

A literature study on the disruption risk in cold chain logistics of fresh food e-commerce enterprises with pre-warehouse

Yue Zhao

School of Economics and Management, Chongqing University of Posts and Telecommunications,
Chongqing 400065, China

347224848@qq.com

Abstract. China's fresh food e-commerce market developed rapidly in 2020, with the scale of the fresh food e-commerce industry reaching 458.49 billion yuan, an increase of 64.0% from 2019. In this context, the fresh food e-commerce front-end warehouse operation model has attracted much attention in China's social capital market due to its high profitability, high repurchase rate and high consumer loyalty, and commercial giants have entered the investment, which has promoted the rapid development of the front-end warehouse model fresh food e-commerce. However, there are still many factors that hinder the healthy development of the cold chain logistics industry, mainly in the uneven professional quality of practitioners, imperfect cold storage, refrigerated vehicles and other cold chain infrastructure equipment, high fresh loss rate in distribution and transportation, and the difficulty of realizing the whole cold chain. Therefore, it is necessary to study the literature related to the disruption risk in the cold chain logistics of fresh e-commerce front-end warehouses, which will have a positive impact on promoting the healthy and long-term development of the fresh e-commerce industry and the cold chain logistics industry.

Keywords: the disruption risk; cold chain logistics; fresh food e-commerce; pre-warehouse.

1. Status of domestic research

1.1 The development of fresh food e-commerce

Fresh produce e-commerce has been developed in China for only a decade, and scholars have mainly focused their research on it in the last decade, Xing Xianghuan (2021) [1] summarized the kinds of models of fresh food e-commerce enterprises: integrated e-commerce platforms, vertical e-commerce platforms, third-party logistics enterprises carrying out fresh food e-commerce, offline supermarkets involved in fresh food e-commerce, and O2O fresh food e-commerce (including the front warehouse model, to-store + to-home model, takeaway model, community franchise model, and crowdsourcing model). Wang Yuan et al. (2018) [2] et al. analyse the evolution process, reasons and problems of the fresh food e-commerce model in the context of new retail, taking Boxma Fresh and Jingdong 7FRESH as examples. Bi, Huina et al. (2021) [3] Analyze the problems of fresh produce e-commerce development based on five aspects: product quality, logistics and storage service quality, platform service quality, fresh produce price and value-added services. Liu Yanhong (2016) [4] pointed out that due to consumer demand and policy support, the domestic fresh food e-commerce market has a lot of room for development, but fresh food has high requirements for cold chain, freshness is perishable, delivery timeliness requirements are strict and people's consumption habits are solidified, etc. are the problems to be solved by fresh food e-commerce.

1.2 Development of fresh food cold chain logistics

Li Xiao (2018) [5] pointed out that there are many challenges of big data application in China's fresh agricultural products e-commerce distribution, and proposed to realize the optimization of fresh agricultural products e-commerce distribution through big data. Chen Zhe et al. (2018) [6] proposed a logistics distribution model based on the joint collaboration of big data service centre and monitoring centre, guided by customer order demand, and combined with multiple distribution under standardized processing. Xu Huimin (2020) [7] Improving the subject of the growth of China's

agricultural cold chain, promoting the growth of third-party fourth-party logistics, improving the application of science and technology, and sound infrastructure support.

1.3 Broken chains in fresh food cold chain logistics

Zhang Xicai et al. (2021) [8] divided the fresh agricultural products cold chain logistics supply chain into six links, including pre-cooling, storage, transportation, distribution, retail and consumer, and analyzed that the weakest link of fresh agricultural products cold chain logistics is the pre-cooling link of origin using two methods: fault tree and Bayesian network model. Zhang Jinyu (2020) [9] Analyzed the main causes of chain breakage in fresh produce cold chain logistics, pointed out that temperature fluctuations would lead to the failure to guarantee the quality of fresh produce, and put forward suggestions such as strengthening cold chain standards, supporting third-party cold chain enterprises, enhancing chain members' awareness of cold chain and strengthening the whole process of cold chain monitoring and tracing system engineering. Liu, Hui et al. (2020) [10] By simulating the effects of the temperature environment on the hardness and sugar-acid quality of peach fruit in 3-fold circulation methods, including room temperature, cold chain and broken chain, it was found that broken chain circulation had a significant negative impact on the quality of the fruit, and pointed out that a constant temperature cold chain should be used as far as possible during the post-harvest circulation of the fruit.

1.4 Status of development of the forecourt model, site selection and path optimisation

In terms of the current situation of front-end development, Xia Manlu et al. (2019) [11] analyzed the operation mode of the Daily Fresh front warehouse, pointed out the operational difficulties of the front warehouse model, and proposed relevant improvement solutions. Qiu, Tian (2020) [12] Taking Daily Fresh as an example, he outlines and analyses the supply chain strategy and demand forecasting under the front-end warehouse model, and makes suggestions for the problems that exist in it, such as insufficient product categories and a single profit model. In terms of site selection and optimisation, Guo Fang et al. (2021) [13] constructed two types of operator models, the model of front-end warehouses providing stocking services helps to recycle vehicle capacity and reduce the number of vehicles used to reduce logistics and distribution costs. Huang, Jikai (2021) [14] Research on front-end warehouse location and distribution path planning from the perspective of omnichannel mode front-end warehouse distribution network design, and research on site-path integration optimization.

1.5 Quality of service management in the forecourt model

Liu, M.F. et al. (2020) [15] combined DEMATEL and ISM methods to construct a multi-layer recursive model of service quality risk influencing factors for fresh cold chain front-end warehouse logistics, pointing out that in-transit fresh produce cargo damage cost, distribution on-time performance and fresh produce logistics operation cost are the core factors for its service quality risk formation.

2. Status of international research

2.1 The development of fresh food e-commerce

Govindasamy R and Italia J (2012) [16] A study of e-commerce models for agricultural products in terms of consumer behavioural factors. baourakis et al. (2015) [17] Focuses on the impact of e-commerce on the marketing of agricultural products and focuses the study on the agricultural and organic food segment. ng (2013) [18] Wei Wenji (2021) [19] constructed three new business models for fresh produce e-commerce in the context of the Internet, including the pre-sale model, vertical logistics model, and value proposition model, and proposed the implementation path of the new business models to reduce corporate transportation costs and enhance the competitive advantage of fresh produce e-commerce. yangyan Shi et al. (2018) [20] analysed the operational models of the

respective suppliers of fresh produce e-merchants in the UK and China, summarised the different consumption trends in the fresh food market, and pointed out that logistics services still need to be improved.

2.2 Development of fresh food cold chain logistics

Nodali Ndraha et al. (2018) [21] argued that the key to reducing losses in frozen foods is temperature management and noted that the latest technologies in temperature monitoring make an important contribution to the food cold chain. Hsin-I Hsiao et al. (2016) [22] analysed the time-temperature information sharing behaviour in the frozen food supply chain by distributing a questionnaire to food manufacturing companies. mercier (2017) [23] pointed out that cold chain food is prone to chain breakage when the optimal temperature is lower than the normal temperature, and argued that rational management of temperature can improve the efficiency of cold chain operations. yong-Shin Kang et al. (2012) [24] analysed the key performance indicators of cold chain systems based on the variation of RFID sensor tags in cold chain systems. thijs Defraeye et al. (2015) [25] pointed out that optimising the packaging of fresh produce can be cost effective in transportation and distribution. ashvin Ashok et al. (2017) [26] (2017) point out that cold chain logistics operations management should be improved in terms of cold chain capacity, new cold chain technologies, temperature and equipment. mike Brison et al (2017) [27] pointed out that cold chain technology and cold chain information processing technology have a significant impact on cold chain performance in low-income countries. yi Jiang et al. (2021) [28] pointed out that the importance of consumer perceptions of last-mile logistics services had a positive and significant impact on consumer satisfaction with fresh produce e-commerce logistics services.

2.3 Fresh food cold chain technology and risks

Bortolini M (2016) [29] A tri-objective logistics and distribution planning method based on operational cost, carbon footprint and distribution time objectives is proposed for the tactical optimization of fresh food logistics and distribution networks. jiajia Ren et al (2021) [30] Based on the impact of cold chain logistics distribution on existing urban traffic, an integrated model of self-built logistics/third-party logistics + joint distribution was designed, combined with a global artificial fish swarm algorithm to effectively solve the cold chain logistics distribution path optimization problem considering carbon tax costs. Hao Zhang et al. (2020) [31] established an intelligent logistics model for fresh food product reliability control to improve the economic efficiency and intelligence of fresh food e-commerce logistics system.

2.4 Broken chains in fresh food cold chain logistics

Ye Jing et al. (2020) [32] (2020) proposed to establish a closed-loop control system of "market access - process monitoring - service evaluation - joint rewards and punishments" centered on road cold chain transportation to improve the service quality and management level of cold chain transportation and reduce the loss of agricultural products in the process of cold chain logistics. Xiao et al. (2022) pointed out that cold chain breakage is related to cooling. [33] (2022) point out that cold chain breakage is the root cause of safety problems related to cooled goods and suggest that cold chain logistics companies can share their logistics information with the government to provide cold chain transparency, traceability and proof of chain breakage, and that the government can manage the information sharing of companies to prevent social losses and recovery costs in case of catastrophic events. [34] suggest that the Internet of Things enables real-time temperature monitoring and machine learning models can be used to detect cold chain breaks. reguera et al. (2019) [35] pointed out that cold chain maintenance is essential for food quality and safety assurance, while gaps in the cold chain can be predicted, and explored the possibility of detecting cold chain breaks using HPLC-FLD to determine the levels of nine biogenic amines (BAs) in albacore tuna.

3. Summary

(1) To sum up, there are abundant research results on the current situation and problems of fresh e-commerce development, the current situation and dilemma of cold chain logistics development, fresh cold chain technology, risk and broken chain, the current situation and dilemma of front-end warehouse development, front-end warehouse location and path optimization, front-end warehouse logistics service quality, etc. In general, most of the research studies use systematic and macroscopic thinking to look at fresh cold chain logistics, and fewer scholars have focused their Few scholars have focused their attention on the direction of cold chain logistics of front-end warehouses.

(2) At the same time, in the direction of fresh cold chain logistics chain breakage, most of the research focuses on three major directions, such as analysis of the causes of chain breakage and countermeasure suggestions, impact consequences and risk evaluation, etc. Few scholars have conducted detailed research and analysis on the risk of chain breakage in cold chain logistics of front-end warehouses.

(3) In terms of research methods, more studies on the risk of fresh cold chain breakage use hierarchical analysis, explanatory structural models, fuzzy integrated evaluation methods, MICMAC methods, fuzzy Bayesian networks and other system engineering methods or mathematical and statistical methods to carry out empirical research, and most of them consider the level or weight of risk from a single perspective, or the hierarchical relationship and interaction between risks, without integrating several of them. It is difficult to analyse the degree of importance and interaction mechanisms of risk influencing factors in an integrated manner.

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