Enterprise Supply Chain Risk Analysis and Research Based on the Background of Big Data

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Abstract. The previous paper introduces the current status of the application of the company's big data technology in the cost management of various links in the supply chain, and evaluates the effect of the application of big data through the cost indicators, and finds some optimization effects, but at the same time also finds some shortcomings, which lead to the constraints on the effect of cost management. This paper will analyze the company's supply chain costs based on the big data background, point out the problems that exist in the costs that have not been optimized in the big data background, and pave the way for the company to propose solutions.

Keywords: Big Data Analytics; Business Development; Supply Chain; Development Optimization

1 Introduction

Since the 1960s and 1970s when supply chain and supply chain management ideas were put forward, it has been rapidly promoted and developed because of the huge profits it has brought to enterprises, and the theory of supply chain management itself has been continuously improved along with the progress of science and technology and the changes in the organizational structure of enterprises [1]. Most scholars also focus only on the advantages of supply chain management, the optimal allocation of resources, the coordination of cooperative relationships in the chain, the optimization of the application of information technology and strategic alliances [2]. However, events such as "9.11" in the United States, SARS in China, and the tsunami in the Indian Ocean in Southeast Asia have brought great impact to the normal operation and management of the supply chain, which has aroused a great deal of attention to supply chain risk from domestic and foreign industries and academics [3]. A large number of scholars have also focused on the supply chain risk management aspect of enterprises.

2 Analyzing the Problems and Causes of Supply Chain Cost Management in the Context of Big Data

From Figure 1, it can be seen that the reasons for companies to incur reverse logistics costs mainly include damaged goods, delivery errors, substandard quality, and goods that do not meet consumer expectations [4]. Among them, the proportion of reverse logistics costs caused by

damaged goods is 41%, which accounts for the largest proportion. Damage to goods occurring in the transportation process, the loss of which is borne by the enterprise itself. The main reason is that excessive attention to reduce the cost of enterprises, ignoring the quality of packaging, but inadvertently increase the cost borne by enterprises. In addition, the proportion of returned goods that do not meet expectations is 22%, shipping errors account for 29%, and substandard product quality accounts for 8%, indicating that errors in the sorting and distribution of goods as well as problems with the quality of goods can cause returns, thus increasing the reverse logistics costs of the enterprise [5].
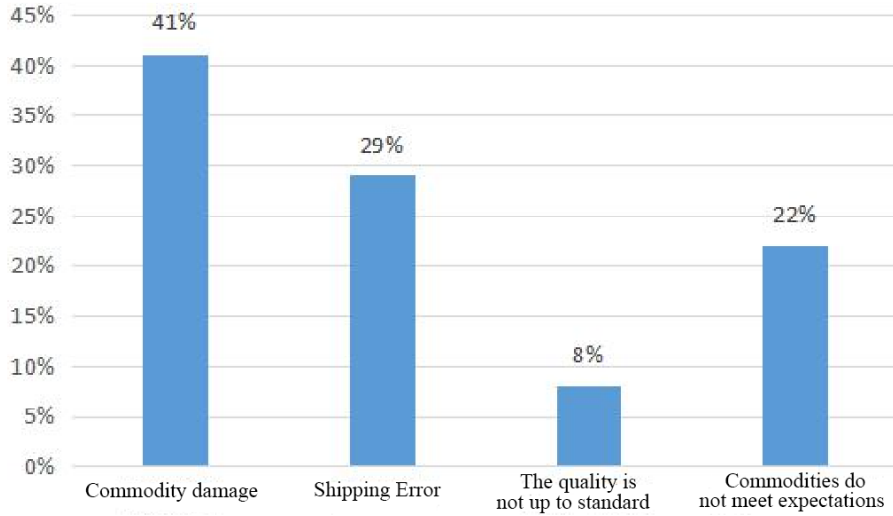

Fig. 1. Reasons why companies incur reverse logistics costs.

3 Relevant big data model analysis

3.1 basic recurrent neural network

Recurrent Neural Network (RNN) is a common approach used for sequence modeling. The RNN introduces a memory to retain historical information, and the memory h_t at moment t is jointly determined by the memory h_{t-1} of the previous moment and the input x at moment t.

The above figure shows on the left the RNN with only one memory, and on the right a schematic of the cyclic kernel unfolding by time step. The memory state h_t is refreshed at each moment t during forward propagation, and the parameter matrix U, W, V remains unchanged: the parameter matrix U, W, V is sequentially updated during backward propagation. The computation of the memory state h_t, and output y_t in forward propagation is shown in Eqs. 1 and 2, respectively.

$$h_t = \sigma(Ux_t + Wh_{t-1} + b) \tag{1}$$

where U, W is the parameter matrix, b is the bias, and σ is the activation function, typically tanh.

$$y_t = \sigma(Vh_t + c) \tag{2}$$

where V is the parameter matrix, c is the bias, and σ is the activation function, typically $softmax$.

3.2 Long- and short-term memory units and gated cycle units

The basic RNN network has to multiply the gradients successively in time steps during backpropagation, which leads to the problem of gradient vanishing or gradient explosion in the case when the length of the input sequence is too long. Long Short Term Memory (LSTM) unit solves the problem of RNN's inability to train longer sequence data to some extent [6]. LSTM introduces three gate structures and cellular states for recording long-term memories and candidate states for summarizing new knowledge on the basis of RNN, as shown in Figure 2 (left).
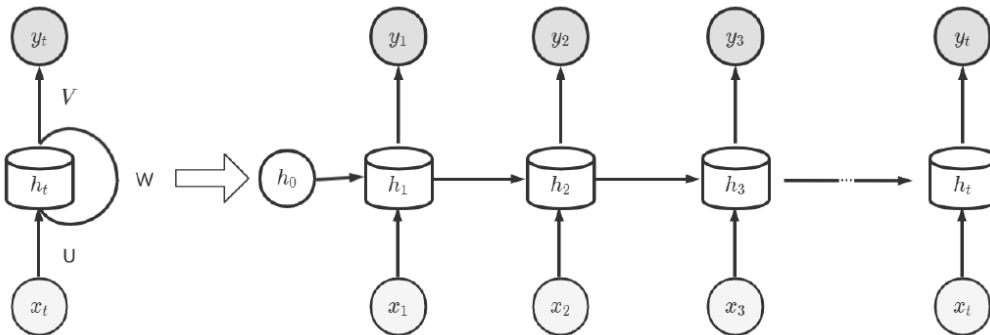

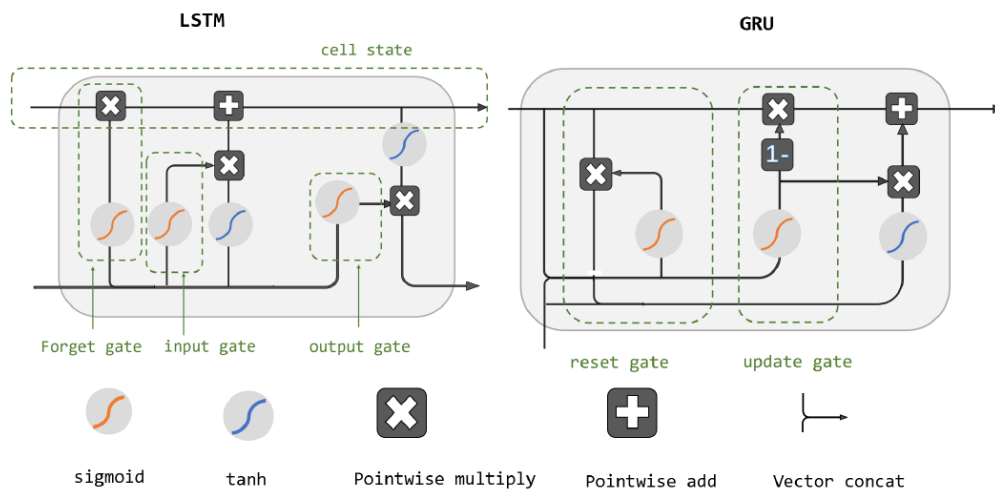**Fig. 2.** recurrent neural network.

Fig. 3 LSTM (left) and GRU (right).

Gated Recurrent Unit (GRU) predictions are close to LSTM with fewer training parameters and has only two gate structures, the reset gate and the update gate, which is a simplification of the LSTM structure [7]. The GRU structure is shown in Fig. 3 (right), and this chapter uses GRU units for user sequence modeling of users' long and short-term behaviors. The GRU forward propagation process is:

(1) Calculate update gates and reset gates:

$$z_t = sigmoid(W_z x_t + U_z h_{t-1} + b_z) \tag{3}$$

$$r_t = sigmoid(W_r x_t + U_r h_{t-1} + b_r) \tag{4}$$

wherein z_t is an update gate responsible for controlling the historical state information retained by the current state and the new information received from the candidate state. r_t is the reset gate at moment t.

(2) Updating the candidate state $\tilde{h}_t$ by resetting the gate and the last moment memory.

$$\tilde{h}_t = tanh(x_t W_{xh} + h_{t-1} W_{hh} + b_h) \tag{5}$$

(3) Calculate the current moment memory h_t:

$$h_t = z_t \odot h_{t-1} + (1 - z_t) \odot \tilde{h}_t \tag{6}$$

4 Problems of external supply chain cost management of companies in the context of big data

4.1 Poor product quality increases the cost of losses

The company's product quality is not up to standard in addition to the aforementioned reverse logistics costs, but also additional loss costs, which are borne by the enterprise, not only increase the cost of the enterprise, but also damage the image of the enterprise. The cost of reverse logistics due to product quality problems is 8%, and reducing this part of the cost can also reduce the total cost of the enterprise to some extent [8]. However, in the case of a company, the goods are circulated throughout the supply chain from the supplier until the consumer discovers the quality problem, there is no way to tell at which point in the supply chain the problem has occurred, and there is no way to obtain compensation, which can only increase the cost of loss to the company.

4.2 Low consumer activity and high customer acquisition costs

It is difficult for offline consumers who are not members to independently access all of their information, such as the amount of money spent, preferences, feedback on the product and on the brand, etc., which makes it impossible to recommend appropriate promotions based on their needs and preferences, and does not ensure the activity of offline customers [9].

4.3 Reasons for Problems in Supply Chain Cost Management within Companies in the Context of Big Data

The unsatisfactory management of the company's procurement costs is partly due to the fact that the prepayment method increases the procurement risk and procurement costs, and partly due

to the fact that the unclear definition of the duties of the procurement staff results in fraudulent behavior, which leads to the selection of suppliers whose prices are not fair or whose quality is not high, and which increases the procurement costs. At the same time, the company's non-electrical goods have a short development time and have not established stable cooperative relationships with suppliers, resulting in weak bargaining power and increased procurement costs. The root cause of these problems is the lack of a comprehensive procurement program. In the supply chain, a perfect procurement plan includes analyzing suppliers to determine who to work with, specifying the commodities to be purchased, selecting the procurement method, and evaluating the purchasing staff [10].

Under the supply chain management mode, the company adopts the method of prepayment for commodities to carry out procurement mainly because of the lack of trust between the enterprise and the suppliers, weak bargaining power, and the lack of long-term accumulation of high-quality suppliers for the enterprise to choose, so that it cannot get a stable source of supply. Secondly, there are many kinds of non-electrical commodities, so it is impossible to carry out unified procurement, and it is necessary to cooperate with a large number of suppliers, which increases the company's procurement cost. The company does not include suppliers in the supply chain costs to fully analyze and share information when purchasing non-electrical goods [11]. Suning has also failed to establish an information sharing mechanism with Alibaba, Jingdong and other enterprises with strong bargaining power to improve the Company's bargaining power in the procurement process and reduce the impact of the prepayment payment method.

The Company's purchasing method is mainly turnkey distribution, which means that the head office centralizes purchases from suppliers and then the head office distributes them according to the needs of the subsidiaries. The company's centralized purchasing and distribution has led to a series of problems such as unified purchasing of non-similar products without quantity discounts, separation of purchasing and use units to increase logistics transfer, large purchasing quantities resulting in shortages and leakages, and delays in the timeframe when the use units need to replenish the goods in an urgent manner, which have increased the company's purchasing costs. At the same time, the quantity of slow-moving commodities should be purchased with adequate market research, product positioning, and rationing according to needs.

The company involves only one purchasing department in the unified purchasing, the huge purchasing volume and many suppliers cause the purchasing department to have a large workload, thus the duties of the purchasing staff are not clearly defined, and the internal auditing of the enterprise can not be carried out effectively, which gives the purchasing staff an opportunity to commit fraud and increases the purchasing cost. The main reason for this is that the Company's procurement program does not have an effective and feasible performance evaluation of procurement personnel, and the performance of procurement personnel is not closely related to the procurement process, resulting in procurement personnel being able to seek personal benefits from suppliers. If indicators such as the cost of negotiation, the percentage of cost reduction, and additional services provided by suppliers are included in the performance evaluation of purchasing staff, it can largely monitor the fraudulent behavior of purchasing staff, and also encourage purchasing staff to improve the quality of their work and reduce the purchasing cost of the enterprise.

4.4 Inefficient use of marketing expenses

The Company has continued to expand its investment in advertising, leasing and promotional expenses in order to increase the influence of its brand and improve its overall competitiveness, but it has not received good results due to the inefficient use of the Company's investment in marketing costs. In this article, we select the "app activity" ranking of retail e-commerce enterprises to illustrate the situation. The ranking of "App Activity" in January 2020, when there were no large-scale promotions, was chosen because it takes into account the popularity of the app among consumers, search, use and sharing, and indicates the actual number of visits to the app during this period.

4.5 Low capacity for information integration in the logistics chain

Inadequate utilization of transport means and overlapping of transport paths in the transportation process of the company will incur additional costs, resulting in a waste of logistics resources. When a company receives an order, how to choose the transportation vehicle, mode of transportation, and transportation route based on the items to be transported, and all of these require strong information integration capabilities. Although the company has been digitizing its logistics system, the results have not been satisfactory. In order to meet the requirements of "half-day delivery" and "next-day delivery", the transportation frequency of enterprises becomes faster, the empty rate is high, the transportation efficiency is reduced, and the transportation cost is increased. Secondly, when companies make late-night deliveries, they only carry a small amount of returned goods on the return trip, resulting in a high rate of empty loads and a waste of resources, all of which can greatly increase logistics and transportation costs.

For the cost of reverse logistics, the first reason for the return of goods accounted for 41% of the damage, perhaps in the sorting process, packaging process or transportation. The company does not monitor the collection of information during the transportation process, so it is not possible to determine at what point the damaged goods were damaged, increasing the cost of the loss to the company.

4.6 Reasons for Problems in External Supply Chain Cost Management of Companies in the Context of Big Data

(1) Immature product traceability mechanism and high return costs

The company's return costs due to quality issues are mainly due to the immature traceability mechanism for the quality of goods and the lack of quality monitoring of goods throughout the supply chain. First of all the supplier selection process, whether the supplier has been assessed for credit. Then in the receipt of goods with or without damage, into the warehouse to organize whether the state of the product has been checked and supervised, sorting out whether to carry out inspections, as well as in the transportation process of the quality of goods is qualified. Each step of the process may cause damage to the goods, therefore The company lacks a mechanism for tracing the quality of the goods, and lacks supervision of each step of the process to find the problem when it occurs, thus increasing the cost of loss to the company.

(2) Enterprise sales channels are more monotonous, consumer adhesion is not strong

The company's dual-channel operating model, although more special in the e-commerce, there are many e-commerce companies gradually penetrate into the offline, for example, Vipshop has established an offline Vipshop warehouse, Box Horse has established a fresh food supermarket.

5 Conclusion

This paper selects the Baidu search index and information index of Taobao, Jingdong and the company from the NetSense e-commerce database from 2016 to 2020. Baidu Search Index includes the number of PC searches and the average daily search volume of the mobile terminal, which comprehensively reflects the attention of Internet users to keywords, and can measure the consumer's attention to the company, as well as reflecting the degree of consumer adhesion to the enterprise. Based on the technical support foundation of big data, this paper carries out an optimization study of the company's management logistics chain in conjunction with big data. The enterprise supply chain has been researched and analyzed, and some factors that can be avoided while analyzing the risks have been avoided, which is a great guidance for the development of the enterprise.

References

[1] Dai Ying,Li Xiaojia,Song Han et al. Research on the impact of green supply chain management on environmental performance in automobile manufacturing industry [J/OL]. Journal of Chongqing University of Technology(Social Science), 1-14[2023-11-15]
http://kns.cnki.net/kcms/detail/50.1205.T.20231109.1616.004.html.
[2] Li Yuanzhi, Guo Zhiquan. Research on Evaluation System of Supply Chain Digitization Capability of Manufacturing Enterprises [J]. Industrial Technology Innovation, 2023, 10 (05): 60-67. DOI:10.14103/j.issn.2095-8412.2023.10.008
[3] Liu Y. The mechanism of network embedding affecting supply chain financing performance of small and medium-sized retail enterprises under the dynamic capability perspective [J]. Business and Economics Research, 2023, (19): 37-42.
[4] Yang Xu. Path analysis of supply chain transformation and upgrading of supermarket chain enterprises under the background of new retail [J]. National Circulation Economy, 2023, (18): 12-15. DOI:10.16834/j.cnki.issn1009-5292.2023.18.016
[5] Dana Tong. Research on Supply Chain Network Optimization of Micro, Small and Medium Enterprises in Ziyang County [J]. Public Relations World, 2023, (17): 123-125.
[6] Sun Muzi. Digital intelligence empowers the development of logistics industry [N]. China Water Transportation News, 2023-09-04 (003). DOI:10.28142/n.cnki.ncsyb.2023.001255
[7] Yu, Dongyang. Optimization of supply chain management operation mode of logistics enterprises in the era of big data [J]. China Logistics and Purchasing, 2023, (17): 83-84. DOI:10.16079/j.cnki.issn1671-6663.2023.17.028
[8] Song Yu. Research on digital transformation path of petrochemical enterprises [J]. Petrochemical Technology, 2023, 30 (11): 212-214.
[9] Huang Jatong, An Chen. Prevention of Supply Chain Risks in Medical and Pharmaceutical Industries [J]. Intelligent China, 2023, (10): 66-68.

[10] YANG Shenggang, XIE Jinyuan, CHENG Cheng. Cross-border e-commerce, supply chain optimization and enterprise internationalization - Empirical evidence based on big data text analysis [J]. International Trade Issues, 2023, (10): 1-18. DOI:10.13510/j.cnki.jit.2023.10.001

[11] Jingyan Chen. Exploration and practice of commercial value-added application of supply chain data assets in power grid enterprises [J]. Journal of Xinyu College, 2023, 28 (05): 68-73