

## Development of Agricultural Mechanization in China and Its Current Strategic Focus

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**Abstract.** China's agricultural machinery development has gone through five stages in its 100-year history: Germination stage of agricultural machinery development (1917-1949), Construction Stage of Modern Agricultural Machinery Industry System in China (1949-1979), System transformation Stage (1980-1995), Market-oriented stage (1996-2003), Rapid development stage (2004-2014). After the 12th Five-Year Plan, China's 13th Five-Year Plan has been going on for three years. Significant Achievements in Agricultural Mechanization has also made in recent 10 years. Although Agricultural Mechanization in China has made considerable progress, there are still great gaps in agricultural mechanization level compared with developed countries. In order to further narrow the gap between China's agricultural mechanization and developed countries, enhance the scientific and technological innovation ability of agricultural machinery, strategic focus of agricultural mechanization have been presented in China. The development strategy of "three steps" is defined, that is, the strategic objectives of China's agricultural machinery science and technology innovation and agricultural mechanization development to 2025, 2035 and 2050. Two Development Principles which are full process mechanization and Comprehensive mechanization, and from 1.0 to 4.0 of China Agricultural machinery are emphasized in China.

**Keywords:** agricultural mechanization, China, agricultural machinery development strategy.

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## Развитие механизации сельского хозяйства в Китае и его текущая стратегическая направленность

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**Реферат.** В 100-летней истории развития сельскохозяйственного машиностроения в Китае можно выделить пять этапов: зарождение отрасли (1917-1949); системное развитие (1949-1979); преобразование системы (1980-1995); ориентация на рынок (1996-2003); интенсивное развитие (2004-2014). На сегодняшний день в стране третий год продолжается реализация 13-го пятилетнего плана. В последние 10 лет достигнуты значительные успехи в механизации сельского хозяйства. Однако ее уровень не достаточен по сравнению с развитыми странами. Чтобы сократить этот разрыв, а также повысить конкурентоспособность сельскохозяйственной техники, в Китае разработана стратегия научно-технического инновационного развития механизации сельского хозяйства. Она получила название «стратегии трех шагов», так как в ней обозначены цели развития сельскохозяйственного машиностроения механизации аграрной отрасли в соответствии с тремя периодами – до 2025, 2035 и 2050 годов. В настоящее время в Китае реализуются два принципа развития, которые представляют собой полную механизацию производственных процессов и всего сельского хозяйства в комплексе.

Ключевые слова: механизация сельского хозяйства, Китай, стратегия развития сельскохозяйственного машиностроения.

The fundamental way out for agriculture lies in mechanization. The experience of all countries in the world shows that agricultural mechanization is an important scientific and technological support for modern agricultural construction. Agricultural mechanization in China has played an important role in improving agricultural labor productivity, land productivity and resource utilization, and has made important contributions



to ensuring food safety. It can be said that the level of mechanization of a country also reflects its comprehensive national strength. In the past hundred years, China's political situation has changed from turbulence to stability, and the agricultural mechanization of New China has also experienced a gradual development from backwardness before the founding of the People's Republic, and has made tremendous progress [1-6].

#### *I History of Agricultural Mechanization*

##### *Germination stage of agricultural machinery development (1917-1949)*

Before the founding of New China, China could only produce hand-made farm tools such as hoes, sickles, shovels and some old-fashioned animal farm tools. Since the 1930s, China's agricultural machinery has developed to a certain extent. Eight farm implements factories have been set up. They are small in scale and simple in equipment. They mainly imitate machines, but their level is not high. During the World War II, livestock products, manual sprayers and other products began to be developed and produced. These backward technologies and low efficiency farm implements played a very limited role in promoting agricultural production. In 1945, the Government accepted the financial support of the United States Universal Corporation and sent 20 students to study the design and manufacture of agricultural machinery in USA. After three years, they returned home and were all allocated to universities, research institutes, factories and government departments in the field of agricultural machinery.

##### *Construction Stage of Modern Agricultural Machinery Industry System (1949-1979)*

China invested 324 million Yuan to set up a number of farm machinery factories. Starting from the production of old farm implements and imitation of new foreign farm implements, by 1957, the national farm machinery repair and manufacture factories had grown to 276, with 123,000 employees and a total industrial output value of 384 million yuan. Industrial machinery, and began to plan the production of tractors, agricultural machinery industry output value rapid growth. Agricultural mechanization schools were established in all provinces and some key areas of agricultural machinery development, thus forming a relatively perfect agricultural machinery education system.

After 1960, China's key industries such as tractors, internal combustion engines, machine-driven agricultural tools and other key industries have developed rapidly, and the production capacity has increased considerably, basically forming a product system corresponding to the level of agricultural development and rural purchasing power at that time, which provides a strong guarantee for the recovery and development of agricultural production.

##### *System transformation Stage (1980-1995)*

From 1980 to 1995, it was the stage of system transformation of agricultural machinery industry in China. With the deepening of reform and opening up, the role of

market mechanism in the production and extension of agricultural machinery is gradually enhanced. The state has gradually liberalized the planning and management of agricultural machinery industry. Social and non-governmental capital began to enter the field of agricultural machinery industry. Farmers were allowed to buy and use agricultural machinery independently. The pattern of co-existence of diversified management forms of agricultural machinery and equipment. The structure of agricultural machinery products has also changed accordingly.

The first is to adjust from large and medium-sized agricultural machinery to small and medium-sized agricultural machinery. Secondly, the production and sales of various small and medium-sized tractors, small and medium-sized combine harvesters, small and medium-sized agricultural by-products processing machinery, feed machinery, animal husbandry machinery and aquatic feeding equipment have increased rapidly. Small four-wheel tractors and agricultural transport vehicles with Chinese characteristics emerged as the times require.

##### *Market-oriented stage (1996-2003)*

Since the mid-1990s, the process of industrialization and urbanization in China has accelerated. With the transfer of rural labor to non-agricultural industries and cities, the seasonal and structural shortage of rural labor force has appeared. The voice for accelerating the process of agricultural mechanization has become increasingly high. Under the strong pull of market demand, a new round of development climax of China's agricultural machinery industry has emerged.

In the late 1990s, great progress was made in the research and development of self-propelled corn harvester, self-propelled full-feeding rice-wheat combine harvester and mobile rice transplanter with Chinese characteristics. The technology of the product was gradually mature, and it had the ability of mass production and marketing.

The number of private enterprises has increased year by year, and the proportion of assets and sales revenue has increased year by year. International famous multinational corporations have built factories wholly or jointly in China. A diversified industrial structure consisting of state-owned or state-owned holding enterprises, private enterprises and foreign-funded enterprises has initially been formed.

##### *Rapid development stage (2004-2014)*

China launched the subsidy policy for the purchase of agricultural machinery in 2004. The central government allocated 0.7 billion yuan (RMB) in subsidies. In 2004, and in 2015, 23.75 billion yuan (RMB) in subsidies. The central government has invested 214 billion yuan in supporting farmers to purchase advanced agricultural machinery till 2017.

In 2010, the China State Council promulgated the Opinions on Promoting Agricultural Mechanization and the Sound and Rapid Development of Agricultural Machinery Industry.

From 2004 to 2014, the national policy support, the scale of agricultural machinery industry, enterprises' independent innovation ability, scientific research and development, product quality level, joint venture cooperation and import and export trade all reached the highest level in history. China's agricultural machinery ushered in the best period of development in history, known as the "golden decade" of China's agricultural machinery.

## *II Present Situation of Agricultural Mechanization*

After the 12th Five-Year Plan, China's 13th Five-Year Plan has been going on for three years. Significant Achievements in Agricultural Mechanization has also made in recent ten years. According to the statistics, total power of agricultural machinery in 2017 reached 1.146 billion kilowatts, large and medium-sized tractors, transplanters, combine were 6.454 million units, 771,000 units and 1902,000 units, respectively. The level of comprehensive mechanization of crop cultivation has reached over 66%. By 2017, the level of mechanization of crop tillage, seeding and harvesting in China was 83.45%, 59.36% and 54.21%, respectively. The level of mechanization of weak links such as rice transplanting and maize harvesting by machine had made remarkable breakthroughs, and the mechanization of production of major cash crops such as cotton oil and sugar had made substantial progress, with production increasing efficiency and resources saving. The area of environmental friendly agricultural mechanization is growing.

In 2017, there were 187,000 agricultural machinery operation service organizations in China, of which 63,000 specialized agricultural machinery cooperatives were established; the total income of agricultural machinery operation in China reached 538.8 billion yuan, the system of agricultural machinery specialization and socialization was more perfect, and the efficiency was continuously improved, making it a prosperous rural economy. And an important force to increase farmers' income.

## *III Strategic Focus of Agricultural Mechanization*

Although Agricultural Mechanization in China has made considerable progress, there are still great gaps in agricultural mechanization level compared with developed countries. In order to further narrow the gap between China's agricultural mechanization and developed countries, enhance the scientific and technological innovation ability of agricultural machinery, strategic focus of agricultural mechanization have been presented in China.

### **Three-step Strategic Target**

*Step I:* By 2025, agricultural mechanization will be basically realized, and the ability of scientific and technological innovation of agricultural machinery will be significantly enhanced. We will focus on breaking through the weak links and key core technologies in the development of agricultural mechanization to achieve "from scratch" and "from scratch to completion" of Agricultural Mechanization in China.

*Step II:* By 2035, agricultural mechanization will be

realized in an all-round way, and the scientific and technological innovation ability of agricultural machinery will basically reach the level of developed countries, with emphasis on information technology to enhance the level of agricultural mechanization, so as to realize the "from all to good" Agricultural Mechanization in China.

*Step III:* By 2050, agricultural mechanization will reach a higher level and realize automation and intellectualization. Agricultural machinery science and technology innovation ability will run side by side with developed countries, and some areas will lead the development of agricultural machinery, focusing on Intelligent technology, so as to realize the "from good to strong" of Agricultural Mechanization in China.

### **Two Development Principles**

*Principle I:* Full process mechanization and Comprehensive mechanization.

Full process mechanization mainly includes the production mechanization of each link. The whole process of pre-production, production and post-production is mechanized. Comprehensive mechanization mainly refers to mechanization of crops in all, industrial development and regional development. Crop in all is from grain crops to cash crops, horticultural crops, forage crops. The comprehensive development of industry: from planting to breeding (livestock, poultry, aquatic products), and primary processing of agricultural products. The comprehensive development of "regional": from plain area to hilly area.

*Principle II:* From 1.0 to 4.0 of China Agricultural machinery.

Agricultural machinery 1.0 refers to "from scratch", characterized by the replacement of human and animal power by machines. At present, China has made great achievements in this stage, but there are still many "shortcomings" and weak links. Agricultural Machinery 2.0 refers to "from existing to complete", which is characterized by full mechanization. This is the direction that China should vigorously "popularize" at the present stage. Agricultural machinery 3.0 refers to "from whole to good", characterized by the use of information technology to enhance the level of agricultural mechanization, this stage is being tested "demonstration". Agricultural Machinery 4.0 refers to "from good to strong", that is, to achieve automation and intellectualization of agricultural machinery, agricultural machinery + Internet, that is, intelligent agriculture and agricultural robotics technology, this direction needs to be actively explored.

According to China's national conditions, from agricultural machinery 1.0 to agricultural machinery 4.0 can not follow the path of sequential development, we must develop in parallel and promote synchronously.

### **SUMMARY**

With the increasingly serious global food crisis and labor shortage, new opportunities and challenges put forward the need to accelerate the development of agricul-



tural mechanization. With the rapid development of agricultural mechanization, how to save costs, eco-environmental protection and improve efficiency is the task facing every country.

Although Agricultural Mechanization in China has made considerable progress, there are still great gaps in agricultural mechanization level, agricultural machinery equipment manufacturing level, product reliability and agricultural machinery operation efficiency compared with developed countries. The weak basic research and key technology research of agricultural mechanization, the low degree of technology integration and the weak ability of sustainable development have become the "short board" and bottleneck restricting the transformation and upgrading of agriculture.

Great strides in economy and science and technology have made great achievements in the development of Ag-

ricultural Mechanization in China, and the content of science and technology in agriculture is also increasing. In the era of knowledge-based economy, modern agricultural mechanization equipment with multi-disciplinary and cross-cutting characteristics is the solid backing to support the sustainable development of agriculture. Therefore, we should actively strengthen the innovation of science and technology and the improvement of management level, grasp the market law, develop agriculture, seize the opportunity, promote the development of agricultural machinery science and technology, strengthen the technological innovation of agricultural machinery, and construct a perfect new agricultural mechanization service system, so as to make the leap-forward development of agricultural mechanization become a reality in China.

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