

Research on the Dynamics of Quality Risk Diffusion in the Supply Chain of Specialized and Special New Enterprises

Haiyan Zhang, Qiang Liu, Bing Li*, Ming Liu

School of Economics and Management, Liaoning University of Technology, Jinzhou, Liaoning, 121001, China

**Corresponding author*

Keywords: Specialized and special new enterprises, supply chain quality risk, risk diffusion

Abstract: In recent years, as a new type of enterprise supported by the state, specialized and special new enterprises have attracted more and more attention from the society. Their focus on innovation ability, innovation vitality and anti-risk ability has also prompted the government to issue various decrees to promote its rapid development. However, taking small and medium-sized enterprises as the main force of scientific and technological innovation must be full of various risks in its development process. Therefore, this paper takes the supply chain of specialized and specialized enterprises as the research object, analyzes its risk diffusion mechanism, and provides certain reference significance for the continuous development of specialized and specialized enterprises, so as to further improve the quality of enterprise development.

1. Introduction

With the rapid development of the global economy, and by further guiding the development of specialized and special new enterprises, the development vitality and development momentum of small and medium-sized enterprises have been further stimulated. In this process, it is necessary to continuously strengthen the cooperation within the enterprise, produce high-quality products and continuously win the advantages of participating in market competition for the enterprise. In the production process, the formation of each product has come from the complex and huge supply chain network within the enterprise. Any problem in any link may affect the operation of the entire supply chain, or even lead to the interruption of the supply chain in serious cases. Uncertain factors in the supply chain are the root causes of supply chain risks, and quality risk is one of the most important risks in the supply chain. Therefore, it is necessary to strengthen the management of supply chain quality risk by specialized and special new enterprises.

2. Literature Review

The quality risk of supply chain is not only the focus of attention in life, but also the focus of research by scholars at home and abroad.

Foreign countries have been paying attention to the quality risk of supply chain since the 1990s

[1]. Chang and Visser proposed a distributed quality control framework for the supply chain to simplify the links of information exchange in the supply chain, exchange quality information faster, and conduct rapid product and process design through only information technology and artificial intelligence technology, and control the quality of the supply chain on the premise of ensuring quality. For specific risk management, the International Aeronautics and Space Quality Organization (IAQG), the European Aeronautics and Space Quality Coordination Organization (EAQG), the National Aeronautics and Space Administration (NASA) of the United States, Boeing and IBM of the United States have made substantive research on the quality risk management of the supply chain, and accordingly put forward the corresponding supply chain quality risk model. Baiman et al. Xu Tongbang, through the study of supply chain quality management issues, proposed that enterprises should not only carry out quality management on their own design and manufacturing process of products, but also carry out quality management on supply chain related enterprises such as developers, suppliers and retailers, so as to achieve strict quality control on the whole process of product and service formation [2]. Huang Xiaoyuan and Lu Zhen studied the change of supply chain quality control under the condition of information asymmetry, and established the corresponding quality cost model of the buyers and suppliers in the supply chain in cooperation, and analyzed that the quality level of products is not observable, which may lead to the hidden quality information of suppliers and the adverse selection of buyers [3]. Wang Shixiong analyzed the probability of sudden risk in the supply chain under different network conditions and the probability of its generation and diffusion by establishing a risk contagion model of the complex network of the supply chain [4]. Li Gang briefly described the transmission process of supply chain risk through qualitative analysis through the analysis of supply chain risk transmission [5].

From the above research, we can see that there is a very close relationship between enterprise product quality and supply chain, so the effective and safe operation of supply chain is the most important to ensure enterprise quality. In the process of production and operation, the integration of raw materials or parts obtained through procurement, the quality risk of products produced by the enterprise, the quality risk of products in the process of transportation, and the quality risk of sales and after-sales becomes the quality risk under the supply chain [6]. It is impossible to estimate the loss that the quality risk of the supply chain will bring to the enterprise. Therefore, strengthen the quality risk management of the supply chain so that the enterprise can establish quality risk management measures that are practical for the whole supply chain system, thus reducing the loss that the quality risk of the supply chain will cause. Therefore, strengthen the research on the quality risk of the supply chain. It has important practical significance for Chinese enterprises to strengthen the prevention of supply chain quality risk and improve their competitiveness [7].

3. Analysis on the Diffusion Mechanism of Supply Chain Quality Risk of Specialized and Special New Enterprises

3.1. Formation Mechanism of Supply Chain Quality Risk

Under the influence of the huge market economy system, the suppliers of raw materials, parts, manufacturers of product production, logistics providers of product transportation, and the sellers after the completion of products, as well as the cooperation process with many other enterprises, constitute a complete supply chain. From this, we can see that the supply chain is the aggregation of capital chain, logistics chain and information chain. In the supply chain, ensuring the quality of these chains is an important factor for enterprises to compete. From the work chain of the supply chain, we can see that from the supply of raw materials for product manufacturing to the formation of products, it reflects the formation of the quality of the supply chain products, and also reflects the transmission and accumulation of the quality of raw materials; When a product is formed, it enters

the logistics delivery process through the manufacturer, and then reaches the sales stage, and the product is delivered to users through the seller, which also reflects the transmission and accumulation of product quality [8]. At the same time, various uncertain factors will affect the product quality in this process, and these uncertain factors are the risks we mentioned earlier. It can be seen that the final quality of the product is affected by all links in the whole supply chain. The product quality risk of the supply chain is the collection of raw materials, parts quality risk, product quality risk, logistics and transportation quality risk, sales and after-sales quality risk in the whole process of the supply chain [9].

3.2. Characteristics of Supply Chain Quality Risk

With the continuous change of the market economic environment, the customer's demand for products is also changing, the types of product research and development of specialized and special new enterprises are also increasing, and the life cycle of product manufacturing itself is also shrinking, resulting in the continuous growth of various uncertainties in the supply chain. As one of the major risks in the supply chain that are difficult to predict, quality risk has always been the focus of scholars and enterprises. The quality risk of the supply chain includes the following aspects:

3.2.1. Transmission of Supply Chain Quality Risk

The quality risk of the supply chain runs through the whole process of the supply chain, and the quality risk is not simply linear transmission along the supply chain. From the raw materials provided by the supplier to the final consumption of production into the hands of the customer, any product has the possibility of producing risks in a series of processes of design, production and sales, and many unpredictable things will occur in the process of risk diffusion, These events may lead to new quality problems. There are many nodes in the whole supply chain, and they are distributed in a complex network. When quality problems occur in the nodes, it cannot be said that they are the source of risk. The quality risk diffusion in the supply chain is a complex process. Therefore, each node in the supply chain network may become the source of quality risk diffusion.

3.2.2. Time Delay of Supply Chain Quality Risk

The quality risk of the supply chain is different from other common risks. When the quality problem occurs, it often takes a certain time for the risk to appear in the supply chain. Only when the environment with certain conditions appears, the latent quality risk will appear, and the quality problems that appear are the quality problems that cannot be accurately estimated previously, such as the aging of a part of the product and the inability to realize some functions. This also increases the technical risk and cost risk of the product. This characteristic of time delay makes quality problems possible at any node and at any time in the supply chain, and the consequences of the problems may also be different due to the time and node of the problems.

3.2.3. Supply Chain Quality Risk is Dependent

The quality risk of the supply chain is generally not an independent individual, and each quality problem has an interactive relationship with other risks in the supply chain. At a low level, the quality risk of the supply chain can be transformed into the cost, time and product risk of the core enterprises of the supply chain under certain environmental conditions [10]. Cost risk refers to various product inspection costs caused by product quality problems, loss costs caused by product failures and costs of subsequent guarantee for products. In the current operation, it also includes the

risk of production suspension and the risk of product rectification and research and development. Time risk is the risk that the delivery date of products will be delayed due to quality problems in the production process. Product risk refers to the risk of product surplus, excessive management or additional services due to the product quality failing to meet customer needs. All the above risks may become the fuse of supply chain cost risk, and may eventually be transformed into other risks.

3.2.4. The Evaluation of Supply Chain Quality Risk is Subjective

For the quality risk evaluation of the supply chain, each person will have different evaluation criteria with different evaluation indicators, so subjectivity is the characteristic of the quality risk evaluation of the supply chain [11]. From the perspective of customers' demand for products, in the case of the same product quality, due to the different customer expectations, personal preferences and experience, the same products will also bring different experiences, which will lead to different supply chain demand risks [12].

3.2.5. Supply Chain Quality Risk is Controllable

Different from ordinary natural disasters, the quality risk of supply chain can be regarded as the perceived risk. Due to the limitations of product technology and management level, the production of supply chain risk is inevitable. However, the generation of quality risk requires certain environmental conditions and the accumulation of certain quality risk factors. If we can identify and predict the environment and factors that may lead to the generation of risk, so as to avoid the risk conditions, we can control the supply chain quality risk within the acceptable range of the enterprise, but it is also impossible to completely avoid the supply chain quality risk. By identifying and changing the conditions of the occurrence of supply chain quality risk, the supply chain quality risk can be resolved. On the contrary, the supply chain quality risk will be transferred and spread.

4. Supply Chain Quality Risk Diffusion of Specialized and Special New Enterprises

From the perspective of specialized and special new enterprises, in the supply chain, each enterprise participating in this business has more or less business relations with other enterprises, while the internal members of the enterprise are affected by the internal environment of the enterprise and are faced with a large number of uncertain factors, which also leads to the potential quality risk of each node in the supply chain. As the accumulation of uncertain factors in a certain section of the supply chain reaches a certain upper limit, the quality risk of the enterprise will be reflected in the production of products and product services, and spread to other member enterprises in the supply chain with the help of the carrier of the two or the sudden new quality risk. This is also the most common chain diffusion mode in the supply chain. In this mode, the quality risk of the supply chain is not spread in a simple form and quantity, but is transformed into a more serious quality risk along the diffusion path.

In the production process, the enterprise starts from the purchase of raw materials to the production and manufacturing, and finally transports the products to the customers. When an enterprise purchases raw materials, it will choose from multiple sources, so it can be seen that the quality risk is a relationship of multi-source aggregation in the process of enterprise procurement, and the product distribution is delivered to different customers through a variety of different routes, so the quality risk is a relationship of distribution in the distribution process, which can also be seen as a simple risk series relationship. The quality risk of the supply chain is constantly transferred between various related relationships until the risk occurs. Because of the complexity of the supply chain of specialized and special new enterprises and the universality of the quality risk of the supply chain. Therefore, every node in the supply chain of specialized and special new enterprises may have certain problems because of the quality of that node, and the quality risk generated by it will

spread with other enterprises with business relations through the nodes. Therefore, no matter any node in the supply chain has a quality problem, it will eventually spread out directly or indirectly through the connection between nodes, and then affect the entire supply chain. The diffusion result of supply chain quality risk may break the original supply chain state and may also change the expected operation route of the supply chain. The degree of its impact mainly depends on the size of the risk itself and the ability of each enterprise in the supply chain and the supply chain as a whole to resist the risk. In addition to the traditional risk management elements, the key factors that affect the quality risk of the supply chain also include the ability of specialized and new enterprises to resist risks, the degree of efforts to resist risks, the risk diffusion carrier and the supply chain itself.

5. Conclusion

With the assistance of national policies, the development of specialized, special and new enterprises has made rapid progress, and the development of each enterprise has reached a new height. With the increasing number of enterprises involved in the supply chain, the management of the supply chain has become more and more complex, and the risks of the specialized, special and new enterprises' supply chain have become increasingly prominent, which is also the focus of national attention. How to effectively control these quality risks is the basis for ensuring the normal operation of enterprises. Promoting the continuous improvement of the supply chain is also the key factor of enterprise product quality, which is also the focus of scholars' research. With the continuous development of the Internet, the competition between enterprises is intensifying, and the quality of enterprises' products will also continue to meet new challenges. Based on the complexity and the impact of various uncertainties in the process of supply chain quality risk diffusion, there are still many problems in the mechanism of supply chain quality risk diffusion that need to be discussed continuously.

Acknowledgements

This work is supported by Social Science Planning Fund Project of Liaoning Province (L22BGL029).

References

- [1] Stanley L.L., Wisner J.D. *Service quality along the supply chain: Implications for purchasing*. *Journal of Operations Management*, 2018. 287-306.
- [2] Baiman S., Fischer P., Rajan M. 2000. *Information, contracting and quality costs*. *Management Science*, 2019(6): 776-789.
- [3] Chang S.I., Visser J.J. 1984. *A framework of distributed quality control*. *Computers and Engng*, 2016: 181-184.
- [4] Huang X.Y., Lu Z. 2003. *Quality control strategy of supply chain under asymmetric information*. *Journal of Northeast University (Natural Science Edition)*, 2015 (10): 998-1001.
- [5] Zhang C.H., Huang X.Y. 2003. *The influence of asymmetric information on the quality and cost decision of supply chain*, *Journal of Northeast University (Natural Science Edition)*. 2004 (3): 303-305.
- [6] Wu Q., Xu T.B. 2001. *Supply Chain Quality Management -- New Ideas of Quality Management in the 21st Century*, *China Quality*, 2001 (12): 45-47.
- [7] Li G. *Research on supply chain risk transmission mechanism - China's circulation economy*, 2011(1): 41-44.
- [8] Wang S.X. *Research on the mechanism and control strategy of supply chain sudden risk infection*. Shanghai: Donghua University, 2010.
- [9] Zhang J.G. *Research on the operation mechanism of enterprise immune system*. Wuhan University of Technology, 2012.
- [10] Li Q.X., Sun P.S., Jin F.H. *Research on the connotation and mechanism of supply chain quality management immunity*. *Journal of Northeast University (Social Science Edition)*, 2010, 12(06): 504-510.
- [11] Li Q.X., Sun P.S., Jin F.H. *Research on supply chain quality management model based on immune perspective*. *Business Research*, 2010(07): 72-76.
- [12] Xu H., Ji C.L., Li J., Zhou B., Jin X. *Research on the risk response mechanism of technology-based SMEs from the perspective of organizational immunity*. *Managing the world*, 2011(02): 142-154.