Implementation of Bigdata Techniques in Supply Chain Management: Evidence from Predictive Analytics

Fanrong Liu
Eurasia Internation School, Henan University, Kaifeng, China

Keywords: Bigdata Analysis, Supply Chain Management, Risk Management.

Abstract: Supply chain management (SCM) is changing as a result of several technologies that are propelling significant digital trends. Numerous supply chain situations, such as demand forecasting, supplier management, risk management, transportation management, and sales and marketing analysis, make use of big data analytics. Supply chains are changing as a result of big data analytics breakthroughs that enable these connections. This study summarizes the progress with an emphasis on the supply chain's two modules of risk management and prediction analysis. In addition to analysing the tenets and outcomes of big data analysis technology in these two connections, this article highlights the significance of predictive analysis and risk management modules in supply chains. This research delves into the difficulties that predictive analytics and risk management encounter while utilizing big data analytics, as well as the future prospects. Overall, these results offer a synopsis of the constraints and potential applications of big data analysis in the two fields.

1 INTRODUCTION

Oliver and Webber made their original proposal for supply chain management (SCM) in 1982. Supply chain challenges are getting more and more complicated in today's globalized world, where there is an increasing need for innovation, diversity in products, and offshore manufacturing. International material and financial flows, foreign policy, responsibility for society, economic dangers, and other intricate processes are among these complicated frameworks. In this case, SCM continues to be an area that requires substantial scholarly attention (Yalcin, Shi & Rahman, 2020). Over the past ten years, the supply chain has seen a significant transformation, evolving from a merely operational function to an autonomous supply chain management function. The supply chain management role now prioritizes sophisticated planning techniques including analytical demand planning; ensure sure that supplier and customer operations are connected. Furthermore, partner cooperation and trust are highly valued in supply chain management (Attaran, 2020). Businesses have been driving the development of Big Data Analytics (also known as BDA) for supply chains (SC) over the past few years because of the increasing demand in big data. The goal of SC is to obtain valuable information that will improve their ability to estimate, anticipate, and identify hidden patterns—all of which will increase their competitiveness. This most recent development offers companies fresh chances to develop new trade patterns and improve current operations, which will help the market but also present unforeseen difficulties (Chehbi-Gamoura et al., 2020).

SCM unifies supply and demand management both within and between businesses. The supply chain management process begins with the purchase of raw materials. The product manufacturer's supplier obtains the raw ingredients. The manufacturer provides the finished product after refining the raw material. The product's distribution is beneath the distributor's control. Customers usually purchase things from merchants, while retailers get these products from wholesalers (Taj et al., 2023). Superior supply chain performance has strategic importance since it can result in quick financial gains, increased earnings and productivity, and advancements in important worldwide competitive advantages. The impact of the digital economy on supply chains is significant. The digital economy, which conducts commercial activity both online and on mobile devices, is built on electronic computing technologies. In this economy, connections between individuals, devices, channels, and organizations, all made

Liu, F.
Implementation of Bigdata Techniques in Supply Chain Management: Evidence from Predictive Analytics.
DOI: 10.5220/0013208100004568
In *Proceedings of the 1st International Conference on E-commerce and Artificial Intelligence (ECAI 2024)*, pages 143-147
ISBN: 978-989-758-726-9

possible by technology, create value. Customers explore and purchase products using digital channels like social media, mobile networks, and e-commerce. Customers can purchase whenever and wherever they choose, tailor their requirements to their specifications, and anticipate delivery in a few days. Businesses are able to get real-time data about the locations, products, and methods of consumers' purchases, and customized product delivery is starting to spread over the world. The transformation of traditional supply networks is imperative in the digital age. Important components of supply chain operations are currently digitizing more quickly. Innovation and technology are two major aspects influencing how the supply chain is evolving. With the use of contemporary technologies like big data, the cloud, IoT, and sophisticated computing driven by algorithms that utilize machine learning, intelligent digital models of supply chains are being produced. These technologies are starting to replace traditional supply chain structures. Shorter response times, increased collaboration, improved visibility, and better insight are all made possible by this new digital supply chain (Attaran, 2020).

Big data analytics techniques can be used to analyse the data gathered by numerous businesses in order to create business growth plans, forecast market instructions and simulate the manufacturing process, optimize delivery, manage inventory, reduce risk, and carry out numerous additional supply chain tasks like marketing and sales procedures. In the framework of big data technology, this article examines the pertinent uses of risk management and predictive analytics in the supply chain and offers opinions on their drawbacks and future directions. The application scenarios of SCM and big data technology are introduced in the second section. The theory and findings of the supply chain prediction analysis are presented in the third section. An introduction to risk management application is provided in the fourth section. Lastly, an analysis is conducted regarding these two application scenarios' future development and constraints. This work began the literature review by searching electronic databases, such as ScienceDirect and Google Scholar, among others. Using different keyword combinations such as "risk management," "supply chain management," "predicting analytics," "applications," and "positive effects" ensures a comprehensive search of academic journals, conference proceedings, and related publications.

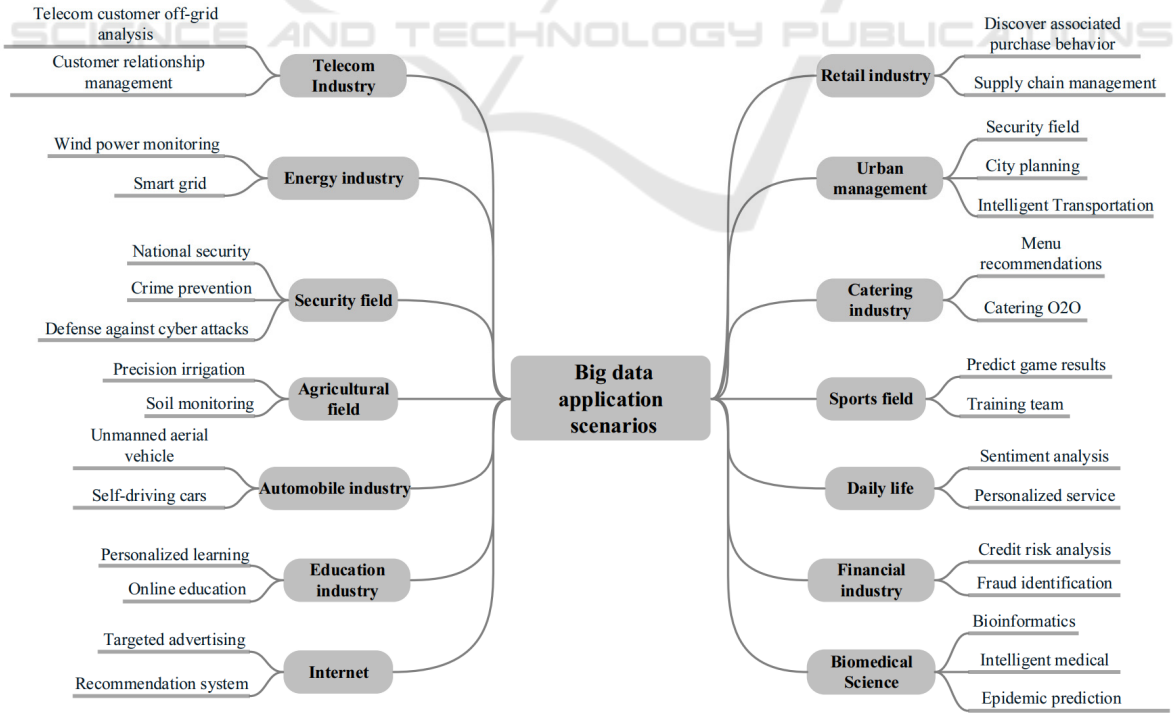

Figure 1: Big data application scenarios (Wang et al., 2020).

2 DESCRIPTIONS OF BIGDATA

The advent of big data, one of the key themes of this century, is a result of recent information technology advancements. Big data, describes the practice of businesses gathering vast volumes of data from various sources. This data is analyzed by sophisticated computer systems to provide business insights that can boost the organization's productivity(Albqowr et al., 2024).

Big data technologies can advance scientific research and increase production efficiency. Innovative algorithms are needed to tackle certain difficult and complex jobs that are outside the scope of conventional methods. Big data technology has permeated every area of people's life and been used in a wide range of sectors (including energy, sports, entertainment, banking, Internet, catering, and healthcare). Fig. 1 illustrates how big data is used in a variety of sectors. (Wang et al., 2020) The ideas and outcomes of pertinent application scenarios of risk management and predictive analysis in the context of big data in the supply chain will be the main topics of this presentation.

3 PREDICTIVE ANALYTICS

The application of statistical algorithms, machine learning, and data mining approaches to historical data analysis and future event or trend prediction has been referred to as predictive analytics. Predictive analytics offers a proactive solution to supply chain management (SCM) problems such inventory control, supply chain interruptions, and fluctuating demand (Oyewole et al., 2024). Early supply chain management (SCM) predictive analytics research concentrated on simple forecasting techniques that relied on historical data and employed straightforward statistical models for computations. More advanced predictive analytics methods have been developed as a result of improvements in processing power and data storage. Understanding the fundamental terms and concepts is crucial to comprehending the predictive analytics environment in supply chain management. Machine learning, data mining, and predictive modeling are essential elements. The predictive analytics environment inside SCM is depicted in the Fig. 2.

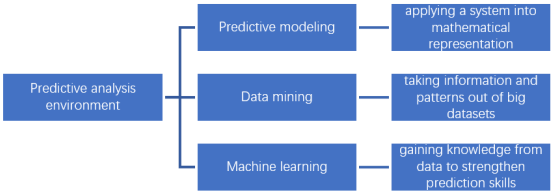

Figure 2: Predictive analysis environment.

The application of predictive analytics in the supply chain visibility, inventory management, and demand forecasting domains of supply chain management (SCM) has been the subject of numerous research that have looked at its practical ramifications. These domains range from more conventional statistical methods to more sophisticated artificial intelligence (AI) and machine learning algorithms. These studies offer insightful information about applications that are successful, difficulties encountered, and the overall effect on supply chain performance. Utilizing past data, current market conditions, and outside variables, predictive analytics creates complex models that increase the precision of demand projections. These models can optimize inventory levels, predict changes in client demand, and streamline production procedures. Accurate data integration and information exchange improve supply chain performance by lowering inventory and squeeze, improving demand visibility, and reducing inventory. One of the most important components of an efficient supply chain is inventory management optimization. Analytics that predict Determine the ideal inventory levels by looking at lead times, past sales information, and outside variables that impact demand. Organizations can use sophisticated algorithms to find patterns and connections that help them decide on order quantities, safety stock levels, and stock replenishment. A primary advantage of implementing predictive analytics is enhanced visibility across the whole supply chain. Predictive analytics provides firms with information on supplier performance, the efficiency of their transportation, and general logistics management, enabling real-time tracking of critical supply chain indicators.

Simultaneously, the elasticity of the supply chain and overall efficiency are enhanced by the control of potential hazards. Estimating future demand, optimal utilization of inventory, and supply chain transparency are just a few real-world examples of how predictive analytics can revolutionize supply chain management processes. These applications, which demonstrate the significant advantages of predictive analytics in SCM processes, are not merely

theoretical ideas; rather, they are supported by actual data and real-world instances.

4 RISK MANAGEMENT

Any supply chain that has to make decisions while dealing with uncertainty does so in part by using a risk management strategy. Information ignorance is the source of risk, and many risk factors (e.g., COVID-19), are uncontrollable by humans, but big data analytics may help us create a robust supply chain system that can strengthen the information system and reduce risk (Araz et al., 2020). Big data analytics can generally be used to protect against hazards associated with shipping, default between merchants and suppliers, dangerous chemicals during the connection between recyclers and remanufacturers, and environmental harm (Ghalehkhondabi et al., 2020).

Risks in supply chain management (SCM) include globalization, shorter product life cycles, demand forecasts, cost pressures, outsourcing, and offshore. The business environment is become more uncertain as a result of the increasing complexity of SCM and networks. These are supply chain risk events that have an impact on the network as a whole. An indication of a potential disruption to the supply chain is a risk event. Global supply chains are more vulnerable to risk and confront several obstacles. Increased openness and information exchange amongst supply chain actors are necessary for this. Globalization and nations' economic interactions with partner nations have altered global production methods. Each of these raises the supply chain's risk and complexity. Distribution centers are another name for distribution centers in contemporary global supply networks. The needs of buyers are fulfilled at the operations center. Because their effectiveness influences the overall SCM value, these centers must be efficient. Pay close attention to how the disaster affects the supply chain and make sure it has an effect on operational performance as well. In the current global marketplace, supply chain interruptions and the related risks to operations and finances are among the most urgent problems affecting rival businesses. Still, there's a distinction between danger and disruption. An indication of supply chain risk is disruption. However, the risk is still remained unaffected (Gurtu & Johny, 2021).

5 LIMITATIONS AND PROSPECTS

Supply chain management is now much more efficient thanks to big data analysis. Although supply chain management can benefit greatly from predictive analytics, there are certain drawbacks to its application. First, historical records provide the data. Inadequate historical data can have an impact on how well predictive analysis works. The second issue is a compatibility issue brought on by predictive analysis tool upgrades. It will be possible to thoroughly examine how the forecasting tool improvement affects the forecasted results in the future.

There are also restrictions on this paper's use of risk management. This document only chooses a small number of key phrases; an article may go unresearched if it does not have the word "risk" in its title, keyword, or abstract. Further research on particular under- or undiscovered areas can be conducted using the summary results of this paper. It is anticipated that this study of the literature will help scholars investigate supply chain risk management (SCRM) more thoroughly. The way supply chains function across industries will continue to change as a result of these applications. Supply chains will depend more and more on big data analytics as technology continues to change the world around us. This will increase the reliance of these networks on ubiquitous digital information at every link. Big data analytics will play a significant role in the ongoing development and improvement of the supply chain. It may also provide solutions to the various issues that various sectors are facing as a result of market trends. The foundation of the world economy, supply chains promote trade, consumption, and growth in the economy.

6 CONCLUSIONS

To sum up, the foundation of the world economy, supply chains promote trade, consumption, and growth in the economy. The rapid advancement of modern information technology has made data an essential basis for the development of manufacturing supplies and techniques. In this study, the architecture of big data services, some existing big data application scenarios, and predictive analytics based on big data and risk management services are analysed. This study first provides an overview of the history, state of development, and future prospects of SCM. The big data analysis technology and its

application scenarios are then briefly introduced. Next, this study presents the use of big data in two supply chain components: risk management and predictive analytics. This study concludes by summarizing the drawbacks and potential applications of big data analysis to these two areas.

REFERENCES

Albqowr, A., Alsharairi, M., Alsoussi, A., 2024. *Big data analytics in supply chain management: a systematic literature review.* VINE Journal of Information and Knowledge Management Systems, 543, 657.

Araz, O. M., Choi, T. M., Olson, D. L., Salman, F. S., 2020. *Data analytics for operational risk management.* Decis. Sci., 516, 1316.

Attaran, M., 2020. D*igital technology enablers and their implications for supply chain management.* Supply Chain Forum: An International Journal, 21(3) 9258-172.

Chehbi-Gamoura, S., Derrouiche, R., Damand, D., Barth, M., 2020. *Insights from big Data Analytics in supply chain management: an all-inclusive literature review using the SCOR model.* Production Planning Control, 315, 375.

Ghalehkhondabi, I., Ahmadi, E., Maihami, R., 2020. *An overview of big data analytics application in supply chain management published in 2010-2019*. Production, 30, e20190140.

Gurtu, A., Johny, J., 2021. *Supply chain risk management: Literature review.* Risks, 91, 16.

Oyewole, A. T., Okoye, C. C., Ofodile, O. C., Ejairu, E., 2024. *Reviewing predictive analytics in supply chain management: Applications and benefits.* World Journal of Advanced Research and Reviews, 213, 568-574.

Taj, S., Imran, A. S., Kastrati, Z., Daudpota, S. M., Memon, R. A., Ahmed, J., 2023. *IoT-based supply chain management: A systematic literature review.* Internet of Things, 24, 100982.

Wang, J., Yang, Y., Wang, T., Sherratt, R. S., Zhang, J., 2020. *Big data service architecture: a survey*. Journal of Internet Technology, 212, 399.

Yalcin, H., Shi, W., Rahman, Z., 2020. *A review and scientometric analysis of supply chain management SCM.* Operations and Supply Chain Management: An International Journal, 132, 123.