

# Suggestions for the Development of Smart Agriculture in China

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## Abstract

With the emergence of new technologies such as mobile Internet, Internet of Things, artificial intelligence, 5G technology, intelligent sensor network and cloud computing, and the arrival of the era of Big data, the development of various industries has been affected. The continuous popularization and application of these technologies have provided a large amount of data and information, laying a solid foundation for the application of smart systems. When "Internet plus" and artificial intelligence technology really penetrate into various traditional industries, it is not simply the addition of the two, but the in-depth integration of Internet communication technology and network platform with traditional industries to achieve digital, networked and intelligent development. In the new situation and era, cultivated land, as an important foundation of agricultural production, also faces many new opportunities and challenges, and there are still many problems to be studied.

## Keywords

Smart Agriculture; Intelligent Agricultural Machinery; Automatic Navigation; Precision Operation; Information Technology.

## 1. Introduction

Cultivated land is the basic Means of production for human survival, which directly affects the development of agricultural production and food security. From a global perspective, cultivated land has become a hot topic in land use/land cover change, and land system research. China is a major agricultural country. Although its total arable land ranks fourth in the world, the per capita arable land area is less than 0.095hm<sup>2</sup>, less than one-third of the world average. The rapid development of the economy and the continuous surge in population, coupled with the implementation of various measures such as ecological restoration and environmental protection, pose great challenges in stabilizing the number of cultivated land. At the same time, the quality of arable land in China is not optimistic, as many areas are affected by water resource limitations, soil conditions, and environmental pollution, which cannot guarantee good agricultural planting conditions. Although China's grain production has achieved a historic "twelve consecutive increases", there are many problems hidden behind the use of arable land, such as low agricultural production technology, extensive agricultural management, and excessive investment. Therefore, how to scientifically strengthen the protection of cultivated land that integrates "quantity, quality, and ecology" is a strategic issue related to China's "three rural" issues, maintaining national stability, and social coordinated development. It is also a key focus of scientific research on cultivated land resources in China. Agricultural informatization (smart agriculture) is an inevitable choice for achieving

agricultural modernization and accelerating the transformation from a major agricultural country to an agricultural powerhouse. As a new type of productivity, information technology is the core element of agricultural modernization and the commanding point of modern agriculture. It supports and leads the development, transformation, and upgrading of agricultural modernization, and promotes and even drives agricultural modernization through agricultural informatization, It is of great significance for promoting the sustained and coordinated development of China's economy and society.

## **2. Problems in the Utilization of Traditional Cultivated Land Resources**

### **2.1. The Area and Spatial Distribution of the Household are Still Unclear**

Different departments in China have used remote sensing technology to investigate the quantity and spatial distribution of arable land nationwide, and analyzed its dynamic changes and patterns. However, there are currently many inconsistencies in different remote sensing datasets of cultivated land. Due to the influence of statistical caliber and methods, the cultivated land area in statistical yearbooks is inconsistent with the interpreted cultivated land area from remote sensing images, resulting in significant differences. The difference in quantity and area leads to an inability to accurately grasp the overall situation of arable land, and the actual situation of implementing arable land cultivation may not be consistent with the expected situation, resulting in significant errors. On the other hand, incomplete or misaligned spatial location data of arable land directly affects the accuracy of arable land spatial positioning. Due to the previous management of arable land mainly relying on paper maps and manual drawing, there were issues such as low data accuracy and untimely updates. With the continuous popularization and promotion of computer technology and GIS technology, management departments are gradually using electronic information technology to manage data on cultivated land area and spatial location. However, the accuracy of basic data still needs to be improved.

### **2.2. Difficult to Achieve Estimated Farmland Yield**

The production capacity of arable land is also an urgent issue to be solved. Traditional agriculture is mostly based on individual farmers, and their production capacity estimates are mostly based on farmers' experience and judgment. From the investigation of different grain producing areas, it can be seen that the application of agricultural planting techniques is not very high, and farmers mainly rely on their own experience for farming. However, the yield of cultivated land is simultaneously affected by various factors such as soil environment, individual variety differences, climate, and human interference. Without a comprehensive monitoring and estimation mechanism, relying solely on human judgment can lead to high or low expectations of yield, which is not conducive to farmers implementing their original plans and transactions. For the adjustment of planting structure, farmers cannot make effective judgments and predictions based on their own experience. They need to comprehensively grasp various aspects such as global markets, climate change, and domestic demand. At the national level, the planting type and yield are directly related to the self-sufficiency of domestic people's food and the plans for foreign export transactions and imports. Overcoming income or a large surplus are not conducive to the sustainable development of domestic agriculture.

### **2.3. The Overall Quality Management of Arable Land is Backward**

Since the end of 2016, China has implemented the national standard of "Cultivated Land Quality Grade", which is applicable to the classification of cultivated land quality grades at all levels of administrative regions and specific regions. The cultivated land quality is divided into 10 grades. However, due to the short implementation time, many remote rural areas still implement local "large-scale mixed planting", which is based on the planting experience of predecessors and

their own needs to independently classify species types. It is impossible to accurately determine the quality level of land to adapt to local conditions. This will lead to a large amount of waste of farmland, a decrease in yield, and the degradation of originally high-quality soil and a decrease in soil fertility due to incorrect farming methods. At present, it is necessary to further accelerate the classification of farmland quality levels, popularize its standards, and carry out unified and standardized cultivation operations in order to reduce the waste and degradation of farmland resources. On the other hand, the development of cities requires a large amount of arable land, and the quality of supplementary arable land has always been a concern. Although the country has implemented many policies such as "occupying one to supplement one" and converting supplementary farmland according to levels, the overall quality of reserve resources is not high, which restricts the planting management of supplementary farmland.

### 3. Current Situation of Smart Agriculture Development in China

With the continuous progress and promotion of modern information technology, the relationship between internet technology and different industries has become increasingly close. Among them, the production mode of "internet technology+agriculture" has broken through the traditional agricultural production mode, completed the integration of traditional agriculture and emerging technologies, and entered a new stage of traditional agricultural production, that is, the stage of smart agriculture. Smart agriculture breaks the existing agricultural production mode, By combining the Internet of Things (IoT) 3S technology, wireless communication technology, and high-end agricultural technology talents, a series of precise and intelligent control processes have been achieved, including remote control of agricultural product production, remote monitoring of agricultural product growth environment, and early release of disaster warning notices. At present, with the promotion of government policies and the efforts of scientific research organizations and agricultural enterprises, some regions of China have built agricultural IoT demonstration parks, and smart agriculture is showing a good development trend. From the perspective of agricultural production, some regions in China are gradually realizing smart farmland planting, smart livestock breeding, and smart aquaculture. Henan, Liaoning, Guizhou, and other places use greenhouse temperature control technology to conduct intelligent monitoring of the brightness, humidity, and temperature of various stages of vegetable growth. On one hand, it ensures that the vegetables produced are green and organic, and on the other hand, it breaks through the seasonal limitations of vegetable growth, Ensure sufficient market supply In 2018, Ali Group and JD.com successively launched A pig technology to establish an Internet of Things intelligent breeding system to achieve intelligent control of the breeding process; From the perspective of agricultural product circulation, smart agriculture based on "Internet of Things+Agriculture" relies on Internet of Things technology to achieve information technology in agricultural management. It utilizes modern information technology to achieve transparency and integration in production, logistics, and sales, breaking geographical limitations in agricultural product circulation and greatly shortening the distance between production and consumption, Greatly improving the efficiency of agricultural product circulation, breaking through the single agricultural product sales model, gradually forming a diversified sales model mainly represented by B2BB2C and O2O. According to data from the National Bureau of Statistics, the total online retail sales in rural areas reached over 777.1 billion in 2019, accounting for 16.1% of the total online retail sales. In addition, e-commerce enterprises have started to switch to traditional e-commerce platforms such as Alibaba and JD Suning, which have established agricultural product production bases and county-level business outlets in rural areas, greatly promoting the development of rural e-commerce; From the perspective of agricultural services, smart agricultural production uses "3S" technology and Internet of Things technology to obtain Big data of agricultural production, scientifically predict farmers' "what to plant" and "how to",

and break through farmers' planting thinking relying on experience to predict. The construction of an agricultural information platform aims to provide farmers with accurate weather change data, market supply and demand data, reduce the cost of information collection for farmers, provide scientific basis for production decision-making, and enhance their ability to resist risks.

## **4. Suggestions for Promoting the Development of Smart Agriculture**

### **4.1. Improving the Agricultural Research System and Enhancing the Conversion Ability of Smart Agricultural Research Results into Actual Productivity is the Key to Promoting the Rapid Development of Smart Agriculture.**

Firstly, we need to continue to introduce policies that are conducive to the development of smart agriculture, increase financial and human investment in the agricultural research system, promote the establishment of a standardized agricultural research system, strengthen cooperation and exchange among agricultural research institutions, and concentrate all efforts to tackle key core technologies that constrain the development of smart agriculture. Secondly, we need to increase the promotion of agricultural technology, utilize various channels to promote the concept and technology of smart agriculture, build an online communication platform for agricultural information, conduct agricultural production technology training, and enable farmers to better accept modern agricultural technology, apply agricultural research results to actual agricultural production, and improve the application level of smart agriculture.

### **4.2. Cultivating Smart Agricultural Operators, Improving Farmers' Technological Quality, Cultivating New Professional Farmers Suitable for the Development of Smart Agriculture, and Matching Them with Smart Agricultural Technology are Necessary Measures to Ensure the Development of Smart Agriculture.**

To this end, firstly, carry out smart agriculture talent training courses in universities, cultivate a group of agricultural IoT technology professionals, innovate and apply agricultural IoT technology, agricultural modernization information technology, and provide intellectual support for the development of smart agriculture. Secondly, encourage agricultural migrant workers to return to their hometowns for innovation, and cultivate a group of functional farmers among existing middle-aged and young farmers who can accept new things and use agricultural high-tech technology. Thirdly, vigorously promote the strategy of rural revitalization, narrow the gap between rural and urban life, improve the quality of life of grassroots agricultural technology personnel, retain a group of high-quality agricultural talents who understand technology and operation, and provide a continuous source of power for the development of smart agriculture.

### **4.3. Strengthen the Integration of Agriculture and Modern Information Technological Convergence to Promote the Development of Smart Agriculture**

The level of agricultural technology content is an important indicator for measuring the development of smart agriculture. Therefore, the technological level of agricultural production, circulation, and sales should be improved. Firstly, the core of smart agriculture is to use network technology as a medium to achieve the collection of crop growth data and intelligent management of agricultural production processes. Therefore, rural information construction is an important guarantee for the development of smart agriculture. To this end, we should firmly

establish regional channels, ensure that there is a path for information transmission, and create Targeted Poverty Alleviation in the context of the information age.

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## References

- [1] K. K,Anand J A,Tanwar P, et al. Advanced Technologies for Smart Agriculture[M].River Publishers: 2023-06-27.
- [2] Roopali D,Shalli R,Aman S, et al. Deep learning model for detection of brown spot rice leaf disease with smart agriculture[J]. Computers and Electrical Engineering,2023,109(PA).
- [3] Sangik L,Jong-hyuk L,Youngjoon J, et al. Agrivoltaic system designing for sustainability and smart farming: Agronomic aspects and design criteria with safety assessment[J]. Applied Energy, 2023, 341.
- [4] Ning S,Beibei F,Yahui D, et al. Analysis of the Development Status and Prospect of China's Agricultural Sensor Market under Smart Agriculture[J]. Sensors,2023,23(6).