

Agricultural Product Supply Chain Disruption During Public Emergencies: Analysis and Insights from China

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Abstract. Public emergencies, such as natural disasters or pandemics, will significantly and often disrupt the complicated supply chain web. The challenges posed by such emergencies underscore the critical need for robust contingency plans, efficient risk management strategies, and agile supply chain frameworks. The interdependencies and vulnerabilities within the supply chain make it particularly susceptible to disturbances caused by these unforeseen events. The outbreak of COVID-19 has made supply chains worldwide face huge impact and interference, so the interruption of the supply chain has once again become the focus of global attention. Scholars have researched supply chain risk identification, risk assessment and risk response strategies under public emergencies. This paper will sort out the research results of scholars on the coping strategies of agricultural supply chain interruption in the background of public emergencies in China, summarize and put forward the prospect of the future research direction, and provide a reference for the coping strategies of agricultural supply chain interruption in the background of public emergencies.

Keywords: Supply chain risk management, Supply chain disruption, Agricultural product supply chain, Public Emergency.

1. Introduction

Public emergencies often have unpredictability and sudden, if not timely effective measures, not only will seriously affect public health, more will affect social stability, and economic development, also to a certain extent, cause agricultural supply chain interruption according to the extent of the impact of the adverse impact on the society. Therefore, studying its supply chain interruption response strategy for the masses' "vegetable basket" and "rice bag" is particularly important. In the late COVID-19 outbreak, the chain effects of the agricultural supply chain disruption and the public panic and public opinion have brought the issue of agricultural products into the social focus. For example, SARS in China in 2003, nuclear radiation in Japan in 2011, and hoarding food masks and medicine in 2020 all impact the necessities supply chain, including agricultural products under public emergencies. The interruption of the geponic products supply chain has become the focus of social concern, and it is urgent to ensure maintain the stable development of the agricultural product supply chain.

At present, the mainstream research direction of scholars is on supply chain interruption coping strategies. The coping strategy for supply chain interruption has always been a noteworthy issue, but as Guo Qian et al. pointed out, in recent years, scholars' research on the risk management of supply chain interruption is still in the initial stage, which is generally scattered and lack of systematic [1]. Public emergencies can cause supply chain risks to the supply chain and thus may evolve into supply chain interruption. This situation is often uncontrollable, and it is necessary to formulate coping strategies in public emergencies. Scholars have developed the government intervention mechanism, emergency logistics innovation, recovery mechanism and other response strategies. However, to solve the response strategies of supply chain interruption in the background of public emergencies, Liu Fan et al. left the following problems that need to be analyzed to solve the response strategies of supply chain interruption in industries with a high probability of supply chain interruption [2]. Jianli Luo et al. proposed that the outbreak of emergent public events of international concern, such as example, COVID-19 makes finding appropriate supply chain strategies to mitigate supply chain disruptions and achieve supply chain sustainability an urgent issue to address [3]. Therefore, this

paper focuses on the background of the COVID-19 epidemic in China, which significantly impacts society, and the response strategies of agricultural supply chains with a high incidence of supply chain interruption. This paper reviews the response strategies of the emergency mechanism and the post-recovery mechanism in the background of public emergencies.

2. The Interruption of Agricultural Supply Chain in the Chinese Situation

Ding divided the supply chain of agricultural products into links: supply of production, production, processing, distribution and retail [4]. This paper believes that in the context of COVID-19 in China, the interruption of the agricultural supply chain mainly consists of four problems: production, logistics, warehousing and retail.

2.1. Production Interruption

In the early days of the COVID-19 outbreak, the regional blockade adopted by various provinces and cities in China affected the production and operation of the animal husbandry and breeding industry. It made it easier for breeding production activities to carry out normally [5]. The COVID-19 outbreak greatly adversely impacts the variability of inputs such as labor and capital used for agricultural production. The strict control measures in the early stage of the epidemic have reduced or directly interrupted the factor input of several agricultural industries, mainly livestock and poultry breeding, affected by production interruption.[6].

2.2. Logistics Interruption

During the virus outbreak, the sealing and control blocked logistics activities, so the interruption of the agricultural supply chain was inevitable [7]. Early on the COVID-19 outbreak, to prevent the further spread of COVID-19, traffic control was implemented between urban and the countryside, which became a huge obstacle to the logistics of agricultural products due to the obstruction of logistics [6].

Wang and Jing believe that there are two reasons for interrupting agricultural products' logistics in epidemic prevention and control. On the one hand, the closure of the wholesale market leads to the effective docking between the supply and demand of agricultural products, the unsalable agricultural product supply, and the shortage of farm products, granting the circulation of agricultural products in chaos. On the other hand, when will coronavirus mutants begin to appear in China because its epidemiological rule has not been found to deal with the uncertainty; some areas have increased the intensity and scope of prevention and control, which has seriously affected the trunk logistics activities including the circulation of agricultural products, issue in the blockage of the circulation of farm products [7].

2.3. Warehousing Interruption

Wang Hainan et al. pointed out many problems in China's cold chain logistics system, leading to the high circulation cost and loss rate of fresh agricultural products. First, China's cold chain logistics infrastructure could be better, and the overall scale needs to be improved. Second, China has a scattered cold chain storage map influenced by the amount of zonal agricultural products, time-dependent changes, regional consumption base and other factors. Third, the core technology of the cold chain is relatively backward, and cold chain management needs to be standardized. Many operation employees need a better understanding of the whole process and temperature concept. They are prone to the cold chain interrupt in the transit process, making it difficult to realize the whole cold chain [8].

2.4. Retail Sales Interruption

At the beginning of the COVID-19 pandemic, the retail end of the agricultural supply chain was seriously unbalanced [9]. Behind the South China seafood market, where COVID-19 was launched,

it reflects the problems of the old agricultural and sideline wholesale market, the main port of the agricultural products supply chain, with backward facilities and equipment, inadequate management and unreasonable layout [10]. Liu et al. based on the risk influencing factors of retail supply chain interruption of Grey-DEMATEL. From the perspective of causes and factors, after the occurrence of a public health emergency, the government fails to take timely, effective and reasonable emergency management measures to alleviate the serious consequences caused by the incident or takes too strict traffic control to obstruct transportation routes, which may interrupt the retail supply chain. At the same time, if the enterprise lacks risk awareness and warning mechanisms in the operation process, it will also interrupt the retail supply chain. From the perspective of outcome factors, affected by the impact of public health emergencies, urban blockades and people's travel restrictions cause the reduction of employees and residents' inability to consume normally. At the same time, traffic control makes the transportation road poor, and the efficiency of product distribution decreases; all these problems will lead to the risk of interruption of the retail supply chain. From the point of importance analysis, the government, in response to public health emergencies, often introduced a series of strict controls, which may affect product production, transportation, sales, production raw material access difficulties, product transportation road, product inventory backlog of supply chain cohesion will cause retail severe impact supply chain [11].

3. Countermeasures for Agricultural Supply Chain Disruptions

3.1. Prevention in Advance

3.1.1 Suggestions for prevention

In terms of grain circulation system optimization under public emergencies, Qian et al. proposed: first, optimize the central and local grain reserve structure; second, promote the diversified exhibition of grain reserve subjects through market-oriented reform; third, improve the social grain storage system in towns and villages; fourth, improve the connection between provinces, logistics channels and cross-transportation; fifth, improve the top design of grain logistics, strengthen grain logistics intensification, scale and network management [12]. Hu put forward the policy suggestions for further improving the safeguard measures of important agricultural products as follows: first, adjust the idea of grain reserve; second, build the "China agricultural safety net" with risk management as the core; third, build agricultural trade hub network [13]. Wei put forward suggestions to optimize the supply chain system of China's food industry chain: first, to improve the synergistic efficiency of the industrial chain with modern technology; second, to improve the efficiency of the supply chain with modern technology; and third, to use the modern technology to ensure the safety of the supply chain [14].

3.1.2 Digital transformation

Luo et al. used bibliometrics and content analysis to analyze the supply chain industry systematically. They proposed that supply chain industry development has to transform to digital to improve the supply chain's elasticity and reduce the supply chain risk [15]. Bu et al. applied a supply chain strategy selection model, established the outbreak era after an effective business continuity supply chain security management model, analysis of uncertain demand of manufacturing supply chain risk, redefined and built supply chain business continuity management from the strategic perspective, established the main direction of the digital transformation, according to the establishment of enterprise digital supply chain based on its digital ability [16].

To sum up, the response strategy of pre-prevention mainly focuses on the systematization of grain circulation. It optimizes and innovates from the digital transformation and development of agricultural product reserves and logistics.

3.2. In-process Emergency Response

3.2.1 Emergency logistics

Yang et al. put forward suggestions to improve the reserve and distribution of emergency materials: First, improve the efficiency of the reserve. Reasonable distribution of material quantity, quality and category is the basis to ensure the role of emergency material support capacity; second, establish emergency response platform; third, scientifically plan command point and establish coordination mechanism; fourth, scientific stop loss and formulate emergency plan [17].

Subeet al. established a simulation model of a public distribution system to propose a supply chain mitigation strategy: set up supply chain distribution and isolation zone to cope with the disruption caused by the pandemic to meet the needs of necessities such as agricultural products. And design three different PDS scenarios to simulate that the integration of warehouses is helpful in the meeting from the backup warehouse in the event of an interruption [18].

3.2.2 View of supply chain integration

Wan et al. conducted innovative research on grain emergency logistics from the supply chain perspective. They put forward innovative guarantee measures for grain emergency logistics from the perspective of supply chain integration from five aspects: First, innovate the management mode of grain and emergency logistics, improve the transportation speed by improving the logistics transportation mode, and innovate the logistics distribution facilities. Second, a reasonable scientific layout of material reserve warehouses, increase the number of warehouses, gradually form a standard material network, and further improve the warehouse facilities; third, develop the food emergency logistics system by establishing an integrated transportation system and transportation network to build an integrated food emergency supply chain system; fourth, local governments will implement the competition mechanism between grain storage and related logistics enterprises and carry out reasonable incentive methods to stimulate the initiative of enterprises and improve the efficiency; fifth, food emergency logistics information system needs to introduce high-tech technical means, introduce high-tech talents, to provide talent guarantee for the development of food emergency logistics [19].

3.2.3 Government intervention

Incentive model. Liu et al. using starkerberg game model, get the conclusion is as follows: first, when the product is more necessary, Suggest that the government provide higher subsidies, Push manufacturers to pay more capacity recovery efforts to increase capacity, Maintaining social stability, Stable prices; Second, when manufacturers expect to restore capacity to meet demand, Manufacturers will not produce excess capacity, When the government decides on the optimal subsidy ratio, Regardless considering product necessity, So the government doesn't need to take the initiative to raise subsidies; Third, when the expected recovery capacity of necessities is very low, No amount of government subsidies will encourage manufacturers to increase capacity recovery efforts; When the necessity recovery yield is high, The government needs to offer less incentives, Can promote suppliers to increase production capacity to restore the level of efforts; When the expected recovery results is most stable, Manufacturers' profits and government utility can reach the maximum of [20].

Zhang put forward four policy suggestions: first, as soon as possible, introduce policies to support fresh electricity suppliers, supermarkets and other stores to accelerate the construction of pre-warehouse and integrated distribution terminals; second, strengthen the construction and systematization of pre-cooled cold storage in producing area; third, speed up the establishment of support mechanism for the construction of cold chain logistics warehousing and distribution system; fourth, establish the certification supply mechanism of fresh farm products supply chain [10].

Liu et al. evaluated the influencing factors and risk grade of retail supply chain interruption risk through the combination of the Grey-DEMATEL method and fuzzy comprehensive evaluation method; the following suggestions: First, the government should establish a comprehensive and reasonable emergency management system to prevent the serious impact of emergencies, And

increase the support for enterprises affected by public health emergencies, Improve the policies and measures to support enterprises; Second, the government, enterprises and employees should fully cooperate, to ensure the resumption of work and production of enterprises under the condition of ensuring the safety of personnel. To promote industrial transformation and upgrading, Adopt emerging patterns to stimulate consumption; When the government formulates road control measures for public health emergencies, We should also consider opening a green channel to ensure the normal supply of materials, Production and marketing connection [11].

Christopher proposed seven steps to avoid social unrest: first, the labor force must maintain good health; second, the government implements emergency funds for the persons most in need; third, the government saves unemployment insurance through temporary recruitment in important industries; fourth, retailers restrict the sales of necessities to control herd behavior; fifth, follow the recommendations of pandemic experts on personnel movement; sixth, avoid protectionism; seventh, punishing persons engaged in unfair trade practices [21].

To sum up, the emergency strategy scholars from emergency logistics, supply chain integration and government intervention model three aspects, show that emergency strategy needs to develop agricultural products emergency logistics system and innovative agricultural emergency distribution facilities, government intervention government to support agricultural supply chain link, ensure the effective supply of agricultural products.

3.3. Recovery Afterwards

3.3.1 Full supply chain recovery mechanism

Yang et al. took the government's epidemic response policy as a sample. They adopted the theoretical framework of the supply chain comprehensive recovery mechanism based on identifying the key influencing factors and contextualized characteristic factors. The research shows that the overall recovery should be made from the global perspective to promote the full awakening of the supply chain, realize the distribution, determine and awaken key enterprises based on overall planning and gradually awaken the whole supply chain. The awakening mode can ensure the dynamic recovery of the supply chain to adapt to the changing epidemic [22].

3.3.2 Finance helps with the recovery of the industrial chain

Chu et al. put forward financial suggestions for the recovery of the industrial chain; first, to guarantee farmers' income and accelerate rural construction; second, to provide preferential short-term liquidity support to save agriculture-related enterprises and cooperatives; third, financial institutions strengthen online services to ensure the operation of agricultural delivery chain; fourth, increase the support of agricultural insurance and improve the insurance guarantee level [23].

To sum up, the post-recovery strategy can be divided into a supply chain distribution awakening mechanism, digital intelligent transformation of the supply chain, and financial assistance for the agricultural products supply chain. The government and enterprises need to coordinate the development and accelerate the recovery of the agricultural supply chain after the event.

4. Conclusion

This paper combs and analyzes the problems of agricultural products supply chain interruption in the background of public emergencies from four aspects: logistics interruption, retail interruption, storage interruption and production interruption. The response strategies for the interruption of agricultural products in the background of public emergencies were summarized, and the literature on the response strategies of pre-prevention mechanism, in-process emergency mechanism and post-recovery mechanism were reviewed. Through the research review, it is found that: first, there are many suggestions on the response strategy of agricultural products and fewer studies on model construction; second, the government is the main body of the response strategy, and fewer studies on

other topics; third, the selection of public emergencies affecting the agricultural products supply chain takes more COVID-19 as the background.

China's agricultural products should optimize the reserve structure in peacetime, build agricultural products logistics hubs and use modern technology for digital transformation. When a public emergency interrupts the agricultural product supply chain, integrate the supply chain system, improve the emergency logistics system, and actively respond to the government policy call. When the event's impact is controlled, the agricultural supply chain integrates resources with multiple parties to promote the recovery of the agricultural supply chain. This paper suggests that further research can focus on the following directions: firstly, the empirical study of the agricultural supply chain interruption in the background of the public emergency in the world; secondly, proposing the response strategy of the public emergency; thirdly, establishing the emergency and recovery model of the interruption of the public emergency; and exploring the development environment of the agricultural supply chain in the new period.

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