

# *Data Driven "Internet +" Open Supply Chain System for Fresh Agricultural Products*

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**Abstract**—The Internet is changing the development of China's fresh electricity supplier industry. This paper expounds the characteristics of fresh agricultural products, analyzes the supply chain mode of China's fresh agricultural products, analyzes the open supply chain mode of fresh electric business, and puts forward the existing problems of fresh agricultural products supply chain, and puts forward the construction of fresh agricultural products that adapt to "Internet+" under the background of data driven. In order to promote the circulation efficiency and development of fresh agricultural products, the open supply chain system of products including the construction of Internet of Things(IOT) agricultural support system, the establishment of supply chain information sharing mechanism, the promotion of standardization of fresh agricultural products, the construction of market supervision and quality assurance system support framework.

**Keywords**—*Fresh agricultural products ; Internet ; Supply chain ; Ecosystem*

## I. INTRODUCTION

In the era of new technology and digitalize promoting the circulation of fresh agricultural products through all channels, people's demand for high-quality fresh agricultural products has been upgraded. The promotion of "Internet+", the application of SaaS (Software-as-a-Service), the Internet of things and big data, promote the change of fresh agriculture circulation. Relying on "Internet+" to develop fresh agricultural specialized social services, establish an ecological system suitable for the electricity supplier security system, link up the precise and efficient production of the market, establish a traceable system, promote the circulation mode and trading mode of fresh agricultural products, and establish a supply chain, an industrial chain and a value chain suitable for the electricity supplier safety system is necessary; solve the problems of production and marketing balance, product upgrading, and so on. It is of great significance to promote fresh agriculture to improve quality and efficiency, broaden new employment and income channels for farmers.

The research on the "Internet+" fresh agricultural product supply chain has developed from the initial research on the theoretical framework of fresh agricultural products e-commerce to the development of fresh agricultural products supply chain and operation. Design global supply chain system of food via electronic marketing [1], analyses data for Supply

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Chain Management [2], elate Information systems more flexible, proposed a Semantic Metadata Enrichment Software Ecosystem [3], Using IOT in Analysis and Monitoring Agricultural Field [4], using long short term memory analysis of RFID supply chain path [5], under the Belt and Road Initiatives, use a system dynamics approach enhancing ecological benefits of agro-products' Closed-Loop supply chain [6], handling uncertainty in agricultural supply chain management [7], zero-packaging grocery stores to improve the social and environmental impacts of the food supply chain [8]. Use e-commerce service platform for agreement based circulation of fruits and vegetables on supply chain management [9], research on cold chain logistics of fresh produce in China [10]. household consumption behavior and retail terminal layout of fresh agricultural products in small and medium-sized cities [11], main problems and countermeasures for the development of fresh agricultural products by e-commerce [12], the framework of e-commerce policy support system for fresh agricultural products from the perspective of ecosystem health [13], from the perspective of big data, analyzed the development of fresh e-commerce and agricultural products [14], studied the value creation of the open innovation supply chain [15], "Internet +" transformation of the fresh agricultural products suppliers based on the function expansion strategy [16], research the "Internet +" fresh agricultural products supply chain C2B business model, based on the community economy [17], pricing of fresh products and supply chain coordination [18], evolution stage and investment strategy of agricultural e-commerce ecosystem [19].

Based on the in-depth analysis of the supply chain of fresh agricultural products in China, This paper presents a new framework of an open supply chain ecosystem based on "Internet+" under the new data driven perspective, and puts forward the corresponding support framework, which opens up a new direction for the future open supply chain research.

## II. FRESH AGRICULTURAL PRODUCTS SUPPLY CHAIN

### A. Fresh Agricultural Products

Fresh agricultural products are a special part of agricultural products, mainly covering fruit and vegetable, meat and aquatic products. The main characteristics are perishable, seasonality, periodicity and regional. Freshness is an important indicator of the value of fresh agricultural products. According

to ZhiYan Consulting Group's Research Report on Market Competition and Future Development Trend of Fresh Products Industry in China from 2018 to 2024, the online penetration rate of fresh agricultural products is only 1% compared with other products such as clothing, shoes and hats. However, fresh agricultural products have the characteristics of strong consumption stickiness, high repetitive purchasing rate, period purchasing cycle and high market activity, so the potential market size is huge. According to BCG's "China's Fresh Consumption Trend Report: The Way to Win the Fresh Market in the New Era", the proportion of fresh online consumption will increase from 7% to 15% by 2020, driven by demand. Fresh e-commerce market will reach 347 billion yuan.

### B. Fresh Agricultural Products Supply Chain

Fresh products have short shelf life, low standardization, high decay and strong regional and seasonal constraints. Therefore, unlike other products, fresh products have higher requirements for supply chain management. Fresh agricultural products cold-chain logistics process consumes a lot, costs are high, and the development of cold-chain logistics is low, which is the main reason for the decline of freshness and loss of nutritional value of agricultural products. Because of the particularity of fresh agricultural products, it is necessary to control the cold chain process in the process of supply chain by temperature zoning according to the characteristics of product categories. The layout ability of fresh fruit and vegetable enterprises and the ability of online and offline integration and development become the key to determine the next step of business development.

## III. ANALYSIS OF FRESH AGRICULTURAL PRODUCTS SUPPLY CHAIN MODEL AND PROBLEMS

Fresh agricultural products logistics system has formed a complex multilevel system. It mainly includes three modes: traditional supply chain mode, supermarket closed supply chain mode and open platform supply chain mode.

### A. Traditional Supply Chain Model

Traditional supply chain model (Figure 2) is one of the main forms of traditional fresh agricultural products logistics, mainly to meet the purpose of delivery in the wholesale market delivery. Small vendors or peasant households transport vegetables to the wholesale market of origin in a self-organized way, or join agricultural cooperatives as a unit. The wholesalers transport vegetables from the wholesale market of origin to the wholesale market of sales place, and then distribute them to various agricultural markets through urban distribution centers. Traditional supply chain mode needs self-built logistics facilities and equipment, and has a large one-time investment. It is difficult for farmers and markets to connect in information flow, logistics and capital flow. Farmers and markets are scattered, there are many middle channels, logistics distribution is relatively single, and efficiency is low. Lower logistics volume leads to higher distribution cost. Due to the limited capacity of individual farmers or agricultural production bases, the market resistance to risk is low.



Fig. 1. Traditional supply chain mode

### B. Supermarket Closed Supply Chain Model

Fresh agricultural products are formed closed logistics supply chain model, supermarket self-built purchasing team, assume the role of circulation of the whole industry chain, from large-scale procurement, transportation equipment, refrigeration equipment, etc., to form a closed-loop fresh from production to sales. Its characteristics are self-purchasing and self-selling, high cost and high efficiency. In the closed supply chain model of supermarket, fresh products selection, logistics, loss rate, procurement dimension are relatively efficient, and management ability is relatively standardized. The indicators for measuring fresh purchasing ability mainly include: selection ability, category richness, efficiency of logistics center, wastage rate, fresh proportion and fresh gross profit rate. The closed-loop capability of fresh supermarket supply chain is higher than that of other supermarkets, but there is a problem of insufficient ability to expand in different places.

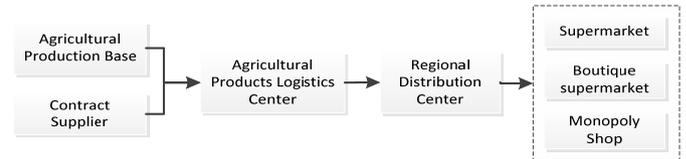


Fig. 2. Supermarket closed supply chain model

### C. Open Platform Supply Chain

The population of domestic agricultural workers has declined, and the decentralized standardization of procurement has been gradually solved by the company-based breeding and planting. The intensification process of the main body of agricultural products circulation market has accelerated. Platform-based fresh supply chain system is being formed (as shown in Figure 3 below). Platform-based supply chain has certain advantages in scale operation and circulation management, mainly in reducing circulation links of fresh agricultural products, reducing losses and management costs; using new technologies to update systems and services; and using professional inventory management to optimize distribution and provide flexible and diverse care. Provide flexible customer service, creating added value and so on. Supply chain system integrates upstream planting and breeding bases, collects orders to achieve large-scale collection and transportation, forms an open platform, serves decentralized supermarkets, catering and so on.

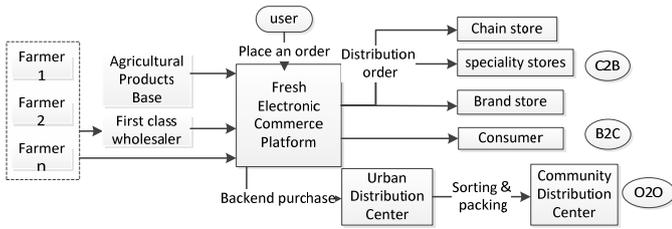


Fig. 3. Open Platform Supply Chain

D. Analysis on the Supply Chain of Fresh Agricultural Products

Fresh product resources and consumer markets are scattered, and there are many problems in the supply chain of fresh agricultural products, mainly reflected in the following aspects:

1) Information asymmetry in fresh supply chain

The supply chain system of fresh agricultural products is complicated and the information transmission efficiency is low. The product has a small circulation radius, a large number of circulation links, a long circulation chain, and a large loss of products; the agricultural cold chain facilities and equipment are not inadequate, and the information level is low, so that the cold chain logistics circulation rate is low, the production cost increases, and the risk increases. The fragmentation of resources in the agricultural product industry has led to insufficient utilization of agricultural resources and asymmetric market information, and market demand cannot be effectively reflected in the planting end. The information of individual vendors in the farmer's market is in a state of information asymmetry.

2) Lack of product quality standards

The quality of products at the end of production is lack of standard and the safety of products, it is difficult to control effectively. Fresh products have particularity and diversity, integrating natural and economic laws. It is difficult to standardize their taste, color, character, size and other measurement dimensions. The differences in regional conditions, natural conditions and production methods, make the quality of products of different batches and different origins of the same product vary greatly. The standardization of fresh products is not only related to the smoothness of online transactions, but also to the safety of food.

3) Imperfect traceable system and inadequate market supervision

Fresh agricultural products cold-chain logistics system has large consumption and high cost in operation. The service system is imperfect; the technology application level is low; the traceable system and market supervision have become the key problems restricting the development of agricultural economy at this stage. Due to the lack of technology and data, it is difficult to supervise the quality of agricultural products market in place, the credit system of enterprises has not been fully established, and the brand effect of enterprises is insufficient.

IV. CONSTRUCTION OF AN OPEN SUPPLY CHAIN ECOSYSTEM FOR FRESH AGRICULTURAL PRODUCTS

At present, the retail channels of fresh agricultural products are too dispersed, and the standardization degree of fresh industry in China is relatively low. Only by integrating resources and adopting innovative mode through specialized division of labor and cooperation, can we maximize complementary resources and win-win cooperation.

A. Ecological System of Open Supply Chain for Fresh Agricultural Products

We should build an ecosystem of open supply chain suitable for "Internet+" fresh agricultural products, and establish a standardized system for the standardization and operation of fresh products. Establish industry linkage mechanism, digitalize to promote the scale of order procurement, and intensify the front-end demand impels the efficiency of back-end supply chain. According to the strong regional characteristics of fresh products, the ecological system of fresh open supply chain is built by all parties. It is composed of fresh e-commerce trading platform enterprises, agricultural producers and consumers. It aggregates all aspects of fresh products supply chain, such as planting, quality inspection, processing, sales and distribution, and centers on the three main supply chain financial service enterprises and logistics enterprises. Organizations such as industry and equipment providers organize information sharing and co evolution among members of the supply chain through alliance or virtual cooperation, so as to achieve self-organization and organization, and form an online and offline integration of the "Internet +" ecosystem. As shown in Figure 4.

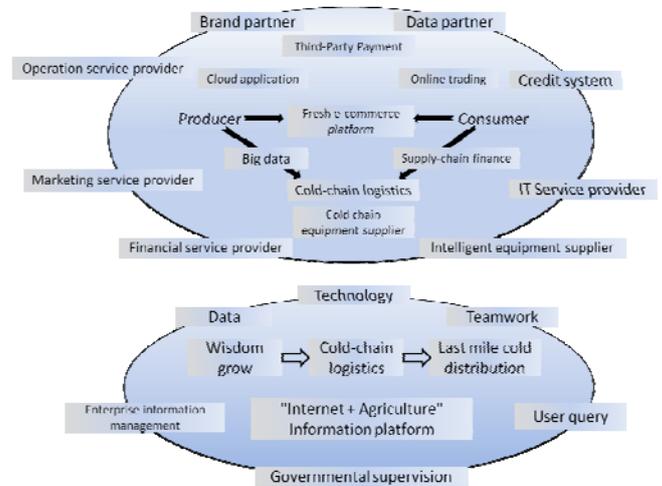


Fig. 4. Fresh agricultural products open supply chain ecosystem

According to the strong regional characteristics of fresh products, the ecological system of fresh open supply chain is jointly built by all parties, and the upstream and downstream enterprises of the industrial chain are gathered together to integrate all aspects of the supply chain, such as planting, quality inspection, processing, sales and distribution of fresh products, to form a fully functional fresh industry cluster. To

allocate various fresh professional elements, supporting professional services and policy guidance; Establish product standardization and traceable system; To form a centralized service platform for fresh food e-commerce and a centralized, coordinated and efficient urban distribution system; Centralized financing platform to provide innovative financial support.

#### *B. Support framework for the ecological system of fresh agricultural products*

##### *1) Building the Internet of things agricultural support system*

The open ecological system of fresh agricultural products supply chain needs to build an intelligent supply chain system of fresh agricultural products based on the Internet of things technology, including intelligent planting, intelligent breeding, whole-process cold chain system and other aspects. Use of Internet, satellite positioning, mobile Internet information technology to establish cold chain logistics data such as information collection, processing and publishing system, from the seed (breeding) to the records of the whole process of the market, realize the whole process of cold chain logistics information, digital, transparency, visualization, to big data analysis and the use of supply chain. In the smart planting link, the main information points include seed information, supplier information, plot information, planting (breeding) activity information and environmental monitoring information. The whole-process cold chain system includes the whole system from picking (cutting) of agricultural products, through the whole seamless cold chain transportation and storage to the display cabinet of the supermarket and the user. The main information points include: receiving information, temperature information, packaging information, shipping information, processing and distribution information.

##### *2) Establish supply chain information sharing mechanism*

The supply chain information sharing mechanism should be established, and the "Internet+ agriculture" public information network platform data center will be formed. Access management of agricultural Internet of things, integrated agricultural management, emergency command and disaster warning will be realized. Integrate resources such as products, cold storage and refrigerated transport vehicles, provide the society with information on cold storage, cold chain transport and goods supply and marketing, realize data exchange and information sharing, promote efficient matching and docking between market demand and cold chain resources, and improve the comprehensive utilization rate of cold chain resources. The information of smart planting (aquaculture) and the whole cold chain enters the data server of the supply chain public information network platform, and the data of the data server is used to guide the agricultural production and operation management, government supervision and social public services. Upstream and downstream information is completely transparent, through multiple visual control traceable and monitoring. The Internet of things technology and modern information technology are integrated into every link from planting (breeding) to sales of agricultural

products, the management system of enterprises is improved, the information management process of production and circulation enterprises is optimized, and the risks in the production process are minimized through effective management.

##### *3) Promote the standardization of fresh agricultural products*

Standardization of fresh agricultural products refers to the quality control and improvement of fresh products from the source. It mainly includes standardization of production norms, testing system and circulation norms.

Production process standardization will effectively promote fresh standardization. Standardized production lays a solid foundation for e-commerce branding and further grasping brand premium. Due to the lack of standardization and scale of current agricultural production, the characteristics and scale of fresh products are not reflected, and the differentiated competition of fresh e-commerce is low, seriously hindering the sustainable development of fresh e-commerce. It is necessary to guarantee quality and quality on the basis of standardization, create rich product content, form a long-term market interaction reputation, select product categories, and explore product post-processing value for differentiated competition. build brands and grab brand premium, achieve product differentiation and mass production through standardized production such as quality control and production process guidance.

##### *4) Establishing market supervision and quality assurance system*

Using IOT technology is more conducive to government supervision. Establish a traceable system for the quality and safety of agricultural products, so that the whole links of the production, procurement, storage and transportation of agricultural products can be traced. To strengthen the responsibility of each subject in the supply chain, through the back body consumers through a terminal system scan or information input, information consulting, food traceable and complaint reporting channels can inquire and traced back to the source of the whole plant (breeding materials) for agricultural products. Production process and complete information of cold chain logistics process, from farmland to dining table all-the-way tracking and traceable. The system can find the subject responsible for product quality, and force enterprises with hidden safety risks to withdraw from the market. Enterprises with good production quality can also establish reputation archives, and protect enterprise reputation by establishing enterprise credit information archives.

In addition, policy support should be strengthened, mainly including financial, fiscal and taxation policies, policies on products of origin, and supporting policies on logistics supply. We should change the overlapping regulatory system and eliminate the blind spots in the cross-supervision of industry and commerce, quality supervision, food and drug administration and other functional departments.

## V. CONCLUSION

With the application of SaaS and Internet technology to improve the efficiency of the industry chain, fresh product supply chain management is not only directly related to the quality of goods, consumer experience, but also more importantly to the overall efficiency and operating costs of the fresh industry. This paper analyses three types of fresh agricultural products supply chain, which are traditional supply chain mode, supermarket closed supply chain mode and platform open supply chain. There are mainly problems in fresh supply chain, mainly include information asymmetry, lack of product quality standards, imperfect traceable system and inadequate market supervision. In view of the existing problems, to address the above issues, this paper establish an open supply chain system of "Internet+" fresh agricultural products, which is suitable for data orders, and improve the organization level, production and organization mode of fresh agricultural products. Combine the "Internet+" with the agricultural production, processing, sales and other industrial chain links to improve the enterprise's quality control ability and risk resistance ability. To achieve these goals, support framework of the ecological system of fresh agricultural products was put forward, including the construction of Internet of Things (IOT) agricultural support system, the establishment of supply chain information sharing mechanism, the promotion of standardization of fresh agricultural products and the construction of market supervision and quality assurance system. Next step, we will further study the operation index and efficiency of the open supply chain of fresh agricultural products.

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