

# *Quality Risk of Core Enterprises in Manufacturing Supply Chain*

Yan Liang<sup>1,\*</sup>, Qiang Liu<sup>1</sup>, Yu Guo<sup>2</sup>, Ming Liu<sup>1</sup>

<sup>1</sup>*School of Economics and Management, Liaoning University of Technology, Jinzhou, Liaoning, China, 121001*

<sup>2</sup>*School of Economics and Management, Harbin Engineering University, Harbin, Heilongjiang, China, 150001*

*\*Corresponding Author: Yan Liang*

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**Abstract:** In recent years, quality problems have occurred frequently in manufacturing enterprises. The core enterprises in the manufacturing supply chain are important nodes in the supply chain, and the quality risks caused by small-scale enterprises in the supply chain can't be ignored. Therefore, the quality risk of core enterprises in the manufacturing supply chain can reduce or avoid the quality risks faced by other enterprises in the manufacturing supply chain. At first, this study explains the basic core concepts, and then uses CiteSpace to summarize and analyze domestic and foreign documents, explore the keyword clustering analysis of quality risks of core enterprises in the manufacturing supply chain by domestic and foreign scholars, so as to grasp the current domestic and foreign scholars' studies. The results trends are summarized at the end, with a view to deriving the follow-up study directions and key elements.

## **1. Introduction**

The supply chain runs through various industries and is the chain hub for other companies in the industry to connect, communicate, and transmit information. The core enterprise transmits information and resources to upstream and downstream enterprises through the supply chain[1-3]. The manufacturing industry is the driving force of national and regional development. The manufacturing supply chain is the core outline for the development of the entire manufacturing industry. As the core node in the supply chain, core enterprises have a lot of influence on other manufacturing enterprises, especially those under the strategy of a strong quality country. With the development, how to weaken or reduce the quality risk brought by the core enterprises of the manufacturing supply chain has become an important proposition of current research[4-6].

This study first defines the concept of supply chain, manufacturing supply chain, and quality risk; secondly, keyword co-citation and cluster analysis are carried out through CiteSpace document analysis visualization software, in-depth study of the achievements and study context of domestic and foreign scholars; finally, it is aimed at CiteSpace based on the results of literature analysis, extract key nodes and element information for follow-up academic study.

## 2. Basic Concepts

### 2.1. Supply Chain Concept

Supply chain is one of the forms of enterprise development and scale expansion, especially the value chain on which modern manufacturing depends for survival under the strategy of manufacturing power. Companies in the supply chain break through the conceptual definition of traditional industries and are able to survive in a complex and changeable external environment. There is a solid trust relationship between enterprises in environmental market competition. As the core hub of the supply chain, the core enterprise is a transaction and replacement center that integrates information, capital, and material. It is the key to connecting upstream and downstream enterprises on the supply chain network[7-10].

In the 1880s, the concept of supply chain was first mentioned. Until the 1890s, the study of supply chain was gradually valued by scholars and began to transfer the study of supply chain to enterprises. The supply chain is a flow of manufacturers as the initial starting point and individual customers as the end point, through the supply chain to continuously create value and distribute products and services[11-13]. Robert believes that the supply chain covers the procurement of raw materials, and through the transformation of raw materials, they are finally supplied to individual supply network clusters through suppliers and sellers[14-16]. Evens believes that the supply chain has the function of information feedback, which can collect the feedforward information of manufacturers and the feedback information after the sale of products, and build the supply chain into an information exchange network centered on manufacturers, sellers, distributors and individual users[17-20]. Ma believes that the supply chain takes the enterprise as the core, which refers to the process of purchasing raw materials from manufacturers, processing the materials into handicrafts or finished products, and selling the products to users through dealers or distributors. Important nodes in it, such as manufacturers, Suppliers and sellers have formed a supply network to continuously increase the value of raw materials and bring huge benefits to society and enterprises[18].

To sum up, this study believes that the supply chain is a network chain structure centered on the core enterprise. The core enterprise can be a manufacturer or a supplier, depending on the position of the enterprise in the supply chain. Therefore, the supply chain The chain has the following characteristics[20-22]: (1) Supply and demand. There is a supply and demand relationship between each node in the supply chain. Manufacturers purchase raw materials for processing and manufacturing, and provide them to suppliers and sellers, and supply them to final consumers in sequence according to the supply chain structure. Therefore, there is a supply and demand relationship between the supply chains to ensure Supply chain development and enterprise production and operation. (2) Dynamic. The supply chain and each node enterprise in the chain are disturbed by the external environment and their own conditions. If the information sharing is not accurate and timely, the manufacturer receives the information, which mutates and amplifies the consumer demand and triggers the bullwhip effect; the market economy is sluggish, resulting in market prices changes and other conditions will cause fluctuations in the supply chain. At this time, each node enterprise in the supply chain will dynamically adjust according to market demand and its own conditions. (3) Intersection. In order to ensure their own development and economic needs, the node enterprises in the supply chain are likely to provide products and services for another supply chain. In this way, the supply chain network is not a single supply network, but an intricate intersection of information resources. The cross and complex relationships between nodes increase the difficulty of coordinated control of the supply chain. (4) Be guided by user needs. Any

enterprise is guided by user demand. Although the supply chain is an overall network, it is still user demand-oriented from a systematic and macro perspective.

## **2.2. The Concept of Manufacturing Supply Chain**

The manufacturing industry is the cornerstone of the economic development of various countries. The manufacturing industry covers a wide range of industries, which refers to the processing and manufacturing of raw materials into handicrafts or semi-finished products. The manufacturing supply chain refers to the consideration of internal factors of the enterprise, such as economy, manpower, material resources, and financial resources. Organize resources and other elements, and develop jointly with other manufacturing companies to achieve complementary advantages and avoid the barrel effect[15-22]. Scholars have found that the node companies in the supply chain will not change, and the dynamics of the change structure of the manufacturing supply chain are mainly manifested in the changes of the node companies in the supply chain. Some scholars believe that the manufacturing supply chain relies on the network, facing a complex and changeable market environment, the node enterprises on the supply chain adjust according to their own economic conditions and strategic goals[12-21]. This study believes that the concept of manufacturing supply chain is: take core enterprises as the center of the manufacturing supply chain, and reshape a new functional supply chain network for manufacturing according to market demand or environmental changes.

The characteristics of the manufacturing supply chain are as follows[16-18]: (1) Dynamic. Node companies in the manufacturing supply chain face risks inside and outside the network at any time. When the node companies in the manufacturing supply chain are at risk, they will cause fluctuations and shocks to other chain companies, which will affect the economic development of the node companies. Therefore, the manufacturing supply chain Dynamic adjustments will be made according to changes in the context, in order to protect node enterprises in the supply chain while adapting to changes in social development and economic trends. (2) Swiftness. The manufacturing supply chain is intricate, and the changes of a single node enterprise will have an important impact on the overall supply chain system. For some enterprises, it may be beneficial to the development of other node enterprises, but for some directly imagined enterprises, it will Cause a certain risk, so the node companies in the supply chain must quickly make adjustments to reduce economic losses caused by other companies. (3) Resource sharing. The node enterprises in the manufacturing supply chain realize complementary advantages and share resources. The collection of information by a single enterprise is restricted by economic conditions, and it is very likely that they cannot search for complete and complete information resources. However, each node enterprise is in the manufacturing supply chain and has related interests. To promote resource sharing among node enterprises. (4) High complexity and high risk. In the overall management of the manufacturing supply chain, effective unity cannot be achieved, so the system management is very complicated. At the same time, there is a supply-demand relationship in the manufacturing supply chain. When there is mistrust or mismatched information between the node companies in the supply chain, it is easy to cause the quality risk in the manufacturing supply chain to expand, and then lead to some network defects in the manufacturing supply chain.

## **2.3. The Concept of Quality Risk**

Domestic and foreign scholars have conducted in-depth study and discussion on quality risks from different aspects. From the perspective of risk management, some scholars believe that quality risk refers to the deviation of consumers' expected quality of products and services from product creation to sales to the end user, and therefore believe that the product has quality defects.

According to the definition of quality and risk, some scholars believe that quality risks exist in all links of the supply chain, with many uncontrollable factors, and hidden dangers of quality risks, causing economic losses and adverse consequences for enterprises and individuals. Some scholars believe that the quality risk problem is mainly due to the improper operation of employees in the enterprise, employee awareness, and the failure of various links in the supply chain, which cause cascading failures in the supply chain[19-22].

Therefore, this study believes that quality risks exist in the production and operation of various enterprises, and enterprises cannot directly eliminate them, and can only reduce and avoid losses to the greatest extent and reduce the harm caused by consumers. Especially for manufacturing companies, there are more quality risks than other industries. The processes from raw material manufacturing, employee quality inspection, and product transportation will have a knock-on effect on other companies. At the same time, there are cross-chains in the supply chain where the manufacturing industry is located, which has a complex impact on other companies. A single company's quality risk may cause the supply and demand of the entire supply chain to be slow, and there are hidden quality risks.

### 3. Cite Space Literature Analysis

This study takes “manufacturing”, “core supply chain enterprise” and “quality risk” as the themes, and retrieves the literature from 2001 to 2021 in the core essays of Web of Science and CNKI. The study on corporate quality risk is relatively early, but domestic study on it is relatively scarce. Therefore, the subject English search is carried out on the core studies of Web of Science, and the full text Chinese search is carried out on CNKI. The retrieved documents are screened and exported to CiteSpace for data conversion and analysis. Figure 1 shows the trend of the number of studies published by scholars with the theme of “quality risk” derived from the core database of Web of Science.

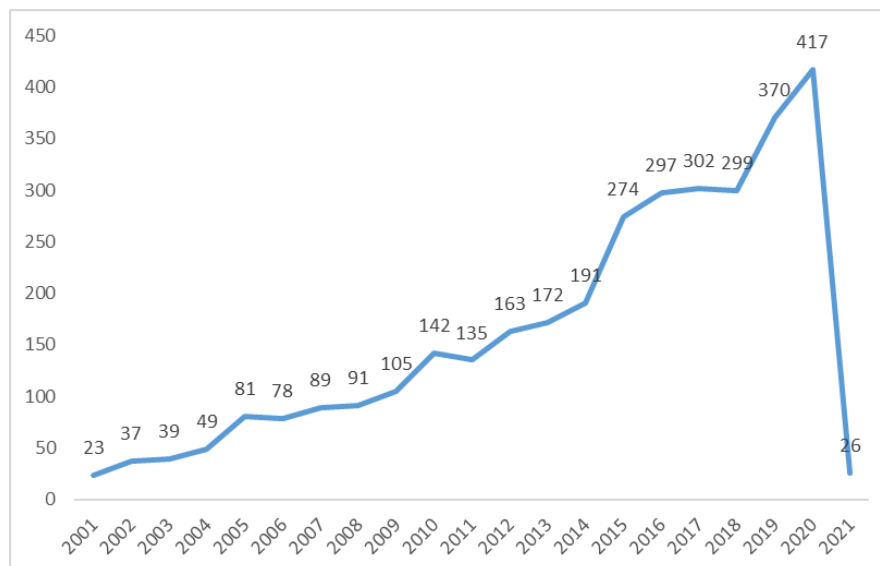


Figure 1: The number of publications based on “quality risk” in the past 20 years.

Figure 1 shows that since 2001, scholars' study on “quality risk” has been increasing year by year. By 2021, the number of studies published has reached 417, and by February 2021, a total of 26 studies have been published. In other words, scholars are reaching a climax on issues related to

“quality risk”. Based on this, the core studies of Web of Science and CNKI were used to summarize and analyze the literature to screen out the key themes and elements.

### 3.1. Analysis of Foreign Literature

The subject is “Quality Risk”, the document types are “Study” and “Review”, and the language is selected “English” to search in the core collection of Web of Science studies. CiteSpace clustering analysis of 3380 documents was derived, and 11 clustering types were obtained, namely: supply chain management, human, design quality, heavy metals, food safety, safety, bronchopulmonary dysplasia, intensive care, therapeutic use, semiconductor devices and pm2.5.

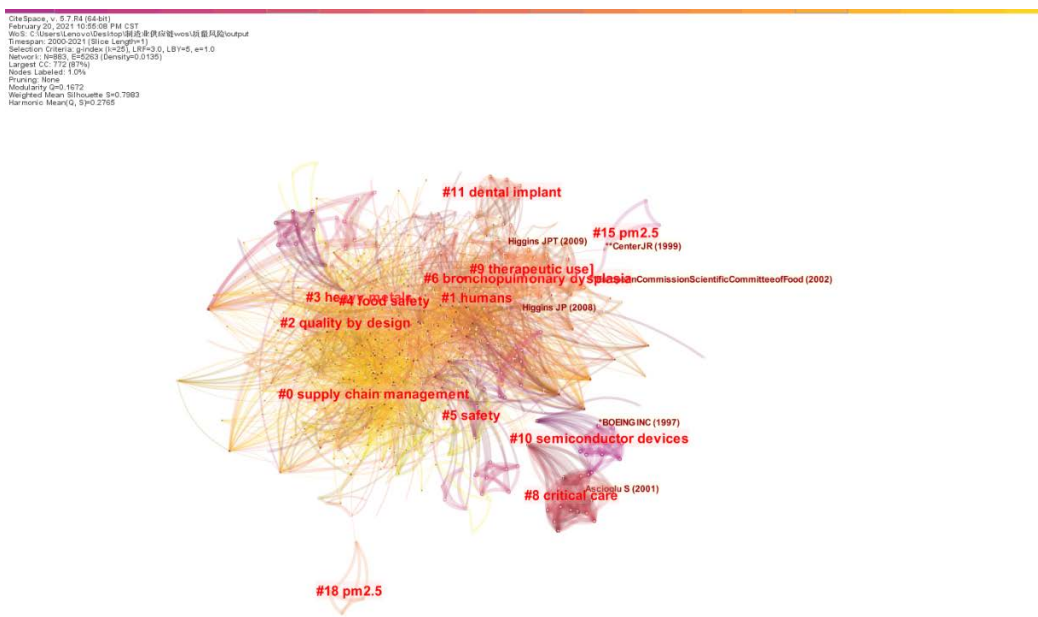


Figure 2: Cluster analysis diagram of foreign language.

It can be seen from Figure 2 that foreign study on quality risks can be roughly divided into four parts: one is medical treatment, which mainly discusses human medical treatment, monitoring and treatment; the other is industrial enterprises, including heavy metal production, semiconductor device production. The third is the quality risk caused by food safety; the fourth is the quality risk in the supply chain management process.

### 3.2. Domestic Literature Analysis

Due to the relative lack of “quality risk” in domestic study, the total number of documents searched for subject retrieval is not enough for literature analysis. Compared with Figure 2, the Chinese clustering analysis chart is clearer, and the lines obtained by clustering are clear, further verifying the relative lack of domestic study on quality risk. According to the current clustering results, it can be seen that quality risk studies mainly focuses on supply chain management, supply chain, risk management, and incentive mechanisms. There are also fewer nodes to study individual cases, such as member management, management models, and node enterprises. Study on quality risk issues under the three keywords; explore quality risk issues in SME financing models and Internet finance; study quality risk issues in dynamic logistics service supply chains and system construction.

## 4. Study Conclusions

The CiteSpace analysis and review of the literature found that foreign study on “quality risk” started earlier, with a larger number of published documents, and relatively mature medical study; domestic study on “quality risk” is relatively backward, and scholars study the direction of the company mainly focuses on supply chain management, financial risk and other aspects. In the key themes of the foreign literature, the problem of quality risk in supply chain management is clustered. Therefore, there are more and more studies on the quality risk problems of core enterprises in the manufacturing supply chain, and the related issues of quality risks in the core enterprises of the manufacturing supply chain need to be explored and discuss.

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## References

- [1] Tse Ying Kei, Minhao Z, Wenjuan Z, Jie M. (2021) *Perception of supply chain quality risk: Understanding the moderation role of supply market thinness. Journal of Business Research, (122): 822-834.*
- [2] Talarmin Chloé, Kerob Steven, Cartier François, Madelaine Isabelle, Mukenyi Sarah, Schwartz Eden, Boissel Nicolas, Baruchel André, Thieblemont Catherine,Parquet Nathalie, Brignier Anne, Lesprit Emmanuelle, Desproges André, Magdelonnette Lorène, Larghero Jérôme, Mebarki Miryam.(2020) *Quality risk management of the chimeric antigen receptor T cell pharmaceutical circuit in one of the first qualified European centers. Cytotherapy, 22(12): 792-801.*
- [3] Pintu B. Prajapati, Khushbu Radadiya, Shailesh A. Shah. (2020) *Quality Risk Management Based: Analytical Quality by Design Approach to Eco-Friendly and Versatile Chromatography Method for Simultaneous Estimation of Multiple Fixed-Dose-Combination Products of Anti-Diabetic Drugs. Journal of Pharmaceutical Innovation, (prepublish):1-18.*
- [4] Zhang M,Cheng Y M, Hu W, He H Y.(2014) *Quality risk evaluation and improvement analysis based on DEMATEL method. Statistics and Decision, (12): 180-183.*
- [5] Feng T, Keller L R, Wang L (2010). *Product quality risk perceptions and decisions: Contaminated pet food and lead-painted toys. Risk Analysis: An International Journal, 30(10): 1572-1589.*
- [6] Yan Z E. (2013) *Quality Risk Transmission Model of Supply Chain Based on QFD. Science and Technology Progress and Policy, 30(12): 22-25.*
- [7] Tse YK, Tan K H. (2011) *Managing product quality risk in a multi-tier global supply chain. International Journal of Production Research, 49(1): 139-158.*
- [8] Ying Kei Tse, Minhao Zhang, Kim Hua Tan, Kulwant Pawar,Kiran Fernandes.(2018) *Managing quality risk in supply chain to drive firm's performance: The roles of control mechanisms. Journal of Business Research, (97): 49-57.*
- [9] Frizenschaf J, Mosley L, Daly R, Palmer D.(2015) *Managing drinking water quality risks from acid drainage discharges to the lower river Murray while protecting farming activities. Water: Journal of the Australian Water Association, 42(1): 53-60.*
- [10] Sun Y, Zhang X, Song Q H. (2020) *Asset-light operations, the nature of equity and capital efficiency: an empirical study based on my country's listed manufacturing companies. Business Research, (12): 99-109.*
- [11] Zhu L G. (2020) *Research and Implementation of Supplier Management System in Enterprise Supply Chain. China Logistics and Purchasing, (22): 44-45.*
- [12] Fan J C, Fu H, Li Y H, Hong D J. (2020) *Supply Chain Quality and Coordination under Channel Power Structure and Responsibility Cost Sharing. System Engineering Theory and Practice, 40(07): 1767-1779.*
- [13] Dong H, Xu D M. (2020) *Four-level closed-loop supply chain quality control model and profit decision. Control Engineering, 27(2): 323-328.*
- [14] Haiwang D, Haiwang D, Jing L.(2020) *Research on PC Component Quality Risk Evaluation Based on Intuitionistic Fuzzy Analytic Hierarchy Process. IOP Conference Series: Earth and Environmental Science, 525(1): 12-43.*
- [15] Nakas Alexandros, Dalatsi Athanasia M,Kapourani Afroditi, Kontogiannopoulos Konstantinos N, Assimopoulou Andreana N, Barmpalexis Panagiotis (2020). *Quality Risk Management and Quality by Design for the Development of Diclofenac Sodium Intra-articular Gelatin Microspheres. AAPS PharmSciTech, 21(4): 127-132.*

- [16] Fu H, Li L Q. (2020) Considering the supply chain decision-making and coordination of the strong downstream enterprises holding the weak upstream enterprises. *Industrial Engineering and Management*, 25(2): 172-178.
- [17] Fu H, Li L Q. (2020) Supply chain coordination for downstream companies investing in upstream companies when supply is unreliable. *Industrial Engineering and Management*, 25(2): 44-50.
- [18] Ma S H, Lin Y. *Supply Chain Management (Second Edition)*. Beijing: Machinery Industry Press. 2005.
- [19] Shen H C (2000). *Supply Chain Management Theory and Method*. *Chinese Management Science*, (8): 1-9.
- [20] Song Y J. (2020) Analysis of Product Quality Risk. *Productivity Research*, (9): 180-181.
- [21] Haddad Ghada, Greene Anne. (2020) Quality Risk Management-A Role-Based Competency Model. *PDA journal of pharmaceutical science and technology*, 74(1): 58-72.
- [22] Ying Kei Tse, Kim Hua Tan. (2012) Managing product quality risk and visibility in multi-layer supply chain. *International Journal of Production Economics*, 139(1): 291-303.