Industrialization Path of Agricultural Intelligent Equipment

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Abstract: China has been one of the most responsible countries in the world, and its influence on the world is growing. Since ancient times, agricultural stability is stable, agricultural prosperity is national prosperity. The stable development of agriculture is beneficial to the stability of our society and the stability of our international position. In the current information society, intelligent equipment can be seen everywhere in daily life. The application of intelligent equipment in agriculture is also getting more and more attention. However, due to the limited policy support, weak overall strength and poor external development environment in China, the industrialization of intelligent equipment in China's agriculture has fallen into a bottleneck period. Starting from the significant problems in the application of agricultural intelligent equipment in China, this paper adopts SWOT analysis method and field research method to analyze the feasibility of promoting the industrialization of agricultural intelligent equipment in China, aiming to explore the industrialization path of agricultural intelligent equipment in line with China's national conditions, promote agricultural development and help China's Renaissance. The results of this paper show that the per capita cultivated land area in China is far less than that in the world, and the contradiction between man and land has been accompanied by the development process of China, so it is imperative to promote the industrialization of agricultural intelligent equipment. Increasing publicity, raising farmers' awareness, increasing purchase subsidies, expanding the scope of use, enhancing scientific innovation capacity and improving hardware quality are conducive to breaking the current bottleneck and promoting the development of agricultural intelligent equipment industrialization.

Keywords: Agricultural Intelligent Equipment; SWOT Analysis; Contradiction Between Human and Land; Industrialization of Agricultural Equipment

1. Introduction

Since ancient times, the contradiction between man and land has been accompanied by the development of our society. With the continuous advancement of urbanization, China's cultivated land area is gradually reduced, the agricultural population is also continuously lost, and the contradiction between man and land is increasingly fierce. It is one of the ways to solve the problem to change the agricultural development mode and increase the yield of unit land. With the development of science and technology, more and more
intelligent devices have been introduced into agricultural production, which has alleviated the contradiction between man and land to some extent. Promoting the industrialization of agricultural intelligent equipment is conducive to solving the contradiction between man and land. Agricultural intelligent equipment industrialization forward a small step, agricultural development forward a big step, promote agricultural intelligent equipment industrialization is urgent. Agricultural intelligent equipment to replace human labor is the future development trend of agriculture, but also one of the signs of agricultural modernization.

Promoting the industrialization of agricultural intelligent equipment has profound implications for China's agricultural development and then economic and social development [1]. Apply smart devices to agriculture is beneficial to the refinement of farming land, not only can reduce the waste of resources such as pesticide, fertilizer, improve the yield per unit area, improve working efficiency, also can reduce the constraint natural conditions for agriculture, extend the value chain of agricultural products, reduce market risk, improve the core competitiveness of the agricultural industry [2-3]. The increase of yield per unit area means that more land can be used to produce more food and feed more people, which is conducive to increasing farmers' income and enhancing social stability [4]. Once the formation of agricultural intelligent equipment industrialization is conducive to the liberation of productivity, more labor force will flow from the primary industry to the secondary and tertiary industries, promoting the optimization of China's industrial structure [5].

In the process of promoting the industrialization of agricultural intelligent equipment is faced with some difficulties, such as: agricultural intelligent equipment investment is large, ordinary farmers can not afford; There are many systems and complex operations, which are difficult for older farmers [6]. This paper aims to study the path of agricultural intelligent equipment industrialization and promote the modern development of agriculture. This paper first sorts out the evolution path of China's agricultural intelligent equipment industrialization, and then uses SWOT analysis to analyze the advantages, disadvantages, opportunities and challenges of industrialization of agricultural intelligent equipment in China[7]. Then, the importance and feasibility of promoting the industrialization of agricultural intelligent equipment are analyzed with greenhouses planting as a case. Finally, the paper discusses the path of agricultural intelligent equipment industrialization in China [8].

2.Method

2.1 Evolution Path of Agricultural Intelligent Equipment Industrialization

Up to now, China's agricultural intelligent equipment industrialization has experienced forty years of ups and downs. In these forty years, although China's agricultural intelligent equipment industrialization started slowly and had a thin foundation, it developed rapidly and made brilliant achievements [9]. Development course mainly divided into initial stage, rapid development and application of scale stage three periods [10]. In the 1980 s, under the influence of the reform and opening up, China's agriculture is in a new road, gradually began to pay attention to the power of science and technology, has obtained the proud achievement in agricultural expert systems, water-saving irrigation, crop planting, pests and other fields, this also see that our country gradually introducing smart devices trend in the development of agriculture[11]. In the 1990 s, in the rapid phase in the development of agricultural intelligent device, the robot into the agriculture is a landmark event, Means that the agricultural development of our country a big step forward [12]. So far, into the scale application period: agricultural intelligent equipment industrialization of high speed development, the development of science and technology increasing inspired robot types and a wide range of applications, like big data, 3 s technology and cloud computing technology is combined with agriculture gradually, "agriculture +" pattern is more and more rich[13]. The evolution of the industrialization of agriculture intelligent device path can be summarized as follows:

(1) The evolution from traditional agriculture to mechanical agriculture. Traditional agriculture mainly uses manpower and energy storage as the main production tools and is greatly influenced by natural conditions. With the development of society, more and more production tools, agricultural machinery, fertilizers and pesticides have been widely used in agriculture, the traditional agricultural production model almost collapsed.
(2) The evolution from mechanical agriculture to intelligent agriculture. With the development of science and technology, 3S technology, Internet of things technology, big data technology and other modern technological means are gradually integrated into agricultural development. Smart devices are starting to help agriculture, technically transforming agriculture into smart agriculture, increasing crop yields and quality, and dramatically increasing land use.

(3) Continue to promote the industrialization of agricultural intelligent equipment. More and more areas of agriculture can see the shadow of intelligent equipment, such as drones for plant protection operations, production and marketing integration. But at present, due to insufficient publicity and promotion, intelligent equipment is expensive, and the use threshold is higher, agricultural intelligent equipment has not yet formed industrialization. At the present stage, the most important task is to promote the industrialization of agricultural intelligent equipment. Only when the industry is formed, the advanced science and technology can fully play its role and the agricultural benefits can be maximized.

2.2 Feasibility Analysis of Promoting the Industrialization of Agricultural Intelligent Equipment
Taking greenhouse planting as an example, the harsh conditions of greenhouse planting provide objective conditions for agricultural intelligent equipment to enter this field and continuously promote industrialization. Relevant personnel should actively play their subjective initiative and seize the opportunity to enter in time. On the other hand, the deepening of rural revitalization requires agriculture to accelerate the speed of transformation and development. The state has introduced a lot of preferential policies to facilitate the transformation of agriculture, among which the promotion of agricultural intelligent equipment industrialization is also an important means, which is undoubtedly another opportunity. Promoting the industrialization of agricultural intelligent equipment in the field of greenhouse planting can not only realize the modernization and intelligentization of greenhouse planting, but also liberate the productive forces and improve the output.

3. Case Study on Promoting the Industrialization of Agricultural Intelligent Equipment in Greenhouse Planting Field
Greenhouses have been very common in China, it is conducive to agricultural production out of the constraints of natural conditions, so that people can eat out-of-season vegetables become a reality. Greenhouse planting is to establish a small artificial ecosystem in the greenhouse for the growth of crops, so there are strict and accurate requirements for temperature, light, ventilation, etc., if a condition is not met, it may affect the growth of crops. And the emergence of smart agricultural equipment can not only solve these problems well, but also do better than experienced farmers. For greenhouses, agricultural intelligent equipment can be installed in greenhouses, which mainly includes sensor collection, video monitoring and remote control. The sensor collection part can collect the changes of these elements in real time through the equipment such as temperature and humidity sensor, light sensor and soil moisture content sensor, and check whether they meet the standards. The video monitoring can not only fully grasp the basic situation in the greenhouse but also clearly observe the specific growth of crops. The remote control can precisely control the greenhouse environment according to the data collected by the sensor collection equipment, which can control and manage the crops production anytime and anywhere.

4. Discuss

4.1 SWOT Analysis on Promoting the Industrialization of Agricultural Intelligent Equipment in China
This paper adopts SWOT analysis to analyze the promotion of agricultural intelligent equipment industrialization in China, which can be referred to in table 1.

(1) Advantages: China is a big country in the world of agricultural machinery manufacturing and use, and the rapid development of agricultural equipment industry has laid a good technology for the development of agricultural intelligent equipment industry. Scientific and technological innovation has gradually changed from "made in China" to "created in China", and the innovation ability has made a substantial breakthrough, which provides technical support for the development of intelligent equipment industrialization. At present,
the understanding of intelligent equipment industrialization in China is not deep enough and its application is not perfect enough, which means its development prospect is broad and development potential is huge.

(2) Disadvantages: there is still a gap compared with foreign smart devices, especially in large-scale breeding and planting equipment, the most prominent of which is the sensor problem. In the past, few agribusinesses have used smart devices with sensors, and farmers have little or no understanding of this need. Intelligent equipment is mainly used in scientific experiments, and its performance, appearance and stability are not as good as those made by foreign manufacturers. In addition, intelligent devices must be combined with information technology to play a role, if information technology is the human brain and nerve, intelligent equipment is muscle and bone, to make people flexible activities, both must be compatible.

(3) Opportunities: after the construction of "new socialist countryside", China has put forward the rural revitalization strategy, and the importance of the three rural issues has been raised to an unprecedented height. The country has introduced a lot of preferential policies, covering all fields and aspects of agriculture. In manpower aspect, set up farmer training class, improve farmer quality, train new farmer; raise wages, attract agricultural talents to the countryside. In terms of material resources, we will give farmers purchase subsidies and strengthen policy support. In terms of financial resources, we will give preferential treatment to relevant enterprises, introduce social capital and solve financial problems.

(4) Challenges: at present, the promotion of intelligent equipment industrialization still faces many challenges. On the one hand, the development foundation of this field is still relatively weak, including the data fragmentation which leads to the unsmooth communication of all links, and the waiting for improvement of science and technology, which leads to the low stability of some intelligent devices which cannot be widely promoted, and it is difficult to form industrialization. On the other hand, the industry competition in this field is relatively extensive, emphasizing marketing rather than product research and development, resulting in the lack of development momentum. In addition, the concept of farmers needs to be updated, the lack of understanding of intelligent equipment.

Table 1. SWOT analysis on promoting the industrialization of agricultural intelligent equipment in China

| Project       | Make a concrete analysis                                                                 |
|--------------|-----------------------------------------------------------------------------------------|
| Advantage    | Rapid development of agricultural equipment industry;                                   |
|              | Improvement of scientific and technological innovation capacity;                       |
|              | Large space for industrialization of agricultural intelligent equipment                 |
| Disadvantages| The quality of agricultural intelligent equipment is not up to standard                  |
| Opportunity  | Support of national policies                                                            |
| Challenge    | Weak development foundation; extensive management mode;                                  |
|              | Lack of farmers' understanding of intelligent equipment                                  |

4.2 Comparative Analysis of the Per Capita Cultivated Land Area Between China and the World

On the one hand, the continuous advancement of urbanization leads to the continuous decrease of China's cultivated land area; On the other hand, China has a large territory but a large population and a large base, which makes the per capita cultivated land area of China far lower than that of the world. As shown in table 2 and figure 1 below, the per capita cultivated land area of China in 2019 is only 1.46 mu/person, which is only the average of the world's per capita cultivated land area. The contradiction between people and land has always accompanied the development course of China. The cultivated land area is inversely proportional to the total population, which requires increasing the output per unit area of cultivated land to feed more people, and promoting the industrialization of agricultural intelligent equipment is an indispensable means in the new era.

Table 2. Comparison of the per capita cultivated land area between China and the world
Time | Per capita cultivated land area in China (mu/person) | World per capita cultivated land area (mu/person)
--- | --- | ---
2014 | 1.497 | 2.97
2015 | 1.49 | 2.94
2016 | 1.482 | 2.925
2017 | 1.473 | 2.91
2018 | 1.463 | 2.9
2019 | 1.46 | 2.89

*Data from the document of China Data Statistics Bureau in December 2019

4.3 Path Research of Agricultural Intelligent Equipment Industry

(1) To strengthen publicity and raise farmers' awareness. Compared with foreign countries, there is still a long way to go for the industrialization of agricultural intelligent equipment in China. Some of the staff of relevant departments have not enough thorough understanding of the industrialization of agricultural intelligent equipment, not enough attention, not enough initiative; Most farmers, especially those in the economically backward regions in the central and western regions, are still unfamiliar with agricultural intelligent equipment. They do not know its function, nor do they have the ideological consciousness to introduce agricultural intelligent equipment into agricultural production. If you want to walk fast, you must first think correctly. Relevant departments and industries should strengthen the publicity and expand the promotion. On the one hand, they should have a profound understanding of agricultural intelligent equipment, and on the other hand, they should open the minds of farmers and let them accept agricultural intelligent equipment. Strengthening publicity is conducive to promoting the industrialization of agricultural intelligent equipment to clear the early obstacles.

(2) Increase purchase subsidies and expand the scope of use. At present, the price of agricultural intelligent equipment is relatively expensive, and individual farmers cannot buy it alone or it is risky to buy and use it. The government can increase purchase subsidies to ease farmers' purchasing pressure, and relevant enterprises can increase preferential measures, increase service links and time limit, so as to solve farmers' difficulties in using equipment and relieve them of worries. The two ways can attract more farmers to buy and use smart equipment, expand the scope of use, and promote its industrialization.

(3) Enhance the capability of scientific innovation and enhance the quality of hardware. At present, some agricultural intelligent equipment is not stable enough and related technologies are not mature enough, which forces the enhancement of scientific innovation ability. Enhance the ability of scientific innovation, improve...
the quality of equipment, so that farmers can buy comfortable, assured use.

5. Conclusion
China's economic development has entered a new normal, and agricultural development is in a critical period of the transformation from traditional agriculture to modern agriculture. With the development of industrialization and urbanization, agricultural development is increasingly constrained by the decrease of land resources and the deterioration of production environment. Only by increasing the investment of agricultural science and technology and strengthening the application of agricultural intelligent equipment in the agricultural field can we break through the double restraint and bottleneck of agricultural development and improve the output per unit area of land and the utilization rate of related resources. The promotion of agricultural intelligent equipment industrialization can not only accelerate the transformation and development of agriculture, but also be a strong expression of China's scientific and technological progress and strong national strength. To promote the industrialization of agricultural intelligent equipment is the trend of The Times.

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References
[1] Wang Zhijun, Zhang Shaoshuai, Gao Xiuyun. A tentative plan for the industrialization of science and technology education and training in agricultural research institutions: a case study of the Chinese Academy of Tropical Agricultural Sciences [J]. Agricultural development and equipment, 2019, 34(8): 34-35.
[2] Zhou Haotian. Research on innovation and development of agricultural industrialization consortia under the strategy of Rural Revitalization -- Analysis of operation characteristics, development difficulties and paths [J]. Jiangsu agricultural science, 2019, 47(17): 32-35.
[3] Julie, Jiang Jian. Research on the optimization path of agricultural science and technology foreign exchange Development -- Taking Anhui Province as an example [J]. Management observation, 2019, 16(20): 13-14.
[4] Lin Weiyi. Study on the formation mechanism and path of Internet agricultural town [J]. Western leather, 2019, 41(10): 12-13.
[5] Qi Fei, Li Kai, Li Shao. Study on the Enlightenment of the development of intelligent equipment for facility horticulture in the world to China [J]. Journal of agricultural engineering, 2019, 35(2): 183-195.
[6] Wang Yu, Zheng Zihui. Application direction and development path of artificial intelligence technology in agriculture [J]. Information and communication technology and policy, 2019, 34 (6): 19-20.
[7] Chen Junjiang, Li Jinzhao, Hai Xia. Research on the innovation path of modern agricultural system under the perspective of "Internet plus" -- Taking Chengdu as an example, [J]. Agricultural economy, 2018, 31(1): 11-12.
[8] Ren ting. A study on the basic path of China's rural economic development from the perspective of modern agricultural industry system construction [J]. Agricultural economy, 2019, 34(7): 34-35.
[9] Li Yulin. Research on the development path of modern agriculture under the background of "Internet plus" [J]. Hubei agricultural mechanization, 2019, 14(16): 23-24.
[10] Yun Tao. The development path of "Internet plus" eco agriculture in the perspective of Rural Revitalization [J]. Farmer staff, 2019, 23(10): 35-35.
[11] Liu Wei. Research on innovation of agricultural industrialization mode in Henan Province [J]. China management informatization, 2019, 24(16): 19-20.
[12] Wang Gang. Research on the path selection of structural reform of agricultural supply side in Guangxi [J]. Journal of Nanning Vocational and technical college, 2018, 24(4): 67-70.
[13] Yuan Lihua. Research on deepening the "Trinity" reform path in Zhejiang Province under the
background of the agricultural cooperation Union [J]. China business theory, 2019, 34(15): 34-35.