imported agricultural machinery include diesel engine, big-horsepower tractor, cotton picker, grass machinery, agricultural products processing machinery and so on (see Table 3).

Table 3: The Import and Export of Agro-machinery

Year	Exports value ( 100 million USD )	Imports value ( 100 million USD )
2002	15.21	19.55
2003	21.31	42.19
The half of 2004	14.92	32.34

Exports increased by 28.6% and imports increased by 53.7%.

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## 2)4 Agricultural Machinery Industries Entered Into High Developing Phase

The agricultural machinery industry in China has stably grown in recent years, because the economy develops rapidly, the central government pays great attention to the development of agricultural machinery industry and agricultural mechanization, the rural labor forces move into industry production. Since 2003, the increase rate for the total output value of industry and sale income have both been over 20%. The economic benefit has also risen year after year, the increase rate reached 61.7% in 2003. The situation of production, sale and profit for the scale enterprises, excluding the enterprises of farm diesel engine and irrigation and drainage machinery, in 2002, 2003 and in the half of 2004 are as following (see Table 4).

Table 4: The Situation of Production, Sale and Profit for the Scale Enterprises of Agriculture Machinery

Year	The total output value of industry		Sale income		The total profit	
	Output value (100 million Yuan)	Increase rate ( % )	Income value (100 million Yuan)	Increase rate ( % )	Total amount (100 million Yuan)	Increase rate ( % )
2002	634.8	18	551.8	16	9.9	53
2003	753.4	22	695.9	26	16.3	61.7
The first half of 2004	437.4	20	400.8	22	11.1	21.4

## 3) Present Situation of Agricultural Mechanization

### 3)1 The Total Amount of Agricultural Machinery Is Smoothly Increasing

The total power of agricultural machinery reached 0.61 billion kW. in 2003, increased by 5% of the previous year. The annual power increasing rate smoothly keeps at the level of 20 million kW. For each 1000 ha. cultivated land, there are 312 kW agricultural mechanical power, 11 tractors; tractor power is 85 kW, 148 farm vehicles and 165 farm tools. The value of agricultural machinery all over China was about USD 43 billion, the average value of agricultural machinery per rural family takes 1/3 of rural family's fixed property for production. The popularized rate of tractors for farmers is 6.1% and that of farm vehicles is 8.3%.

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Deducting non-agriculture farmers in the countryside, the popularized rates respectively reached 7.8% and 10.6%, surpassed the products oriented phase and entered fast developing growth phase.

### 3)2 The Field Operation by Machines Is Raising Gradually

In 2003, mechanical plowing/harrowing, mechanical seeding and mechanical harvesting only took 47.2%, 27.2% and 18.5% of the total mechanical operation volume. Among them, the level of wheat mechanical seeding and harvesting respectively reached to 73% and 70%, generally realized farm mechanization: Level of maize mechanical seeding and harvesting respectively reached to 47% and 1.7%: Level of rice mechanical transplanting and harvesting respectively reached to 6% and 20%. Along with the development of cereal production mechanization, the extension and application of newly introduced agricultural mechanization speeded up. The farm area of mechanical water-saving irrigation accounted for 12.8% of the irrigation-controlled area; the area for corps straw returned to field took 7% of the seeding area. The area of forage mechanical seeding and harvesting started from blank but now respectively reached to 720000 ha. and 16 million tons. The crops of cotton, sugarcane, rapeseed, potato all entered mechanical operation extension period.

### 3)3 Remarkable Result of Agricultural Machinery Socialization Services (Field Operation Service System)

For many years, innovations for the forms of agricultural machinery service appeared continuously from a farmer offered operation services with his machine, several rural families' joint operations, and groups contracting service to trans-regional operation. All kinds of agricultural mechanical operation service organizations and service families in whole China were 29.67million with 35.54 million employees. Among them, agricultural mechanical service families were 29.4 million, took 12% of the total number of rural families. The number of those who specialized in agricultural machinery operation service was 3.3 million, took about 11% of the total number of agricultural mechanical service families. Agricultural mechanical service families and agricultural production business organizations became the main parts of agricultural machinery socialization service. Especially the service model of combine trans-regional operation for wheat harvesting started in 1996 accelerated the marketing process of agricultural machinery service, specialization and socialization. The number of combines involved in trans-regional operation in 2003 reached to 200000 sets, finished 18.6 million hm<sup>22</sup> wheat harvesting area;. The efficiency of trans-regional operation of agricultural machinery greatly raised and the result of cost-saving and income growing for the grain planting families was obvious, that solved the contradictory between family scale business with mechanical operation, thus well accepted by the farmers.

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At present, trans-regional machinery harvesting developed from wheat to the main crops of rice, corn, soybean and potato. Agricultural machinery operation scope extended from harvesting to pre-harvesting, post-harvesting, extended fields from planting to animal husbandry and agro-product processing industry.

### 3)4 The Organization and Policy Supporting System for Agricultural Mechanization Development

- The Organization System of Agricultural Mechanization

Experienced many years of reformation and development, China gradually formed a fairly complete and perfect supporting system for the development of agricultural mechanization of agricultural machinery management, scientific research, identification, authentication, technology extension, education and training, safety supervision and managing, repairing, social service and etc. There are 31 agricultural mechanization management organizations at provincial level, 346 at regional level, 2745 at county level and 34317 at town level across the country. There are 49 agricultural machinery test and appraise organizations at regional and city level, 122 agricultural machinery research institutes. 2413 agricultural machinery technology extension organizations at county level, 2900 safety supervision and managing organizations for agricultural machinery, 2213 agricultural machinery education and training organizations. The administrative regions above county level in China all set up the organizations of agricultural machinery management, technology extension and supervision, more than 260000 employees engaged in agricultural machinery management, extension, identification and supervision, of which the scientific and technological staff takes 50%.

- Supporting Policy for Agricultural Mechanization Development

In recent years, government at each and different levels formulated a series of policies and measures to support agricultural mechanization development. First, it provides subsidy to the farmers who purchased new agricultural machine. From 1998, financial department of Center Government in China allocated a special funding to subsidy the agriculture for heavy occurrence of plant diseases and insect pests, agricultural environmental protection machinery and new agricultural machinery. The formulation on “Laws of Agricultural Mechanization Promoting” started in 2004, placed supporting for agricultural mechanization development into the orbit of legal system. Starting from 1990, financial departments at each rank provided 20% -- 40% subsidy based on purchasing prices to the new machinery for local advantage crop production, environmental protection and anti-disaster agricultural machinery. Secondly, it provides financial support for agricultural machinery R & D work. Since 1998, each five-year

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program of our country all established special projects for the important scientific research in agricultural mechanization, supported the developing work on fundamental products with social benefits. Thirdly, it provides special funding support for important new technology modeling and extension projects in agricultural mechanization. Such as straw mechanization and returned to field, grain drying in growing area, conservation tillage, mechanical water-saving and construction of commercial grain base, agricultural machinery investment in construction of agro-products base and etc. Fourthly, adopting the policy of favorite value-added tax rate with 13% to the agricultural machinery manufacturers (the other trade is 17%). It provides convenience and favorite support for trans-regional operation of agricultural machinery in the respects of passing roads and bridges. Especially in recent 5 years, nearly half of the provincial (regional and municipal) governments worked out resolutions or decisions on accelerating the agricultural mechanization development, created better developing surroundings for agricultural mechanization development, played an important role in speeding up the development.

### **3. The Future of Agricultural Mechanization Development in China**

In quite a long period of coming days, the agriculture in China will still be at the transition phase from traditional agriculture to modern agriculture. The co-existence of small-scale household farm and the large modern farms with concentrated operation will be the necessity option of the future agriculture operation in China. At the era of economy globalization, the development of agricultural mechanization in China will take the international comparative advantages to promote actively the technology of production mechanization of industrial crops and fruit, vegetable and horticulture meanwhile continuous improving the technology of modernization equipment for grain production; during developing the mechanization technology for harvesting, we'll extend the technologies for prior and post-harvesting, make efforts to forward the technology that is in keeping with agriculture sustainable development and agro-products value-added processing; lay emphasis on R & D for traceability of mechanization technology in every field of agriculture, actively adopt the modern electronics technology and information technology.

1. Mechanization during the whole production process of the main grains that guarantees food safety will develop to rice and corn whole production process after basically realizing mechanization for wheat during the whole production process. At the same time, the mechanization level for seeds breeding will be greatly upgraded. We'll apply the high-tech. achievements of electronic information to develop the machinery with large-medium size, high speed and easy operation. Raise the technical characteristics and reliability of the machinery operation by way of traceability control and diagnosis to the breakdown so as to realize high efficiency, high quality and low cost of machinery operation.
2. Accelerate the strategic adjustment to the agriculture and rural economy structure, the

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technology of agricultural mechanization for increasing farmers' income will be rapidly developed. Take the advantages of market competition of industrial crops to quicken up the develop of animal husbandry, made great efforts on developing agro-products processing industry, adjust the patterns of agriculture, widen the space for farmers employment are the top tasks of agricultural structure adjustment and raising farmers' income at the new stage in China. The production mechanization for superiority industrial crops and the technologies of storage and processing will be developed rapidly, such as the mechanization technology of oil-bearing crop (soybean, rape and peanut), cotton, potato and tomato. The complete technology of animal husbandry intensive raising, high new-tech and equipment of agro-products further processing will be the focus fields that need to be opened up in the development of agricultural mechanization.

3. The technology of improving agricultural ecological environment and realizing sustainable development becomes the highlight fields of the development of agricultural mechanization. The technologies of high efficiency utilization of agricultural resources, mechanization technology of protected agricultural engineering, mechanization technology of grasslands ecology and animal husbandry engineering, mechanization technology of comprehensive prevention and control to the biological calamity, the agricultural aviation technology and the technology of traceability for food production will have fairly good market.

In order to adapt to the development of economic globalization, the technical levels of agricultural machinery products will be raised continuously. At present, the production capacity for small-scale agricultural machinery is comparatively surplus in agro-machinery manufacture industry in China and the market competition is fierce. The production capacity for medium and large sized products is obviously insufficient. Quite numbers of the agricultural machinery from the world famous enterprises entered into the Chinese market. Their coming greatly pushed the technological progress in this industry. General technologies of modern designing method of agricultural machinery, reliability design technology, testing technology, advanced manufacturing technology and fundamental parts, modern hydraulic technology, instrument and control technology, modern microelectronic technology and information technology will be successively applied.

China is a big agriculture producer with over 0.2 billion rural families. The population in China takes 1/5 of the world population, but regarding to the natural resources, water resources per capita in China only takes 1/4 of the world average level, while farmland per capita is only 1/3 of the world average level , the area of grasslands per capita is 1/2 of the world average level, agricultural production needs the advanced agricultural mechanization technologies and products.

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