

Research on Optimization of Fresh Agricultural Products Logistics Distribution Path Under New Retail Environment

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Abstract: With the continuous upgrading of household consumption, the demand for personalized, customized and diversified products keeps growing, and public awareness of food safety and quality has been gradually enhanced. Given the fresh attributes and quality requirements of agricultural products, cold chain logistics has emerged at the right moment. To maintain the freshness and quality of products, reduce the risk of deterioration and preserve product value, cold chain logistics imposes strict requirements on storage and transportation environments and higher standards for logistics service quality. At present, in response to national policy guidelines, regions across China have been actively developing cold chain logistics services to reduce cargo damage and loss in logistics processes. Local governments have successively introduced policies and measures to encourage enterprises to develop cold chain logistics, and improved cold chain infrastructure and information sharing management platforms.

Keywords: New Retail; Cold Chain Logistics; Fresh Agricultural Products.

1. Introduction

Since 1998, the rise of e-commerce has greatly influenced people's daily life and brought greater convenience and efficiency to many aspects. However, it has also brought huge impacts and threats to the traditional physical retail industry. In recent years, with the rapid growth of China's middle class and the substantial improvement of residents' living standards, people have gradually pursued a high-quality lifestyle. The demand for fresh agricultural products such as meat, milk, fish, eggs and vegetables has increased significantly, and the demand for cold chain logistics has also risen accordingly. Meanwhile, consumers of idle goods value consumption convenience more. How to meet people's requirements for the freshness and diversity of agricultural and sideline food and the efficiency and convenience of logistics has become a new issue that all enterprises must address.

Nevertheless, China suffers from relatively high cargo damage and loss, which is mainly caused by non-standard operations and weak awareness in cold chain logistics. The cold chain logistics industry is in urgent need of adjustment and optimization [1].

2. Overview of Agricultural Products Circulation Under the Background of New Retail

2.1. Overview of Agricultural Products Circulation Under the Background of New Retail

At present, the main circulation modes for Chinese farmers to deliver agricultural products from fields to dining tables include agricultural market aggregation mode, rural cooperative organization-driven mode, and docking mode between large supermarkets and leading processing enterprises. However, this traditional circulation mode involves multiple links from production areas to consumption

areas, resulting in serious loss of agricultural products. In addition, the scattered distribution of planting areas and small-scale farmers, together with the information asymmetry between production and consumption, leads to high circulation cost of agricultural products and the phenomenon of "difficulty for farmers to sell and high price for consumers to buy".

On the basis of traditional circulation modes, new retail enterprises expand online channels to sell agricultural products, especially fresh agricultural products such as fruits and vegetables, meat and aquatic products, emphasizing the collaboration between online and offline channels. Most of them adopt the mode of farmer-supermarket docking. Although this mode shortens the circulation chain to a certain extent, it puts forward higher requirements for agricultural product logistics distribution technology and timely response to customers' demand for characteristic agricultural products [2].

2.2. Definition of New Retail Concept

New retail is a new retail mode, and there is no unified concept at present. Compared with traditional retail, new retail is a retail activity that guides with new concepts and thinking, supports with Internet innovative technologies, improves and innovates the original traditional retail, and provides services for consumers. New retail is not a simple integration of omni-channel methods; the integration of online, offline and logistics cannot be simply called new retail. It should transcend omni-channel, break the previous boundaries of the retail industry, integrate new-generation technologies such as big data and cloud computing, and reconstruct retail formats to bring consumers a brand-new experience.

Therefore, new retail integrates online and offline retail modes and emphasizes the integration of the two. Of course, the specific connotation and implementation path of new retail still need continuous exploration. At present, both academia and business circles have much consensus on the

connotation of new retail. First, new retail is mainly manifested in the integration of online and offline channels. Second, new retail should be built on the basis of digitalization; only by realizing digitalization can the supply and demand relationship be better matched. Most critically, new retail should take consumers as the core, constantly explore consumers' needs through big data analysis, and provide corresponding services to improve consumer experience [3].

2.3. Current Situation of Agricultural Products Circulation Under the Background of New Retail

New retail is an upgrade of e-commerce and traditional retail, and e-commerce retail enterprises are the main force leading the development of new retail. Under the development of new retail mode, omni-channel retail enriches consumers' shopping choices, and the sales volume of fresh agricultural products increases year by year. According to the data compiled by the National Bureau of Statistics, in 2019, the national online retail sales of agricultural products reached 416.86 billion yuan, among which fresh agricultural products accounted for 162.0 billion yuan, with a year-on-year growth of 50.40%, making it the category with the largest growth scale and fastest speed among all agricultural product categories.

With the increasing market demand, more and more e-commerce enterprises have entered the fresh food sector of new retail, and the scale of the fresh new retail industry continues to expand. The market size of China's fresh food e-commerce market will reach 311.74 billion yuan in 2021, as shown in Figure 1. In addition, affected by the COVID-19 pandemic, the requirement for contactless distribution has further promoted the rapid growth of the online fresh food market. As the transportation medium of fresh agricultural products, the cold chain logistics market has developed rapidly.

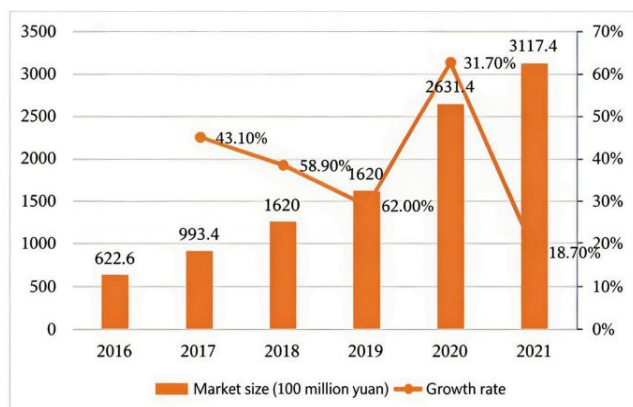


Figure 1. Market size of fresh produce

With the continuous expansion of the market scale, increasing industry participants, increasingly fierce competition and rising industry concentration, the service level of each participating platform faces greater challenges. As shown in Table 1, from 2017 to 2021, the number of industry participants continued to increase, and the number of active users grew significantly. Although the new retail fresh food e-commerce market has large space, under the increasingly fierce competitive environment, fresh new retail platforms need to continuously improve service quality and performance. Improving customer satisfaction and increasing

customer stickiness are the breakthrough points for enterprises to enhance their market competitiveness [4].

Table 1. Data of China's fresh produce e-commerce platforms from 2017 to 2021

Year	Number of Users (10,000 persons)	Number of Platforms
2017	1762.38	45
2018	3262.83	109
2019	6625.32	276
2020	10827.90	197
2021 (estimated)	26528.36	125

In terms of the demand for cold chain logistics, food demand accounts for 90%, much higher than the demand for medicine and chemical industry. Among food demand, fresh products account for 88%, and vegetables and fruits account for 28% and 24% respectively, which are the two categories with the highest cold chain demand among fresh products, as shown in Figure 2.

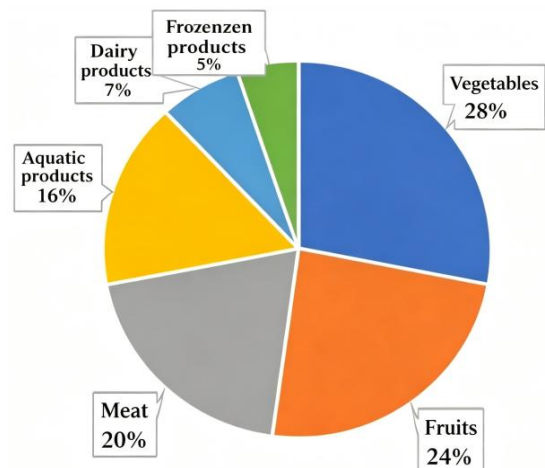


Figure 2. Proportion of cold chain applied to fresh food

Taking "fresh agricultural products under new retail" as the keyword to search on CNKI, this keyword appeared in 2017, and the research heat increased year by year and peaked in 2021. By summarizing the literature from 2017 to 2021, the following three characteristics are concluded:

First, starting from consumer demand, digital technology is used to integrate and analyze the purchase data of consumers in various regions, and establish an end-consumer-driven "pull" supply chain.

Second, user experience is valued. Fresh food e-commerce enterprises have begun to expand offline stores, and consumers can choose to place orders online and pick up offline or get home delivery, forming an omni-channel sales mode of "product + service".

Third, higher requirements are put forward for distribution logistics. Due to the perishable characteristics of fresh products, fresh food e-commerce enterprises need to treat cold chain logistics with high standards. The temperature and humidity during transportation should be controlled to ensure the high quality of products, so as to prevent fresh products from rotting due to transportation problems and affecting product sales and customer satisfaction [5].

2.4. Development of Agricultural Products Circulation Under the Background of New Retail

With the deepening of the new retail concept, the traditional fresh agricultural products industry has further developed, mainly focusing on the following two aspects.

On the one hand, consumer demand promotes the development of the fresh new retail industry. The sudden pandemic at the end of 2019 showed that the information circulation of the fresh food industry lagged behind, and fresh food supply and store sales encountered numerous difficulties. After the mid-stage of the pandemic, contactless distribution and home delivery brought opportunities for fresh cold chain and fresh new retail industries, which can be seen from the growth of fresh food e-commerce users from 2019 to 2020. Compared with 5.27 million daily active users of fresh food e-commerce during the Spring Festival in 2019, the number reached 10.09 million during the Spring Festival in 2020, doubling the user scale.

Large fresh food e-commerce platforms, such as Hema Fresh, Duodian, Dingdong Maicai, Missfresh and JD Daojia, have achieved varying degrees of growth in sales volume and users. For example, the daily active users (DAU) of Hema Fresh during the Spring Festival in 2020 increased by 2.95 million compared with that in 2019, with a growth rate of 127.5%. In addition, the analysis of WeChat Mini Programs in the QuestMobile 2020 China Mobile Internet "Anti-epidemic" Special Report found that among the TOP 50 WeChat Mini Program industries in terms of daily active user increment during the 2020 Spring Festival holiday compared with before the holiday, "life services" accounted for 4%, ranking fourth. Among the TOP 10 WeChat Mini Programs in terms of daily active user increment, the increment of city service DAU reached 5.87 million [6].

On the other hand, the development of Internet digital technology promotes the development of the fresh new retail industry. The combination of Internet technology, platforms, business operation modes and communication technologies forms a value network integrating logistics, information flow and capital flow. It accelerates the information interaction speed of each node in the fresh food e-commerce supply chain, makes information more accurate, and improves the degree of information sharing.

Due to the perishable characteristics of fresh products, cold chain transportation is usually adopted. Real-time update of logistics information shortens the turnover period of fresh products, improves the operation efficiency of cold chain logistics, and ensures the freshness of fresh products. The information-based management of upstream fresh agricultural product production improves the speed of information circulation and reduces circulation costs.

3. Enterprise Profile and Current Situation

3.1. Profile of SF Express Cold Chain Company in Kunming

SF Express Cold Chain Company in Kunming is a limited company belonging to the road transportation industry. Its business scope mainly includes: licensed items: road cargo transportation (excluding dangerous goods); express delivery services (projects subject to approval in accordance with the law can only be carried out after approval by relevant

departments, and the specific business projects are subject to the approval results). General items: international cargo transportation agency; domestic cargo transportation agency; general cargo warehousing services (excluding hazardous chemicals and other items subject to approval); information consulting services (excluding licensed information consulting services); machinery and equipment leasing; car rental; non-residential real estate leasing; ticket agency; sales agency; information technology consulting services (except for projects subject to approval in accordance with the law, business activities can be carried out independently with business license in accordance with the law).

3.2. Current Situation of the Company

After years of development, SF Express has initially established the ability to provide customers with integrated comprehensive logistics solutions. It not only provides high-quality logistics services at the distribution end, but also extends to the production, supply, sales and distribution links at the front end of the value chain. Starting from customer needs, it uses big data analysis and cloud computing technology to provide integrated comprehensive logistics services such as warehouse management, sales forecast, big data analysis and settlement management.

The company's logistics products mainly include various express delivery services such as business express, e-commerce express, warehousing and distribution, and international express; heavy cargo transportation services such as general logistics transport and heavy cargo express; as well as cold chain transportation services for customers in the food and pharmaceutical fields. In addition, SF Express also provides value-added services such as insured service and cash on delivery to meet the personalized needs of customers.

SF Express is also an intelligent logistics operator with network scale advantages. It has a huge logistics network reaching both domestic and foreign regions, including aviation network, branch network, ground transportation network, transit yard network, customer service call network, industrial park network, etc., with significant scale advantages. Meanwhile, the company has always attached importance to IT resource investment and continuously improved the intelligent level of logistics operation and internal management. It is an intelligent logistics company with the core competitiveness of "sky network + ground network + information network".

In terms of business operation mode, SF Express adopts a direct operation mode. The headquarters implements unified operation and unified management of all branches, organizes unified collection and delivery networks and distribution processing and transportation networks within the scope of business, and independently allocates network resources according to the actual needs of business development. At the same time, SF Express extensively uses information technology to ensure the implementation of unified standards across the network, and establishes multiple business information systems to improve the overall operation quality of the network.

3.3. Problems Existing in Cold Chain Distribution Business of Fresh Products

China's "14th Five-Year Plan" points out that the facilities and equipment of agricultural product cold chain transportation and the knowledge level of staff in China need

to be improved. At present, the problems of "chain break" and "pseudo cold chain" in cold chain logistics are prominent, which are related to product quality and safety. Cold chain logistics undertakes the arduous task of stable food supply. It is necessary to continuously improve the service capacity of professional cold chain logistics, standardize market operation order, improve the traceability system, and meet consumers' use and safety needs.

For fresh agricultural products, low cold chain circulation rate and high cargo damage rate are the biggest problems affecting fresh agricultural product cold chain at present.

(1) The Cold Chain Logistics Research Report of Fresh Food E-commerce issued by the China Federation of Logistics & Purchasing Cold Chain Logistics Committee points out that due to the timeliness and perishable characteristics of fresh agricultural products, cold chain logistics efficiency is a key factor affecting the development of fresh food e-commerce. According to the statistics of China Agricultural Products Circulation Industry Development Report, the refrigerated transportation rates of fruits and vegetables, meat and aquatic products in China are 35%, 57% and 69% respectively, while the average refrigerated transportation rate in developed countries reaches more than 90% [7].

(2) The low cold chain circulation rate in China is an important reason for the high cargo damage rate of fresh products. In the circulation process, "chain break" changes the environmental temperature of products, which is not conducive to the preservation of fresh products. In addition, the time accumulation of multiple links is another reason for the high cargo damage rate of fresh products. The data of the Cold Chain Logistics Research Report of Fresh Food E-commerce shows that the cargo damage rates of fruits and vegetables, meat and aquatic products in China are above 10%, 2-3 times that of developed countries, as shown in Figure 3 [8].

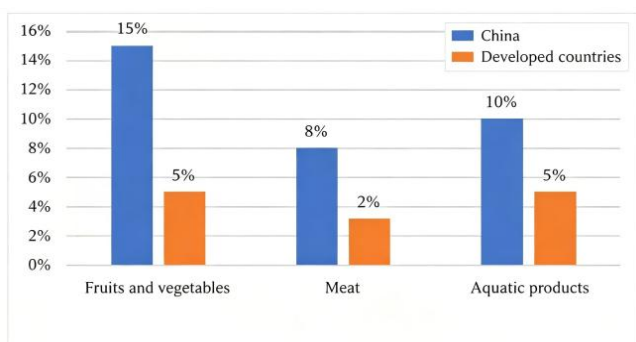


Figure 3. Comparison of fresh product cargo damage rates between China and developed countries

(3) Timeliness and freshness are the most important factors for fresh products. However, due to the insufficient cold chain infrastructure and equipment and the imperfect cold chain logistics distribution system in China, the "chain break" problem occurs during the transportation of fresh products, making it difficult to realize full-process low-temperature transportation. After transportation from the production area to sales stores and then to end customers, the product quality is difficult to guarantee, leading to reduced customer satisfaction.

4. Application of Optimization Path of Cold Chain Crowdsourcing Logistics Sharing Mode

4.1. Integrating the Concept of Sharing Economy

Sharing economy generally refers to a new economic model based on strangers, with the main purpose of obtaining certain remuneration and temporary transfer of the right to use articles. Its essence is to integrate idle offline items, labor, education and medical resources. Some also believe that sharing economy means that people fairly enjoy social resources, pay and benefit in different forms, and jointly obtain economic dividends. This kind of sharing is mostly realized through the Internet as a medium.

The sharing economy involves three main subjects: the demand side of goods or services, the supply side, and the sharing economy platform. As a link connecting the two sides, the sharing economy platform establishes a series of mechanisms such as mobile LBS applications, dynamic algorithms and pricing, and two-way evaluation system, so that the supply and demand sides can conduct transactions through the sharing economy platform.

Integrating the concept of sharing economy into the cold chain distribution of fresh agricultural products is a new development trend of "Internet + agricultural products" at present. It can quickly realize the sharing of various resources, change traditional ideas, effectively improve the transportation efficiency of cold chain logistics and save transportation costs [9].

4.2. Building an Information Sharing Platform

Cold chain logistics is an important guarantee for implementing the development concepts of "innovation, coordination, green, openness and sharing", improving food and drug safety guarantee capacity, improving people's quality of life, and building a moderately prosperous society in all respects. At present, the construction of comprehensive logistics service platforms is mostly dominated by regional general cargo logistics information platforms, lacking a national professional comprehensive platform for cold chain logistics. The existing cold chain public service platforms have weak service functions, prominent information island phenomenon in logistics platforms, and the credibility of cold chain public service platforms needs to be further improved.

Meanwhile, cold chain logistics platforms have become obstacles restricting the digital economy sharing platform of cold chain logistics in terms of information sharing, tax policies, credit evaluation, financial technology, and intelligent hardware investment.

Therefore, it is urgent to establish a national cold chain logistics information interconnection and sharing platform, so as to promote the in-depth integration of Internet innovation and cold chain logistics, and realize the digitization of cold chain logistics activities, online transactions and standardized services. At present, China's digital sharing platforms have taken initial shape, but there is a lack of data sharing mechanism between platforms, and they are still in a state of information isolated islands. It is suggested to establish an interconnection mechanism for digital platforms. Government departments, industry associations and logistics information platforms should open data on vehicle resources and cold storage resources, promote platform resource

sharing, and improve the efficiency of digital platforms [10].

4.3. Establishing a Sharing Alliance of Cold Chain Enterprises

The cold chain enterprise sharing alliance is composed of supply enterprises, third-party logistics enterprises, joint distribution centers, sellers and cold chain logistics joint distribution information platforms. It can help give play to the self-discipline role of industrial alliances, guide platform-based enterprises such as rural e-commerce, express delivery and logistics to improve platform service agreements, transaction rules and credit evaluation systems, carry out resource exchange and sharing such as data technology, and jointly improve the utilization efficiency of urban and rural cold chain logistics facilities and the distribution efficiency of agricultural product refrigeration and preservation.

The alliance can jointly build a "one-piece chess" system for primary processing of agricultural product refrigeration, implement the "one network" strategy for cold chain logistics, complement the "first mile" of circulation and strengthen the "last mile" community cold chain storage system, and build a "one platform" service for the coordinated development of industrial alliances [11].

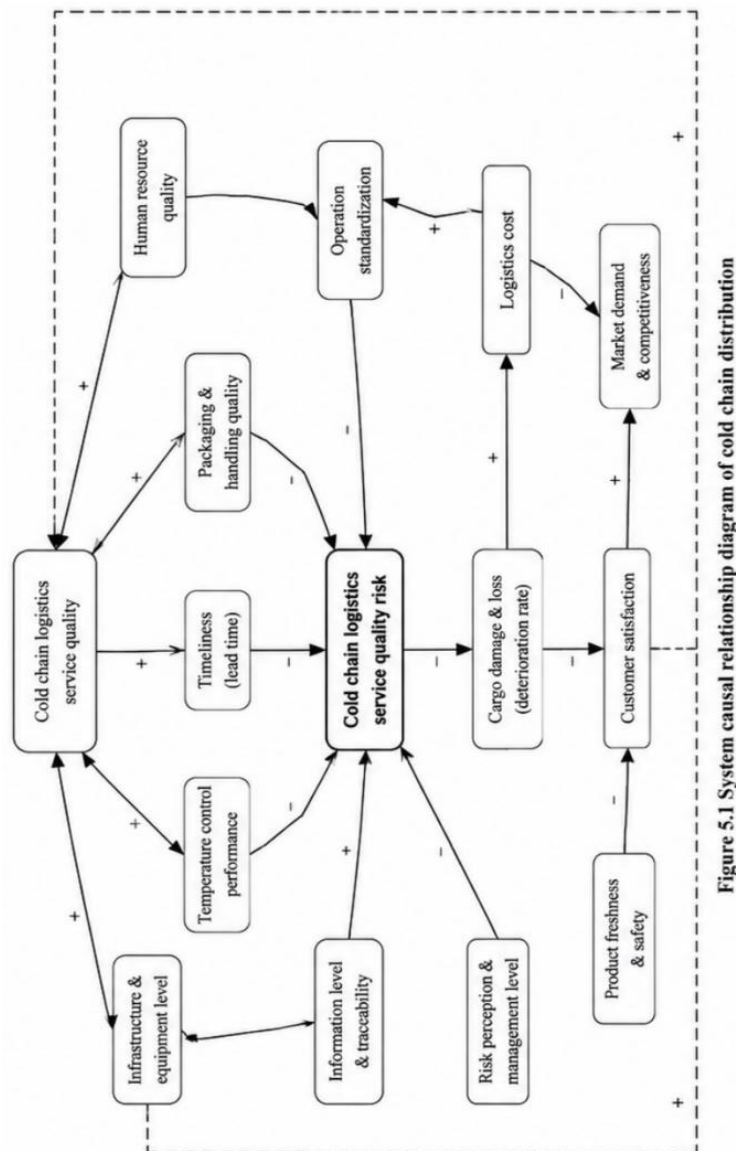
5. Construction of System Dynamics Model

5.1. Causal Loop Diagram

Causal loop diagram is the logical framework of system dynamics model, which is composed of system components and the action chains between components. Since causal loop diagram mainly describes the feedback relationship within the object system, it is also called "causal feedback diagram" or "causal relationship diagram".

To draw a causal loop diagram, first, the system boundary should be reasonably determined; second, the causal chains should be correctly drawn; on this basis, the feedback loops should be identified, and the behavior of the feedback loops should be analyzed. As one of the modeling steps of system dynamics, the causal loop diagram provides a framework on which the quantitative model expands its structural description. Therefore, a high-quality causal loop diagram is crucial to the system dynamics model.

By combining and adjusting the causal relationships of the enterprise subsystem, customer subsystem and product subsystem, the causal relationship diagram of the cold chain distribution system is obtained, as shown in Figure 4.



5.2. Stock and Flow Diagram

The stock and flow diagram models the above causal relationship diagram, shows the system feedback and dynamic laws, and reflects the differences between variables of different properties and the specific forms of risk generation. The main variables include state variables, rate variables, auxiliary variables and constants.

Among them, state variables refer to system stock, which is equal to the value of the previous period plus the change amount within the time period, represented by square symbols.

Rate variables reflect the speed of increase and decrease of state variables, represented by variables on the arrows of square symbols. Auxiliary variables are calculated from other variables, and their current values are independent of future values. Constants are variables not affected by system factors, and can also be called decision variables; the system can be intervened by changing the value of constants.

Based on the above causal relationship diagram, this paper constructs a stock and flow diagram of cold chain logistics service quality risk management strategies for fresh agricultural products, as shown in Figure 5.

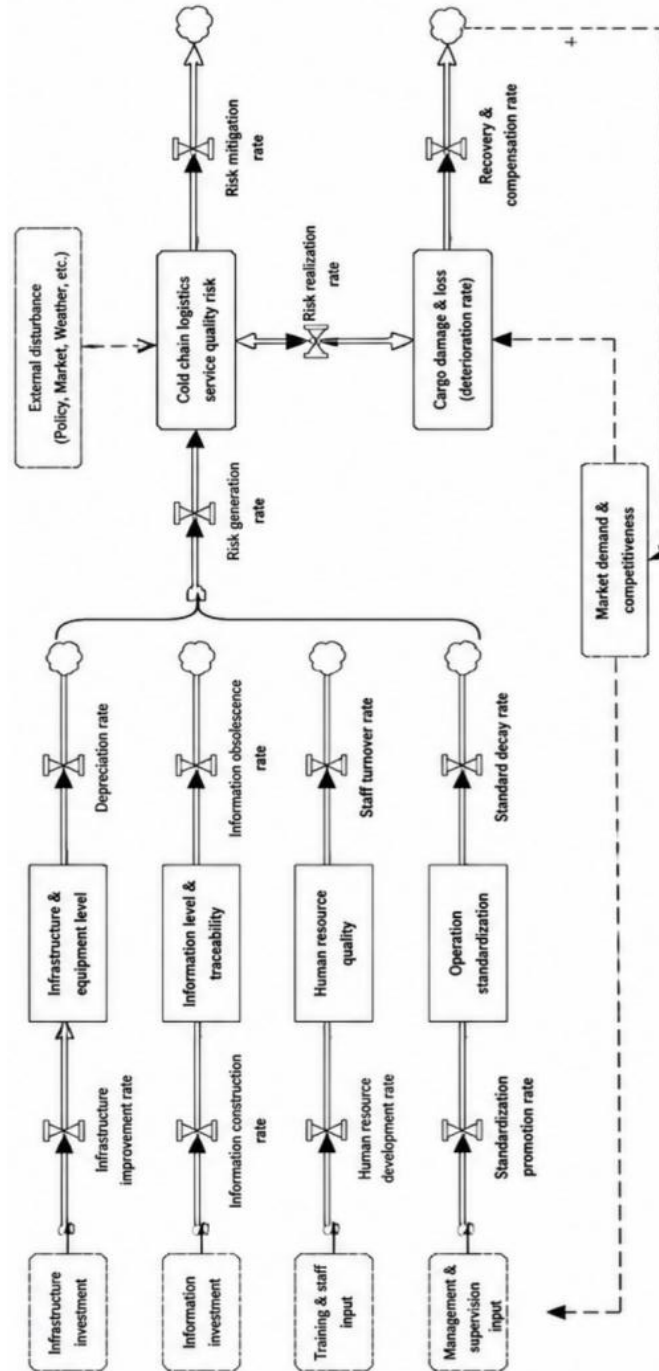


Figure 5. Stock and flow diagram of cold chain logistics service quality risk

6. Empirical Analysis

Through the analysis and research on the cold chain logistics sharing mode of fresh agricultural products of SF Express in Kunming, combined with the current business development situation, this paper clarifies its development

status and existing problems. Meanwhile, it also finds the development advantages of this mode in cold chain logistics distribution, and tests the stability and effectiveness of distribution.

6.1. Stability Test of Distribution

The distribution links of large domestic cold chain logistics enterprises such as JD.com and SF Express are an integrated cold chain process from the starting end to the terminal end of fresh agricultural products, and form a logistics fresh-keeping line composed of storage refrigeration and distribution refrigeration. It includes the processes of supply, storage, processing, packaging and sorting of fresh agricultural products, and finally reaches the demand place as soon as possible to realize product value-added.

The logistics mode of fresh agricultural products is very different from that of other commodities, and its requirements are often relatively high, especially in the distribution link. SF Express has excellent service concepts and logistics advantages, and strives to shorten the supply chain and provide better services. In terms of commodity storage, it is equipped with multiple professional warehouses with multi-temperature control zones. Meanwhile, relying on the world's leading WMS warehouse management system, it has perfect and efficient order processing capacity, providing a solid guarantee for the product process.

For example, in the fresh lychee competition in May, SF Best had already stationed in the lychee origin as early as January to investigate the supplier situation, climatic conditions and surrounding environment.

In addition to Beijing and Shenzhen, SF Best also prepared operation points in East China and South China, and organized a procurement team to conduct direct procurement from origins across the country. After buyers personally select the food and seal the boxes, a trump card of SF Express in e-commerce has to be mentioned - "SF Airlines", a joint venture with Shenzhen Taihai, which guarantees the efficiency of cross-regional logistics. "We can deliver food from branches to tongues within 24 hours. As long as we do not encounter extremely bad natural factors, we can ensure the same speed and stability every day," said Yang Jun.

As for the long-standing "last mile" problem of fresh food e-commerce, Yang Jun introduced that SF Express now has more than 140 temperature-controllable transport vehicles, and has been strictly implementing cold chain requirements. After the supply chain is shortened, there will be price advantages. Then, through the improvement of operation efficiency and innovative business model, costs will be reduced, and finally benefits will be passed on to consumers [12].

6.2. Effectiveness Test of Distribution

SF Cold Chain strives for perfection in every link of the whole distribution process. SF cold chain logistics includes three main links: origin source, logistics transit and terminal delivery. To ensure scientific management of each link and realize dynamic management of the fresh cold chain process, SF Express adopts methods such as pretreatment centers, packaging and cold chain technology, and fully guarantees the transportation and delivery of fresh fruits through the mature logistics distribution network accumulated by SF Express.

As a leader in the cold chain logistics industry, SF Cold Chain aims to transform the production mode of products from a low-end mode of decentralized operation to a centralized and intelligent mode. It links with local governments and plans comprehensive product production and research bases integrating fresh food procurement, off-season sales and IT services in multiple domestic regions, firmly grasping the first link of cold chain logistics -

production bases.

Second, strengthen the management of logistics transportation equipment. SF Express has concentrated funds to purchase more than 300 refrigerated trucks. It has made great efforts on refrigerated trucks: in addition to setting GPS to strictly locate logistics transportation routes, it also installs high-speed refrigeration equipment and strict thermal insulation devices on refrigerated trucks.

Logistics links play a vital role in the whole fresh food e-commerce, and the establishment and improvement of the cold chain logistics system is the key to truly promoting the development of this market. With a strong "background" - at least 130,000 delivery staff and more than 20 aircraft, SF Express does not seem to worry about this link. After exploring the cold chain for one year, SF Best has accumulated rich experience and prepared cold chain storage in East China and South China, and later made layout in Guangzhou in the second half of the year, purchasing ProLogis multi-functional (refrigerated, frozen, constant temperature and humidity) warehouses at a high price.

SF Best believes that the superior quality of products, the gradual optimization of the supply chain and the substantial improvement of operation efficiency are its biggest advantages. For warehousing and cold chain logistics, any enterprise with sufficient funds can achieve them [13].

6.3. Result Analysis

SF cold chain logistics is in a rising period. Internally, it needs to continuously consolidate the foundation and improve its logistics process; externally, it should fully absorb the experience of other cold chain logistics enterprises. Of course, as the first domestic enterprise to initially build a national cold chain network, SF Express has unparalleled advantages over other enterprises - automated refrigeration equipment and intelligent humidity monitoring systems, which can provide customers with long-term and stable logistics services.

7. Conclusion

With the continuous expansion of China's middle class and the huge population base, the pressure to meet people's consumption demand for fresh agricultural and sideline products is increasing day by day, which puts forward higher and higher requirements for the development of China's cold chain related industries.

Different from other logistics, the shelf life of refrigerated food at normal temperature is not long, especially fresh food. In the process of corruption and deterioration, fresh food will accelerate the decay of other foods, because cold chain food has strict requirements on storage and transportation environment. To maintain the sustained, stable and rapid growth of the cold chain market, ensure people's food safety, reduce the logistics loss of fresh agricultural products, reduce the no-load rate of food transportation and distribution, and improve their freshness and quality, it points out the direction for the reform of fresh agricultural products cold chain logistics.

This research provides feasible reference ideas for the low-loss and efficient operation of fresh cold chain logistics under the new retail background, and offers valuable enlightenment for subsequent related optimization research.

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