DOI 10.15302/J-SSCAE-2019.05.019

Study on Quality Evaluation of Domestic Agricultural Machinery Equipment: An Analysis Based on Farmer Survey Data from Central China

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Abstract: Improving the quality of domestic agricultural machinery is crucial to strengthen the agricultural machinery manufacturing industry in China. This study summarizes the status quo and existing problems of this sector in China focusing on its empirical examination of survey data. Based on the data collected from surveys conducted in Central China, farmers' subjective evaluation of the quality of domestic agricultural machinery is investigated from the aspects of hardware quality, applicability and operation convenience, as well as operational effectiveness of the machinery. The results suggest that farmers' satisfaction with the quality of steel used and the engine, fuel consumption, and the frequency of failure of domestic large- and medium-sized agricultural machinery is significantly lower than that of non-domestic agricultural machinery. Less than half of these farmers were satisfied with the matching degree of machine–land as well as the match of ergonomic aspects of machine–driver such as effective sun and rain protection of both domestic and non-domestic machinery. Moreover, their satisfaction with the operating speed, operating coverage, and savings effect (for factors such as water, fertilizer, pesticide, and seed) of domestic agricultural machinery was low. To this end, countermeasures are proposed to improve the quality of domestic agricultural machinery, including forming a national team to overcome technical difficulties in key components, establishing a long-term and enterprise centered innovation system, optimizing research and development of intellectualized and eco-friendly agricultural machinery, and reconstructing the discipline system for agricultural machinery in universities.

Keywords: domestic agricultural machinery; quality evaluation; farmer survey; Central China

1 Introduction

Against the background of an acceleration in the transfer of the rural labor force to the city, rising labor costs in agricultural production, and the aging and feminization of the agricultural labor force, mechanization becomes the key to improving the quality and efficiency of agriculture to increase the income of farmers. Farmers are the main body of agricultural production which, for a long time, was the most important employment mode and livelihood activity of most farmers. Since the 1990s, an increase in the number of laborers leaving the sector has caused a shortage in the agricultural labor force and a rapid rise in labor costs, which threatens grain security and agricultural sustainable development [1]. Therefore, using machinery and equipment to replace labor and draught animals in agricultural production is one of the key measures to maintain and consolidate the symbiotic and

Received date: September 25, 2019; **Revised date:** October 10, 2019

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Funding program: CAE Advisory Project "Research on National and Regional Food Security and Sustainable Development Against the Background of Internationalization and Greenization" (2016-ZD-09)

Chinese version: Strategic Study of CAE 2019, 21 (5): 060–066

Cited item: Zhou Jing et al. Study on Quality Evaluation of Domestic Agricultural Machinery Equipment: An Analysis Based on the Farmer Survey Data from Central China. *Strategic Study of CAE*, https://doi.org/10.15302/J-SSCAE-2019.05.019

interdependent relationship between farmers and agriculture, by reducing costs and increasing income, and building a more modern agriculture [2]. China's agricultural production has now entered a new stage of mechanization.

The quantity, structure, and quality of agricultural machinery and equipment form the basis on which to rapidly mechanize agricultural overall. The basic national conditions and historical mission have determined that China should improve the quality of domestically designed and manufactured agricultural machinery. First, in the long term, relying on imports of agricultural machinery and equipment, especially high-tech machinery, means that China's food security is controlled by developed countries which could impact on social stability. High-tech machinery is the mainstream trend for the future, and without independent intellectual property rights of its core technology and key parts China may be exploited by those countries from whom they source the machinery. If the United States and other developed countries set up various obstacles to restrict or even prohibit the import of key technologies and components of agricultural machinery, China's production and stable supply of agricultural products will be under grave threat. Second, the variety of crop types, planting systems and topographical conditions mean that China must design and manufacture many types of agricultural machinery and equipment to suit local conditions. Third, as a responsible power in the world, China should be in the position to provide agricultural machinery products and services for agricultural modernization in developing countries.

For over ten years and with the support of the *Law of the People's Republic of China on the Promotion of Agricultural Mechanization* and the agricultural machinery purchase subsidy policy, China's agricultural machinery experienced a golden development period. So what is the current situation of the development of domestic agricultural machinery and equipment in China? What is the quality and reliability of agricultural machinery and equipment? What is the gap between domestically manufactured agricultural machinery compared to that of developed countries? Answering these questions is key to promote the transformation and upgrading of the domestic agricultural machinery and equipment manufacturing industry and supply side structural reform in order for China to become a powerful agricultural machinery manufacturing country. The evolution trend of agricultural machinery production capacity in China since 2004 must be scrutinized to summarize the problems and gaps in the domestic manufacture of agricultural machinery and equipment, and the survey data of farmers in Central China examined to evaluate its quality and reliability. Based on the research, policy suggestions that will promote the transformation and upgrading of the manufacture of domestic agricultural machinery will be proposed in the conclusion section.

2 General situation of domestic agricultural machinery development

2.1 The trend of domestic agricultural machinery production capacity

China's agricultural machinery industry is developing rapidly because of an increase in demand for these products and the purchase subsidy policy. At the same time, the production structure of the equipment is developing in the direction of higher horsepower, higher performance, and diversification. Since 1949, China's agricultural machinery industry started from the beginning without assistance, and has since gone through four stages: the construction stage of the modern agricultural machinery industry system in the early days of the People's Republic of China; the transformation stage of the system; the market-oriented stage; and the stage of high-speed development in accordance with the law [3]. Explosive growth in the fourth stage has pushed the output and value of China's agricultural machinery and equipment manufacturing industry to first place worldwide. China is now the world's largest manufacturer of agricultural machinery [4].

On the one hand, both the output value and investment of the agricultural machinery manufacturing industry in China have developed rapidly in recent years. Table 1 shows that from 2004 to 2016, the sales value of China's agricultural machinery manufacturing industry increased from 50.3 billion to 471.2 billion yuan, ranking first in the world. At the same time, the number of agricultural machinery manufacturing enterprises, the export delivery value, and fixed assets increased at an average annual rate of 26.33%, 19.13% and 19.51%, respectively.

On the other hand, the structure of agricultural machinery production, for example, high horsepower, high performance, and new agricultural machinery design and manufacturing capacity has been greatly improved. Table 2 shows that from 2008 to 2016, the output of large- and medium-sized tractors in China has doubled, while the output of grain and corn harvesting machinery has increased 1.6 times. In addition, the production of agricultural machinery and equipment has extended from farming to post-harvest treatment, food crops to cash crops, and planting to aquaculture.

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The rapid growth of agricultural machinery manufacturing capacity has made a great contribution to improving the level of agricultural mechanization in China. It is estimated that the expansion of production capacity and an improvement in service levels, China's domestic agricultural machinery and equipment products will, for the most part, meet the needs of mechanized production of major grain crops, as well as 90% of the domestic market's requirements [3,4]. The comprehensive mechanization rate of crop cultivation and harvest reached 67.23% in 2017. In particular, the comprehensive mechanization rate of wheat, rice, and corn reached 86.94% in the same year. This means that China's agricultural production mode has completed a historical transformation from human and animal power to mechanical operation.

Table 1. Changes in the main indicators of China's agricultural machinery industry from 2004 to 2016 (Unit: RMB 100 million).

Year	Number of enterprises	Sales value	Export delivery value	Fixed assets
2004	151	502.78	38.53	119.93
2008	2349	1864.08	200.06	329.11
2012	2076	3251.17	291.57	792.90
2016	2496	4711.53	314.69	1018.46

Source: *China Agricultural Machinery Industry Yearbook.*

Table 2. Production of all types of agricultural machinery in China from 2008 to 2016 (Unit: 10000 sets).

Year	Tractor			Harvesting machinery	Post-harvest processor	Feed production machinery
	Large-size	Medium-size	Small-size			
2008	5.72	24.60	172.32	40.69	—	19.19
2012	5.60	40.73	178.72	111.43	42.99	49.82
2016	6.30	56.69	135.53	86.64	90.09	47.72

Source: *China Agricultural Machinery Industry Yearbook.*

2.2 Gaps and problems in the development of domestic agricultural machinery and equipment

Although China's domestic agricultural machinery and equipment manufacturing industry has made remarkable strides, these achievements are based on quantity rather than quality. There are many outstanding problems in the domestic market, such as the gap between the manufacturing quantity and quality compared to developed countries, the contradiction between the supply and demand structure of small-scale agricultural machinery, the dependence on imported medium- and high-end products, and the improvement of equipment reliability and applicability. How to transform from a large supplier to a robust one will be an important issue to be solved in China's future agricultural mechanization.

For example, there is a big gap between China and the United States in the design and manufacturing levels of tractors and harvesters. The shift technology, tractor closed center hydraulic system, and high-power tractor manufacturing are 44, 39, and 35 years later than the United States respectively, in tractors; and while for harvesters, the longitudinal axial grain combine, wide cutting range and high-power grain combine are all around 35 years later than the United States [4]. So the core technology and key parts of high-end agricultural machinery in China are heavily dependent on imports. In 2016, the output value of China's imported agricultural machinery products reached US $12.1 billion. In terms of output value, the top three commodities are the core parts for the positive ignition piston internal combustion engine, the compression ignition piston internal combustion engine with output power no smaller than 132.39kw, and the marine diesel engine.

On the other hand, there are glaring structural contradictions between supply and demand. From a market share perspective, domestic agricultural machinery and equipment enterprises basically meet the needs of small agricultural machinery, but the effective supply of high-end agricultural machinery and equipment is obviously insufficient. [3,4] For instance, farmers in Northeast China would rather spend ten times the price to buy an imported plow from Germany. A sharp rise in new business entities' demand for large and high-end agricultural

machinery products has contributed to the structural contradictions between supply and demand of domestic agricultural machinery. Further structural contradictions between supply and demand in many fields such as operation link, crop type, agricultural sector, and terrain area also exist [5].

In addition, there is a large gap between the quality and reliability of domestic agricultural machinery compared with developed countries. For example, in 2017, the mean time between failures of domestic large tractors reached 330 hours, which is equivalent to Italy in the 1980s [4].

3 Farmers' evaluation of the quality of domestic agricultural machinery and equipment

In order to further evaluate the reliability and adaptability of domestic agricultural machinery at a micro level, a team researching food safety sustainable development strategy in Central China launched a field survey in Jiangsu, Anhui, Jiangxi, Hunan, and Hubei provinces in Central China from January to March 2019, and collected the satisfaction data of agricultural machinery households (including agricultural machinery households for household use and providing services to other farmers), and farmers regarding the hardware's quality and operational effectiveness of agricultural machinery in grain production, cultivation, and harvest. Grain production has the highest level of mechanization in China, and a correspondingly higher level of design and manufacturing in all aspects of grain production. Thus the survey results can, to some extent, indicate the quality and effectiveness of domestic agricultural machinery.

The research group distributed 60 questionnaires to ordinary farmers in each province, and finally recovered 276 valid questionnaires. In addition, a total of 154 responses from agricultural machinery households were collected, including 71 specialized agricultural machinery households who provide operational services for other farmers. Most of the remaining 83 agricultural machinery households are small-scale agricultural machinery owners, with a few large-scale farmers who have large- and medium-sized agricultural machinery.

All the agricultural machinery households investigated have large- and medium-sized agricultural machinery. This paper will study the subjective evaluation of the quality of domestic agricultural machinery from three aspects: hardware quality, applicability and operation convenience, and operational effectiveness. Although these evaluations may not be completely objective, they reflect the reliability and applicability of domestic agricultural machinery to some extent and may even affect farmers' purchase decisions regarding domestic agricultural machinery. Based on this, the study has certain reference value.

3.1 Evaluation of hardware quality of agricultural machinery by agricultural machinery users

This paper compares the subjective evaluations of the owners and users of the following types of agricultural machinery: small; large- and medium-sized domestic; and large- and medium-sized non-domestic (the latter consisting mainly of Sino foreign joint venture production) from four dimensions, namely, steel quality, engine quality, fuel consumption, and failure frequency.

According to the survey data, compared with the hardware quality of large- and medium-sized domestic agricultural machinery, users were more satisfied with small, and large- and medium-sized non-domestic agricultural machinery (Fig. 1). More than 80% of farmers were satisfied with the steel quality, engine quality, and failure frequency of small agricultural machinery, but less than 50% were satisfied with the fuel consumption index of small agricultural machinery. The key technologies of small agricultural machinery in grain production are easy to break through and price of this machinery is cheaper, so the quality of domestic equipment is relatively guaranteed. For agricultural machinery users, fuel is the most important cost besides the fixed cost, so their dissatisfaction may increase subjectively in accordance with the fuel consumption of agricultural machinery. Only around half of the users were satisfied with the steel quality, engine quality, fuel consumption, and failure frequency of large- and medium-sized domestic agricultural machinery. However, more than 80% of users were satisfied with the above indicators for large- and medium-sized non-domestic agricultural machinery. In the survey, some of the statements made by respondents include "domestic agricultural machinery steel will rust in a few years, but foreign brand agricultural machinery won't"; "domestic agricultural machinery engines are filled with dust when they are disassembled, and their sealing is not good, but a Kubota harvester engine a few years old is almost as good as a new one"; "Domestic machines won't break in the first year, but they will start to have problems in the second year. The more time that's passed, the more problems arise." The differences between the degree of satisfaction of the domestic and non-domestic agricultural machinery and the above statements show the gap in the quality of the hardware between domestic and foreign brands for large- and medium-sized agricultural machinery. These results are consistent with the conclusions of relevant experts and extant literature.

DOI 10.15302/J-SSCAE-2019.05.019

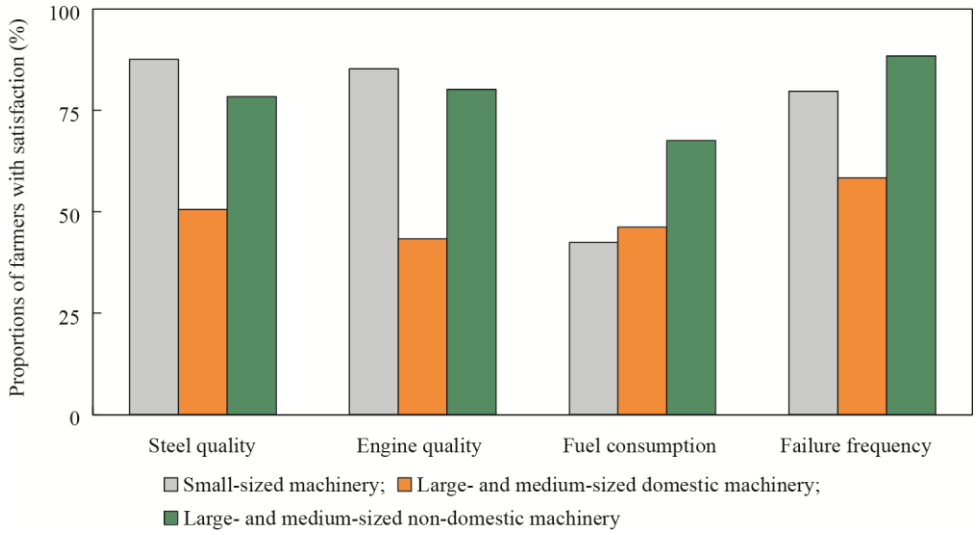

Fig. 1. Farmers' satisfaction with hardware quality of agricultural machinery.

3.2 Evaluation of the applicability and operation convenience of agricultural machinery by agricultural machinery users

This paper analyzed the subjective evaluation of the applicability and operation convenience of agricultural machinery from five dimensions: the degree of match with the land parcel, the degree of match with the driver, the degree of operation comfort, the flexibility of turning, and the effectiveness of shelter from the sun and rain.

According to the survey results, the satisfaction of users with the operation comfort and turning flexibility of large- and medium-sized domestic agricultural machinery was significantly lower than that of the foreign brands, while the satisfaction levels for all large- and medium-sized agricultural machinery regarding the degree of match with land parcel, the degree of match with drivers, and the effectiveness of sun and rain protection was low (Fig. 2). More than 65% of users were satisfied with the matching degree of small-sized agricultural machinery with the land parcel, the degree of match with the driver, the operating comfort, and the flexibility of turning. However, less than 60% of users were satisfied with the matching degree between both large- and medium-sized agricultural machinery and land parcel as well as drivers. Against the background of land fragmentation in China's planting industry, matching large- and medium-sized agricultural machinery with small and scattered land parcels with irregular shapes is a big challenge for equipment manufacturing and agricultural machinery operations. Due to differences in height, arm span, and skill levels of agricultural machinery drivers, it is also difficult for standardized agricultural machinery to match personalized operation requirements. This is one of the problems that needs to be solved in the future design and manufacture of agricultural machinery according to personal characteristics of operators. Compared with foreign brand agricultural machinery, the low satisfaction of users in respect of operation comfort and turning flexibility of domestic large- and medium-sized agricultural machinery indicates that there is room for improvement in its product design, material selection, and hardware. In addition, agricultural machinery users were not satisfied with the efficacy of sun and rain protection. Agricultural machinery operations, especially plant protection and harvesting operations, are generally carried out in sunny and hot weather, so shelter from the elements is an important indicator that reflects care for users of agricultural machinery. Improving the efficiency of shading and rain protection in agricultural machinery through product design and material selection should be a direction of research in the future.

3.3 Evaluation of the operational effectiveness of agricultural machinery by farmers

We will analyze farmers' subjective evaluation on the operational effectiveness of agricultural machinery from five dimensions: operation speed, operation omission, consistency in operation depth, damage to farmland (such as the soil cultivation layer), and saving factors (water, fertilizer, pesticide, seed). For small agricultural machinery, the satisfaction of owners with the efficiency of self-service was mainly investigated. For large- and medium-sized agricultural machinery, the satisfaction of ordinary farmers with the operation service effectiveness of specialized households was mainly investigated.

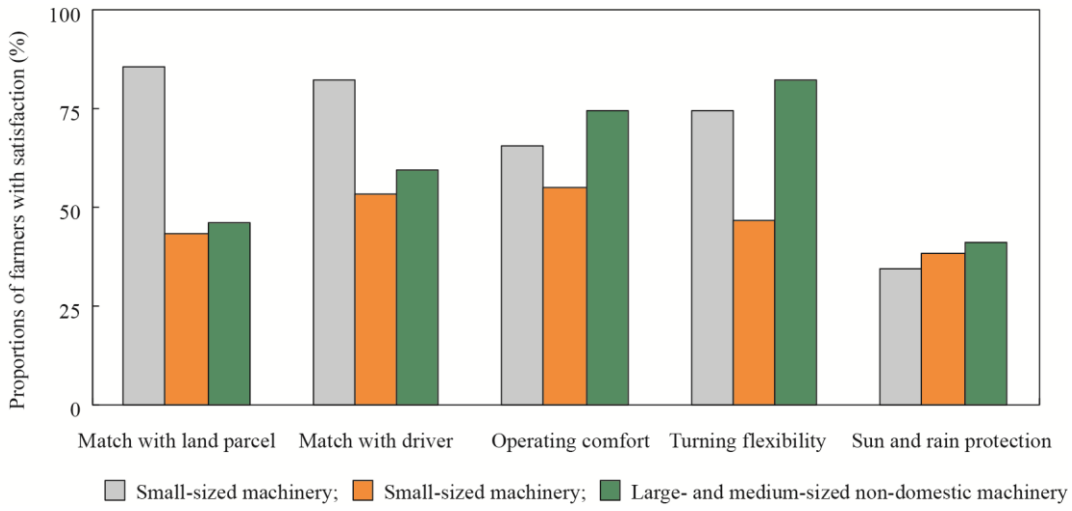

Fig. 2. Farmers' satisfaction with adaptability and operation convenience of agricultural machinery.

According to the survey data, farmers' satisfaction with the operation speed and no omission of large- and medium-sized domestic agricultural machinery was significantly lower than that of large- and medium-sized non-domestic agricultural machinery, while most farmers' satisfaction with the effect of saving factors of both types of large- and medium-sized agricultural machinery was also very low (Fig. 3). Less than 50% of ordinary farmers were satisfied with the operation speed of large- and medium-sized domestic agricultural machinery. In the survey, some farmers pointed out that "foreign brand harvesters are fast, some can harvest one mu of rice in six minutes, while domestic brand harvesters generally take more than 10 minutes." This shows a large gap between domestic equipment and foreign equipment in terms of operation speed. In addition, less than 40% of ordinary farmers were satisfied with the no-omission operation of large- and medium-sized domestic agricultural machinery. Some farmers said that "in the process of harvesting with domestic machines, it is often necessary to pick up the missing rice, and those margins are most likely to be missed." Thus improving the performance of domestic agricultural machinery, particularly its accuracy of operation, is an issue worthy of attention. In contrast, more than 70% of ordinary farmers were satisfied with the relevant indicators of large- and medium-sized non-domestic agricultural machinery. Regardless of whether the brand was domestic or foreign, the satisfaction of ordinary farmers with the saving factors of large- and medium-sized agricultural machinery was less than 30%. This means that agricultural machinery and supporting technology which can save water, fertilizer, pesticide, and seed in grain planting is relatively deficient. With the concept of green agriculture and sustainable development becoming increasingly popular, it will be an important topic for the future research of agricultural mechanization to improve the intelligence level of domestic agricultural machinery and equipment to help realize its precise operation and technological application to agricultural waste treatment.

4 Suggestions for the development of domestic agricultural machinery and equipment

4.1 Create a "national team" to overcome difficulties in core technology and key parts of agricultural machinery to ensure a major breakthrough in the short and medium terms.

The R&D capacity of core technology and key parts of high-tech agricultural machinery are severely lacking and excessively dependent on imports, which is the most obvious shortfall in the current design and manufacturing of agricultural machinery in China. It will be key content in China's agricultural mechanization development strategy to realize a major breakthrough in the research, design, and manufacture of key parts. The *Action Plan for the Development of Agricultural Machinery and Equipment (2016–2025)* (hereinafter referred to as "the plan") proposes that the manufacturing technology of core parts and the self-sufficiency rate of key parts should be fully mastered and exceed 70% in 2025. We will further have implemented special plans for the development of ten key components—agricultural diesel engine; steering axle and its suspension system; special sensors for agricultural machinery; agricultural machinery navigation and intelligent control operation device; stepless transmission; electrohydraulic control unit for the intelligent operation of large tractors; high performance transmission belt; high

DOI 10.15302/J-SSCAE-2019.05.019

performance knottier; hydrostatic drive device; and high performance underwater acoustic detector. The next 5–10 year period will be critical for the key parts of agricultural machinery to overcome difficulties.

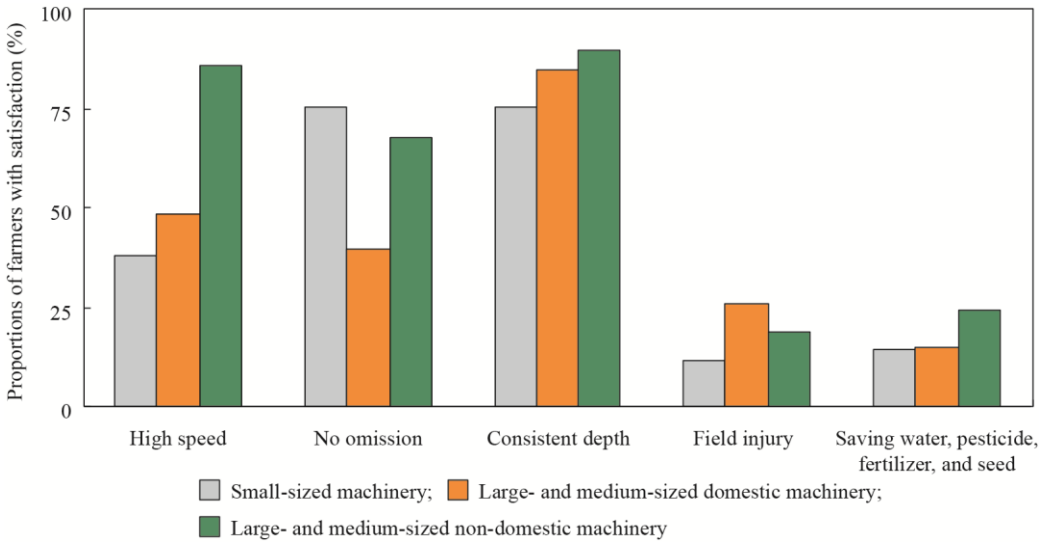

Fig. 3. Ordinary farmers' satisfaction with the effectiveness of agricultural machinery operation.

With the unfavorable factors of heavy task, shortage of time, and a complex and unpredictable international trade environment, it is necessary to concentrate national superior talent resources, form a "national team" to overcome the difficulties of the core technology of agricultural machinery, and implement a centralized and efficient working mechanism in the "national team". This is a pactical strategy to achieve the goal of catching up to and surpassing the core technology of agricultural machinery in the short and medium terms.

Due to the small market space, low profit, long investment cycle, and the high risk of its common technologies and key parts, manufacturers of agricultural machinery usually lack enthusiastic investment. Lack of capital and talent makes it difficult for ordinary agricultural machinery enterprises to gain sufficient financial support for R&D of core technologies. Thus, full attention should be paid to the institutional advantages of concentrating efforts on major events and a "national team" created to overcome difficulties in key parts of agricultural machinery and equipment manufacture. In 2013, the Ministry of Agriculture and Rural Areas established the Professional Group for Agricultural Mechanization Science and Technology Innovation and formed a working system with an expert group. It is worth noting that this R&D team was mainly focused on the machine as a whole and agricultural technology fields, and did not conduct special research on all the agricultural machinery and key components shared in various fields. This organizational form disperses the research and development strength, thereby reducing its efficiency which counteracts the acceleration of R&D for key parts. In addition to the Professional Group for Agricultural Mechanization Science and Technology Innovation, a National Expert Group for Technology Innovation in High-tech Key Parts of Agricultural Machinery could be established separately to focus on core areas that require development.

Due to the strategic position of key parts, the aforementioned group could refer to the successful experience of the R&D working group of key technologies in China's defense science and technology industry from the 1960s to 1980s in terms of team building and working mechanism, while more favorable personnel welfares, incentive mechanisms, and achievement transformation means can be adopted than that in the 1960s–1980s. In line with the development projects regarding the ten key parts proposed in the "plan," ten key "national teams" should accordingly be created.

4.2 Build a long-term innovation system of agricultural machinery and equipment technology through a fair institutional environment and both encouraging and competing policies

In a market economy environment, enterprises should be the main body of technological innovation of agricultural machinery and equipment. Through more than ten years of continuous development, a number of domestic agricultural machinery and equipment manufacturing enterprises have grown in scale and competitiveness. In the long run, to create a fair competition system environment and to implement both

encouraging and competing policies is the fundamental strategy to promote increased strength and size of domestic agricultural machinery and equipment enterprises which will help build and improve technological innovation systems for agricultural machinery and equipment.

First, standardize and implement a patent protection system of agricultural machinery and equipment to create a fair market environment for technological innovation. Non-standard protection of intellectual property not only gives multinational enterprises the opportunity to use intellectual property to suppress local production of agricultural machinery, but also causes unfair competition with the homogeneity of domestic agricultural machinery, thus reducing enthusiasm of local enterprises to invest in R&D. Improving and implementing mechanisms of creation, application, management, and protection of intellectual property rights will create a fair institutional environment for innovation of agricultural machinery enterprises. In particular, we need to investigate infringement cases of agricultural machinery and equipment technology and punish quality violations and brand counterfeiting within the boundaries of the law. Moreover, preferential policies for purchase subsidies should be cancelled for products of agricultural machinery and equipment enterprises that have infringed the intellectual property rights of other enterprises.

Second, we should optimize the direction and strength of policy support for the purchase of agricultural machinery and equipment, and reasonably increase the motivation of domestic agricultural machinery and equipment enterprises to self-upgrade technology and product quality. The purchase subsidy policy for agricultural machinery and tools implemented continuously since 2004 has so far played an important role in promoting R&D and manufacturing capacity of domestic enterprises [6]. Extending the subsidy's scope and strength is expected to further promote the scientific and technological innovation ability of domestic agricultural machinery and equipment enterprises in the future. However, for enterprises which have been developed from square one to a certain scale, the kind of subsidy policy which involves price protection will decrease the positive incentive effect and increase negative incentive effect, which will not be conducive to the independent implementation of technological innovation. The subsidy policy for the purchase of agricultural machinery substantially reduces the price of domestic middle- and high-end agricultural machinery, which is the main reason that it could replace the same type of foreign products with better quality but at a higher price. If the gap in product quality and performance is hidden by low prices over a period of time, it becomes easy for local enterprises to rely on price subsidies and become apathetic in technological innovation. Some studies have suggested that [7] imported agricultural machinery should be brought within the scope of subsidies, and the same level of purchase subsidies given to domestic and imported agricultural machinery would create a fair market competition environment to compel the domestic agricultural machinery enterprises to improve their product quality. An equal competition environment for domestic enterprises, foreign enterprises, and joint ventures should be provided. The choice intention of agricultural machinery manufacturers will bring the pressure of technological innovation to domestic agricultural machinery manufacturing enterprises, and when this pressure is transformed into the driving force of product innovation, they will develop and expand with higher quality.

4.3 Seize the opportunity of a new round of industrial revolution and realize the automation, intelligence, informatization, and green of high-end agricultural machinery and equipment

With the advent of the fourth industrial revolution, automation, intelligentization, informatization, and greenization of the agricultural machinery technology has quietly improved. These technologies, characterized by rapid information collection and intelligent processing, is the development direction for agricultural machinery in the future.

China's agricultural machinery manufacturing industry can take advantage of the opportunity of the fourth industrial revolution with green and intelligent manufacturing as its core to develop automatic and intelligent technologies such as satellite positioning, automatic navigation, variable fertilization, precision seeding, timely yield measurement, unmanned driving, automatic environmental monitoring and control, etc. We should seize the opportunity to upgrade the agricultural machinery manufacturing and realize the independence and localization of high-end agricultural machinery technology as soon as possible.

4.4 With the opportunity of "double first class," reconstruct a new discipline system of agricultural machinery in universities to create the advantages of agricultural machinery professionals and technical personnel

A solid talent team is the foundation of R&D and the manufacture of high-end agricultural machinery.

DOI 10.15302/J-SSCAE-2019.05.019

Agricultural and forestry colleges and universities in China are generally faced with the dilemma of the agricultural machinery discipline being seriously weakened. Some of the problems in this discipline includes scattered specialties, unreasonable planning, shrinking number of students, and reduction of teachers. Strengthening the first class discipline construction of agricultural machinery and equipment and accelerating the cultivation of innovative talents of agricultural equipment is imminent.

It is suggested that the opportunity of the "double first class" construction project be combined with the higher education in China. The agricultural engineering discipline with agricultural machinery and equipment as the main characteristics should then be listed in the national "first class discipline" construction sequence. The existing agricultural machinery dicipline system of colleges and universities as well as provincial agricultural research institutions should be integrated and rearranged. Furthermore, the reintegrated agricultural machinery and equipment related disciplines should be included in the "double first class" support plan. Then government's support of the "double first class" discipline of agricultural machinery and equipment will encourage the recruitment of students majoring in agricultural engineering, attract high quality students to specialize in agricultural machinery and equipment undergraduate studies, expand the scale of postgraduate training, and encourage teachers and students specializing in agricultural machinery to go abroad for further study. In addition, the government should actively introduce international high-end agricultural machinery professionals to join scientific research on agricultural machinery in China.

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