Research on data-driven risk prevention and control system of recycled metal raw materials

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Abstract. the risk management of the supply chain of recycled metal raw materials is very important to ensure the sustainability of modern industry. However, the risks involved in the supply chain, such as supply chain interruption, price fluctuation and environmental sustainability, make the supply chain complex and diverse.The purpose of this study is to explore the construction and optimization of data-driven risk prevention and control system for recycled metal raw materials, and to deeply study the key steps of risk identification, evaluation, early warning and response, as well as the application of data-driven methods in this field. The research results highlight the importance of data-driven risk prevention and control, so as to improve the sustainability of supply chain, reduce enterprise risks and promote the sustainable development of recycled metal raw materials industry.

Keywords: recycled metal raw materials, risk prevention and control, data-driven, risk management

1 Introduction

The supply chain of recycled metal raw materials is a key component of modern industry, which involves many complex risks, including supply chain interruption, price fluctuation and environmental sustainability. We must pay attention to the construction and optimization of the risk prevention and control system of recycled metal raw materials supply chain in order to improve the sustainability of the supply chain, reduce the risk of enterprises and provide strong support for building a socialist modern country in an all-round way.

2 The importance of the supply chain of recycled metal raw materials

Recycled metal raw materials are key raw materials in industrial production, covering many industries, including construction, automobile manufacturing, electronic products and energy production. The supply chain management of these raw materials

Z. Wang et al. (eds.), *Proceedings of the 2023 2nd International Conference on Public Service, Economic Management and Sustainable Development (PESD 2023)*, Advances in Economics, Business and Management Research 273,
https://doi.org/10.2991/978-94-6463-344-3_79

involves many links, from the acquisition, transportation and processing of raw materials to the production of final products[1]. Therefore, the stability and sustainability of the supply chain of recycled metal raw materials are very important for modern industry.

2.1 Risk of supply chain interruption

Supply chain interruption may be caused by many factors, such as natural disasters, political turmoil, supplier closure and so on. These factors may lead to the interruption of production and delivery, which directly affects the profitability of enterprises.

Natural disaster is a serious risk factor of supply chain interruption of recycled metal raw materials. Natural disasters such as earthquake, flood and hurricane may cause great damage to the core infrastructure, transportation system and production capacity of suppliers in the supply chain. These disasters may directly lead to the interruption of supply chain and restrict the transportation and production of raw materials. The earthquake may have triggered the production interruption of the global steel industry, reduced the production capacity, led to a sharp rise in steel prices, and then had a chain reaction to the global industry. However, the unpredictability of natural disasters increases the complexity of supply chain interruption risk.

Political turmoil and social instability may also seriously interfere with the supply chain of recycled metal raw materials. Political conflicts, strikes, social protests and other factors may lead to supply chain interruption. Political conflicts in countries may lead to the closure of borders and the inability to transport goods smoothly, thus interrupting the supply chain. The risks of these political and social factors need to be actively tracked and analyzed by enterprises in order to formulate risk coping strategies and maintain the sustainability of the supply chain.

One of the most critical risks in the supply chain of recycled metal raw materials is related to suppliers. There are usually multiple key suppliers or partners in the supply chain, but sometimes enterprises may rely too much on a single key supplier, which will increase the risk of supply chain interruption. If key suppliers face bankruptcy, economic problems or production problems, it will have a direct adverse impact on the production plan and profitability of enterprises.

2.2 Risk of price fluctuation

The fluctuation of the price of recycled metal raw materials will have a direct impact on the profitability of enterprises. Unstable prices may lead to rising costs or falling profits, making it difficult for enterprises to plan and forecast.

The price fluctuation of recycled metal raw materials is a crucial risk in supply chain management, which directly affects the profitability and stability of enterprises. The fundamental reason for this volatility lies in the change of supply and demand in the global market, the influx of new market participants, and the interruption of supply. The fluctuation of market demand is one of the main driving forces of the price fluctuation of recycled metal raw materials. An increase in demand usually pushes up prices, while a decrease in demand may lead to a decline in prices. The fluctuation of

market demand is influenced by many factors, including the macroeconomic situation, the production demand of specific industries, and the emerging trends of the global market. The influx of new market participants may also change the pattern of market supply and demand, increase supply and exert downward pressure on prices. The market strategy, production technology and price competition strategy of new market participants may affect market dynamics and further promote price fluctuations.

2.3 Risks of environmental sustainability

Environmental sustainability risk plays a vital role in supply chain management and enterprise economic performance [2]. The production and processing of recycled metal raw materials, especially without proper environmental protection measures, may have a negative impact on the environment. This kind of environmental risk includes waste of resources, excessive consumption of energy and potential environmental pollution [3].

The core of environmental sustainability risk management is to deal with more and more stringent environmental regulations. The government and regulatory agencies have issued stricter laws and regulations, requiring enterprises to take measures in production and processing to reduce negative environmental impact. This includes reducing waste emissions, effectively treating wastewater, improving energy efficiency and reducing greenhouse gas emissions. Enterprises must actively abide by these laws and regulations, otherwise they may face the risk of huge fines, legal proceedings and even reputation damage. This means that environmental sustainability has become an indispensable part of supply chain management and needs to be effectively applied throughout the supply chain.

3 Construction of data-driven risk prevention and control system for recycled metal raw materials.

3.1 Risk Identification and Assessment

In the first step of building a data-driven risk prevention and control system, we are committed to accurately identifying and evaluating risks that may affect the supply chain. This includes the scope of risks covering supply chain stability, price fluctuation, environmental sustainability and other dimensions. We will establish a comprehensive risk database by means of data collection and analysis, This database will be the basis of our risk assessment, enabling us to better understand and identify potential risks [4]. At the same time, data analysis and modeling will also become a powerful tool for risk severity and probability assessment. We will use a data-driven model to quantify the possibility and potential impact of risk events to determine which risks are the most urgent and serious. This helps enterprises to formulate risk management strategies and response plans more pertinently.

3.2 Risk early warning and response

After risk identification and assessment, we will establish an enhanced risk early warning system. This system will integrate all kinds of data sources, including real-time supply chain data, market data, political and social event data, etc [5]. Through data analysis and monitoring, we will be able to detect potential risk signals in advance. Once the risk signal is detected, the enterprise will take action quickly and make corresponding emergency plans [6]. These plans will cover supply chain adjustment, inventory management, contract renegotiation, risk transfer strategy, etc., to ensure that enterprises can respond quickly when risk events occur and reduce potential impacts. Enterprises need to establish effective communication channels to ensure that risk information can be communicated to relevant departments in time, so as to improve their coping ability.

3.3 Information sharing and collaborative management

The data-driven risk prevention and control system also covers the key components of information sharing and collaborative management. This step aims to promote information sharing and collaborative management among all links in the supply chain, so as to improve the overall stability of the supply chain [7]. This requires the establishment of an information sharing platform that allows all participants in the supply chain to share risk information, data and coping strategies in real time. Information sharing and collaborative management can strengthen the connection between all links in the supply chain, help enterprises coordinate their actions better, reduce information asymmetry and improve the overall perception of risks. This helps to prevent potential problems in advance, improve the flexibility of supply chain and reduce losses caused by risk events.

4 Discussion on risk prevention and control strategy of data-driven recycled metal raw materials.

4.1 Innovation leads the supply chain of recycled metal raw materials

(1) Promote technological innovation. Technological innovation is the key to the sustainable development of supply chain. Enterprises should actively guide and support research and development, including materials science, green processing technology and resource recovery technology. By constantly promoting technological innovation, enterprises can improve production efficiency, reduce environmental impact and realize sustainable supply chain.

(2) Industry-University-Research uses cooperation. Innovation requires the cooperation of enterprises, academia and government to jointly promote the research and development and application of technologies and products. The cooperation among enterprises, research institutions and universities introduces innovation into all aspects of the supply chain. This will help to accelerate the commercialization of new technologies and improve the efficiency and sustainability of the supply chain.

(3) Industrialization of achievements. Innovation doesn't just stay in the laboratory, its ultimate goal is to realize industrialization and large-scale application. Government, enterprises and investors can work together to turn research results into practical products and services. This will help promote the integration of technological innovation and industrial development and create new business opportunities.

4.2 Market-led sustainable supply chain

(1) Investment decision and technology selection. Market law is an important part of supply chain management. Enterprises should respect the laws of the market, give full play to the decisive role of the market in resource allocation, and pay attention to the government's strategic planning and market supervision to create an environment conducive to the sustainable development of the supply chain. Market-oriented supply chain management requires enterprises to pay more attention to market demand and integrate it into investment decision-making and technology selection. Enterprises need to flexibly adjust their production and supply chain strategies to meet the rapid changes in the market.

(2) government guidance and regulation. The government plays an important role in market-oriented supply chain management. The government can guide the development of the industry through strategic planning, formulate relevant standards and regulations to maintain market order and ensure the sustainability of the supply chain. The government can also provide financial and tax incentives to encourage enterprises to participate in the construction of sustainable supply chain.

4.3 Supply and demand coordination and dynamic balance

(1) Balance of supply and demand. Enterprises need to ensure that the production and supply in the supply chain can meet the market demand. The sustainability of supply chain needs to meet internal demand as a priority task. Enterprises should focus on the new development pattern and new demand, stabilize the reasonable proportion of raw material industry, strengthen resource guarantee, improve supply quality and promote the coupled development of supply chain.

(2) Resource guarantee. In order to ensure the sustainable supply of resources, enterprises need to adopt a variety of strategies, including diversifying supply sources, establishing long-term partnerships, recycling and reusing resources, improving transparency and traceability, conducting risk assessment and planning, and maintaining strategic inventory. These strategies are helpful to reduce the risk of interruption of resource supply chain, improve the resilience of supply chain, and ensure that enterprises can adapt to the changes of market and regulations. By establishing a long-term relationship with reliable resource partners and adopting sustainable resource management practices, enterprises can realize a sustainable resource supply chain, meet market demand and reduce the uncertainty brought by the environment and regulations. This will help to improve the profitability and competitiveness of enterprises.

5 Conclusion

Data-driven risk prevention and control system of recycled metal raw materials plays a vital role in ensuring the sustainability of supply chain, reducing risks and promoting the sustainable development of recycled metal raw materials industry. By making full use of data collection, analysis and application, this comprehensive system gives enterprises more accurate and rapid risk perception and coping ability, which helps to ensure the smooth operation of the supply chain, reduce economic and environmental risks, and promote the sustainability of the supply chain of recycled metal raw materials. In a challenging global supply chain environment, data-driven risk prevention and control system has become an indispensable tool for enterprises to succeed.

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