

AI-Driven Data Analytics to Mitigating Supply Chain Disruption: Insights from the Aftermath of the COVID-19

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Abstract. This study explores ways to address the risk of supply chain disruption by applying Artificial Intelligence data collection and analysis in the wake of COVID-19. The outbreak disrupted many organizations' supply chains, and supply chain disruption is an extremely serious issue for organizations. Traditional supply chain risk management is based on analyzing historical understanding of the extent of an event's impact. However, when faced with a rare and severe catastrophic event such as COVID-19, traditional approaches struggle to quantify the risk due to a lack of historical data, leading to serious losses for organizations. Describing the supply chain through mathematical modeling and data analytics allows predictions to be more realistic and forward-looking, helping to counter or respond to the risk of supply chain disruption during a pandemic. These strategies not only reduce the risk of supply chain disruptions faced by organizations but also drive digital transformation and improve the competitiveness of organizations. This paper highlights how AI-based data collection and analysis methods in the context of epidemics can help companies better respond to the risk of supply chain disruption and achieve sustainable development.

Keywords: Supply chain disruption, AI-driven data analytics, Digital Transformation, Risk management

1. Introduction

The aftermath of COVID-19 and the turmoil caused by COVID-19 led to disruptions in the supply chain of many organizations, and supply chain disruption is an extremely serious problem for an organization. Traditional supply chain risk management is based on the analysis of historical understanding of the level of impact of the event, and this approach, combined with the quantification of the level of risk in historical data, can, to a certain extent, be very good at coping with some common supply chain problems. In the face of rare and severe catastrophic events such as COVID-19, the traditional approach is difficult to quantify due to the lack of historical data, leading to severe losses for some companies.

Through COVID-19, people began to mathematically describe the supply chain through computer modeling and data analysis, shifting from focusing on what disrupts the supply chain to what disrupts the supply chain, and this computer modeling and data analysis approach makes their predictions more practical and forward-looking without shifting from the accident itself. This paper will focus on applying computer modeling and data analysis to avoid supply chain disruptions or to face supply chain disruptions during an epidemic.

2. Supply Chain Disruption

During the pandemic according to Accenture, 94% of Fortune 1000 companies experienced supply chain disruptions due to the pandemic. In the face of supply chain disruptions during the pandemic, traditional supply chain risk management predictions often do not work as well as they should. Due to the rapid development of technology, today's companies have a series of high-tech technologies such as computer modeling and data analysis, which can be very good for helping companies cope with and overcome the special environment. Supply chain disruptions. The optimization of data from computer modeling is fast-responsive and forward-looking, and such models can not only assess the risk of such disruptions but continuously update and learn to improve the enterprise's profitability.

For supply chain, supply chain is the connection or business linkage of various stakeholders before the goods reach the consumers; at the same time, clarifying the concept of supply chain disruption is an important prerequisite for the study of supply chain disruption, supply chain disruption refers to the failure of an enterprise's supply or demand cannot be met, at the same time, according to related research shows that supply chain disruption is due to the occurrence of major emergencies that lead to serious deviations in supply, demand, quality, cost and other aspects of the enterprise. This shows that supply chain disruptions are highly unpredictable. Unexpected events make the supply chain more vulnerable, and the whole supply chain system is difficult to operate efficiently and normally [1]. Traditional supply chain management is based on logistics tracking of goods, which makes the enterprise's knowability about the supply chain limited; in the popularity of COVID-19, this limited monitoring makes the enterprise face a huge risk of supply chain disruption; the enterprise must have a way to know still the latest events that happen in the case of most people in the society who work at home, and make a combination of these events to the supply chain methods. By collecting this data stream, we can integrate and detect social network time in real time, and this approach can help supply chain decision-makers make informed decisions about future changes in the commodity stock market. A generic architecture based on information technology and business synergy is also proposed in that paper, which combines NLP and machine learning techniques with sourcing expertise. Then, a general study of factors affecting raw material price volatility is conducted, and it is found that events affecting inventories are related to commodity supply and demand and macroeconomic conditions. Based on the case study of phosphate in the paper, it can be found that the establishment of a temporal search engine on social media data streams to detect events that may affect the price of phosphate in real-time and thus help enterprises to complete the prediction of the market price direction of phosphate, which shows that the collection and analysis of data can help enterprises to complete the prediction of the raw materials and the various links in the supply chain. During the popularity of COVID-19, due to human contact has become less, people get information more limited in the way of social software. Due to the lack of historical experience of COVID-19 events, it is difficult for people to rely on experience to make reasonable strategic decisions. Social software information has a rapid response; enterprises can determine the main types of the latest impact events through the monitoring and collection of data, summarize the latest experience and the main types of the events, and summarize the latest experience and the main types of the events. Types and summarizes the latest experience and possible development direction, so using AI-based data analysis and prediction is the best way to prevent the risk of supply chain disruption in an epidemic. As mentioned in the literature, this method can monitor the development direction of a link in the supply chain and make accurate predictions by combining the analysis of a large amount of data.

3. AI-Based Data Analytics for Mitigating Supply Chain Disruption

3.1. AI-Driven Solutions for Supply Chain Disruption

With data collection and analysis based on AI, it will be easier for enterprises to have an effective and highly time-sensitive source of information during an outbreak. Suppliers have a huge impact on the global supply chain during the ongoing spread of the outbreak. Suppliers are facing great operational pressure in this environment. Enterprises need to predict the results to cope with the risk of supply chain disruptions that may occur. Historical data for the enterprise Historical data has become irrelevant to the forecasting needs of the organization. Attempts to find appropriate data from previous crises are only partially effective due to differing market conditions. If a company continues to use traditional supply chain management methods to combat the risk of possible supply chain disruption, traditional management strategies and simple calculations often result in leaders focusing on strategic, high-fee suppliers that are important to the product while ignoring the risks posed by low-cost commodity suppliers. The result is that managers need to take the right actions, waste resources, and expose the organization to potential risks. This is especially true during epidemics, where companies often overlook unexpected events if they don't use mathematical modeling to

analyze data to address the risk of supply chain disruptions. During epidemics, when the situation is rapidly changing, new mathematical models can help managers make sense of the situation and analyze it as quickly as possible. The models can identify potential risks to help managers identify the highest-risk segments of the supply chain network. The highest-risk segments, and because of the nature of big data analytics, AI can help companies analyze or filter out the potentially disruptive effects of small probability events on the supply chain network, which allows companies to focus on identifying the highest-risk segments and mitigating their effects rather than trying to quantify the likelihood of small probability, high-risk events occurring [2]. For example, Ford Motor Company found through computerized mathematical modeling that the amount of money a company spends annually on each supply chain link has little to do with the impact on performance resulting from a condition occurring in that link. This shows that mathematical modeling can help companies to exclude some of the events that seem to affect the supply chain; the epidemic occurred during all kinds of events such as policy blockade, home office, etc., the traditional management approach will be classified as a high-risk event, but in this situation, the epidemic brought a high frequency of emergencies, which makes the company must focus on a small number of events if you take the traditional management approach, it will be difficult to face a large number of events [3]. If the traditional management approach is adopted, it will be easier to cope with many emergencies. Mathematical modeling and data analytics help companies to analyze the high frequency of emergencies and the expected impact of each link in the supply chain, so companies facing a large number of emergencies during the epidemic must use artificial intelligence data analysis and prediction, which allows companies to cope with the risk of supply chain disruption.

3.2. Digital Transformation and Big Data Analytics in Epidemic-Era

Companies need to incorporate a variety of information specific to the epidemic period to perform big data analytics during the epidemic and to mitigate the impact of irrelevant historical data on demand forecasting, industry-specific use of their external economic or financial indicators to quantify the causal relationship between them and the demand for their products, and their use of their predictive machine learning models [4]. While different industry vendors will recover gradually over time, companies' use of data analytics to address most of the challenges during the outbreak can make it simpler for companies to continue to grow or transform. For example, a data analytics-based dashboard can allow companies to visualize the location of their factories around the world, tracking changes in the outbreak and changes in policy, which can allow them to better This allows companies to make better decisions about which factories to reopen first to address the risk of supply chain disruptions, demonstrating the foresight and practicality of mathematical modeling and data analytics. This forward-looking and practical approach to mathematical modeling and data analytics can help companies identify, manage, and mitigate supply chain risks. This helps organizations avoid the impact of factors that could cause supply chain disruptions, such as widespread infections among employees of supplying factories or policy embargoes and directly addresses the causes of supply chain disruptions.

Not only did manufacturers improve data-driven decision-making by applying big data analytics during the epidemic, but data analytics also provided many opportunities to respond to the risk of supply chain disruptions by changing sales methods and marketing channels in response to changing demand. Many companies have accelerated their digital transformation in response to the pandemic, and data collection and analytics have provided information that has significantly reduced the risk of supply chain disruption for these organizations.

Another example is the food industry, where the time-sensitive nature of the supply chain has necessitated the adoption of AI-based data analytics and forecasting, which has helped companies improve transportation modes and delivery channels, as well as gather extensive information on customer satisfaction, which has allowed them to improve their resilience to risk and significantly increase customer satisfaction during the epidemic, thereby increasing their risk tolerance. This allows companies to improve their resilience during epidemics, as well as significantly improve

customer satisfaction, which in turn boosts product sales [5]. In a way, AI allows companies to reduce the fragility of their supply chain while improving their competitiveness. Data analytics and forecasting play an important role in the food industry to prevent supply chain disruptions. Based on the supply chain network, data analysis can gradually construct multi-objective models of fresh food for enterprises at different stages of the epidemic [6]. Since supply chains are characterized by complexity, dynamics, coordination, nonlinearity, and large scale, which apply to all supply chain enterprises, we first construct supply chain networks using data analysis to prevent supply chain disruption. Before the epidemic, most scholars solved the optimized supply chain model with cost and customer satisfaction as the goal, but after the epidemic, the optimization of network transportation and distribution for the supply network of fresh food while considering multiple goals of the supply chain network from the perspectives of economic, social, epidemic prevention, and network stability. This requires that we consider the robustness of each node in the network and its correlation with each other, whether the robustness of the overall supply chain is greatly affected when a node suffers damage, to enable enterprises to clearly and real-time grasp this information, enterprises must use mathematical modeling to mathematically describe the supply chain network, because, after the outbreak of the COVID-19 epidemic, the food industry suffered a great deal of "urgency" and "shortage" after the outbreak of COVID-19 epidemic, the use of mathematical modeling and big data analytics allows companies to improve the timeliness of problem-solving [6]. At the same time, this approach allows companies quick access to information and problem-solving capabilities, which helps them grasp the various nodes of the supply chain and make adjustments as quickly as possible when a problem arises at one of the nodes. As a result, using mathematical modeling data analysis and forecasting during COVID-19 can go a long way toward preventing the risk of supply chain disruptions.

It is obvious that the epidemic crisis accelerated the development process of digitalization and, at the same time, elevated the business model innovation to a new strategic height. The environmental dynamics of the epidemic crisis are not only an important starting condition for the ability to acquire big data resources but also play a positive moderating role in the relationship between the ability to analyze and integrate big data and the innovation of business models. The epidemic has triggered new environmental dynamics and changes in consumer habits, which makes small and medium-sized enterprises (SMEs) face great pressure for innovation and upgrading. Also, it pushes the production and lifestyle to digitalization, intelligence, and platformization [7]. According to the research, it can be learned that the enterprise's big data capability can significantly enhance the performance of small and medium-sized enterprises (SMEs) and that the capability of acquiring big data resources and analyzing and integrating them has a significant positive impact on the performance of enterprises [8]. The epidemic not only makes the enterprise face a huge supply chain disruption pressure but at the same time makes the consumer behavior habits; the application of big data analysis and prediction methods not only helps the enterprise to reduce their own supply chain disruption risk but also makes the enterprise comply with the direction of scientific and technological development. The dynamic nature of the epidemic crisis environment makes it a good opportunity for enterprises to develop digital transformation during the epidemic because not only is there special support from government policies during this period, but big data can also provide significant economic enhancement to existing business models, while at the same time, enterprises can also cope with the risk of supply chain disruptions that may occur during the epidemic, which is a win-win decision, no matter from what point of view you judge it [9].

Addressing the risk of supply chain disruptions that companies may experience during an epidemic through AI-based data collection and analysis is excellent. Firstly, during an epidemic, it is difficult for traditional management forecasting models to make accurate predictions due to the lack of previous cases of similar catastrophic events in society; according to the relevant research, 210 valid questionnaires were empirically examined using a questionnaire survey, and the results showed that big data analytics capabilities have a direct contributing effect on supply chain resilience [10]. Secondly, the ability to access big data resources enables companies to easily obtain internal and

external data resources to support their business, obtain enough professionals for data analysis, obtain professional equipment, and promptly update the required data, talent and technology. Integrating big data analytics also allows companies to process raw data to obtain high-quality information when multiple pieces of information about an epidemic strike and to monitor consumer behavior, product quality, and product performance during an epidemic. The information collection of consumer behavior, shifts in supply and demand of products and services, updates in production, management, and trading patterns in the supply chain, and government and social support through financial, monetary, and human resources during the epidemic. The turbulence generated by the epidemic and the large amount of data require AI modeling to construct the best data prediction model for data prediction. Finally, disruptive risks often have a domino effect on the supply chain, and traditional supply chain management can address disruptive risks by dealing with each relatively independent risk. However, most companies have used various off-the-shelf planning applications since 1980; there still needs to be better mathematical models to predict COVID-19, a rare and highly hazardous disaster. After COVID-19, people need to build more powerful and responsive mathematical models based on artificial intelligence for data collection and predictive analysis because this kind of mathematical modeling based on artificial intelligence shifted from focusing on the causes of supply chain disruptions to the factors of supply chain disruptions, so it has strong accuracy and practicality during the COVID-19 period and can play a more important role than in the day-to-day period. It can also be more forward-looking than traditional management forecasting during the day-to-day period, and companies need to promote and learn from this approach to better prepare for future risks.

4. Conclusion

The investigation of an event-based approach to improve commodities supply chain management, as described in Elliot Maitre, in which the best way for companies to deal with supply chain disruptions during outbreaks is to analyze data based on artificial intelligence, has led to the conclusion that the best way for companies to deal with supply chain disruptions is to analyze data based on artificial intelligence. The investigation of an event-based approach to improve commodities supply chain management, such as the investigation of an event-based approach to improve commodities supply chain management by using artificial intelligence to build a data streaming event detection model to assist experts in predicting changes in commodity prices to improve the prediction of supply chain disruptions, as mentioned in Elliot Maitre. This type of learning is even more important for organizations during an outbreak to deal with the risks that may come their way, as the approach relies on an advanced AI engine that can continuously learn and update to achieve continuous intelligence and optimal decision-making. Organizations can use traditional supply chain risk management during normal times to help them make the best decisions. Still, during an epidemic when everything changes rapidly, AI-based data prediction modeling is the best and only way to help the organization survive.

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