

## Research on the Construction of Risk Index System of Agricultural Products Supply Chain under E-commerce Environment

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### Abstract

With the popularization of e-commerce, the circulation of agricultural products through transactions on the Internet has brought about tremendous changes, and it has enabled China's agricultural products circulation industry to achieve vigorous development. This article takes the opportunity of traditional agricultural product supply chain development in the Internet era, analyzes the operational risks that affect the expected earnings of enterprises in the agricultural product supply chain under the e-commerce environment, establishes the risk indicator system model of agricultural product supply chain under the e-commerce environment, and proposes the supply of agricultural products to China. Chain risk prevention measures and suggestions help companies in the supply chain to reduce the harm caused by business management and reduce the losses of enterprises and consumers.

### Keywords

E-commerce, agricultural supply chain, indicator system.

### 1. Introduction

In recent years, e-commerce has continued to integrate into all areas of life, gradually changing the way of life and business. China is a big country in agriculture. Agricultural products occupy an important position in both economic and social life, and agricultural products have always had their own circulation. With the advent of e-commerce, the circulation of agricultural products has changed and has achieved vigorous development. A large number of emerging online agricultural trading platforms have emerged. Compared to the mature foreign agricultural e-commerce model, the development of China's e-commerce of agricultural products is still in its infancy. The problems of imperfect infrastructure, food quality and safety, and final kilometer delivery are still a problem. Moreover, with the rapid development of agricultural electricity suppliers, more and more problems have been exposed. The industry ushered in a period of reshuffle in 2016, and a large number of small and medium-sized fresh e-commerce companies went bankrupt or acquired. Practice in recent years has shown that In order to expand this blue ocean, the supply chain must play its integration role to ensure the healthy and sustainable development of the entire agricultural supply chain. However, the uncertain supply, the diversity and uncertainty of the demand side, and the degree of infrastructure improvement in the supply side of the agricultural supply chain have greatly increased the risks of the agricultural product supply chain operation in the e-commerce environment. Therefore, based on the agricultural product supply chain under the e-commerce environment, we analyze the operational risks and characteristics of the agricultural product supply chain from the perspective of the entire chain, identify and analyze the risks of the agricultural product supply chain under the e-commerce environment, and strengthen the supply chain of agricultural products. Risk management plays an important role in improving the income of supply chain node members, meeting the daily consumer demand of the supply chain, and promoting the sound development of agricultural electricity suppliers.

### 2. Theoretical Foundation and Research Hypothesis

#### 2.1 E-commerce Theory

E-commerce has developed rapidly in China. E-commerce of agricultural products, as a new circulation mode of agricultural products, has played a very important role in improving the

circulation efficiency of agricultural products and enhancing the competitiveness of agricultural products. The concept of the supply chain first originated from the “economic chain” proposed by Peter Drucker. The concept of supply chain has not been uniformly defined so far, and the concept of agricultural supply chain is also natural. Chinese scholars Wang Yubo and Ma Shihua believe that the supply chain of agricultural products is the acquisition, processing, transportation and distribution of agricultural products and finally delivered to customers. The process consists of interlocking chains [1]. Hu Jinhuan believes that supply chain risk refers to the effect of supply chain enterprises in the production process due to unpredictable uncertainties in various realizations. It is a deviation between the actual income and the expected return of the supply chain enterprises, resulting in damage of risk and possible [2]. This paper adopts the above concepts about the agricultural product supply chain and supply chain risk.

## 2.2 E-commerce Theory of Agricultural Products

Due to the late development of agricultural e-commerce in China, relevant research on e-commerce of agricultural products has only appeared in recent years. Tan Haixia et al. pointed out that for the development of agricultural e-commerce in China, the main factors affecting its development are the following: the logistics infrastructure is not perfect, the distribution system is not perfect, and relevant laws and regulations are not widely involved. There are certain flaws in the credit system and there is a lack of relevant talents to promote its progress [3]. Shi Luda explored six aspects of the development of e-commerce in agricultural products by exploring Heilongjiang Province agricultural products e-commerce, including e-commerce platform visibility and the degree of branding of agricultural products [4]. Xiao Fang analyzed four models of domestic fresh e-commerce: integrated e-commerce, vertical e-commerce, offline supermarket transformation, and logistics enterprise transformation [5]. Ge Jun explored western developed countries to develop the current inadequacies of the development of agricultural e-commerce in China, and gave relevant opinions at the same time. They also believe that if China's e-commerce of agricultural products wants to promote its own development, it should Emphasis on related infrastructure construction and standardization system construction [6]. Hong Tao studied the development background, development status, innovation model, and profit model of agricultural products e-commerce. He believed that China should encourage the exploration of multiple e-commerce models for agricultural products and speed up e-commerce construction of agricultural products [7].

## 2.3 Supply Chain Risk Study

Domestic and foreign scholars have many research results in the supply chain risk assessment, but they are mainly reflected in the construction of the supply chain risk assessment index system and supply chain risk assessment methods. Mason-Jones and Towill divide supply chain risk sources into four intertwined types: environmental risk, demand and supply risk, process risk, and control risk [8]. Mangla through empirical research, elaborated the process of risk management in green supply chain. First, identify the risk is divided into 25 categories of 5 categories, and collect expert opinions, use fuzzy analytic hierarchy process to analyze the causes of the risk, and finally get the operational risk. Is its main source of risk [9]. Xiao Yan et al. concluded that domestic and foreign scholars believe that there are two main sources of risk, namely supply chain external risk and supply chain internal risk [10]. Fucai Xu and Shaodong Meng believe that market failures and government failures are the main causes of the food supply chain, which leads to food quality and safety risks, logistics risks, information risks and institutional risks [11].

Although a large number of scholars have done a lot of research on agricultural supply chain development and agricultural product supply chain risk, few scholars have studied the risk of agricultural product supply chain under the e-commerce environment, especially from the perspective of the whole chain. Based on the study of the entire agricultural supply chain's business risks, this article analyzes and studies the agricultural product supply chain risk in the e-commerce environment, and attempts to establish a risk indicator system under this environment.

### **3. Construction of Risk Evaluation Index System for Agricultural Products Supply Chain under E-commerce Environment**

#### **3.1 Evaluation Guidelines and Basic Principles**

The guiding ideology is guided by the scientific outlook on development, closely follows the development trend of modern agriculture, and fully reflects the content of the agricultural product supply chain under the e-commerce environment, so as to realize the comprehensive consideration of the supply chain's internal and external cooperation and cooperation, and promote the supply of agricultural products under the e-commerce environment. The efficient operation and healthy development of the chain.

Basic principles:

- (1) Systematic principles. The agricultural product supply chain system contains numerous subjects and nodes. Therefore, when evaluating the supply chain system, we must integrate the internal and external environment of the entire chain. The evaluation index system must be designed systematically.
- (2) Principle of objectivity. The indicator system should not only reveal the most important aspects of supply chain risk as much as possible, but also prevent one-sidedness, and objectively reflect the actual situation of the risk of e-commerce environmental products and agricultural supply chain from different perspectives.
- (3) The principle of dynamics. The indicator system must be able to comprehensively reflect the status quo and development trend of supply chain risk, so as to facilitate forecasting and management.
- (4) The principle of science. The index system must be able to select as many independent and representative specific indicators as possible and comprehensively, and scientifically classify relevant indicators to ensure that the indicator system can scientifically and accurately reflect the characteristics of supply chain risk.
- (5) In order to avoid the mutual interference between refinement indexes in the environment assessment index system constructed, the specific indicators should be representative when selecting indicators. When dividing specific indicators into higher-level indicators, attention should be paid to differences and classification. The specific indicators between the index systems are independent and reduce redundancy.

#### **3.2 Selection of Evaluation Methods**

In the evaluation index system research, the literature reading method, the analytic hierarchy process, and the expert scoring method are widely used. Analytic Hierarchy Process (AHP) refers to a complex multi-objective decision-making problem as a system, which decomposes the goal from macroscopic to micro-level into several levels of multiple indicators, and on this basis, qualitative and quantitative analysis of decision-making methods. In the e-commerce environment, the risk assessment index system of agricultural product supply chain adopts the methods of literature analysis and analytic hierarchy process. The advantage is that it is relatively mature in theory and easy to apply. It can combine qualitative indicators and quantitative indicators.

#### **3.3 Design of evaluation index system**

According to the guiding ideology and basic principles followed by the evaluation index system, combined with the content requirements of the analytic hierarchy process and the expert rating method, the assessment system for agricultural product supply chain risk under the e-commerce environment is divided into three levels as the target level, and the second level indicator. For the criterion level, the three-level indicator is the indicator level. The composition of risk is comprehensively considered in terms of environment, subject and node. see Table 1.

Table 1 Risk Evaluation Index System

Target layer	Criteria layer	Indicator layer	Explanation of indicators
Environmental risk	Natural environment	Environmental disaster risk	The impact of natural disasters such as floods and drought on agricultural products
		Environmental pollution risk	Contaminants include heavy metals from the land, excessive effects of pesticides
	Policy Environment	Economic environment risk	External economic cyclical changes
		Policy and Regulation Risk	National regulations and policies for different companies, and imperfect laws
	Technical environment	Network System Risk	Agricultural Product Supply Chain Depends on Platform Websites and Network Stability
		Data storage risk	Platform data loss and storage security
		Transaction security risk	Examples include hacking, threatening account security, and transaction security
Subject risk	Producer	Productivity risk	Unable to complete production plan at a predetermined cost
		Production cycle risk	Different segments of agricultural products have different production cycles
		Product quality risk	The quality of production materials determines the quality of l products
	Processing company	Processing environment risk	Agricultural product deterioration and loss caused by processing environment
		Operator risk	Processing staff's quality affects the production efficiency or causes the loss
		Product quality risk	Excessive use of additives or chemicals affect the quality of agricultural products
		Inventory control risk	Damage to improper storage of agricultural products during processing
	Platform Enterprises	Platform strategic risk	Product positioning and development orientation are prerequisites for the normal operation of platform companies
		Operational management risk	Improper management results in the actual operation of the platform has not reached the expected revenue
		Demand fluctuation risk	Uncertain market demand can lead to deviations in platform predictions, affecting corporate positioning
	Logistics Enterprises	Logistics Equipment Risk	The impact of logistics refrigeration and transportation equipment on the quality of agricultural products is serious
		Distribution process risk	Transportation distance, mode and process determine whether agricultural products can be delivered in time
		Information lag risk	Lagging in the logistics information of agricultural products will lead to a large amount of inventory
		Quality of service risk	Logistics companies are service-oriented enterprises, and their quality of service affects their profitability.
		Product loss risk	Loss of Agricultural Products Caused by Logistics Transportation
Inter-node risk	Cooperation	Profit distribution risk	Because the uneven distribution of cooperation profits causes the disruption of cooperation and affects the income
		Target strategic risk	Whether the supply chain has strategic objectives will have an impact on its competitiveness and efficiency
		Corporate credit risk	The level of corporate credit will greatly affect the cooperation of the supply chain
		Contract risk	The degree of completeness of contracts will have an impact on the degree of cooperation between companies
	information	Information	Due to the information asymmetry between companies,

	asymmetry risk	it will cause bullwhip effect
	Information sharing risk	Impede the flow of information. Information cannot be shared in a timely manner, resulting in information failure
	Informatization level	The level of informatization will affect the efficiency of this supply chain operation
	E-commerce application level	The degree of e-commerce application will affect the efficiency of this supply chain operation

#### 4. Risk Management Strategies for Agricultural Products Supply Chain under E-commerce Environment

Through the above analysis, we can see that in order to better respond to the risk of agricultural product supply chain, we need to do the following work:

(1) Establish a strategic partnership, build a trust mechanism and information sharing mechanism among members, and form a common value chain framework. The risk management of agricultural product supply chain needs to rely on the strategic partners in the upstream and downstream of the supply chain to work together to form a favorable situation of mutual trust, information sharing, risk sharing and profit sharing. It's makes achieve effective links and cooperation among all members in competition strategies and then as far as possible to control the risk in the bud.

(2) Drawing on the advanced models of agricultural cooperative organizations in developed countries in Europe and America, we need to strive to improve the mode of decentralization. With the encouraging development of cooperation organizations, we can increase the awareness of logistics, awareness of risk, and market awareness of agricultural producers, improve the quality of agricultural production, and reduce the occurrence of risk uncertain events.

(3) Improve the deep processing and finishing skills of agricultural products in China. Since the production of agricultural products by China's agricultural product producers is not common, it has resulted in low profits for producers of agricultural products, so it is possible to increase the processing degree of processing to obtain more benefits. Agricultural product logistics service companies can also carry out specialized agricultural product logistics value-added services so that agricultural product producers can benefit from the circulation of the entire agricultural product supply chain.

(4)The governments need to take Scientifically and rationally plans and lay out the logistics infrastructure for agricultural products, pay more attention on the development of third-party agricultural product logistics, and give full play on the industrial price, service value, and professional value of third-party logistics. We also can appropriately expand the scale of third-party agricultural product logistics enterprises and reduce the proportion of self-managed agricultural product logistics. Scientifically develop techniques for preservation, processing, and storage of agricultural products to effectively for avoiding logistical security risk incidents caused by logistics errors and deterioration.

#### 5. Conclusion

This paper analyzes the three major categories of risk factors in the supply chain, which are environmental risk, subjective risk, and risk at each node, based on the agricultural product supply chain model under the e-commerce environment. The model builds a top-level indicator with three major categories and nine secondary indicators of the evaluation index system. By analyzing the composition of risk factors, strategies for dealing with the risk management of agricultural product supply chain are proposed.

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