

# Research on Innovation of Agricultural Product Logistics Circulation System under the Background of Big Data <sup>†</sup>

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**Abstract:** Digital rural agricultural engineering is the most widely representative innovative application of digital technology in the field of modern China's new agricultural technology and economic development and the practice of China's new rural economy and society under the background of the process of modern social knowledge networking, intelligent information society, and the digital sharing of social information resources. Using the method of literature research, this paper analyzes the problems existing in the current logistics circulation system of agricultural products. Through the co-occurrence analysis of technical keywords, this paper studies the current situation in the field of agricultural product logistics circulation systems and puts forward countermeasures and measures to promote the innovation and development of agricultural product logistics circulation systems. Finally, it is concluded that we should explore and innovate to build a fresh circulation supply chain system of new smart agricultural products in the new era of agriculture driven by rural big data.

**Keywords:** agriculture products; artificial intelligence; logistics circulation system; big data



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## 1. Introduction

Digital village is the application of networks, informatization, and digitalization in agricultural development and rural economy and society. It is an endogenous modernization transformation development path used to improve farmers' modern information skills. The implementation of the digital village strategy will fundamentally change market factors, such as agricultural scale, ecological environmental protection, fresh food e-commerce, self-media public participation, and user consumption experience by presenting higher requirements and new challenges. The innovation of the modern agricultural product circulation system involves multiple dimensions, such as the main body of the circulation market, the circulation business model, the circulation infrastructure, the quality traceability supervision, and the circulation technical means, and is an important part of the implementation of the digital village strategy. China's existing agricultural product circulation system is based on a decentralized-centralized-decentralized model with a large agricultural product wholesale market as the center, mainly offline face-to-face bulk transactions, and storage and transportation at room temperature with extremely low cold chain rates. The disadvantages of low price, high cost, high corruption, and information asymmetry have led to the contradiction between the low price of fresh and high-quality agricultural products in the hands of farmers and the high and poor quality of residents' purchases.

## 2. Literature Review

The current research on agricultural product circulation systems in China and abroad mainly covers several aspects: (i) The theoretical framework, system, and strategy of

agricultural product logistics, including organization and system, logistics technology and infrastructure, supply chain strategy, just-in-time strategy, continuous replenishment strategy, value-added service strategy, guided production strategy, etc.; (ii) The rural e-commerce circulation system, which mainly includes the agricultural product supply chain system, information system, circulation system, organizational system, service system, safety system, agricultural product cold chain logistics system, etc., and its existing problems. These existing problems mainly include the widening of the gap between market size and market circulation, backward circulation methods and business formats, insufficient circulation infrastructure, weak strength of circulation entities, serious waste of circulation links, low efficiency, and failure to form a supply chain of agricultural products; (iii) The design of the information system, including the agricultural product e-commerce system, e-commerce application, logistics information technology, fresh food e-commerce ecosystem, and the fourth-party agricultural product e-commerce service platform [1]; (iv) Research on the distribution channels of rural e-commerce, including circulation links, cost structure, profit distribution, channel operation performance, channel power changes, participants, circulation formats, government policy support systems, channel strategy, structure, function, and terminal [2]; (v) Research on the efficiency of rural e-commerce circulation, which mainly includes the evaluation index system of agricultural product circulation efficiency, agricultural product circulation mode, circulation structure, distribution network layout, agricultural product circulation efficiency framework, and the influences and mechanisms of the circulation efficiency of agricultural products [3]; and (vi) Research on the rural e-commerce model, which mainly includes the online direct sales of agricultural products of origin, cross-border agricultural product e-commerce, fresh agricultural product e-commerce, the exploration of new standards for non-standardized agricultural products, and county-level e-commerce [4].

The research on rural e-commerce big data in China and abroad mostly adopts technologies and methods such as cluster analysis, recommendation algorithms, and association rules.

Law, Li Rongrong (2017) built a Hadoop-based big data mining framework for e-commerce platforms based on the characteristics of big data in e-commerce platforms and analyzed the mining process in detail [5]. Peng, Zhen Long, and Huang and You Lan (2014), taking the e-commerce data of tea set companies as an example, used the FP-growth algorithm to obtain frequent itemsets and mined user behaviors through association rules, which further realized user classification and precise marketing [6]. Reference [7] crawled the review data of water purifiers, conducted cluster analysis research on it, and identified the advantages and disadvantages of the water purifiers. Zhang Yumei and Jin Yibo (2019) used web crawler technology to analyze the characteristics of Wuwei agricultural products on Taobao.com. They collected and analyzed data such as the number and names of payers and finally put forward measures and suggestions on the brand building, quality control, and industrial extension of Wuwei's characteristic agricultural products [8]. Jiao Huiying et al. (2019) used machine learning algorithms to mine the data of residents' and enterprises' behavior, electricity consumption, and payment on the State Grid e-commerce platform to realize user portrait analysis and provide new ideas on the comprehensive management of business processes, which is the business model of the State Grid e-commerce platform [9]. Qian Dandan and Zhou Jinhai (2019) took the e-commerce data of Chinese herbal medicine companies as an example, designed a business intelligence architecture platform, and used the K-Means clustering analysis algorithm to group consumers to achieve personalized marketing for different consumers [10]. Other scholars have studied the big data processing process of rural e-commerce logistics systems. The McKinsey Global Institute defines big data as a collection of data that is so large that its acquisition, storage, management, and analysis far exceed the capabilities of traditional database software tools. Big data has rich resource types and diverse application processing methods, but the basic process of information processing is roughly similar, including four stages of data collection, processing and integration, analysis, and data interpretation [11]. The processing flow is

shown in Figure 1 and includes obtaining the required data from the data source, processing the data of different structures in a unique way, standardizing it into a unified data type, processing and analyzing it through appropriate data analysis methods and tools, and finally obtaining a reasonable result before using visualization technology to show the data to users [12].

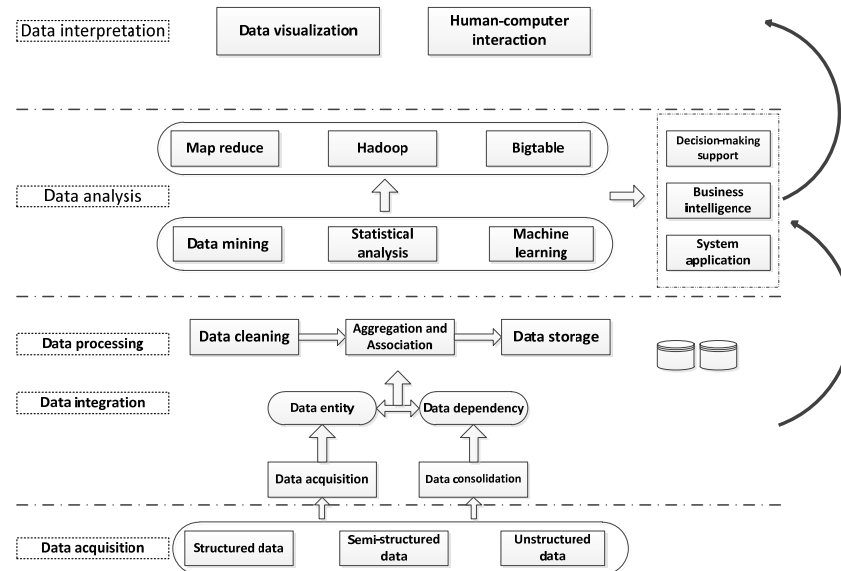


Figure 1. Big data processing process.

Some scholars have conducted research on the data mining of rural e-commerce logistics system. Data mining, also known as data collection and data exploration, is a technology that uses machine learning, mathematical statistics, data visualization, and other multi-field technologies to sort out valuable laws and models from massive amounts of noisy and incomplete information. The basic tasks include classification and prediction, cluster analysis, association rules, time series patterns, deviation detection, intelligent recommendation, etc. [13]. Data mining methods are generally used to determine the characteristics of target data sets or to summarize current information to further predict future situations [14], as shown in Figure 2.

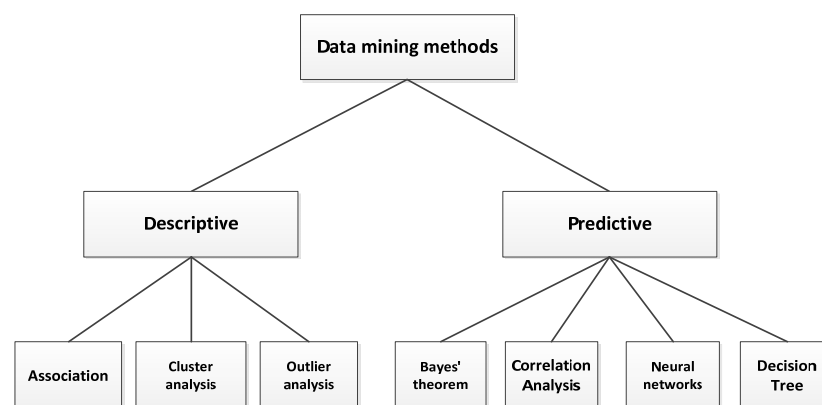


Figure 2. Data mining methods.

### 3. Analysis on the Problems Existing in the Logistics Circulation System of Agricultural Products

#### 3.1. The Service Is Backward, and the Resource Integration Ability Is Not Strong

How can we develop a middle class in the current rural e-commerce environment in China? The transaction data system of agricultural product networks in various parts of

the country and the data of agricultural and sideline products market supply and demand information platform data are not necessarily mature and perfect. E-commerce online transaction information and data in large production areas, price trends, and market supply and demand of major agricultural products in various agricultural markets are also relatively incomplete, comprehensive, and transparent. The constraints also restrict the large-scale sellers and traditional networks of rural e-commerce in China. Fast, timely, and accurate connections between sellers, origin e-commerce platforms, traditional Chinese rural sales network terminal e-commerce platforms, and large-scale agricultural products e-commerce buyers information services are needed, and because the current agricultural product e-commerce is not enough to improve its own relatively open and effective industrial operation supporting system and the combination of industrial policy support and supporting support, it is not in line with the current domestic market innovations in various agricultural fields known as "Internet + agriculture". The separation and independence of elements and rural entrepreneurial talent space resources limit the potential and development of the future rural e-commerce market to bring huge investment opportunities potential space and potential huge growth market space.

The grade of cold chain logistics equipment is not high. Most of the facilities and equipment in the cold chain logistics of agricultural products are outdated, and some even use cold storage built in the 1980s. The existing cold storage refrigeration equipment and refrigeration principle are backward, the technology update speed is slow, and the investment starting point is generally low. The cold chain logistics of agricultural products have the characteristics of heavy assets, high investment, and a long return period. Considering the cost, most investors generally adopt low-cost business strategies, and the planning and design costs of procurement, refrigeration equipment, and construction concepts are generally low.

### *3.2. The Rural E-Commerce Model Is Unclear, and the Blind Duplication of Construction Is Serious*

Rural e-commerce is a systematic project, and its elements mainly include e-commerce platforms, operation teams, county and rural logistics distribution systems, cold chain facilities, training and incubation, etc. The operation mode of e-commerce platforms can be divided into B2C, B2B, O2O, micro businesses, etc. The county area is the main battlefield of rural e-commerce, with the county-level operation center being the main carrier. In the process of rural e-commerce construction, the planning and guidance of the county government play a key role. However, due to the extreme lack of top-level design teams and technical operation teams proficient in rural e-commerce in the county, the model is unclear and blind duplication of construction is serious. At present, it is very difficult for domestic counties to cooperate with platforms such as Village Tao, Ganjie.com, and Juchao.com, and they are on the verge of being eliminated.

The construction of rural e-commerce is a complex systematic project, which not only requires the support of government policies and the guarantee of special financial expenditures to improve the rural logistics network and infrastructure but also requires departments such as agriculture, supply and marketing, transportation, postal services, e-commerce, express delivery, and other departments. Cooperation and collaboration among other enterprises. In addition to the e-commerce giants (Alibaba, JD.com, Suning, etc.) deployed in the rural market, traditional supply and marketing enterprises have also accelerated the development of rural e-commerce through deepening comprehensive reforms. At the same time, provincial-level rural e-commerce website models have emerged, including the docking model of housing, the resource docking model of agricultural enterprises and cooperatives, the direct sales model of e-commerce companies' self-built platforms, the county-level e-commerce model, the "local government + e-commerce platform + local operator" tripartite operation platform, and other models. Despite this, the development of rural e-commerce still faces problems such as imperfect infrastructure and supporting conditions, poor logistics, and distribution paths, homogeneous competition

among enterprises, lack of e-commerce professionals, and blindly repeated platform construction in various places, which seriously hinder the rural economy's development and the realization of the rural revitalization strategy.

### *3.3. Weak Innovation and Lack of Core Competitiveness*

At present, the overall construction mode of the national rural e-commerce platform is mostly dominated by large private enterprises whose own strength is still relatively single and weak and has not yet been able to form a national rural e-commerce platform with regional representative characteristics. The business platform system is its underlying structure, which fails to meet the actual support needs of the national "agriculture, rural areas and farmers" policy. The government's policy orientation mostly focuses on how to enter the e-commerce platform, carry out talent training, and decorate and upgrade store management, etc., which has led to the general similarity of how to build rural e-commerce in various places, without any obvious regional differences, and the lack of continuous innovation. The investment in support policies such as technology and R&D is less than that in local areas, which makes it difficult for local areas to promote innovation with independent intellectual property rights, develop and operate rural e-commerce platforms, and explore new business models for industrial development models. Another problem of rural e-commerce is the lack of brand effect. In the current online business environment, whether it is Tmall, Taobao, JD.com, or other platforms, there are many miscellaneous products, and the competitiveness of stores is insufficient. Creating a rural e-commerce atmosphere requires not only guidance and support from local county-level governments but also more and more need to rely on a group of industry benchmarking and leading enterprises to demonstrate, drive or guide, and give play to their industry leaders. It plays a leading role in the market leading and establishes its industry benchmark. At present, although the number of leaders in the field of rural e-commerce in China is still very small, and many small and medium-sized traditional e-commerce companies have also started their rural e-commerce business in the country, in the end, most companies will still be based on the industry. Due to the policy orientation problem, it eventually fell into a chaotic situation of the same development model and no actual replicable rural e-commerce performance growth model. It is urgent to cultivate two-three rural e-commerce leaders who can become unicorn enterprises and, proceeding from reality, cultivate professional operation teams, enhance R&D and innovation capabilities, establish industry benchmarks, and drive an industry development atmosphere.

## **4. Countermeasures and Measures for Promoting the Innovative Development of Agricultural Products Logistics Circulation Systems**

### *4.1. Adjust the Direction of Guidance, Focus on Research and Development, and Promote Innovation*

To promote the innovative development of agricultural products logistics circulation systems, we suggest (i) adjusting the direction of government policy support and guidance from the policy orientation of e-commerce training, outlet decoration, and e-commerce base construction to focusing on research and development and encouraging technological innovation; (ii) strictly formulating policy support fund standards, increasing the proportion of enterprise R&D investment, technical patents, team structure, talent education, etc. in the evaluation indicators, selecting enterprises that focus on R&D, and promoting the innovation ability of local enterprises; and (iii) implementing the unicorn leader plan, focusing on fresh food e-commerce, agricultural materials e-commerce, rural distribution, agricultural cold chain processing, county-level new retail and other fields. The project team of the rural e-commerce unicorn will provide strong and continuous support to its team leader.

### *4.2. Improve the Support Mechanism and Change Subsidies into Equity*

To improve the support mechanism and change subsidies into equity, we suggest transforming the financial subsidy funds related to rural e-commerce into a entrusted

equity investment + entrusted loan model, in accordance with the “Company Law” and the modern corporate governance structure, vigorously supporting mixed-ownership enterprises to develop rural e-commerce, and vigorously promoting a 4:3:3 equity structure, that is, 40% of state-owned capital, 30% of social capital, and the implementation of a governance model of 30% of management. In this model, state-owned shareholders do not directly participate in business operations and operate in full accordance with market rules, give full play to the guiding role of financial funds, mobilize the enthusiasm of social capital to participate, and ensure that the executive team continues to be cohesive.

#### *4.3. Strengthen the Construction of Cold Chain Logistics Infrastructure*

In the entire agricultural product circulation system, the overall improvement of the cold chain logistics infrastructure is the fundamental and key point to truly solve the problem of agricultural product circulation quality. Guided by the promotion of policy implementation from the perspective of policy top-level design and industry overall planning, based on the innovation of fourth-party logistics and rural e-commerce business models, we suggest taking Jiangxi as an example and relying on supply and marketing cooperatives to build the province’s cold chain backbone network, trying to improve and solve practical problems, such as the extremely low circulation rate of the cold chain, the backward circulation method, unsound systems, weak cold chain logistics infrastructure, small scale, and the lack of a network of cold chain logistics, so as to guarantee the realization of high-quality circulation of agricultural products, improve the circulation quality of agricultural products, shorten the circulation cycle of agricultural products, and promote the construction and implementation of the cold chain circulation system in terms of policy and practice.

### **5. Conclusions**

At present, the modern circulation mode system of bulk agricultural products in my country still adopts the traditional decentralized-semi-centralized-quasi-decentralized mode with the traditional large-scale regional agricultural product wholesale market center as the logistics center. There are serious disadvantages, such as an obvious asymmetry of information, and the traditional offline market is mainly based on the face-to-face trading mode of bulk products. The successful implementation of the digital village strategic plan has brought about fundamental changes in the structure of various market factors such as the scale of traditional agricultural operations, ecological environmental protection, and the development of fresh food e-commerce, which has prompted the existing extensive circulation price system of Chinese agricultural products. Once again, fundamental change is urgently needed. Taking the reform and innovation experiment of the new rural e-commerce model as the starting point for exploring the efficiency of improving the circulation of agricultural and sideline products and taking the innovative experiment of constructing the cold chain logistics system of agricultural and sideline products as the breakthrough point to innovate and improve the quality of the food circulation system, the big data method of agricultural products and the dynamic modeling of agricultural products are used. Analysis tools are used to complete the design analysis and operation practice of the integrated e-commerce platform for fresh agricultural products and explore and innovate the construction of a new smart fresh agricultural product circulation supply chain system in the new era of agriculture driven by the background of rural big data.

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