Using the internet of things to promote the sustainable development of modern agricultural management mode

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Abstract: From the perspective of agricultural development, this paper analyzes the role of the Internet of Things on agricultural development, and how to promote the sustainable development of modern agricultural management. Make rational use of scientific and technological resources, improve the efficiency of agricultural production, and promote agricultural development.

1. Background Study

With the increasing application of science and technology in agriculture, the expansion of the Internet of Things will accelerate the modernization of agriculture, as shown in Figure 1. Internet of things is the use of information sensing device according to the protocol to connect any object and the network, and on the basis of object information exchange and communication, achieve the goal of intelligent identification, positioning, monitoring and with the complexity of agricultural production model, machine learning must collect more data, aerial remote sensing, geographic information system, ground Internet of things, artificial intelligence technology development and application of precision agriculture become a practice.[1]
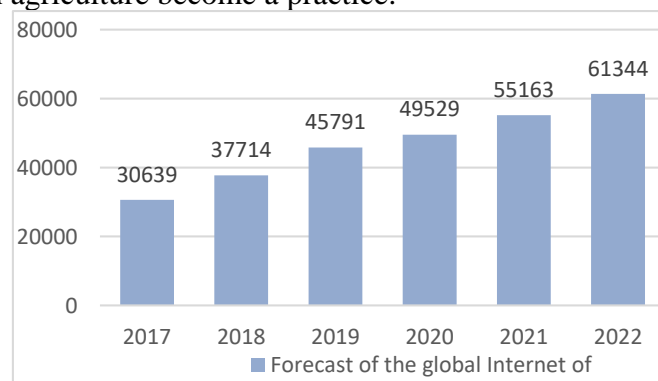

Figure 1: Forecast of the global Internet of Things market size in 2017-2022

At present, according to their national conditions, countries apply the Internet of Things technology to agriculture through remote sensing satellites and GPS precision planting, obtain surface cover and internal structure information, analyze the spectral and spatial distribution characteristics

of crops, and monitor the main components of soil. In addition, satellites can alert them before a disaster occurs. Taking China Agricultural Meteorological Administration as an example, the data transmission and real-time monitoring of agricultural data are realized by using the Beidou communication function. The joint application of Internet and satellite positioning technology is conducive to the real-time operation of agricultural machinery and sharing on the network [2] accelerates the development of modern agricultural model.

2. Theoretical Elaboration

2.1. Connotation of agricultural modernization

Agricultural modernization refers to the process of realizing the comprehensive, coordinated and sustainable development of agriculture and rural economy on the basis of modern science and technology and management means. Through the popularization of farmers, they realize that agricultural products can be commercialized, and science and technology are widely used in the formation of commodity agriculture, from disorderly market to orderly market, to realize the modern agricultural management mode.

2.2. Study Objectives

According to the Food Outlook report, the cost of global food imports will reach $1.94 trillion by 2022, up 10% from the same period last year, and global agricultural imports will exceed $420 billion, both will more than double the cost in 2020. Through the Internet of Things, world food production will grow by 70 percent to reach a 9.6 billion grain forecast by 2050, according to the Biekhan Research Center. The application of Internet of Things technology in agriculture can provide comprehensive information for agricultural production and develop into efficient agriculture.

2.3. The internal mechanism of the Internet of Things to enable agricultural modernization

The Internet of Things provides a new technological means for the development of agriculture. Through the application of sensors, big data and other information technologies, agriculture can realize the intelligent production management process and improve the production quality.

2.3.1. Impact of the Internet of Things on agricultural governance

Today, the Internet of Things technology has penetrated into the fine agricultural production management, agricultural products transportation, sales and other aspects, such as water, fertilizer integrated system, including water treatment equipment, irrigation, fertilization equipment, control cabinets, monitoring system, etc. Soil water sensors are collected remotely, and crops are monitored in real time through cloud server reading information. Soluble or liquid fertilizer, fertilizer, control pipeline system and drip irrigation device are used to conduct drip irrigation, fertilization, timing and quantitative penetration of crop root growth, so as to ensure appropriate root soil water content and improve production efficiency.

2.3.2. The Impact of the Internet of Things on agricultural development

First, promote the innovation of agricultural production mode. Through the Internet of Things, sensors are used to collect air humidity, sunlight intensity, wind direction, and then WIFI, LORA, NB and other data to collect information screening, and fertilization and irrigation are monitored through the Internet of Things and user interface. Using big data to predict agricultural production

and consumer demand, to help operators better understand the market information.

Second, the rational use of scientific planting means, can promote the sustainable development of agriculture. At present, world food production is growing but declining again, as shown in Table 1. This may be due to the damage to the global environment and other factors. Through the application of the Internet of Things in agriculture, we can complete the monitoring of the agricultural ecological environment and agricultural conditions through low-altitude sensors and wireless sensor networks.

Table 1: Global grain production and growth rate in 2018-2022

a particular year	In 2018 / 19 years	In 2018 / 19 years	In 2018 / 19 years	In 2018 / 19 years
Global grain output (million tons)	26.5	27.1	27.8	28
speed increase		2.3%	2.6%	0.7%

3. The role of the Internet of Things in promoting the sustainable development of agricultural modernization and management
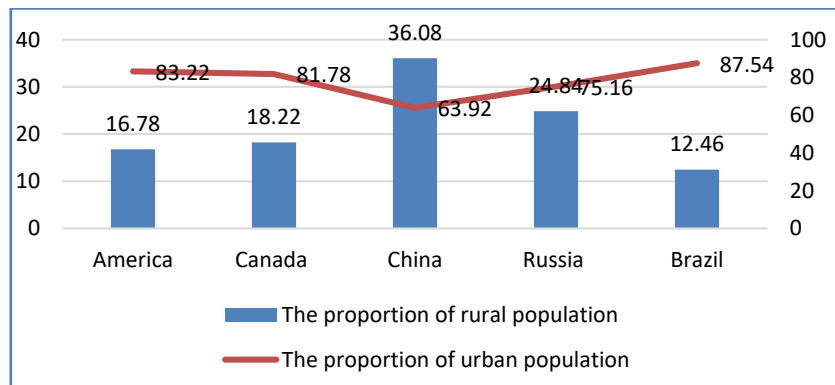

Figure 2: Rural and urban population proportion in 2022

First, make the development of agriculture adapt to the changes of modern society. At present, the proportions of the rural and urban populations are not equal, as shown in Figure 2. Increasing food production in a limited labour force requires increased agricultural productivity. Through IoT monitoring and forecasting, farmers can understand weather, air quality, or soil health issues and plant them precisely to reduce losses and increase food production.

Second, we will promote agricultural modernization. Agricultural individual identification technology in the Internet of things mainly bar code, qr code technology and RFID technology [3], we can collect and upload information of each link in the process of agricultural production, such as planting, processing, storage, to provide traceability query services for relevant personnel, let them understand the indicators in the process of crop growth, consumers can also through barcode about the information of agricultural products. In addition, the use of water and fertilizer system can also ensure the appropriate amount of fertilizer application to ensure the healthy growth of crops and food safety. The development of agricultural big data has realized the multi-dimensional tracking of the circulation of agricultural products, and has directly driven the innovation of business models [4].

4. Accelerate the agricultural modernization of the Internet of Things

4.1. The development status of agricultural Internet of Things technology

The combination of the Internet of Things and agriculture is an inevitable trend. Big data, Internet communication, cloud computing, climate detection transmitter and other related technologies are used to control the weather change in agricultural industry planting areas, so as to maximize the utilization of resources [5]. France has established a relatively complete agricultural regional monitoring system, and China mainly combines GPS and sensing technology to collect agricultural information. In addition, benefiting from the rapid development of China's fourth generation mobile communication technology (4G), fifth generation mobile communication technology (5G), cloud platform, industrial Internet of Things and other technologies in recent years, agricultural Internet of Things products have gradually met the needs of users in terms of price and ease of use [6]. In the early days of its establishment, the American high-tech agricultural company CropX developed a farm production soil exploration technology to provide farmers with intelligent agricultural irrigation and production solutions through topographic exploration and soil water content analysis[7]. We hope to establish a "soil Internet of Things" to optimize the agricultural production process through cloud systems and data analysis.

4.2. Agricultural development priorities of the Internet of Things

In the Internet of Things technology, sensors, information transmission and processing, radio frequency identification and other applications are very important. Sensors are carriers for connecting different physical objects to the Internet. Through data collection and analysis by sensors, it has the reference function of producers and operators, and realizes the digitalization and informatization of agricultural production and operation. In the process of information transmission and processing, the wireless sensor network technology is mainly used to transmit the data collected through the sensor. For the storage, computing and related processing of massive agricultural production data, cloud computing technology can effectively solve it, and a large number of emerging cloud service platforms can realize the storage, search, analysis and other services of massive agricultural information [8]. RFID can be read from external material to obtain accurate information about the cargo. This will greatly improve the management level of agriculture.

5. Research Enlightenment

5.1. Further improve the policy environment

Policy support is an important link. The widespread application of the Internet of Things in agriculture requires the government to increase investment and provide tax incentives, so that agricultural development is supported by adaptive policies. Improve the enthusiasm of farmers and attract related enterprises to participate in the development of agriculture.

5.2. Strengthen the research and development of core technologies

We will vigorously develop satellite communication technology and cloud computing, establish sound satellite communication monitoring stations, ensure a good communication environment, and increase the penetration rate of cloud computing in agriculture. We will deeply integrate agriculture with the Internet of Things and improve the level of agricultural science and technology. For example, the National Satellite Meteorological Center has used Fengyun meteorological satellite data and

products to carry out the operational application of winter wheat crop area extraction, national crop growth monitoring, phenology remote sensing monitoring and agricultural drought monitoring, providing regular services and data support for relevant departments [9].

5.3. Use the Internet of Things to monitor agricultural information

Use the Internet of Things to monitor agricultural information. The sensor obtains the growth state of crops through humidity, temperature and other parameters, which is read by the cloud server and processed by the data center to realize production automation and simplify the work process. At the same time, the screening of various agricultural information and the network intelligent system based on intelligent technology can help the traditional agriculture gradually transform to modern agriculture [10].

6. Conclusion

The use of IoT technology in agriculture demonstrates the desire to utilize advanced equipment and improve food production during sowing, fertilization, and conservation. The Agricultural Internet of Things is the key technology to realize the development of modern agriculture. The combination of the Internet of Things and agricultural development can promote the management mode of modern agriculture and promote the sustainable development of modern agriculture.

Acknowledgements

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