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Risk Management of Fruit and Vegetable Supply Chain based on WSR Method

LI Yu-qing
School of Logistics, Beijing Wuzi University, China

Abstract: The area and output of fruits and vegetables in China are the first in the world, but because of the backward fruit and vegetable preservation industry, the storage and consumption patterns are primitive. The transportation loss rate of China's agricultural products is far higher than the level of about 5% in developed countries, and the fruits and vegetables agricultural products are different from ordinary agricultural products, and are extremely vulnerable to seasonal and cyclical influences, the fruit and vegetable supply chain is a high-risk and complex system. In this paper, based on the logistics perspective of fruit and vegetable supply chain risk management related research, first identify the relevant risk factors, and then put forward the corresponding solutions to specific circumstances, more scientific and more systematic risk identification.

Keywords : *Fruit And Vegetable Supply Chain; Logistics Perspective; Risk Management*

I. PURPOSE AND SIGNIFICANCE OF RESEARCH

China is a big country in the production, sale and consumption of agricultural products. Fruits and vegetables belong to an important category of agricultural products, closely related to people's daily life, is essential to life. According to the China Federation of Logistics and procurement, the loss rate of agricultural products in China is 25%-30% , much higher than the level of about 5% in developed countries. At present, the research on agricultural products mainly focuses on the large-scale, and there are few subdivision studies. Because of the characteristics of fruit and vegetable products, the traditional fruit and vegetable supply chain has some limitations and often has high risks. For some developed countries, the infrastructure of production and logistics related to the fruit and vegetable supply chain is perfect, and the fruit and vegetable supply chain basically realizes modern integration. According to the report of the 19th National Congress of the Communist Party of China, "we should cultivate new growth points and form new driving forces in areas such as medium-and high-end consumption, innovation-led, green and low-carbon economy, sharing economy, modern supply chain and human capital services. " To realize modern supply chain, we must be clear about our own risks, enhance the ability to cope with risks. There are a lot of people in the countryside, the environment has a great influence on the quality of fruits and vegetables, the price and demand will be fluctuated.

II. LITERATURE REVIEW

The concept of Supply Chain Supply Chain, or SC, was first proposed in 1961 by Jay Forrester, the father of Supply Chain design[1].

Cranfield School of Management, UK, believes that supply chain risk management is to reduce supply chain vulnerability by identifying and managing supply chain risks on the basis of coordinating the interests of all members of the supply chain[2].

In 2006, James S. J. , James C. , Evans J. A. A great deal of research on the relationship between temperature, microorganism and transport shows that the cold chain transport system plays an important role in ensuring food quality. The article shows that all transportation systems keep food temperatures close to the limit to ensure optimal safety and high quality shelf life [3].

In 2010, Kuzeljevich and Julia focused their research on a number of issues in cold-chain transport processes, such as the impact of temperature on sensitive goods; and risks in cold-chain supply chains, such as poor handling and loading technologies, the risk of deterioration and damage of goods and commodities as a result of delivery delays and inadequate cold-chain equipment, as well as the trend towards sustainable and reusable packaging and the scientific packaging of goods, can solve a large number of packaging materials into the waste stream[4].

In 2011, Kai-Ying Chen and Yi-Cheng Shaw argue that temperature monitoring is playing an increasingly important role in cold chain supply chain systems, with increasing emphasis on non-contact, real-time features and high data rates in supply chain management. Therefore, automatic data collection will be an important aspect of cold chain management. Temperature data is collected using automated data collection methods such as radio frequency identification RFID technology to track and trace all products[5].

In 2013, Michael Liitjen pointed out that "smart containers" represent a new type of transportation system that can autonomously determine the status of their cargo. The "smart Container" can accurately monitor the condition of the fruit and track its geographical location. As a result, transport losses can be reduced with better climate control and better allocation strategies. This paper focuses on the application of quality-driven Customer Order Channel coupling principle to develop a new distribution scheduling method. Therefore, simulation models can be expected to be developed and used to assess the potential of new scheduling methods based on the concepts of "smart container" and channel coupling[6].

In 2014, O Lavastre, a Gunasekaran, a SPLANZANI argued that risk management in the supply chain has received attention in recent years. On the one hand, in many cases, events such as natural disasters, strikes and terrorism have had a significant impact on the performance of organizations' supply chains, which in turn have affected their competitiveness. On the other hand, business activities related to strategic decision-making, such as supply, procurement, production, distribution, sales, demand management, planning and so on, can be different from the uncertainty caused by expectations. Recognizing the potential impact of these

circumstances on supply chain competitiveness, attempts were made to identify risks and their sources and to identify management that would help reduce the negative impact of risks on supply chains. A supply chain risk management framework, SCRM, is proposed and validated by data collected from 164 French manufacturing companies. Literature Review, Theoretical Framework and empirical research work in this area have enabled SCRM to successfully identify key management, and put forward relevant recommendations [7].

2015, J An. F Han points out that agricultural products are not only about business profits in the supply chain, but also about food safety and safety. On the basis of analyzing the demand and characteristics of cold chain distribution, the paper analyzes the structure of distribution system, and puts forward the rationalization proposal of improving urban cold chain distribution management system[8].

In 2016, D Nakandala, H Lau, j Zhang showed that fresh produce must face various risks throughout the supply chain due to its perishability. In this paper, a total cost model is developed, in which a variety of fresh foods collected from multiple farms are transported to warehouses or retailers, by using genetic Algorithm Ga., several computational intelligence methods of the repair mechanism for the efficiency benchmark using the modular and genetic algorithm FGA and the improved simulated annealing SA program are illustrated[9].

In 2017, Mf Chen and Li Yan-Jie applied differential game theory to analyze and compare the optimal production input level for the current discussion on the development of fresh agricultural supply chain management. The results show that the operating efficiency of fresh agricultural supply chain is closely related to the income and cost of farmers and supermarkets under these two modes. Finally, an example is given to verify the model, and a prediction model 12 for the future of fresh agricultural product supply chain in China is proposed[10].

III. THEORIES

Fruit and vegetable supply chain: then the fruit and vegetable supply chain can be defined as adopting advanced network technology to improve logistics level and reduce logistics cost, connect growers, processors, distribution centers, wholesalers, retailers, and consumers into a mesh chain.

The Characteristics of fruit and vegetable supply chain : Timeliness, complexity, dynamics, instability.

Supply Chain Risk : supply chain risk is an unpredictable and uncertain factor in the operation of each node enterprise. These factors lead the supply chain to deviate from the expected goal, even affect the normal operation of the supply chain.

Supply Chain Risk Management is defined as: coordinating the members of the supply chain, identifying the risks inside and outside the supply chain, and controlling the Brittleness of the supply chain through management.

IV. RISK MANAGEMENT OF FRUIT AND VEGETABLE SUPPLY CHAIN BASED ON LOGISTICS PERSPECTIVE-TAKE AREA A AS AN EXAMPLE

A. Analysis on the current situation of logistics in Area A

Logistics includes warehousing, transportation, distribution, processing, and so on. Only from the transportation to the county seat, from only postal outlets to the three-way access, now all outlets are fully covered. The logistics industry is already relatively saturated, but in the towns and villages closest to fruit growing, the post still has almost all the power. Storage, processing and other links are more farmers themselves, such as fruit picking season farmers will keep a large room, their fruit will be picked for short-term storage (usually the fruit will be washed-medicine-sealed bag) , if it is long-term storage will choose to store in the freezer. Due to the fragmentation of agricultural production areas, most of the harvest season is collected by buyers to farmers' homes, with a small number of farmers selling on their own, such as self-marketing or online sales.

State-owned fruit enterprises have been set up to promote agricultural standardization, industrialization and scale. The company has adopted an online + offline dual track sales model, actively set up a sales platform to achieve the goal of doubling online offline sales, Ehime Prefecture 38 single item cumulative sales of more than 5 million yuan; by combining the way to go out and please come in, expand the company's peripheral market.

B. Construction of logistics index system in Area A

The external environment of the fruit and vegetable agricultural products logistics: The analysis of the external environment of the fruit and vegetable agricultural products logistics refers to the general environment analysis and the industrial environment analysis. General Environment refers to the main social factors that bring opportunities or threats, which have an impact on all enterprises; industrial environment is the external environment that has an impact on the business activities of enterprises. A total of 6 secondary indicators: System Environment, logistics standards and norms, infrastructure, logistics nodes, production, supply. The basic equipment includes two three-level indexes: Transportation and logistics equipment. As shown in table 4-1,4-2

Internal flow of fruit and vegetable agricultural products logistics: Internal Flow analysis of fruit and vegetable agricultural products logistics is mainly to analyze the resources and capabilities of the organization, and to identify and build the core capabilities that the organization needs to successfully implement its strategy. In the analysis of internal process of agricultural products logistics, 6 secondary factors are selected: storage capacity, loading and unloading, circulation processing, distribution, logistics information, logistics technology.

Table 4-1a regional logistics evaluation index system of fruits and vegetables and agricultural products

General Objective	First-class indicator	Secondary indicator	Tertiary indicator
Risk evaluation index of fruit and vegetable supply chain	Evaluation Index of external environment of fruit and vegetable supply chain (F1)	Yield(S11)	
		Production infrastructure (S12)	Traffic(T121)
			Logistics equipment (T122)
		Logistics node(S13)	
		Institutional Environment (S14)	

		Standard Specification for logistics (S15)	
		Availability (S16)	
	Internal process evaluation index of fruit and vegetable supply chain(F2)	Storage capacity (S21)	
		Loading and unloading (S22)	
		Circulation processing (S23)	
		Distribution (S24)	
		Logistics Information (S25)	
		Logistics Technology (S26)	

Rank importance from high to low, the order is loss rate of agricultural products logistics, total value of agricultural products logistics, logistics cost of agricultural products, distribution, loading and unloading, infrastructure, supply, circulation and processing, logistics standard, system environment, logistics information, warehousing, logistics node, logistics technology.

C. Overall evaluation of supply chain based on logistics

1. The infrastructure is not perfect, the level of information is backward

Based on the analytic hierarchy process (AHP) , the logistics level of fruit and vegetable agricultural products in Area A is better than the application of modern science and technology (logistics information, logistics technology) . The logistics industry in Area A is not long, lack of advanced logistics network infrastructure, information platform and information standards are messy. Logistics Technology also remains to do the operation, leading to logistics information cannot track in time, cannot sense the weather, road conditions in advance, resulting in high rate of loss of fruit and vegetable agricultural products. The low level of information leads to high logistics cost.

2. The logistics system lacks organization and competitiveness

Rural Cooperatives, enterprises, individual farmers and buyers are the important parts of the logistics organization of fruits and vegetables. The transportation and distribution vehicles can only work by road, which is inefficient and cannot form scale benefit. Low level of logistics market. In the process of loading, unloading, transportation and distribution, the loss of fruit and vegetable agricultural products, and fruit and vegetable agricultural products, compared with ordinary goods, generally have higher requirements on temperature and humidity, and most of the transport vehicles in Area A are ordinary vehicles.

3. Lack of information flow and lack of harmonization among regions

Due to the fragmentation of fruit and vegetable production areas, there is a lack of communication between the regions and they can not keep up with the market quickly. The degree of fruit and vegetable agricultural products commercialization and information marketing is low.

4. The perfect logistics system of fruits and vegetables and agricultural products has not been established

A region does not have the perfect fruit and vegetable agricultural product logistics system correlation system, especially in the agricultural product quality supervision aspect is not perfect.

5. The level of commercial treatment after fruit picking is low, and the income of farmers is low

The main mode is the buyer's direct purchase of the country of origin, which means farmers bear less risk and relatively low return. A few farmers sell themselves (cooperatives, networks, markets) , the risk is higher, especially the storage part is processed and stored by the farmers themselves, and a few lease the frozen storage, but this way of income is higher than the way of acquisition by the buyers.

V. COPING STRATEGIES

A. Application of cold chain logistics technology

Fruit and vegetable agricultural products have their unique characteristics, so the dependence on high-tech, especially the refrigeration technology. A region should apply cold chain related technology in the logistics of fruit and vegetable agricultural products to reduce the loss of fruit and vegetable agricultural products so as to reduce their costs.

B. Improving logistics infrastructure for fruits and vegetables and agricultural products

Area A should build all kinds of infrastructure (such as circulation center, Network Communication Foundation) in the main hub, and should establish a large number of low temperature, normal temperature warehouse. In order to speed up the circulation rate of fruit and vegetable agricultural products, reduce the rate of fruit and vegetable agricultural products rot.

C. To establish a logistics mode suitable for the development of fruits and vegetables and agricultural products

In Area A and even in China as a whole, agricultural production is basically dominated by individual farmers. The overall characteristics of agriculture are scattered planting areas, small and chaotic logistics. In order to change this pattern, individual farmers should be connected to cooperatives, large cooperatives can purchase storage, packaging, transport equipment. In sales mainly to direct sales-based. For example, direct from the origin of sales to supermarkets, consumers directly from the supermarket fruit and vegetable agricultural products, fruit and vegetable products can reduce the rate of decay in circulation. It can not only reduce the logistics cost, but also ensure the safety and quality of fruit and vegetable agricultural products.

D. Planning strategy of fruit and vegetable agricultural products logistics channel

The main mode of transportation in Area A is by road. At the edge of the county there are highway nodes of agricultural products logistics. These nodes are the crossing points of agricultural products transportation to the city, and they are

also the important part of the urban transportation network. To connect fruit, vegetable and agricultural products to cities, these highway nodes need to have multiple functions. First of all, these highway nodes must have the basic functions of the logistics storage center, such as loading and unloading, distribution, storage and other functions; secondly, the highway nodes of fruit and vegetable logistics must form a multi-modal transportation with the transportation inside the city, let the fruit and vegetable agricultural products logistics can quickly adapt to the local environment; third, the fruit and vegetable agricultural products logistics information system is these highway nodes are also necessary; finally, these highway nodes also need to provide some additional services such as living services.

Therefore, the combination of these highway nodes should include business processing system, transportation system, storage system, information system and parking lot.

E. Planning strategy of fruit and vegetable agricultural products logistics information system

Logistics Information System is equivalent to the central nervous system of agricultural products logistics, which is in a leading position and supports the development of agricultural products logistics. This system is to use current advanced technology to build a unified public information platform for agricultural products logistics, this platform can collect, classify and store the related information of agricultural products logistics operation, logistics process and logistics management in a area. This platform is used to exchange agricultural products logistics information, which can connect with the peripheral logistics information platform, eliminate the "information island" between industries and departments, and make agricultural products logistics form a unified information whole.

F. Policy planning strategy for the development of fruit and vegetable agricultural products logistics

1. The market access policy of fruit and vegetable agricultural products logistics

Market access should not set too many thresholds, and all departments should abide by national laws and regulations, abolish unreasonable regulations, and create a good development environment for the development of the fruit and vegetable agricultural products logistics market, to break the regional blockade, clear the obstacles to market access and protect the legitimate rights and interests of enterprises in accordance with law. Because involves many industries, in order to ensure the healthy development of the market, must uphold the principle of fair competition.

2. Preferential policies for the logistics of fruits and vegetables and agricultural products

A region in the development of agricultural logistics to give a certain preferential, such as land, electricity and other policy preferences. At the same time, the government will do a good job in infrastructure construction, encourage the community to invest in agricultural products logistics, and give preferential treatment in related areas.

3. Agricultural Logistics Tax and investment and financing policies

Many enterprises in a area are still at the initial stage, in order to promote the rapid development of fruit and vegetable agricultural products logistics enterprises, we should give some preferential policies in tax revenue. In terms of investment policies, the government should strengthen cooperation with various investment financial institutions and banks, broaden financing channels, give preferential policies to financing institutions and give priority support to well-developed and strong agricultural logistics enterprises.

4. Agricultural Products Logistics Human Resource Policy

There is a shortage of talents in the fruit and vegetable logistics industry. The government should formulate relevant talent training programs, establish talent training bases and strengthen cooperation with logistics enterprises.

5. Other relevant policy measures

In addition to the above-mentioned policies, the following measures should be taken: a local government should encourage the relevant enterprises with conditions to extend their agricultural logistics operations, in the agricultural products logistics and distribution to give a certain preferential, especially urban distribution, in the traffic and practice to give preferential.

VI. RESULTS AND OUTLOOK

Results and outlook this paper just combs the related content of fruit and vegetable supply chain risk management, hoping to be helpful for the future research, because there is little research on fruit and vegetable supply chain risk in China at present, most of the research is still on the agricultural side. Fruits and vegetables are important for everyone, and future research should continue. The current national policy is to promote modern supply chain, which requires that we should vigorously develop the supply chain in all walks of life. In the future, we should not only promote the modernization of China's fruit and vegetable supply chain, but also study the development of China's fruit and vegetable supply chain in the light of international strategies such as the Belt and Road.

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