The Framework, Development Pattern and Promotion Path of Intelligent Agricultural Technology: Chinese experience

Yiji Yue[1,2], Rui Zhao[1,3,*], Yacheng Xiao[2]
[1]School of Business,Chongqing City Management College, Chongqing,China
[2]School of Economics and Management, Southwest University, Chongqing,China
[3]Faculty of Business and Management, University Teknologi MARA, Malaysia,China
Corresponding Author.

Abstract

Chinese government has always paid great attention to the problems of agriculture, rural areas and farmers. For example, Chinese government clearly proposed to develop the rural digital economy and promote the digital transformation of agriculture in 2019. Besides, try to speed up the promotion of the application of cloud computing, big data, the Internet of things and artificial intelligence in agricultural production and management so as to create intelligent agriculture. This paper intends to analyze the development pattern of intelligent agriculture in China, and puts forward the promotion strategy of intelligent agriculture for reference by starting from the definition and technical framework of intelligent agriculture.

Keywords:*Rural revitalization, intelligent agriculture, Development, Predicament, Strategy*

I. Introduction

In fact, Chinese government has always put the issues of agriculture, rural areas and farmers in an important position related to the national economy and the people's livelihood. For example, the 19th Chinese people's Congress promoted the rural revitalization strategy to the national strategy for layout. The development of agricultural and rural economy has ushered in a major strategic opportunity under the background of the implementation of the rural revitalization strategy. In 2019, the General Office of the CPC Central Committee and the General Office of the State Council issued the outline of Digital Rural Development Strategy as an important deployment for the development of intelligent agriculture. The outline clearly points out that it is necessary to promote the digital transformation of agriculture, speed up the promotion of cloud computing, big data, the Internet of things, and artificial intelligence in agricultural production and management so as to create intelligent agriculture [1]. In addition, the central government issued document No. 1, which further made it clear that it is necessary to promote the deep integration of the digital economy and the agricultural and rural economy in 2020. Digitally transform the service system of agricultural industrialization, emphasizing taking data as the key factor of production. Besides, try to speed up the extensive application of modern information technologies such as the Internet of things, big data, block chain, artificial intelligence, and the fifth-generation mobile communication network in the service system of agricultural industrialization. Moreover, try to promote the deep integration of digital technology and agricultural and rural economy. The construction of intelligent agriculture is not only the strategic direction of rural revitalization, but also an important part of building digital China.

The relevant dividends brought about by information asymmetry in agricultural development are gradually disappearing in the network era. The relevant subjects in the agricultural product market will timely consider the latest national agriculture-related policies and the relevant economic situation, and synchronously adjust the scale and strategy of their production and management. Obviously, they have a great impact on the concept and mode of traditional agricultural management, management and trade. The integration of modern agriculture and emerging technologies has become an important trend of agricultural development in the world with the continuous

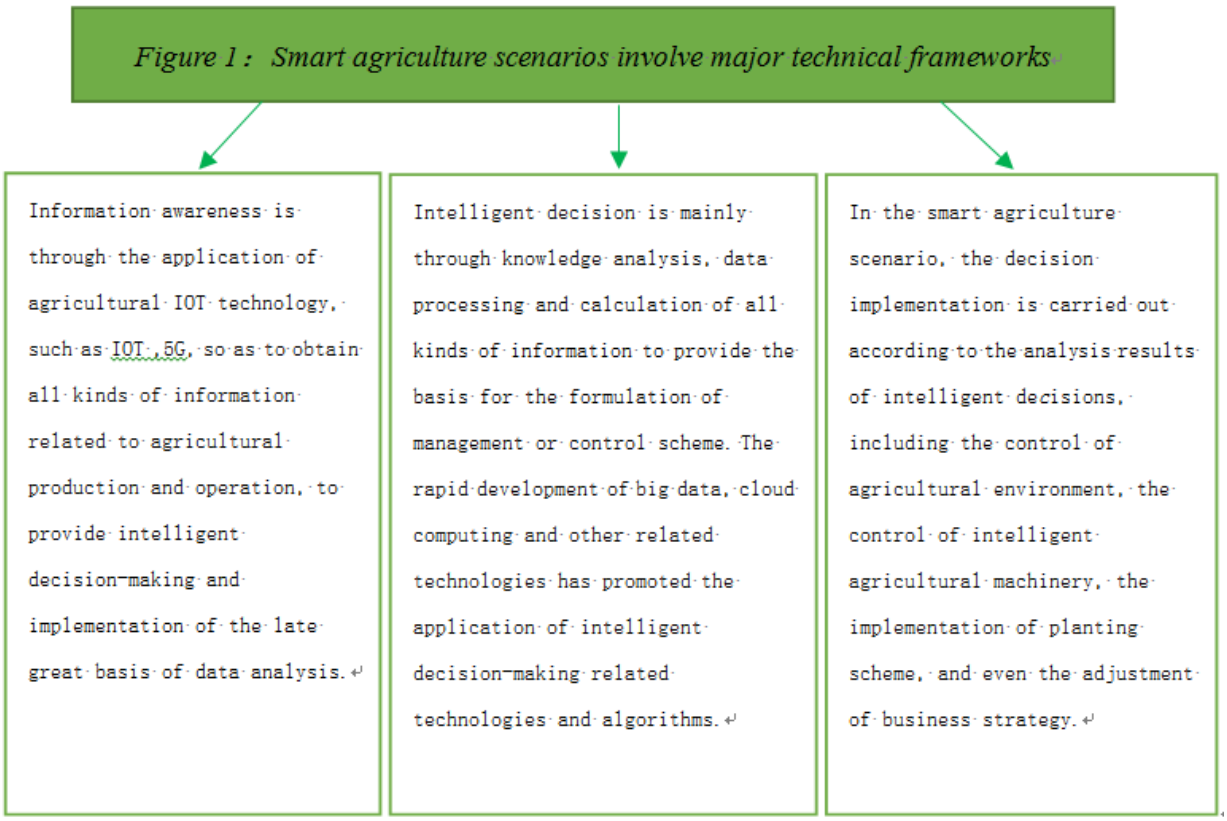
emergence of emerging technologies and the continuous development of the connotation of intelligent agriculture. The modern information technology represented by the Internet of things, cloud computing, big data and block chain provides a rich technological choice and application background for digital agriculture and intelligent agriculture with the deep integration of modern agricultural development and information technology.

In addition, intelligent agriculture is the product of the deep integration of emerging technologies and the whole agricultural industry chain. It is necessary to radiate the Internet of things, cloud computing, big data, mobile Internet, blockchain and other information technologies to the whole process of agricultural supply chain management, including agricultural production, processing, trade, circulation, services, etc. Besides, adding new elements such as information technology, intelligent logistics, supply chain and blockchain to the agricultural format makes agriculture develop towards science and technology, intelligence, green and industrialization. Finally, it realizes the high quality, high efficiency, safety and controllability of agricultural production.

II. Research Content

2.1 The main technical frameworks involved in smart agricultural scenarios

The main technical frameworks involved in smart agricultural scenarios include information awareness (data acquisition), intelligent decision-making (data analysis) and decision implementation (data application) at present (Figure 1) [2-3].



2.1.1 Information perception technology of intelligent agriculture.

As a basis for the implementation of intelligent agricultural scenarios, information perception is the data source of agricultural big data. Agricultural big data includes not only the biophysical information of agricultural production, but also the social and economic information that the actors in agricultural production activities rely on to make management decisions, especially the market dynamic information. Besides, biophysical information perception technology mainly includes all kinds of sensing technology, satellite positioning technology, geographic information technology, remote sensing technology, remote observation technology and so on. In addition, the

perception technology of decision-related information in agricultural production intends to carry out automatic collection through the sharing of distributed system hardware and software resources and the comprehensive management of the system, and based on intelligent agriculture network communication technology, crawler technology.

2.1.2 Intelligent decision-making Technology of Intelligent Agriculture

As the core link of intelligent agriculture, intelligent decision-making is the basis of the application of big data analysis in agriculture. Intelligent decision-making needs to cover the whole process of agricultural production. Agricultural intelligent decision-making has entered a new stage driven by big data with the extensive application of information technology such as Internet of things and 5G. The algorithm of agricultural intelligent decision support system based on agricultural big data is also improving. In addition, the presentation of intelligent decision-making technology of intelligent agriculture is also iterated, including with the relative convenience of data acquisition and the widespread use of smartphones in the whole process of agricultural production. In a word, decision-making consultation can be easily and quickly obtained through mobile phone APP or official account.

2.1.3 Implementation Technology of Intelligent Agricultural decision-making

In fact, the decision implementation technology of intelligent agriculture is mainly presented through agricultural intelligent equipment and related management software. Intelligent agricultural machinery and management software is the presentation form of information perception and intelligent decision-making. The application of agricultural intelligent equipment is an inevitable trend with the aging and decreasing number of agricultural employees in our country. The agricultural intelligent equipment technology is widely used at present, including UAV technology, the main automatic navigation application fields, precision fertilization, precision spraying, transplanting, pollination and so on. Besides, it also includes serve for sowing, irrigation, fertilization, spraying, pruning, picking, environmental control and other intelligent agricultural machinery equipment technology.

2.2 The development pattern of intelligent agriculture in China

The development of agricultural and rural economy has ushered in a major strategic opportunity under the background of the implementation of the rural revitalization strategy. The construction of digital countryside and the development of intelligent agriculture have become an important strategy in the process of new rural construction. China's intelligent agriculture during the 14th five-year Plan should focus on cloud computing, big data, Internet of things, artificial intelligence and other new generation information technology in agricultural production and management by centering on the development concept of agriculture "ensuring supply, and promoting upgrading, improving efficiency and sustainable development". The application of information technology to continuously promote the development pattern of intelligent agriculture.

2.2.1 The digital transformation of agriculture.

Try to speed up the promotion of the application of cloud computing, big data, the Internet of things and artificial intelligence in agricultural production and management. Besides, try to promote the comprehensive and in-depth integration of a new generation of information technology with planting, seed, animal husbandry, fishery and agricultural product processing industries. Moreover, try to build high-tech agriculture, intelligent agriculture and brand agriculture and build intelligent agricultural (animal husbandry) farms and popularize accurate agricultural (animal husbandry) operations [4].

2.2.2 Big data of intelligent agriculture.

The construction of big data Center for Intelligent Agriculture and its application system are inseparable from relevant infrastructure construction, including 5G network construction, special remote sensing satellites for agriculture and rural areas, Internet of things and other infrastructure. The dynamic monitoring and regulation of the whole industry chain of intelligent agriculture can be realized through the application of Internet of things technology, UAV technology, agricultural machinery equipment remote sensing technology, monitoring technology and related application terminals in the key nodes of the industry chain. In addition, we will build an overall, regional and professional agricultural big data center through the development of pilot agricultural science

and technology parks and intelligent agricultural demonstration bases. Besides, we can build a "one map" (agricultural production factors, environmental factors, industrial layout, etc.) and comprehensive supervision platform of the whole industrial chain of agricultural products based on big data Center. We can construct the platform of agricultural product quality traceability system, integrate agricultural product-related information resources and data, and realize the integration of agricultural and rural big data and application system by relying on "Internet +" to realize the sharing of agricultural information [5].

2.2.3 Rural intelligent logistics distribution system

The outbreak of the epidemic makes us further realize the importance of logistics and distribution system for the production, management and circulation of agricultural products. It is necessary to strengthen the basic construction of rural intelligent logistics distribution system, such as agricultural product processing, packaging, cold chain and warehousing, and further build and upgrade rural intelligent logistics distribution system [6]. On the basis of the new infrastructure, we will further promote the popularity of rural postal and express delivery outlets, speed up the construction of a number of intelligent logistics distribution centers, build a green supply chain, and promote green logistics in the post-epidemic era. After all, it not only provides logistics service system support for further deepening the comprehensive demonstration of e-commerce into rural areas, but also has strategic significance for building intelligent agriculture and solving the problem of national food security. Besides, it is an important starting point to promote the high-quality development of agriculture and rural areas.

2.2.4 Development and application of agricultural intelligent equipment

In view of the labor-intensive links in the agricultural industry chain, it is necessary to speed up the development of intelligent equipment such as precision sowing of field crops, precision fertilization / medicine, precision harvest, etc. Besides, try to speed up the development of intelligent equipment such as facility agricultural seedling transplanting, integration of water and fertilizer, green prevention and control, intelligent control, and intelligent equipment such as environmental control, precision feeding and epidemic prevention and control in aquaculture. Moreover, try to speed up the development of the application of intelligent equipment for agricultural products processing and cold logistics.

2.2.5The construction of intelligent agricultural industry chain and supply chain

The development of intelligent agriculture is based on big data, Internet of things and other information technology. However, modern information technology is used as a technical medium and realization method to present the scene of intelligent agriculture. The logic behind the presentation of technology is the integration of natural science and social science. Natural science is the natural law and natural law related to the development of agriculture itself. At the same time, social science is the ability of industrial management and the ability to organize the industrial chain. The comprehensive presentation of supply chain management capabilities, based on the innovative application of agricultural big data cannot be separated from the rules of natural science, but also from the guidance of social sciences. Especially in the embryonic stage of the development of intelligent agriculture, we can effectively enhance the production, decision-making, management and service capabilities of agricultural organizations in production, processing, sales, circulation and other links, and promote the integrated development of the three industries in agriculture through the innovation of industrial chain organization means and supply chain management methods.

2.3 The way to promote intelligent agriculture

As an advanced stage of agricultural production, intelligent agriculture can effectively improve agricultural production efficiency, reduce agricultural production costs, ensure the safety of agricultural products, and make agricultural production and trading processes healthier and more sustainable. China's agricultural development has made achievements that have attracted worldwide attention, but we still need to make accurate efforts in rural infrastructure construction, rural industrial development, technical and skilled personnel and other aspects to promote the establishment of intelligent agricultural system because of historical and practical reasons, especially under the impact of the epidemic, in the new journey of developing intelligent agriculture.

2.3.1 Speed up the construction of infrastructure + Internet in rural areas

The foundation of the construction of intelligent agriculture system in the Internet era lies in the infrastructure construction of modern information technology. Firstly, there is an urgent need to improve the construction level of rural network facilities. Speeding up the construction of broadband communication networks, mobile Internet, digital television networks and other Internet + facilities and equipment in rural areas is the basic project for the upgrading and transformation of intelligent agriculture [7]. Secondly, it is necessary to encourage the development of information terminal products, technical products and mobile Internet application (APP) software that adapt to the characteristics of farmers' rural agricultural public opinion. Farmers with certain information literacy can quickly master the application of agricultural information technology by encouraging the promotion of relevant applications that are easy to learn, easy to operate and in line with the characteristics of agricultural and rural production. Thirdly, try to build a number of comprehensive service platforms for agriculture, improve information technology terminals and service supply, and solve the related problems in the construction of intelligent agriculture in real time in order to minimize the resistance to reform caused by information asymmetry. Finally, it is necessary to speed up the pace of digital transformation of rural infrastructure. Besides, try to speed up the digitization and intelligent transformation of infrastructure such as agricultural production, processing and circulation in rural areas, and promote the construction of intelligent agriculture, intelligent logistics and intelligent transportation.

2.3.2 Strengthen the support of agricultural science and technology personnel

The No. 1 document of the CPC Central Committee and the opinions of the State Council on grasping the key work in the fields of agriculture, rural areas and farmers to ensure a well-off society in an all-round way as scheduled clearly proposed to strengthen the support of agricultural science and technology personnel in 2020. Specifically speaking, the revitalization of rural talents can be carried out from the following aspects. The first is to smooth the channels for all kinds of talents at all levels to go to the countryside and implement the system of overall training and use of talents in the county. Governments at all levels take measures in accordance with local conditions through policy tilt, public opinion guidance, organizational support and other measures to really support college students, ex-servicemen, entrepreneurs and so on to start their own businesses in rural areas. In addition, we will further guide the technical and skilled personnel who "know and love farmers" to take root in rural innovation and entrepreneurship, promote the application of more agriculture-related scientific and technological achievements to the fields, and solve the practical problems existing in agricultural production, packaging, circulation and other links.Urban researchers, engineers, planners, architects, teachers and doctors should be systematically mobilized to serve the countryside, promote rural construction and serve rural development according to the system of overall training and use of talents in the county. The second is to strengthen the cultivation of new farmers with live training resources. Agricultural scientific research institutes, agriculture-related universities, agricultural leading enterprises and other resources, actively carry out knowledge activities to the countryside, strengthen the popularization of network knowledge for those left behind in rural areas, enhance the network and information use ability of new farmers, and speed up the construction of a high-quality peasant education and training system through the integrated use of agricultural broadcasting schools. Thirdly, attach great importance to the training of talents in agriculture-related majors. Agriculture-related majors once became an unpopular major in the college entrance examination due to the low income of traditional agricultural farmers. The No. 1 document of the Central Committee clearly proposes to optimize the setting of agriculture-related disciplines and explore the implementation of "early batch" enrollment of agriculture-related majors in urgent need. Relevant supporting measures need to be introduced as soon as possible to implement the training of talents for agriculture-related majors. Fourthly, we will thoroughly implement the system of special commissioners for science and technology. The General Office of the State Council issued several opinions on the further implementation of the Science and Technology ombudsman system in 2016. It clearly pointed out that the main purpose of the science and technology ombudsman system is to guide all kinds of scientific and technological innovation talents and units to integrate science and technology, information, funds, management and other modern factors of production, go deep into the rural grass-roots line to carry out scientific and technological entrepreneurship and services, and promote the further development of rural innovation and entrepreneurship [8]. The No. 1 document of the Central Committee proposed to further develop and strengthen the contingent of

science and technology ombudsmen in 2020. General Secretary Xi Jinping gave important instructions on the 20th anniversary of the implementation of the science and technology ombudsman system: it is necessary to comprehensively implement the important role of science and technology ombudsmen in strengthening the county economy, promoting the revitalization of villages, and helping to overcome poverty. Besides, try to open the "last kilometer" of scientific and technological services, making agriculture a promising industry.

2.3.3 Strengthen the tackling of key agricultural core technologies.

Agricultural development is inseparable from scientific and technological innovation. Try to strengthen research and development of agricultural biotechnology, vigorously implement the project of independent innovation in the seed industry, implement the national project for the protection and utilization of agricultural germplasm resources, and promote the construction of scientific research and breeding bases. Besides, try to speed up the research, development and application of large, small, medium and small, intelligent and compound agricultural machinery. In addition, try to adopt a long-term and stable way of support, strengthen the construction of the technological system of modern agricultural industry, expand the coverage of agricultural products with distinctive advantages, and allocate scientific and technological resources to the whole agricultural industry chain. Moreover, try to strengthen the construction of a scientific and technological innovation center for the agricultural industry and the construction of national agricultural high-tech industrial demonstration zones, national agricultural science and technology parks and other innovation platform bases. Besides, try to cultivate a number of agricultural strategic scientific and technological innovation forces, promote independent innovation in biological seed industry, heavy agricultural machinery, intelligent agriculture, green inputs and other fields in order to provide a strong core driver for the development of intelligent agriculture [9].

2.3.4 “Upgrading” rural circulation service system.

In fact, the new round of infrastructure construction provides a solid material foundation for the establishment of rural intelligent logistics distribution system. However, the small-scale peasant economy formed in China for a long time has made it difficult to achieve large-scale production and circulation of agricultural products at the present stage, and the coordination of agricultural production, consumption and circulation has become more difficult. As a consequence, it is necessary to promote the development of intelligent agriculture and promote the coordination of industrial chain and supply chain by "upgrading" rural circulation service system. In addition, the government should further play an important guiding role, stimulate organizations and individuals to participate in the construction of rural circulation service system through policy development and supply chain finance. In addition, in the meanwhile, they should further build a comprehensive information service platform for intelligent agriculture and do a good job in serving the market. If we say that the construction of the new infrastructure and the intelligent rural logistics distribution system is the "hardware decoration" of the rural circulation service system, the supporting logistics servicesystem is the "software construction" of the rural circulation service system. Moreover, try to build a more perfect mechanism for sharing information resources, give full play to the role of the government, enterprises and farmers in the transformation and upgrading of the agricultural product circulation service system. Besides, try to promote the construction of intelligent rural areas and the development of modern logistics of agricultural products in rural areas.

2.3.5Speed up the construction of intelligent agricultural industry chain and supply chain coordination mechanism.

Generally speaking, the construction of agricultural industry chain and the chain of agricultural product supply chain are related to the economic interests of farmers, the food safety of consumers, as well as the development of agricultural and rural industries [10]. Try to do a good job in promoting intelligent agricultural organizations, and fully mobilize the broad masses of farmers and all sectors of society to participate in the construction of a smart agricultural system through policy support, public opinion guidance, and tackling key scientific and technological problems. Governments at all levels should increase their support for smart agriculture policies, encourage further pilot demonstration of smart agriculture in accordance with the objective laws of the market, and speed up the construction of an industrial chain of smart agriculture and an overall coordination mechanism for the supply chain. In addition, governments at all levels should actively and effectively, in accordance with the specific requirements of the outline of Digital Rural Development Strategy, integrate the construction of intelligent agriculture into

information planning and key projects for rural revitalization, and improve the supporting policies and measures for the whole link of production, consumption and circulation. Besides, try to deepen the reform of "management and service", properly handle the relationship between the government and the market, and continue to promote implementation. Moreover, try to strengthen researchers and enterprise institutions to deeply study the relevant theoretical research on the industrial chain and supply chain of intelligent agriculture, carry out the evaluation of the development of intelligent agriculture, and continuously improve the coordination mechanism and overall management level of intelligent agriculture.

III. Conclusion

As we all known, the year 2020 is the end of building a moderately prosperous society in an all-round way. Besides, it is also a new stage further promoted by the strategy of rural revitalization. Intelligent agriculture is the deep integration of modern information technology and agricultural industry, forming an intelligent agricultural system driven by information technology and represented by intelligent agricultural information perception, intelligent agricultural decision-making and intelligent decision-making. It is the advanced stage and development direction of modern agricultural production in China.

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