Research on Innovation Management Mode of the Collaborative Cooperation of Smart Agriculture and Science Technology in Beijing and Hebei

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Abstract: In China, a series of policies has been formulated to guide the sustainable development of smart agriculture. However, due to the high investment and low income characteristics of smart agriculture construction, most of them rely on financial subsidies at all levels. And agricultural operators generally are short of initiative in construction. Therefore, this paper conducts research on the management mode of the collaborative cooperation of smart agriculture and science technology in Beijing and Hebei, and proposes innovation management mode so as to achieve the goal of low investment and high income. It is also the basis for solving the problem of sustainable development of smart agriculture in Beijing and Hebei.

Keywords: Smart agriculture, Collaborative cooperation, Beijing and Hebei, Management mode

1. Introduction

Since the 20th century, because of the promotion of mechanization, chemical fertilizers, and biotechnology, agriculture has developed rapidly, with a significant increase and improvement in per capita arable land, per mu yield, and crop performance. The extensive production mode of traditional agriculture is moving towards intensification and precision. The agricultural production has entered the stage of "industrial like" smart agriculture. Early smart agriculture was based on IoT devices and supporting agricultural information systems. Now it is entering the digital economy era. The superposition of new generation information technologies (such as IoT, artificial intelligence, cloud computing, big data, etc.) has transformed the data elements collected by agricultural information systems into agricultural production and process management decisions, which greatly improves resource allocation efficiency. Digital technology is pushing smart agriculture to a new level of digitization and intelligence [1].

As a major trend in modern agriculture, smart agriculture plays a huge role in actual agricultural production. It uses artificial intelligence to intervene in the early production, middle production and late production of agricultural production, to achieve intelligent prediction, intelligent control, intelligent detection and other steps. Then, it analyzes the influencing factors in the production process, intensifies means of production, and improves the labor utilization rate. With the gradual advancement of modern agriculture, agricultural development has shown initial results. To promote the role of smart agricultural management in agriculture further, only smart agricultural management models suitable for regional agricultural development can ensure the promotion of local agricultural development. The acceptance and recognition of farmers should be in line with the management methods of contemporary agricultural development. Therefore, this paper conducts in-depth research on the management mode of smart agriculture in Beijing and Hebei, which proposes a more suitable management mode of smart agriculture for agricultural development. It will promote the improvement of management mode, which has important significance for promoting modern agricultural development and increasing farmers' income.

2. Current Situation of Smart Agriculture

Here we introduce the development of smart agriculture at home and abroad in this paper.

2.1. Smart agriculture

Smart agriculture [2], also known as the intellectual economy in agriculture, is a high-end comprehensive and top-level design system in agricultural management. It relies on modern information technologies, such as the Internet of Things, cloud computing, remote sensing technology, geographic information systems, and global positioning systems. Through automatic control and intelligent perception of the agricultural production environment, intelligent, scientific and intelligent agricultural production can be achieved. Traditionally, it is the comprehensive application of modern information analysis and decision-making technologies such as the Internet, cloud computing, and big data in agricultural production. By collecting information through multiple types of modern sensor node devices and transmitting information through wireless information devices, a unified integrated data resource system and scientific management and operation system are established [3].

2.2. Models of Smart agriculture

As a major food exporting country and region in the world, smart agriculture in the United States and the European Union started early and developed at a high level. In China, smart agriculture started late but developed rapidly, reaching the international advanced level in some technology applications, such as Beidou agricultural machinery automatic navigation and driving, plant factory, UAV plant protection. However, it is subject to the United States, Germany, Netherlands, etc. in some key core fields, such as high-end agricultural environmental sensors, animal and plant growth models and core data. Currently, five creative agricultural production and operation models have been formed, as shown in Table 1 [4].

Table 1: Five Models of Creative Agriculture

Agriculture Model	Creative Types	Main Approach
Dutch Mode	High-tech foreign exchange earning type	Focus on technological research as the development strategy center, and produce high value-added agricultural products moderately on a moderate scale, such as vegetables, eggs, flowers, etc.
German Model	Social life functional type	Utilize urban and suburban agricultural land to develop civic gardens, and use forest or grassland areas to develop leisure farms. Play its role in science popularization, environmental education, and physical and mental recovery
British Model	Tourism and environmental protection type	Develop the tourism industry in rural areas systematically to mesh agricultural tourism and cultural tourism tightly. Enrich agricultural tourism resources
French Mode	Environmental ecotype	Highlight the ecological functions of agriculture, to make farmland a protective wall for urban landscapes and a comfortable living environment for residents
Japanese Mode	Multifunctional Wealth Making Type	Make efforts to promote the "sixth industry" of new agriculture. Integrate the development of three industries. Develop diversified functions such as green, processing, sightseeing, and leisure in agriculture

On the one hand, it has enabled urban residents to rent land and plant vegetables in the countryside, breaking through time and space constraints. The "community supported agriculture model" has truly emerged in China. On the other hand, farms that apply smart agricultural production have innovated the F2F (family to farm) model for family member reservation. It is a new C2B connection method between agricultural producers and end consumers, with the advantage of accurately managing the growth environment of agricultural products to produce high-quality agricultural products.

In addition to these five models, various countries are also introducing various management models suitable for their own agricultural development continuously. For example, in America, there are nearly 70% farms using sensors to collect data, and agricultural robot to sow, spray, harvest and so on. The

digital agriculture platform FieldView built by Climate, a digital agriculture supplier of Bayer, has been applied to more than 60 million hectares of land by farmers in more than 20 countries around the world. After using FieldView to manage farms, the income per hectare of land has increased by 0.5 tons. In Singapore, due to the small planting area, all the plants cultivated have replaced "soil cultivation" with nutrient solution, namely, "water cultivation". There are also mobile plant factories that use LED light sources and nutrient solution to build "greenhouse" in mobile containers. So the capacity can be close to the consumer to reduce the cost of circulation links [5].

2.3. Smart Agricultural Production Bases

For China, refined and intelligent management of agricultural production has been achieved with smart agriculture. At the same time, the utilization and output rate of agricultural inputs have been improved. Ultimately, agricultural production efficiency has been improved. As listed in Table 2, some smart agricultural production demonstration bases are listed, and the production efficiency have been improved significantly.

Table 2: Development achievements of smart agriculture in China

Smart agricultural production bases	Production efficiency
Jiangsu Dazhong Farm	unmanned automated field inspection and fully autonomous pest control have been implemented in the 80000 acre rice and wheat fields of Jiangsu Dazhong Farm, saving nearly 1 million yuan in pesticide costs per year
Chongqing Tixiang Farm intelligent agricultural production base	The 150 mu (1 mu =1/15 hectare) grapes of the base save the annual labor cost of 100,000 yuan and 10 tons of fertilizer, and increase the annual income up to 200,000 yuan
Gobi greenhouse facility agriculture in Dunhuang, Gansu Province	Each jin strawberry average can sell more than 50 yuan; Greenhouse average mu income reached 28 042.95 yuan, 10 times the previous income
Black dragon Jianghong Xinglong breeding cooperative	The productivity of female calves can be controlled at 95% ~ 98%, and scientific breeding of both dairy and meat cattle can increase the income of nearly 15,000 yuan per cow
No-tillage straw test base in central black soil area and northwest wind-sand area of Lishu County	Increasing soil water content by 20% ~ 40% can save the cost of 1200 ~ 1500 yuan per hectare

For the Beijing-Hebei region, there are also many successful cases of smart agriculture. As shown in Figure 1, we can experience the changes brought by "Internet of Things +" everywhere. A smart device at the entrance to the greenhouse displays the temperature, humidity, illumination and carbon dioxide levels inside. Inside the greenhouses, the wide variety of vegetables and modern planting methods are eye-opening. The vegetables here are always in the nutrient solution from sowing, seedling emergence, planting, and ripe picking. Relying on the Internet of Things control system, the greenhouse has a "smart brain", which provides the required nutrients of vegetables on time and in quantity every day, so that the vegetables are always in the best growing environment. It could reduce labor errors and save labor costs with "Internet of Things +". There is no need to worry about pesticide residues and secondary pollution, so as to improve crop yield and vegetable quality. As shown in Figure 2, this smart farm in Tayuanzhuang is an intelligent ecological energy house integrating technology, green and energy saving. It shows the future direction of agricultural development and the production and planting process of raw materials of Tongfu's whole industrial chain. It achieves planting Southern fruits in the north through cutting-edge agricultural technology and greenhouse planting technology, and introduces various new and exotic fruit and vegetable varieties. Relying on its geographical advantages and resource advantages, it has made great efforts to develop characteristic, leisure, green and smart agriculture. Modern agricultural technology and rural e-commerce have been developed.

Figure 1: Cangzhou Impression •Grand Canal agricultural ecological Culture Industrial Park (Source: Hebei Daily).

Figure 2: A smart farm in Tongfu Rural Revitalization Demonstration Park in Tayuanzhuang.

With the application of intelligent technologies such as the Internet of Things, artificial intelligence and big data in agricultural production, traditional agriculture has changed from "heavy labor" to "light brain", and the traditional mode of "relying on the sky to eat" into a refined and efficient intelligent mode, which has fundamentally changed the agricultural production mode.

In addition, Internet giants such as JD, Ali and Pinduoduo have their advantages in digital technology formed in the process of development. Successful cases (as shown in Table 3) prove that digital transformation can improve agricultural productivity, showing the value increment of digital agriculture. The successful cases have proven that agricultural digitization can increase efficiency, improve quality, and reduce costs, which is worthy of active reference for agricultural enterprises. The absolute bargaining power and supply chain integration power of internet platform enterprises cannot be replicated by traditional agricultural enterprises. They need to "focus on consumers" and seize the wave of industrial internet to forge new advantages gradually [6].

Table 3: Development achievements of smart agriculture in China

The Enterprise Name	Specific implementation of smart agriculture
JD	The leap from "integrated purchasing and marketing" to "integrated production and marketing" has been realized with the self-built vegetable base. It has also combined the latest technology to increase vegetable production and save water. For intelligent farming, it integrates pig face recognition, IoT, blockchain and other digital technologies to realize robot feeding and traceability in the whole process, saving feeding costs and so on.
Ali	Agricultural ET Brain has been applied to pig breeding, apple and melon planting and other fields, with full life cycle management, intelligent agricultural analysis, full link traceability and other functions.
Fresh e-commerce platform	Sales and service links close to consumers especially need the traffic of Internet platform to provide convenient channels for agricultural products to go up. Therefore, the combined advantages of "traffic + technology" enable Internet enterprises to create a new benchmark of smart agriculture.

In conclusion, there are some problems between smart agricultural management and technology. Based on the existing agricultural development, how to coordinate the relationship between various factors such as technology and management provides a good theoretical reference for the collaborative management of smart agricultural technology in Beijing and Hebei.

3. Problems and countermeasures in the development of smart agriculture in Beijing and Hebei

Smart agricultural production system includes: data collection, storage system; Data transmission system; Data analysis and decision system; Terminal remote control system for agricultural operators; Executive control instruction system. The five-part system includes many modern advanced technology and equipment, which is the basic support of intelligent agricultural production [7]. For the Beijing-Hebei region, there are many problems in the development process of smart agriculture, as shown in table 4 which also lists the corresponding solutions to these problems in detail.

Table 4: Development achievements of smart agriculture in China

Region	Existing problem	Solution
Beijing-Hebei region	Infrastructure is backward and the construction fund gap is large.	Upgrade infrastructure faster and consolidate funding for such projects, and implement Agricultural e-commerce demonstration projects
	Lack of compound high-quality talents	Speed up the cultivation of high-quality and versatile talents for the management of smart agriculture, and train the farmers with mobile phone application skills
	Lack of scientific and technological support for agricultural production	Raise the support of agricultural science and technology research in Beijing-Hebei region
	The process of land scale management is slow.	Solve the problem of appropriately large-scale land operations, and speed up the flow of information into villages and households
	Lack of information platform	Increase capital input and strengthen the construction of information platform, and strengthen trials to develop agricultural big data

4. Conclusion

With the outbreak of information technology revolution, the senior stage of modern agriculture -- smart agriculture emerges. Smart agriculture will not only help to transform and upgrade traditional production modes, innovate production and operation modes, improve the production efficiency, but it also facilitates the refined intelligent management and promotes the reform of agricultural supply side. However, at present, smart agriculture is still in the initial stage, and the development of smart agriculture still has many problems in Beijing and Hebei. Therefore, it is imperative to speed up the cultivation of high quality complex talents running intelligent agriculture, strengthen the full cooperation of our government, enterprises and farmers, and improve the support of our agricultural science and technology research.

Acknowledgements

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