

An analysis of the application of digital technology in the supply chain

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Abstract. In the digital age, big data, blockchain, artificial intelligence, cloud computing and other information technologies are widely used in society. Based on the related literature on digital technology from 2013 to 2022, this paper summarizes digital supply chain management. It analyzes the specific application of digitization in the supply chain and summarizes the social, environmental and economic performance brought by the combination of digitization and supply chain for enterprises. This study is a systematic review, on the one hand, it can sort out the research ideas of digital technology and supply chain management from a theoretical perspective, and on the other hand, it will help the supply chain management practice of enterprises.

Keywords: Supply Chain, Digitization, Performance.

1. Introduction

The supply chain has been continuously improving since its birth. Former scholars have studied the combination of information technology and supply chain, such as material management technology, bar code technology, and material procurement informatization. However, although the combination of information technology and supply chain has been perfected, it still cannot effectively solve some of the risks and difficulties faced by supply chain management. To improve digital management. This research is innovative in content, and the research is generally oriented to the combination of digitalization and information technology. This research expounds on the impact on the supply chain from the perspective of digitalization and intelligence. The development of today's digital technology has had a great impact on the supply chain. This study summarizes it, which is meaningful for the practical application of supply chain management.

This research used a review to study the operation mode of the digital supply chain to illustrate the positive impact on the operation mode of the digital supply chain and to better promote the management of the digital supply chain. The research first expounds on how four types of digital technologies, artificial intelligence, cloud computing, blockchain, and big data, affect supply chain management. Secondly, according to the impact of the above digital technology on the operation mode of the supply chain, the research is carried out. Then according to the improvement of the supply chain of digitization and then show its impact on the environment, society, economy and so on. Finally, the research is summarized and reviewed.

2. Method

The data of this paper comes from the Web database, and 529 articles are retrieved with the themes of "digitization" and "supply chain". The above deadlines are all defined as April 1, 2022, and the number of documents per year is shown in Figure 1. It can be seen that digital supply chain management has gradually become a research hotspot in recent years.

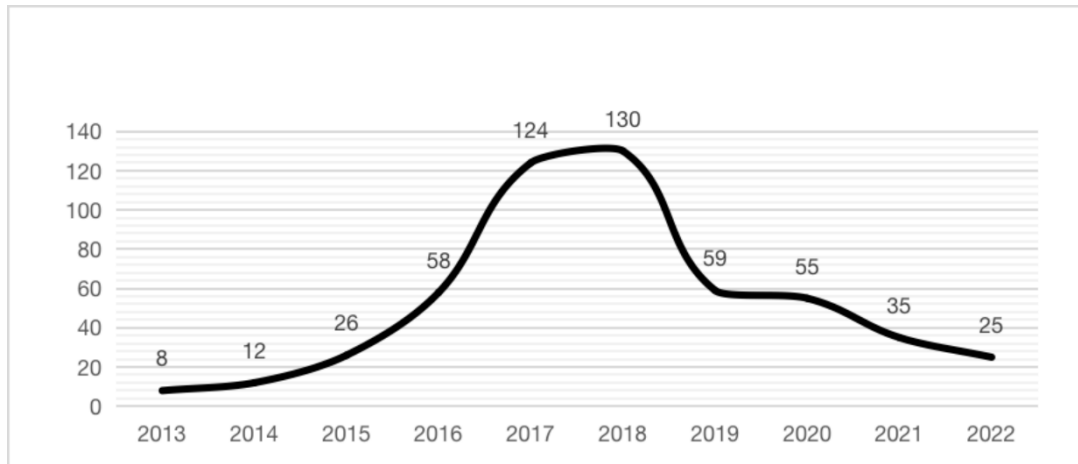


Figure 1. The number of documents per year

In order to refine the core issues of current digital management research in academia, the co-word clustering method is adopted, Bibexcel and Ucinet software are used, through document format conversion, data preprocessing, word frequency number distribution and growth statistics, co-word association statistics, clustering data mining The 6 steps of the theoretical literature title, extracted 7 adjacent words of supply chain uncertainty management, artificial intelligence, cloud computing, blockchain, big data, logistics, procurement, performance as 3 research topics, as well as digital application, performance impact 2 secondary research themes, and 2 primary research themes of digital technology and operation model of the digital supply chain. For documents that do not contain 7 adjacent words or that involve two or more topics, they are classified into the research topic with the highest degree of membership according to their main content, and do not count repeatedly; if they do not belong, they will not be considered as invalid data.

3. Results

3.1 Digital technology

3.1.1 Artificial intelligence

Artificial intelligence is intelligence manifested by machines made by humans. Generally artificial intelligence refers to the technology of rendering human intelligence through ordinary computer programs. Artificial intelligence is applied in medicine, wireless communication, Internet technology, etc. In the supply chain, artificial intelligence can analyze large amounts of data, improve productivity, and improve efficiency.

3.1.2 Cloud computing

Cloud computing is a type of distributed computing, which refers to decomposing huge data computing processing programs into countless small programs through the network "cloud", and then processing and analyzing these programs through a system composed of multiple servers. The applet gets the result and returns it to the user. At present, cloud computing has been widely used in e-commerce, education, medical and other fields. In supply chain management, cloud services provide flexibility and the ability to manage suppliers.

3.1.3 Blockchain

Blockchain is a securely shared decentralized data ledger. Blockchain technology is currently used in the financial industry to provide trusted platform services. The blockchain creates a unique record of every transaction that occurs in the supply chain.

3.1.4 Big data

Big data is the amount of data involved that is too large to be captured, managed, processed, and organized into information that can help companies make more positive business decisions within a

reasonable time through mainstream software tools. Big data is mainly used in urban traffic management, education, biomedicine, smart home, financial industry, retail and other fields. The application of big data technology in supply chain management can improve production capacity, assist manufacturers to adjust production lines of construction enterprises, accurately identify existing resources, and avoid waste of resources.

3.2 Operation Model

Xue proposed the decentralized operation of the supply chain driven by blockchain technology from an information sharing perspective[1]. Jan Holmström, Contributions of the special issue articles are summarized to conceptualize digital artifacts as digital genes that encompass related physical objects, use such digital genes to redistribute activities across organizations and geographic environments, and facilitate the interaction of digital artifacts with external environmental outputs[2]. Zvonko Merkaš combines blockchain technology with the logistics sector, pointing out the significance of blockchain in the digital transformation of logistics and transportation[3].

3.2.1 Logistics

Logistics is an information-intensive sector, and different logistics categories require multiple types of forms. Traditional logistics management typically involves manual data entry, and therefore, is prone to fraud in the process. Logistics usually involves a lot of cooperative departments, and the whole process is cumbersome. Therefore, departments are prone to shirk responsibility and corruption. Achieving supply chain transparency is a challenge. The logistics chain usually spans hundreds of geographic locations, and it is difficult to track the status and origin of goods on the logistics chain, which leads to trade frictions.

As a digital technology, blockchain has the characteristics of immutability, and the combination of the logistics sector and blockchain makes it more stable. More cost savings through more efficient, simpler and more automated processes. By building a procurement information management network platform for the company's global system, one-stop management is carried out to centralize the scattered procurement personnel and reduce the cost of personnel dispersion. Combined with digital analysis techniques to build a supplier evaluation standard system, to carry out a comprehensive control of the entire life cycle of suppliers' products, reconstruct the production process of the enterprise and achieve unified standardization. By continuously selecting suppliers, increasing the number of high-quality suppliers and reducing the total number of suppliers, to ensure that the purchased goods achieve the best price/performance ratio, and ensure the optimization of the total cost of ownership (TCO) of the purchased goods. Discover inefficiencies and price changes in the procurement process with analytics and insights, and provide visibility to business, procurement, and finance staff on procurement cost allocations and real-time cost savings progress. And provide the optimal procurement cost optimization plan. The supplier performance evaluation process is shown in

Figure

2.

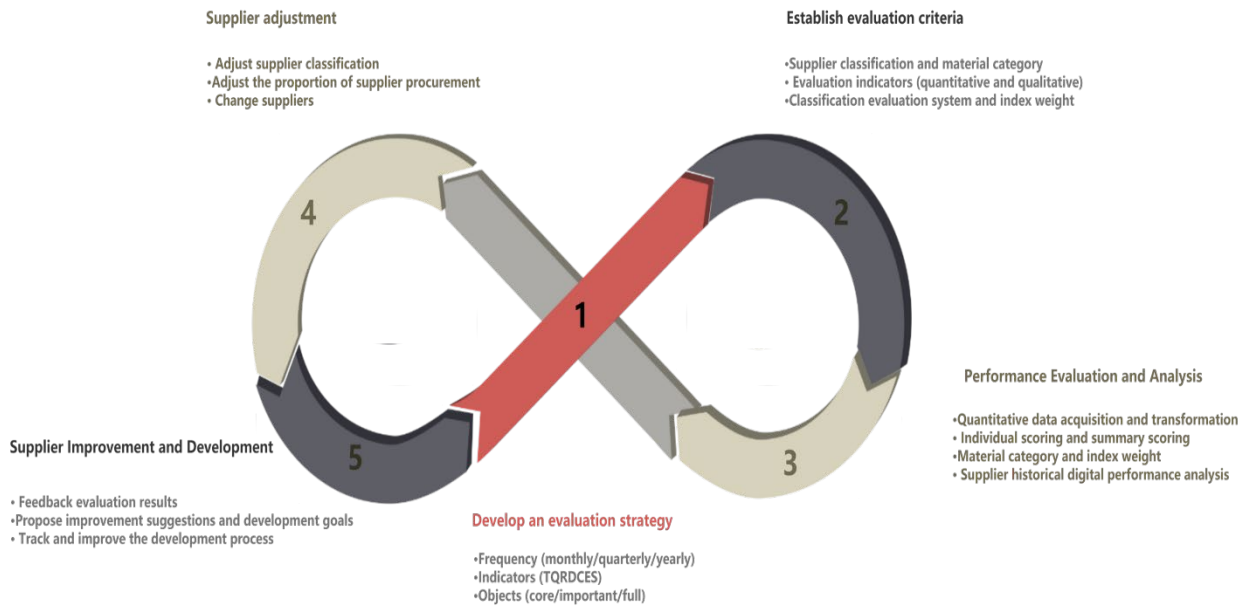


Figure 2. Supplier Performance Evaluation Process

Using blockchain technology, the entire purchase and sales process is tracked, recorded, and transparently managed from the generation of procurement, to sourcing, price inquiry and price comparison negotiation, ordering, transaction, payment and logistics tracking. For example, Carrefour labels certain products, such as tomatoes, oranges, fresh micro-filtered milk and Rocamadour cheese, with a QR code that consumers can take with a smartphone to find out where the food came from.

3.2.2 Procurement

The increasing importance of digitization in the procurement arena for handling virtual information flows and automating transactions. Most companies employ multiple forms of core procurement technologies that combine functions such as spend analysis, e-procurement, contract management, and e-procurement (e-catalog, e-invoicing, etc.). Companies create vast amounts of data, often stored in data silos by department or function as defined by the term big data. The process of using big data analysis is shown in Figure 3. When it is not used or developed to extract business insights and value, it is referred to as “dark data” [5]. If data remains unstructured in silos, companies cannot extract value and insight. The core of the big data concept is to improve the decision-making ability and decision-making speed of enterprises. Valuable data can be extracted to help improve many areas of the business, including business processes, management development, improved capacity planning, and optimization of supply networks [6]. Big data involves a range of technologies that manage, structure, and use data in a variety of ways, including processing large amounts of data with high precision in a shorter period [5].

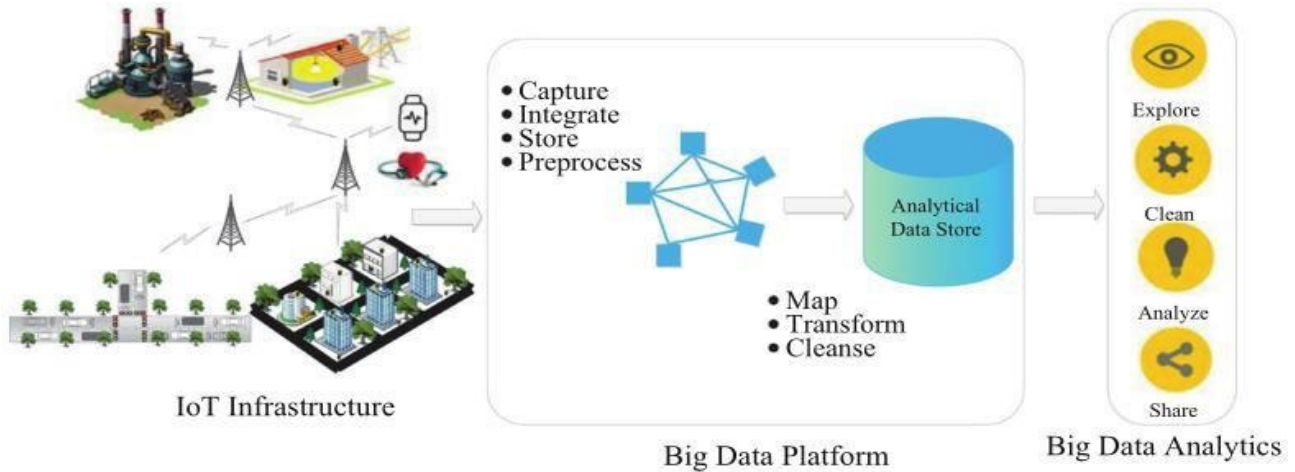


Figure 3. Big Data Analytics[4]

The internet of things (IoT) is a fast-growing segment of sensing and data collection devices that may disrupt areas of supply chain management[5].IoT brings further incremental changes to businesses and consumers through the connection between physical objects [7]. IoT includes the use of sensors, actuators, and data communication technologies built into physical objects (e.g., various types of RFID tags, including environmental sensing tags, wireless sensor networks, GPS, etc.) to help identify physical objects, track and trace, coordinate or control their movement on the Internet [8]. Data generated by these technologies will be collected, routed through internet-based cloud storage, and then analyzed by relevant information systems. As a result, the amount of available information required for the decision-making process is greatly increased. As supported by previous research, various technological applications enable companies to efficiently process large amounts of data [9]. Typical IoT structure in supply chain is shown in Figure 4.

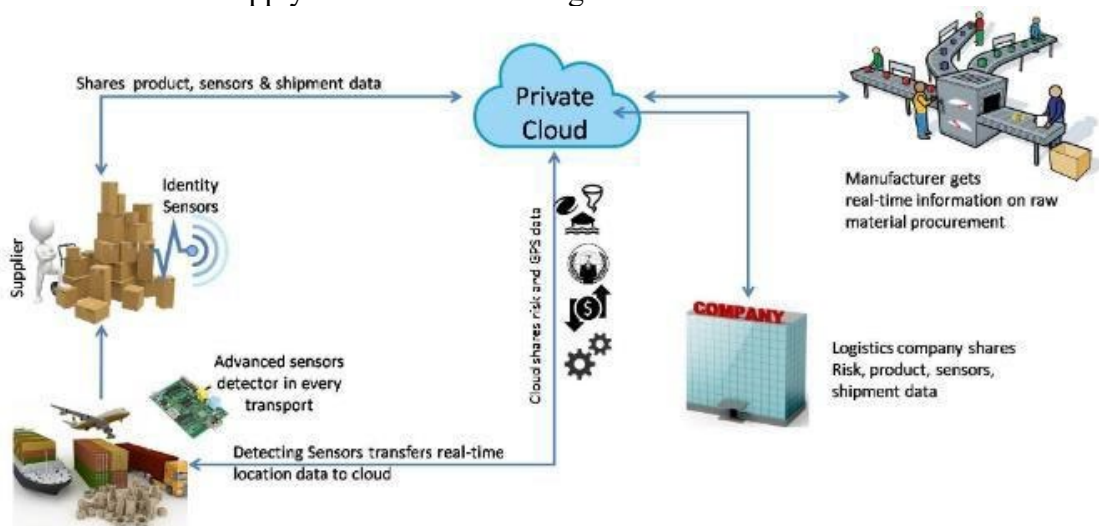


Figure 4. Typical IoT structure in supply chain[10]

3.2.3 Sales

The traditional marketing theory focuses on selecting the correct target market and trying to obtain as much sales revenue as possible with the most limited social market network system construction cost, but it has encountered huge challenges in marketing practice. Because traditional market theory is deeply affected by geographical conditions and means of transportation. Building a wide-scale market network must cost a lot. At present, the main purpose of raising funds for many enterprises is to expand the scale of the market network, which can be seen from the huge cost. Generally speaking, the key for enterprises to reduce overall production cost is to increase sales volume, and the inevitable choice for enterprises to increase sales volume is differentiated sales. However, differentiated sales cause operating costs to rise. In modern society, with the development trend of commodity

diversification and personalized products, it is constantly strengthened. The traditional production model creates personalized products for each customer with expensive production costs, thus rejecting the requirements of many customers for personalized products.

Using big data analysis, enterprises can conduct 360° big data terminal management, terminal not only detailed information (such as location, type and level of data information, etc.), but communicates with each person to process and end all marketing data information (including Ordering, delivery, product sales, etc.) can all be solved in the information system. Using big data analysis of this part of data information, enterprises can also form a comprehensive understanding of end users, thus providing corresponding resource guarantees. Moreover, due to the use of big data analysis of lost customers, companies can also understand where the customer's product is lost, and why the customer inquired about the product and could not understand further, because the product did not meet the demand, or because the product price was too high, even because of the unprofessionalism of the business staff. The company can summarize, track, revisit and analyze the lost customer information, identify the factors of loss, and repair it as much as possible. For old customers, the company can keep interacting with them, predict their next shopping date according to their shopping situation, and realize secondary sales. Achieve high transparency.

3.3 Performance analysis

Qi Yudong and Cai Chengwei used the method of text mining, based on the annual report information of Chinese non-high-tech manufacturing listed companies from 2011 to 2018, constructed indicators to measure the degree of digitalization of enterprises, and examined the multiple influences and mechanisms of the degree of digitalization on enterprise performance according to the resource-based view[11]. believes that digital technology can improve the economic performance of enterprises. It believes that the essence of the digitalization process of an enterprise is a process in which digital technology is deeply embedded in management, sales and production activities, and the intelligent coordination of the above three activities is ensured through digital technologies such as ERP and PLM. In sales activities, companies use digital technology to regroup and optimize resources, transform current production and sales models, existing products, and create new products to respond to competitors' actions or to respond to market opportunity windows. In this process, (1) CRM, DT and other digital technologies can discover potential consumer needs, build product communities, optimize advertising models, and direct online sales, which can increase the accuracy of promotions, reduce promotion costs, strengthen brand value, improve product differentiation, and bring enterprises and consumers closer. (2) Digital technologies such as OA and Hadoop not only support one-way information transmission but also support distributed offices and actively push information. Digital technology can not only break the constraints of space and delay in information transmission, but also overcome Information barriers between departments can achieve hierarchical penetration and overall mastery, ensure the dynamic synchronization of knowledge and information within the enterprise, and help enterprises to respond quickly to market changes. (3) PLM, ERP and other technologies ensure the transformation of enterprises into sales-oriented, improve the enterprise's responsiveness to market changes through instant feedback and overall coordination, and transform the traditional manufacturing industry's "production before sales" into "production based on sales", or even It is the integration of production and sales, which greatly reduces the cost of inventory, and is finally reflected in the way of business model innovation. Taken together, digital technology drives business model innovation by shortening the distance between companies and consumers, reducing management decision-making processes, and reducing production uncertainty[11]. And with data as the core, different peripheral nodes are reduced, and information transmission is changed from linear to mesh. Through digitization, the efficient coordination of the supply chain can be realized, and new marketing ideas can be created. The application of digitalization can replace both manual labor and mental labor. The introduction of robotic process automation will reduce the average processing time of orders to 10% of the original. Through process optimization, the "short chain" operation of the supply chain is realized.

How a company creates value in its products, how it interacts with suppliers, partners, customers, and how to cooperate more in international markets are important. Digitization can improve the coordination ability of the supply chain through information sharing, improve the dynamic ability of the supply chain through information sharing, and avoid social problems such as trade frictions. And digital intervention improves the transparency of digitalization, makes information public, and eliminates social injustice. The digital supply chain can protect the environment to a certain extent and meet the needs of society by promoting the electrification of daily work (paperless), saving green materials, and promoting green and low-carbon development. Digitization can realize intelligent prediction and analysis of optimal suppliers and contract prices, establish a predictable supplier collaboration model, and use artificial intelligence and applied cognitive computing to analyze and predict the price and cost of both parties in the negotiation, to control negotiation risks and reduce them. Purchasing costs, compliant and applicable terms will be automatically identified in the contract signing process to ensure compliance, transparency and social responsibility. Enterprises care about promoting good social, economic, and environmental development, and at the same time, enterprises can obtain greater benefits. Improved social and environmental performance.

4. Conclusions

This article first briefly introduces artificial intelligence, big data, cloud computing, and blockchain in some digital technologies, and then elaborates on the shortcomings of logistics, procurement, and sales in the supply chain, and combines them with digitalization. In order to improve, through the combination of specific examples and icons, it expounds on the significance of the combination of digitization to supply chain management. Finally, through the analysis of economic, social and environmental performance, reflects the combination of digitization and supply chain for enterprises and society. improve.

Since the digital supply chain is still in a process of continuous development, and the corresponding research is still in the development stage, the research in this paper also has limitations, mainly in the following aspects:

(1) This paper only analyzes the three aspects of procurement, logistics and sales in the supply chain, and does not comprehensively cover the overall process of the supply chain.

(2) The digital supply chain is still in its infancy, and this research is not sufficient for specific companies. As a result, only part of the company's initiatives and results are analyzed.

(3) The supply chain and the digital technology mentioned in this article, or its combination with emerging digital technologies, are still in the process of rapid development. There are still many digital technologies that have not been included and have certain limitations.

The following visions are made for the future: This article expounds on the specific application of digitalization in the three links in the supply chain and will focus on integrating the whole process in the future. The integration of physical supply chain links and digitalization, and then an in-depth analysis of the impact of sustainability. For the difficulties and bottlenecks not mentioned in other links, we will analyze and solve them in more dimensions.

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