Current situation and development suggestions of agricultural rural informatization

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Abstract: Agricultural and rural informatization is a key part of national economy and social informatization, and the application of big data in agriculture has provided new technical methods for agricultural and rural informatization construction. This study sorts out the current situation of agricultural and rural informatization construction at home and abroad, summarized the current problems, and analyses the trend of agricultural and rural informatization construction under the background of big data. On this basis, the proposal of agricultural and rural informatization construction was put forward.

Keywords: big data; agricultural and rural informatization; database; cloud platform

1. Introduction

Agricultural and rural informatization is a key part of the national economy and social informatization [1]. It is the most important part of the national informatization strategy. It is an accelerator of agricultural modernization, and it is of great significance to drive agricultural modernization with agricultural and rural informatization to promote the sustainable and coordinated development of national economy and society.

With the development of information technology such as the Internet, mobile Internet, Internet of Things, big data and cloud computing, data is being generated at an increasingly rapid pace, and big data technology is developing rapidly and becoming a major emerging industry in the information age, attracting widespread attention from industries, governments and academic community [2]. Agriculture is a key application field of big data. Achieving big data in agriculture is a key step in realizing agricultural informatization; establishing a national agricultural data centre and continuously promoting the application of modern information technology in the field of agriculture, such as cloud computing and big data mining, are important measures to break the bottleneck in the development of agricultural informatization in China [3-5].
2. Current status at home and abroad

2.1. The current situation of foreign agricultural and rural information construction

Foreign developed countries started early in the development of agricultural and rural informatization, and they have achieved many important research results in the construction of agricultural information infrastructure, basic databases, platforms, and service systems [6-8].

The U.S. agricultural informatization construction has always been in a leading position. Firstly, it has established a comprehensive agricultural information infrastructure and has huge data resources, such as AGRICOLA, NOAA, and USGS, etc. [1]. Secondly, a standardized information dissemination mechanism has been developed, forming an information network for agricultural production, operation, management and services, with the government as the main body, covering different regions and contents from information collection, processing to dissemination [9]. Thirdly, an effective mechanism for common construction and sharing of agricultural information resources has been built. In 1995, the United States established an information resource sharing consortium covering multiple fields of agriculture, and users all over the world can obtain abundant agricultural information data resources for free [10]. Finally, a sound information technology application system has been formed. The United States, relying on its leading modern information technology advantages, has taken the lead in applying many advanced technologies in the agricultural field. After years of exploration and practice, a complete set of information technology demonstration, application, and extension systems have been formed [11].

Germany's agricultural informatization construction level is relatively high. Firstly, a resource data centre for agriculture has been constructed to provide a wealth of information and data for German agricultural production. Secondly, Germany's agricultural and rural informatization infrastructure is sound. Third, a wide range of computer automatic control systems have been developed in the agricultural field to improve the utilization efficiency of agricultural machinery. Fourth, Germany has carried out a large amount of research and development and application of the Internet of Things in agriculture, especially in the field of aquaculture, and realized modern production by using the latest technology [12]. The Netherlands has reached the world's leading level in terms of automated production, crop simulation, and agricultural market services. The agricultural information service system is relatively sound, with developed farmer associations and service organizations, creating good conditions for the promotion and application of agricultural information technology [13]. The application level of French information technology in agriculture is very high. It has a relatively complete agricultural information database, rich agricultural information resources, diverse service entities, and a powerful agricultural information management system [11]. British agricultural informatization is at the forefront of the world. Firstly, infrastructure such as the Internet, mobile phones, and televisions have basically been popularized in rural areas. At present, the Internet and wireless networks in rural areas have basically been covered. Secondly, precision equipment and intelligent systems are developing rapidly. Third, a massive basic agricultural database has been established, enabling the free release of all kinds of agricultural information for farmers, agriculture-related enterprises and agricultural associations [14]. Japan achieved a national network of agricultural information services in the early 1990s, and various expert systems, meteorological systems and production management systems were rapidly applied. Firstly, it has accelerated the construction of agricultural information system, set up several special advisory committees, and attached importance to the development of rural communication, radio and
television infrastructure. Secondly, a comprehensive service system has been constructed. Third, it has a very complete agricultural science and technology support research and development system [15]. Korea's agricultural informatization started relatively late, but developed relatively quickly. The first is the construction of agricultural informatization infrastructure. Secondly, the leading role of the government in the construction of information technology is strengthened. Then focus on the application of information technology in the agricultural field, and vigorously promote the construction of informationized villages. Finally, the construction of agricultural information service system is promoted, and a variety of means are used to achieve the informatization of services [16].

2.2. The current situation of domestic agricultural and rural informatization construction

At present, China's agriculture is in the period of transformation from traditional agriculture to modern agriculture. The construction of agricultural and rural informatization started relatively late, but the development rate is rapid. China is very concerned about the development of agricultural informatization, since the 1990s, a series of major agricultural informatization projects have been launched, such as the "Golden Agricultural Project", the Agricultural Science Data Sharing Center, the construction and application of the National Comprehensive Service Platform for Rural Information, and the National Agricultural Technology Extension Informatization, which have initially formed a pattern of agricultural information services [17].

With regard to the construction of agricultural informatization infrastructure, the implementation of the "Village to Village" project has greatly increased the coverage of telephone, radio, television, and broadband in China's administrative villages (or natural villages). China is implementing the "Broadband China" strategy. It is estimated that by 2020, China's broadband network will basically cover all rural areas and open up the "last mile" of network infrastructure. Relying on the modern distance education system for party members and cadres, the national cultural information resource sharing project, etc., and the use of village committees, farmers' professional cooperative organizations and industry associations, etc., organize and carry out the construction of rural comprehensive information service stations and information staff [18].

The construction of basic agricultural databases is mainly undertaken by various agricultural research institutions and agricultural and forestry colleges. Among them, the more representative ones are the Chinese Agricultural Science and Technology Literature Database, the Genetic Resource Characteristic Evaluation and Identification Database, the Chinese Crop Germplasm Resource Database, the Chinese Livestock Breed Resource Database, the Agricultural Products Fair Trade Price Database, the Agricultural Cooperative Economic Database, and the National Agricultural Economic statistics database, agricultural, animal husbandry and fishery scientific and technological achievements database, etc. [19-21]. In 2003, the Ministry of Science and Technology launched the scientific data sharing project, planning to integrate and share various database resources that have been built. At present, nine scientific data on meteorology, earthquake, agriculture, forestry, earth system, sustainable development, land and resources, surveying and mapping, ocean, basic, medicine and health, energy, environment, water science, advanced manufacturing, and transportation have been established. Sharing center, to maximize the sharing of scientific data resources. Since the Agricultural Science Data Sharing Center was launched in 2005, it has built 7 data sub-centers, which integrate crop science, animal science, fishery and aquatic science, tropical crop science, grassland and grass industry, agricultural zoning science, and agricultural
science and technology. A total of 560 databases (collections) have been constructed based on 12 types of agricultural scientific data including basics.

In terms of agricultural information platform construction, the "China Agricultural Information Network (http://www.agri.cn/)" established by the Ministry of Agriculture and Rural Affairs Information Centre, and the agricultural management departments and education and scientific research departments of local governments have successively opened agricultural information websites on the Internet through the "China Agricultural Information Network", and an agricultural information network platform covering provinces, cities, counties, and townships has begun to take shape. The "Agricultural Information Network" has been established successively, and more than 20 professional agricultural websites nationwide have been established one after another, also more than 3,000 agriculture-related websites have also established links with it [18]. Other representative platforms include the "12316 Agricultural Comprehensive Information Service Platform (http://12316.agri.gov.cn)" and the "China Agricultural Science and Technology Information Network (http://www.cast.net.cn)" established by the Chinese Academy of Agricultural Sciences, the "Agricultural Science and Technology Information Intelligent Service Platform" developed by the Chinese Academy of Sciences, and the basic comprehensive information platforms such as "Nongxintong", "Information Field" and "Jinnongtong" invested and constructed by three basic telecommunication operators have to a certain extent promoted the common construction and sharing of information resources in the national agricultural system [18].

In terms of agricultural information platform construction, the Ministry of Agriculture Information Centre has built the "China Agricultural Information Network (http://www.agri.cn/)", and local government agricultural management departments and education and scientific research departments have successively opened agricultural information websites on the Internet through the "China Agricultural Information Network". "The agricultural information network platform covering provinces, cities, counties and townships has taken shape, with the "Agricultural Information Network" as the main core, and more than 20 professional agricultural websites nationwide have been established one after another, and more than 3,000 agriculture-related websites have also established links with it [14]. Other representative platforms include Other representative platforms include the "12316 Comprehensive Agricultural Information Service Platform (http://12316.agri.gov.cn)", the "China Agricultural Science and Technology Information Network (http://www.cast.net.cn)" built by the Chinese Academy of Agricultural Sciences, and the "China Agricultural Science and Technology Information Network". net.cn), the "Intelligent Service Platform for Agricultural Science and Technology Information" developed by the Chinese Academy of Sciences, and the "Agricultural Information", "Information Field" and "Golden Farming" invested by three basic telecommunication operators. The basic comprehensive information platforms such as "Agricultural Information", "Information Field" and "Golden Farming" invested by three basic telecommunication operators have to a certain extent promoted the common construction and sharing of information resources in the national agricultural system [14].

3. Existing problems

Big data in agriculture has been applied to the field of agricultural and rural information, which has brought revolutionary progress to agricultural information technology and promoted the overall progress of the agricultural industry. However, the fact that the low degree of information normalization and standardisation, the lack of unified deployment and planning, and the incomplete data resource
management technical standards and systems, have caused many problems in sharing agricultural and rural information in China [6,22]. The main aspects are as follows:

3.1. Low level of standardisation of agricultural and rural information

In the process of China's agricultural and rural informatization construction, the standardization of agricultural-related information is a fundamental task and is particularly important. However, there is a general lack of foresight in the development of agricultural and rural information standards in China. The specific manifestation is that in the agricultural industry standards, there are few standards related to informatization; agricultural information description, definition, acquisition, representation and information application environment, information application technology, most of the agricultural information service methods have not yet formed a unified standard. As a result, a large amount of data information is dispersed, department-owned and independent, forming "information islands". It is difficult to use and realize the data sharing of the whole society in a wide area and an integrated environment.

3.2. Lack of overall planning for the construction of agricultural information platform

In the past, due to many reasons such as technology and management, the construction of agricultural and rural informatization lacked integrated planning, information resources were scattered and information platforms were independent, leading to difficulties in sharing agricultural and rural information resources. Nowadays, due to the lack of overall layout of big data construction in agriculture, the construction content of big data in agriculture has not been formulated around serving the whole industrial chain of agriculture services, and the responsibilities and rights of the construction subjects and participants of big data in agriculture have not been clearly defined, and the responsibilities and rights of the construction subjects and participating subjects of big data in agriculture are not clearly defined, and various departments and social subjects are still at a "loss" as to how to build and participate in the construction of big data in agriculture.

3.3. Data resource management technical standards and systems are not yet perfect

The construction of big data in agriculture involves many departments such as agriculture, the development and reform commission, science and technology, and finance, etc. Each department has also carried out big data construction according to its own needs and has a solid data foundation. However, due to departmental constraints and security concerns, these data have not been fully shared between departments, nor has a unified standard system for the generation and application of big data in agriculture been established.

In addition, the databases that have been built generally suffer from a small amount of data, small scale, lack of construction standards, single form of content, incomplete information and untimely updates, which cannot well organize, store and manage the massive and diverse agricultural-related data, and cannot provide effective data support for big data services in agriculture.
4. Analysis of the development trend of agricultural and rural informatization under the background of big data

At present, vigorously developing technology of big data in agriculture, and accelerating the development of agricultural and rural informatization, to promote the integration of informatization and modernization have become important trends in the development of agricultural and rural areas in various countries. The "Big Data Research and Development Initiative" initiated by the U.S. government in March 2012. At the same time, the government funded the establishment of a public data-sharing website, data.gov, on which the U.S. Department of Agriculture established its own portal. There are currently 348 agricultural data sets that can be linked to it. In July 2013, the UK government launched A UK Strategy for Agricultural Technologies, which places a high priority on the use of 'big data' and information technology to improve agricultural production efficiency and aims to make the UK a world-class powerhouse in agricultural informatics [23]. France is striving to build a "big agriculture" data system, with internet applications being incorporated into the system [24]. In Japan, the city of Capitol uses cloud and big data for agricultural production, and the governments of South Korea, Australia and India have begun the process of researching big data to promote the integration of big data and agricultural modernisation [25, 26].

The research related to big data in agriculture is in its infancy in China. In March 2014, the "Government Work Report" clearly pointed out the need to set up a platform for entrepreneurship and innovation in emerging industries, to catch up with the advanced in big data and other aspects, and to lead the development of the future industry. In December 2015, the Ministry of Agriculture and Rural Development issued the "Implementation Opinions of the Ministry of Agriculture on Promoting the Development of Big Data in Agriculture and Rural Areas", comprehensively deploying the development of big data in agriculture and rural areas. At the same time, the Ministry of Agriculture and Rural Development completed the "Comprehensive Agricultural Information Service Platform" (http://12316.agri.gov.cn), which to a certain extent promoted the common construction and sharing of information resources in the national agricultural system; the Chinese Academy of Agricultural Sciences initiated the Global Big Data and Information Service Alliance in Agriculture, aiming to know and share the global big data and national literature information resources in agriculture; Shandong Agricultural University initiated the first strategic alliance of big data industrial technology innovation in agriculture in China, and built the "Bohai Granary Technology Demonstration project big data platform"[3]; In 2014, Data Conference of the Chinese Academy of Sciences was held, specifically setting up a sub-forum on agricultural and rural informatization big data technology and application [27]. In addition, domestic companies also pay great attention to cloud computing and big data. The "Big Data Application Cloud Platform in Agriculture" (http://www.dataagri.com) jointly launched by Quantum Digital (Beijing) Technology Co., Ltd. and Shandong Agricultural University, which integrates multi-channel agricultural related data and introduces data mining display technology, and provides data query, analysis and other application services for users. The "China Big Data Platform in Agriculture" (http://www.agdata.cn) provided by BRIC, is an information platform that gathers a rich and comprehensive data on China's agricultural products, and provides functions such as data retrieval, query, and related research reports; The "China Agriculture Cloud • Big Data" (http://www.nyydsj.cn) constructed by China Zhongjing, which provides data information for agricultural production by collecting and aggregating data on
agricultural arable land, farmland, planting, breeding, demand, supply and trade, and releasing them after analysis through cloud computing.

Information technology is changing rapidly and the application of emerging information technology in agriculture will become faster, more popular, and more effective, and the need for information technology in agriculture will also become stronger. The Internet, Internet of Things, mobile Internet, big data, and cloud computing will surely become new tools for agricultural production and management. "Internet+" has given a new historical mission, and new ideas are emerging. In the future, the technology for big data will provide the basis for decision-making for the government's agricultural macro-management. The process of agricultural production, operation, management, and service is not only a material flow process, but also an information flow process. From the perspective of computer science, it is a process of data collection, transmission and application. Using the idea of big data to perceive agriculture, analyze agriculture, and manage agriculture is an inevitable trend in the future development of agriculture [11].

Cloud services will also penetrate into the whole process of agricultural industry chain, including production, operation, management and services. In the whole process of the agricultural industry chain, a large amount of data will inevitably be generated, and how to manage and apply the data has become an urgent problem to be solved. Technologies such as agricultural cloud computing, cloud storage and cloud services have emerged, and agricultural-related subjects will rely more on cloud services to realize virtualized distributed storage and management of data, reducing the software and hardware costs of informatisation [11].

5. Conclusion

The "13th Five-Year Plan" is a period in which a well-off society will be fully realized and the national economy will continue to develop in a high-speed and coordinated manner. The vigorous development of agricultural and rural big data has a huge role to play in the construction of agricultural and rural informatization, promoting the application of information technology in the field of agriculture and helping the construction of modern agriculture.

Drawing on the successful experience of foreign informatization processes and taking into account the actual situation in China, the following suggestions are put forward for the construction of current agricultural and rural informatization: Firstly, strengthen the construction of infrastructure, especially the construction of national data centres and computer rooms. Secondly, the development of standards and disclosure norms for agriculture-related information. Based on the demand for sharing and exchange of information resources, formulate agriculture-related information standards and disclosure norms. Third, building a basic agricultural database. Based on the general principles of completeness, systematicness, authority, and diversity of expressions of information, the basic agricultural database is constructed. Finally, building a cloud platform for information services. Develop a platform based on the cloud architecture to provide information services for various agricultural-related subjects. Fifth, strengthening the ideas and content of grassroots capacity building. Based on meeting the information needs of townships, villages, farming farms, farmers' cooperatives, farmers and other subjects, strengthening grassroots capacity building, opening up information channels, strengthening the construction of infrastructure in towns and villages, and improving the operation and application level of personnel at grassroots service stations, etc.
Acknowledgments

This paper is one of the milestones of the "Agricultural Economics and Information Research" team project of Hubei Agricultural Science and Technology Innovation Centre (2021-620-000-001-029).

Conflicts of Interests

The authors declare no conflict of interest.

References


