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Endogenetic Risk Analysis of the Replenishment Supply Chain in Large Fresh Supermarket

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Abstract

So far, the offline fruit store is still the basic body of fresh consumption, in order to reduce the supply chain risk of fresh fruit in the process of replenishment, The fuzzy comprehensive evaluation model is used to analyze the endogenous risk in the restocking process of the fruit shop, and the HACCP system is applied to the supply chain risk management to monitor the risk to reduce the loss caused by the risk. The results show that the fuzzy evaluation model can effectively evaluate the internal injury sharing in the supply chain of restocking in fruit shops, and it is of great significance to control the risk in the future.

Keywords

Fresh product supply chain; risk identification; risk assessment; fuzzy synthetic evaluation model; HACCP system.

1. INTRODUCTION

The risk assessment of the supply chain is very important. It can effectively estimate and measure the probability and extent and extent of specific risks. While selecting appropriate risk management tools, it can evade, transfer and reduce the probability of its occurrence [5]. Compared with general commodities, fresh food is an indispensable part of the table. It has the characteristics of strong seasonality, short shelf life, perishable corruption, high storage cost and high loss [1], which leads to its related suppliers. Long-term facing high complexity, high risk and so on. Smelzer and Siferd (1998) used transaction cost theory and resource dependence model to analyze that active procurement management is conducive to controlling agricultural product supply risks and better understanding agricultural product supply risk management from the perspective of procurement management; Golan E. et al (200 2) Investigating and researching fresh produce, cereals, rapeseed and beef products in the United States, and found that the three have experienced great differences in food quality and safety after being tracked by the food supply chain; Tah.J. and Carr.V. (2001) pointed out the shortcomings of current agricultural supply chain risk management processes, tools and techniques, and proposed a risk description language for hierarchical risk statistical structure as a shareable knowledge-driven risk management. The method defines the meaning of agricultural product supply chain risks and establishes corresponding remedial measures.

All of the above studies will focus on the assessment of risks. After the assessment, no corresponding supervision and management system has been established to monitor risks. This paper takes the endogenous risk of supply chain in the replenishment process of a fruit shop purchase joint as an example, adopts fuzzy evaluation model to carry out risk assessment [4],

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and applies the HACCP system used in food safety field to the supply chain for the first time. Risk monitoring in risk to improve risk management.

2. ENDOGENOUS RISK OF THE REPLENISHMENT PROCESS

Supply chain risks can be divided into exogenous risks and endogenous risks. Exogenous risks mainly refer to market demand uncertainty risks, economic cycle risks, policy risks, legal risks and unexpected disaster risks [3]. Endogenous risks mainly refer to moral hazard, information transmission risk, production organization and procurement risk, risk arising from distributor selection, logistics operation risk and corporate culture differences. This article only analyzes the endogenous risks of the capture process.

Effective identification of risks is the first and most important step in risk analysis [7]. In this process, there are several possible risks:

(1)Logistics operation risks. Logistics safety risks caused by loss of fruit and damage caused by transportation, warehousing, handling, handling and distribution; suppliers demonstrate the logistics timeliness risk brought by distribution; the risk of logistics accuracy caused by the loss of wrong delivery .

(2) Risk of information transmission. In the operation process of the fruit shop, the staff member Boone is timely and effective to judge whether a certain fruit in the sales area needs to be replenished; the warehouse staff does not check the out-of-stock fruit in the warehouse; when the replenishment information is conveyed, the fruit needs to be replenished. The type and quantity of information are not in place; after the replenishment information is transmitted to the supplier, the communication with the supplier is not timely, and effective monitoring of the logistics information cannot be implemented.

(3) Procurement risks. The buyer in charge of contacting the supplier in the store for personal gain, taking the rebate and choosing a non-optimal supplier with the specified =, the price risk; the supplier in the process of stocking, because the fruit shop purchaser can not always supervise on the spot, may There is a risk of procurement quality caused by the sub-filling of the fruit; the source of supply risk arises from the lack of supply of suppliers before the procurement or the long-term cooperation of suppliers

(4) Moral hazard. Suppliers have selfishness, hiding or providing unrealistic price information; long-term cooperative suppliers suddenly break down or are unwilling to act proactively according to the buyer's wishes.

3. ENDOGENOUS RISK ANALYSIS BASED ON FUZZY COMPREHENSIVE EVALUATION MODEL

In this paper, a questionnaire survey was conducted in the form of a questionnaire survey, and the data obtained were used for the establishment of the following model.

3.1. Risk Fuzzy Evaluation Form

The risk identified by the above risk identification can be divided into two layers. The main risk layer is logistics risk (R1), information risk (R2), procurement risk (R3), and moral hazard (R4); the specific risk layer is transportation safety. (X1), logistics timeliness (X2), logistics accuracy (X3), replenishment judgment error (X4), replenishment information inaccurate (X5), information sharing not timely (X6), price risk (X7), quality Risk (X8), source of supply risk (X9), supplier provides false information (X10), supplier is not active (X11). The risk ambiguity evaluation table thus established is shown in Table 1 below.

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Table 1. Risk fuzzy evaluation table

Main risk layer	Specific risk layer	High	Higher	Generally	Lower	Low
Logistics risk(R1)	Transportation safety(X1)	0.1	0.1	0.6	0.2	0
	Logistics timeliness(X2)	0	0.125	0.235	0.64	0
	Logistics accuracy(X3)	0.1	0.2	0.6	0.1	0
Information risk(R2)	Replenishment judgment error(X4)	0	0	0	0.1	0.9
	Replenishment information is not accurate(X5)	0	0.278	0.722	0	0
	Information sharing is not timely(X6)	0	0	0.954	0.046	0
Procurement risk(R3)	Price risk(X7)	0	0.1	0.6	0.2	0.1
	Quality risk(X8)	0	0	0.235	0.258	0.507
	Source risk(X9)	0	0	0.573	0.427	0
Moral Hazard(R4)	Suppliers provide false information(X10)	0	0	0.5	0.5	0
	Suppliers are not active(X11)	0	0.2	0.3	0.3	0.2

Assign values to different levels in the evaluation set:

V=(V1 ,V2 ,V3 ,V4 ,V5)=((high, higher, average, lower, lower))=(10, 8, 6, 4, 2)

Combined with the risk indicators in the risk fuzzy evaluation table, the sum of the supply chain risk factor indicators R can be obtained: the logistics risk evaluation matrix:

$$R_1=\begin{bmatrix} 0.1 & 0.1 & 0.6 & 0.2 & 0 \\ 0 & 0.125 & 0.235 & 0.64 & 0 \\ 0.1 & 0.2 & 0.6 & 0.1 & 0 \end{bmatrix}$$

Information Risk Assessment Matrix:

$$R_2=\begin{bmatrix} 0 & 0 & 0 & 0.1 & 0.9 \\ 0 & 0.278 & 0.722 & 0 & 0 \\ 0 & 0 & 0.954 & 0.046 & 0 \end{bmatrix}$$

Procurement Risk Assessment Matrix:

$$R_3=\begin{bmatrix} 0 & 0.1 & 0.6 & 0.2 & 0.1 \\ 0 & 0 & 0.235 & 0.258 & 0.507 \\ 0 & 0 & 0.573 & 0.427 & 0 \end{bmatrix}$$

Moral hazard evaluation matrix:

$$R_4=\begin{bmatrix} 0 & 0 & 0.5 & 0.5 & 0 \\ 0 & 0.2 & 0.3 & 0.3 & 0.2 \end{bmatrix}$$

It can be obtained from the specific index evaluation value $D_K = R_K \bullet V = \begin{bmatrix} D_{K1} \\ D_{K2} \\ \cdots \\ D_{Kn} \end{bmatrix}$:

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202001_6(1).0024

$$D_1 = R_1 \cdot V = \begin{bmatrix} 0.1 & 0.1 & 0.6 & 0.2 & 0 \\ 0 & 0.125 & 0.235 & 0.64 & 0 \\ 0.1 & 0.2 & 0.6 & 0.1 & 0 \end{bmatrix} \cdot \begin{bmatrix} 10 \\ 8 \\ 6 \\ 4 \\ 2 \end{bmatrix} = \begin{bmatrix} 6.200 \\ 4.970 \\ 6.600 \end{bmatrix}$$

The same can be obtained:

$$D_2 = \begin{bmatrix} 2.2000 \\ 6.6556 \\ 5.9080 \end{bmatrix}, \quad D_3 = \begin{bmatrix} 5.4000 \\ 3.4560 \\ 5.1460 \end{bmatrix}, \quad D_4 = \begin{bmatrix} 5.0 \\ 5.0 \end{bmatrix}.$$

3.2. Delphi Method to Determine the Weight

Delphi method, also known as expert law, is characterized by concentrating the knowledge and experience of experts, determining the weight of each indicator, and obtaining satisfactory results in continuous feedback and modification [2]. The basic steps are as follows:

Select an expert. Large supermarket procurement department experts, supply chain risk research experts around 10 to 30 people.

Send the p=4 indicators and related materials to be weighted and the unified rules for determining the weights to the selected experts, and ask them to independently give the weights of the indicators.

Recover the results and calculate the mean and standard deviation of the weights of each indicator.

Return the calculated results and supplementary information to the experts and ask all experts to determine the weight on a new basis.

Repeat steps (3) and (4) until the deviation of the weights of the indicators from their mean does not exceed the pre-given criteria, that is, the opinions of the experts are basically consistent, at which time the weights of the indicators are The mean is used as the weight of the indicator ω1, ω2, ω3, ω4.

The weight we get is as follows:

Logistics risk indicator weight ω1

ω1= (0.5517 0.2255 0.1216)

The weight of the information risk indicator ω2:

ω2= (0.3196 0.1220 0.5584)

The weight of the procurement risk indicator is ω3:

ω3= (0.2857 0.5714 0.1429)

The weight of the moral hazard risk indicator ω4 is:

ω4= (0.8000 0.2000)

3.3. Risk Assessment

(1) Comprehensive evaluation of single risk factors

Obtained from various indicators evaluation results $H_w = \omega_k \cdot D_k$

Logistics risk assessment value $H_1 = \omega_1 \cdot D_1 = (0.5517\ 0.2255\ 0.1216) \cdot \begin{bmatrix} 6.200 \\ 4.970 \\ 6.600 \end{bmatrix} = 5.3438$

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Same principle

Information risk evaluation value H_2=4.8141

Procurement risk assessment value H_3=4.2529

Moral hazard value H_4=5

(2) Comprehensive evaluation

The weight ω of R is obtained by the same method, and Ri is regarded as a subset of five factors of R. The comprehensive evaluation value H can be calculated from the evaluation result Hi of each factor subset.

$$H=\omega\cdot H_i=(0.5133\ 0.2459\ 0.0451\ 0.1192\ )\cdot\begin{bmatrix}5.3438\\4.8141\\4.2529\\5.0000\end{bmatrix}=4.7146$$

Judging from the above evaluation results, the comprehensive level of the risk of the fruit shop replenishment process is general. Specifically: First, the degree of logistics risk and moral hazard is relatively high, reaching 5.3438 and 5 respectively, which indicates that logistics risk and moral hazard are the key issues that the fruit store urgently needs to solve, and the corresponding countermeasures should be proposed first; Second, the information risk is second, 4.8141, and the prevention strategy and policy should be proposed in time; thirdly, the procurement risk evaluation value is the lowest at 4.2529, indicating that the fruit shop is doing the best in purchasing.

4. RISK MONITORING SYSTEM

The HACCP (Hazard Analysis Critical Control Point) system is a management control system that analyzes, identifies, and monitors factors that may cause food safety during processing. The system was originally used in American English and aerospace foods to reduce food hazards. The system is based on the scientific management system of risk assessment and risk management [8]. This paper applies the HACCP system to the fruit store replenishment supply chain risk control to supervise and manage risks.

The steps to establish the HACCP system are as follows:

(1) Hazard Analysis - Identify the nodes that generate risk factors during the replenishment process.

(2) Identify critical control points - identify the nodes in 1 as critical control points.

(3) Develop preventive measures - develop appropriate precautions for each control point.

(4) Establish monitoring system—list key control points, critical limits, and significant hazards to make a HACCP plan, determine the monitoring targets, monitoring measures, and monitoring frequency for each critical control point.

(5) Corrective Action - When the critical control point deviates from the critical limit, appropriate corrective action should be taken

(6) Verification procedure—First, the HACCP system verifies that the fruit shop should adjust the HACCP system at any time according to the actual situation; second, the verification of the key control points.

(7) Recording procedures—establish and maintain an effective system for documenting all procedures involved and their implementation against these principles.

The specific process is shown in Table 2 and Table 3.

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202001_6(1).0024

Table 2. Restocking process risk analysis table

(1) Replenishment process	(2) Possible risks	(3) Is the potential risk significant?	(4) Basis for judging whether it is significant	(5) Preventive measures taken against significant risks	(6) Is this step a critical control point?
Check the goods in the sales area	Whether the replenishment judgment is not accurate	No	In the process of checking the goods, it will be wrongly judged because of the negligence of the personnel.	Secondary check	No
Determine the replenishment information of the sales area	Replenishment types and quantity statistics are not in place	Yes	Statistical errors caused by negligence when replenishing replenishment information	Secondary verification of information	Yes
Check warehouse goods	Replenishment types and quantity statistics are not in place	No	Statistical errors caused by negligence when replenishing replenishment information	Establish information entry system to achieve paperless information collection and entry	No
Contact Supplier	Missing supply	Yes	It is difficult to purchase the goods without prior investigation of the source of supply.	Look for suppliers that can cooperate for a long time, and conduct a good source survey before purchasing.	Yes
Negotiating with suppliers	Price risk, procurement quality risk, moral hazard	Yes	The supplier deliberately concealed the market to raise the price, and shoddy the supply.	When selecting a supplier, you should understand it in a multi-faceted manner, do a good job in market market analysis, and impose corresponding constraints on the quality of the supplied goods.	Yes
Delivery of goods	Logistics safety, timeliness and accuracy	Yes	It is easy to cause damage when the goods are delivered, and the sales loss is caused by the timely delivery.	Standards for the packaging of goods, real-time monitoring of distribution logistics.	Yes

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Table 3. HACCP schedule for replenishment process

Critical control point	Significant risk	Critical limits for preventive measures	monitor			Corrective action	Recording	Verification
			content	method	Monitor			
Determine the replenishment information of the sales area	Replenishment types and quantity statistics are not in place	Replenishment information error frequency must not exceed 1 time / month	Check replenishment information	Manual secondary check	Clerk	The information error frequency exceeds the limit, and the clerk is punished.	Information error frequency record	Regularly check the record and actual situation
Contact Supplier	Missing supply	At least one of the fixed suppliers of the cooperation, at least one supplier identified before the purchase	Check the source of supply	Manually contact the supplier	Procurement staff	Determine the supplier to be selected before purchasing, and confirm that the supplier has sufficient supply	Source missing frequency record	Regularly check the record and actual situation
Negotiating with suppliers	Price risk, procurement quality risk, moral hazard	The purchase price between the market and the market price does not exceed 5%	Check purchase price	Understand the market before purchasing, estimate the purchase price	buyer	The purchase price exceeds the limit to coordinate with the supplier or to re-find the supplier	Price deviation record	Regularly check the record and actual situation
Delivery of goods	Logistics safety, timeliness and accuracy	The damage rate of the goods during the delivery process does not exceed 8%, and the delivery of goods shall not affect the normal sales.	Check the broken goods	Sampling inspection	Clerk	Sign the relevant contract with the supplier, and the damage rate of the goods exceeds the limit to compensate	Record of damage to the goods	Regularly check the record and actual situation

5. CONCLUSION

The risk management of the fresh food supply chain has received more and more attention in China. This paper identifies and evaluates the risk management of the supply chain in a fruit store replenishment chain, constructs a "hybrid supply chain risk assessment model", points out its potential risks, and establishes a HACCP system for risk supervision. All kinds of formats of fresh goods retail have certain guiding significance and reference value. Moreover, because there are many nodes in the fresh food supply chain and there are many risk factors, it is not possible to directly obtain the specific losses caused by various risk factors and the direct

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quantification of the data. In the future research, we hope to obtain more node information of supply chain operations, more and more detailed understanding of the various risks and impacts of the graduate fresh supply chain, and propose better risk control strategies.

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