# Research on Risk Identification of New Retail Supply Chain in the Context of Internet

## Based on Machine Learning Algorithm

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**Abstract.** With the development of the Internet, the overall growth rate of China's traditional retail industry has shown a downward trend, most of the physical stores are experiencing operational difficulties. After the new retail model was proposed, some traditional retail industries gradually tried digital retail transformation. Influenced by the Internet, digital has empowered the traditional retail industry, and the new retail supply chain has received more and more attention as an important chain connecting customers and retailers. Therefore, this paper focuses on the fresh new retail supply chain, which requires high supply chain risk control, and identifies the risks in the supply chain of fresh products in the context of the Internet through factor analysis and machine learning to provide a basis for fresh supply chain risk management decisions.

**Keywords:** internet: digital economy · supply chain · risk identification · machine learning · BP neural network

## 1 Introduction

With the rapid development of mobile Internet, the product structure in China has changed. In the context of the digital economy, new retailing, which combines the Internet and big data, has emerged. Compared with traditional retailing, new retailing relies on the digital economy and uses big data and the Internet to reconfigure the retailing process, and digital technology plays an important role in the whole new retailing process. [1] The "new retail" has made a great contribution to China's real economy, promoting the prosperity of retail enterprises and the real economy through the Internet. At present, the new retail model in the context of the Internet in China still has some problems, [2] and the new retail supply chain is an important chain connecting customers and sellers, so the identification and assessment of the risks of the new retail supply chain can improve the resilience of the supply chain. In recent years, with the development of the Internet, the online sales model of fresh products has emerged, and due to the short preservation period and perishability of fresh products, it is more necessary to improve the stability of its supply chain and maintain the timeliness of fresh product delivery.

At present, scholars' research on supply chain risks is still inadequate. Therefore, this paper takes the fresh supply chain, which has high requirements for supply chain


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risk management in the new retail industry in the context of the Internet, as the research object, uses the SCOR model as the basis, calculates the risk index weights using factor analysis, uses machine learning(BP neural network)for simulation, and gives suggestions for supply chain risk control in fresh food enterprises according to the simulation results to improve the efficiency of the supply chain using the Internet.

## 2 Research Theory and Methodology

### 2.1 Research Theory

The SCOR model is a reference model for supply chain operations, consisting of five processes: planning, purchasing, production, distribution, and returns, building performance measurement metrics, configuration layers, and process element layers into a comprehensive framework.

### 2.2 Research Methodology

The purpose of factor analysis is to explore some kind of framework hidden behind the data of multiple measurements and to find common factors for a set of variable transformations, which can reduce the number of variables and test the hypothesis of the relationship between variables.

BP neural networks are based on the principle of artificial neurons, which are implemented in such a way that their transmission signals are specific real numbers, and the parameters change continuously along with the learning depth, so that each neuron corresponds to a value domain.

## 3 Index System Construction

### 3.1 Risk Identification Based on the SCOR Model

(1) Planning process risk factors

The planning process is the beginning of the supply chain and is the initial design that all firms have to carry out to achieve their purpose. According to the respective studies of scholars [3–5], the following hypotheses are proposed: SCR1: Risk due to inaccuracy of planned production; SCR2: The risk that the objectives of individual members of the supply chain nodes are not in line with the objectives of the overall supply chain; SCR3: The risk when the corporate culture of each fresh food company in the supply chain is not consistent. SCR4: The risk that failure of strategic investment may cause to the whole supply chain.

(2) Procurement process risk factors

The procurement process is the process by which a company obtains the appropriate resources and services according to the planned demand. According to scholars such as Rui-Zhen Cheng [6–9], the following assumptions are made: SCR5: The risk of raw agricultural products caused by substandard quality of raw materials. SCR6: Risk of changes in raw material prices due to exchange rate fluctuations. SCR7: Risk due to uncertainty in supplier selection.

(3) Production process risk factors

Production is the third part of the model, i.e., activities such as processing of raw materials by the firm according to the demand of the strategic plan. According to related literatures [10–12], the following hypotheses are proposed: SCR8: The risk of fresh produce arising from quality problems in the production of products. SCR9: Risk due to insufficient inventory. SCR10: Risk caused by weather factors that prevent production. SCR11: Risk due to uncertainty of supplier cooperation.

(4) Distribution process risk factors

The distribution process is a way for companies to deliver products to customers on time according to their demand, and distribution is crucial to the fresh food supply chain due to the non-preservability of fresh products. According to scholars [13–15], the following hypotheses are proposed: SCR12: Fresh supply chain risk due to the backwardness of logistics technology facilities. SCR13: Fresh supply chain risk due to delivery delays. SCR14: Risk due to loss of fresh products during transportation. SCR15: Fresh supply chain risk due to poor organization of logistics enterprises.

(5) Return process risk factors

Returns are the last process of the SCOR model and mainly involve the recovery of raw materials as well as products with quality problems. Based on the study by Tian Yu [16] et al. the following hypotheses are proposed: SCR16: Risk of customer dissatisfaction due to improper return of goods. SCR17: Risk of poorer corporate image due to higher number of returns. SCR18: Risk of legal disputes caused by return business.

Therefore, based on field research and literature study, the evaluation index system of fresh produce supply chain risk was initially obtained, namely 18 secondary indicators and 5 primary indicators.

### 3.2 Evaluation Index Selection

(1) Data collection and Reliability & validity analysis

The questionnaire was distributed to employees of fresh food logistics companies, customer managers, experts and scholars in the field of logistics in universities and master and doctoral students in supply chain research. A total of 240 questionnaires were distributed, with a return rate of 90% and an effective rate of 94%, and 18 indicators were calculated using a five-level Likert scale. The Cronbach alpha coefficient was 0.931, higher than 0.9, and the KMO was 0.882, much higher than 0.6. The Bartlett sphericity test indicated that the data could be used for factor analysis with good reliability and validity.

(2) Determine final indicators

After factor analysis based on the results of the questionnaire, the risk evaluation criteria system was finally established, as shown in Table 1.

## 4 Empirical Study

Hema Tribe is an emerging fresh food enterprise bred under the "new retail" model, which is more mature in using big data, Internet and digital technologies. Therefore, it is typical to use BP neural network to identify and evaluate the collaborative risk of the entire supply chain of Hema Tribe.

**Table 1.** Evaluation index system of supply chain risk of fresh products

| Fresh produce supply chain risk evaluation index | Tier 1 Indicators | Secondary indicators | Variables |
|---|---|---|---|
| | Program Process Risk | Inaccuracy of planned production | X11 |
| | | Individual members of the supply chain are not aligned with the overall supply chain objectives | X12 |
| | | Inconsistent corporate culture across fresh food companies in the supply chain | X13 |
| | Procurement process risk | Raw material quality is not qualified | X21 |
| | Production process risk | Insufficient inventory | X32 |
| | | Weather factors prevented production | X33 |
| | | Uncertainty of supplier cooperation | X34 |
| | Distribution process risk | Losses of fresh products during transportation | X43 |
| | Return process risk | Improper return of goods causing customer dissatisfaction | X51 |
| | | Return business causes legal disputes | X53 |

Assuming that the risk index of a fresh food supply chain is M, the formula for its calculation is $M = 10.25\%X11 + 11.00\%X12 + 9.74\%X13 + 10.00\%X21 + 10.14\%X32 + 9.06\%X33 + 10.33\%X34 + 10.21\%X43 + 10.44\%X51 + 8.83\%X53$.

### 4.1 Data Collection

In this study, the synergy risk level of the fresh food supply chain was divided into five levels, namely, 0–0.2 was very low risk, 0.2–0.4 was low risk, and so on, and 0.8–1 was very high risk. Ten experts in the fresh food industry were invited to score the companies on the supply chain nodes of Hippo tribe enterprises, which were averaged and weighted for calculation, as shown in Table 2.

### 4.2 BP Neural Network Model Construction

The BP neural network model for the collaborative risk assessment of the fresh supply chain of Hippo tribe is divided into three layers, namely, the input layer, the implicit layer and the output layer. From the fresh supply chain risk evaluation index system, it

**Table 2.** Raw data target expectations

| Sample | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Rating | 0.457043 | 0.407521 | 0.439686 | 0.455434 | 0.50715 |
| Sample | 6 | 7 | 8 | 9 | 10 |
| Rating | 0.486747 | 0.431575 | 0.434915 | 0.352556 | 0.490630 |

can be determined that there are 10 neurons in the input layer of the BP neural network model; the comprehensive evaluation value of the fresh supply chain synergy risk is set as the output layer, and the number of neuron nodes in its output layer is 1, and the training and simulation are carried out with the help of the neural network toolbox GUI in MATLAB.

### 4.3 Training of BP Network Model

First, enter the input data, and the target data in the MATLAB command window, and then enter "nntool" to open the main window. Next, import the data and create the neural network model. Firstly, the training function is set to be "trainlm", the weight learning function is "learngdm", and the mean square error "mse" is set as the error performance function. After several trials, it is found that the training effect is best when the number of implied layers is 7. Therefore, the implied layer transfer function is "tansig", while the output layer transfer function is "purelin". Finally, set the parameters, and after setting the appropriate parameters, the network training is performed in MATLAB. The speaking expectation error is set to "0.0001", the maximum number of training is set to "1000", and all other options are default values, after which the network is trained and the purpose of training is to verify the reasonableness of this model. The training results are shown in Figs. 1 and 2, from which it can be seen that the training effect is good.

From the Table 3, it can be obtained that the training error of this BP neural network model is small, and the relative and absolute errors are within a reasonable range, which basically meets the requirements of practical application for risk assessment. Therefore, this BP neural network model for collaborative risk assessment of fresh supply chain is effective.

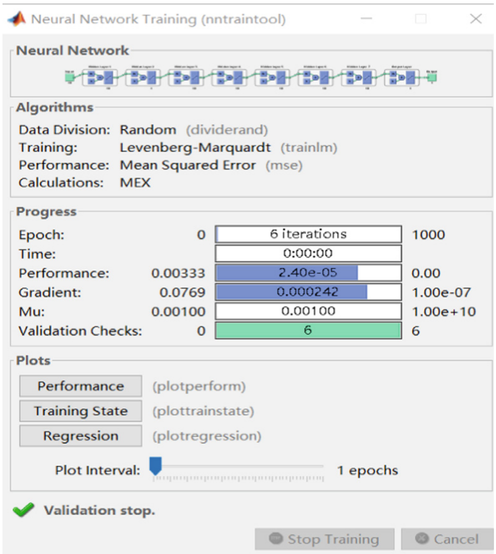


**Fig. 1.** Network training results1

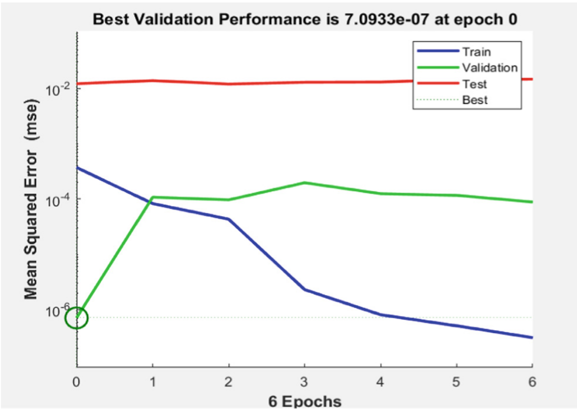


**Fig. 2.** Network training results 2

**Table 3.** Neural network training error table

| Sample number | Expected Value | Training output values | Relative error value | Absolute error |
|---|---|---|---|---|
| 1 | 0.45704 | 0.46358 | −0.0065358 | −0.00654 |
| 2 | 0.40752 | 0.49090 | −0.083382 | −0.08338 |
| 3 | 0.43969 | 0.43970 | −1.6e-05 | −0.00001 |
| 4 | 0.45543 | 0.45615 | −0.00072026 | −0.00072 |
| 5 | 0.50715 | 0.50195 | 0.0052032 | 0.0052 |
| 6 | 0.48675 | 0.48563 | 0.0011154 | 0.00112 |
| 7 | 0.43157 | 0.35347 | 0.078104 | 0.0781 |
| 8 | 0.43491 | 0.42402 | −0.089108 | 0.01089 |
| 9 | 0.35256 | 0.35883 | −0.0062719 | −0.00627 |
| 10 | 0.49063 | 0.48814 | 0.0024935 | 0.00249 |

## 5 Conclusion

In the context of the current Internet economy and new retail business model, the competition among markets has intensified, bringing challenges to the survival of each enterprise. Therefore, based on the SCOR model, this paper conducts a comprehensive analysis of supply chain risks from five processes of fresh produce supply chain, including strategic planning, procurement, production and processing, distribution service and return and recovery, respectively, identifies 5 primary risks and 18 secondary risks, then uses factor analysis to eliminate unreasonable factors, further constructs the final fresh produce supply chain risk evaluation index system, and finally uses machine Finally, the constructed factor evaluation index system is verified by using machine learning, i.e., BP neural network, for Hema Tribe enterprises. However, there are some shortcomings in this paper, and the financial risk and performance evaluation of enterprises are not properly considered. In the future, these two aspects can be incorporated into the index system so that enterprises can make full use of the dividends brought by the Internet, so that the Internet economy can help enterprises through digital information management, production management, and retailing links to fully exploit the market potential and transform digital value into commercial value.

## References

1. Fan Rong, Li Jianling, Zhang Jingjing. Analysis of business model innovation of new retail enterprises in the context of digital economy–Hema Xiang sheng as an example[J]. Modern Business, 2022(09):30-32. DOI: https://doi.org/10.14097/j.cnki.5392/2022.09.010
2. Ding Read. Analysis of retail supply chain management of in the context of new retail [J]. Modern Business,2023(03):7-10. DOI: https://doi.org/10.14097/j.cnki.5392/2023.03.014
3. Huang Yaqing. Research on fresh food hybrid dual-channel supply chain coordination [D]. Beijing Jiao tong University,2020. DOI: https://doi.org/10.26944/d.cnki.gbfju.2020.002667

4. Nan Xi. Analysis of the application of cloud computing in fresh food cold chain logistics [J]. China Market,2021(14): 144-145. DOI: https://doi.org/10.13939/j.cnki.zgsc.2021.14.144
5. Hu S. Yin. Exploration of "Internet + crowdfunding" marketing model for fresh agricultural products[J]. DOI: https://doi.org/10.19932/j.cnki.22-1256/F.2021.04.082
6. Cheng Ruizhen. Logistics cost control in the new retail model-taking fresh food enterprises as an example[J]. Shanghai Business,2021(04):16-17. DOI: https://doi.org/10.3969/j.issn.1007-2845.20 21.04.007
7. Li Xiong. Fresh product logistics model innovation thinking of e-commerce enterprises [J]. Shanghai Business,2021(04):90-91.
8. Huang Jingping. Research on the problems and countermeasures of cold chain logistics management of fresh products in western Guangdong based on the background of Internet of Things technology[J]. China Market,2021(10):157-158. DOI: https://doi.org/10.13939/j.cnki.zgsc. 2021.10.157
9. Xie Fangshu, Zhang Yewei, Liu Jian. Research on the problems and development countermeasures of fresh food e-commerce platform in the new environment [J]. Jiangsu Science and Technology Information,2021,38(09):28-31.
10. Jin Lian, Ma Timiao. Research on fresh agricultural products e-commerce operation mode in the context of big data [J]. Rural Economy and Technology,2021,32(05):172–173+178.
11. Chen Xiaoxia,Li Zhongbin. An empirical study of fresh produce consumers' willingness to accept omnichannel retailing–based on TAM and VAM theoretical models[J]. Journal of Southwestern University (Natural Science Edition),2021,43(03):116-123. DOI: 10.13718 /j.cnki.xdzk.2021.03.017
12. Zhang Li. Research on the coordinated development mechanism of fresh logistics and e-commerce under the mode of "block chain + logistics"[J]. China Storage and Transportation,2021(03):148-150. DOI: https://doi.org/10.16301/j.cnki.cn12-1204/f.2021.03.062
13. Zhai Ruiqi, Qiao Penghui, Luo Jieyin, Hu Yinan, Wang Hui. A study of fresh food e-commerce consumer behavior based on online review content analysis–a case study of Hema fresh produce[J]. National circulation economy, 2021(05):12-15. DOI: 10.16834/j. cnki. Issn1009-5292.2021.05.004
14. Zhang Linqing, Zhao Zhong. Research on risk identification and prevention of fresh agricultural products supply chain[J]. Logistics Engineering and Management, 2021, 43 (02): 52-55. DOI: https://doi.org/10.3969/j.issn.1674-4993.2021.02.016
15. Wang Honglei. Research on fresh agricultural products logistics mode under the background of "Internet+" [J]. Practical rural technology, 2021(02):47-48. DOI: 10. 3969 /j. is s n.1674-4993.2017.09.028
16. Tian Y, Dan B, Liu Molin, Ma Songxuan. Study on the selection and coordination of community fresh O2O model for preserving fresh inputs affecting demand[J/OL]. China Management Science:1–12. DOI: https://doi.org/10.16381/j.cnki.issn1003-207x.2019.1602