

Disruptive technologies in supply chain management such as artificial intelligence and blockchain

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Abstract

Currently, Artificial Intelligence can be used to collect and analyze real-time data, enabling faster and more accurate decision-making, as well as enabling the identification of patterns and trends in consumer behavior. On the other hand, blockchain is a technology that allows for the creation of a decentralized and secure record of transactions, providing greater traceability and transparency in the supply chain. By using these technologies, it is possible to improve operational efficiency, reduce costs, and increase customer satisfaction, as it is possible to identify and resolve problems more quickly and efficiently. The overall objective of this scientific article is to demonstrate the impact of disruptive technologies on supply chain management and how these technologies can improve the efficiency, transparency, and sustainability of logistics operations. In conclusion, the research indicates that it is essential for companies to be prepared to deal with the challenges and opportunities that these technologies present. To do so, companies must have already developed an understanding that these technologies and their applications in supply chain management provide credits for decision-making and add value to everything they produce, especially with regard to improving the supply chain. Keywords: Disruptive Technologies, Supply Chain, Artificial Intelligence.

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1. Introduction

Supply chain management is a complex activity that involves various processes, from raw material acquisition to delivery of the final product to the consumer. In this context, efficiency and transparency are essential to ensure the competitiveness and sustainability of companies. However, supply chain management is also supported by several challenges, such as lack of visibility, chain complexity, supplier diversity, and lack of trust among the involved parties. To overcome these challenges, companies have resorted to disruptive technologies such as artificial intelligence and blockchain.

Artificial intelligence can be used to automate and optimize various processes throughout the supply chain, from demand forecasting to inventory and logistics management. On the other hand, blockchain has the potential to increase transparency and trust in the chain, ensuring the integrity of transactions and simplifying bureaucratic processes such as documents and payments.

To achieve this objective, a comprehensive literature review on the topic was conducted to understand the historical evolution and main applications of these technologies in supply chain management. The overall objective of this scientific article is to demonstrate the impact of disruptive technologies on supply chain management and how these

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technologies can improve the efficiency, transparency, and sustainability of logistics operations. Additionally, we aimed to analyze the main difficulties faced by companies in adopting these technologies and propose recommendations for effective implementation.

The specific objectives are: to identify the main disruptive technologies used in supply chain management, focusing on artificial intelligence and blockchain; to analyze the applications of these technologies in supply chain management, identifying their benefits and challenges; to verify the degree of adoption of disruptive technologies by companies in supply chain management; and to identify the main difficulties faced by companies in implementing disruptive technologies in supply chain management, based on the results obtained in the literature review.

This article is structured into four topics. The first topic presents the introduction, highlighting the objectives of this research. In the second topic, a theoretical foundation is developed that briefly describes how disruptive technologies in supply chain management, such as artificial intelligence (AI) and blockchain, have been the subject of much study and discussion in recent years.

The third topic discusses the methodology used in the article, which involved the study of various scientific sources such as books, scientific articles, periodicals, newspapers, and scientific journals. In the fourth topic, the final considerations are presented.

2. Material and methods

Regarding the approach, this is a qualitative research and the research procedure consisted of a literature review. According to Minayo and Costa (2019, p. 64), qualitative research has as its raw material a set of nouns whose meanings complement each other: experience, lived experience, common sense, and action. And the movement that informs any approach or analysis is based on three verbs: understanding, interpreting, and dialectizing [1].

In the selection of the works that underpinned this research, opinions from older studies were combined with opinions from more recent studies, always taking into consideration their relevance, quality of material, and applicability to the subject in question.

The main documents investigated included books, scientific articles, journals, newspapers, and scientific magazines. These documents were classified into two categories: current reading and reference.

Among the contributions that were researched, the works of authors such as Lambert (1998), Ballou (2006), Corrêa (2019), Rometty (2021), Sharma et al (2021), and Alarifi et al (2022) stand out.

It is known that a good theoretical basis is the foundation for being able to look at the bibliographic data collected and develop our study beyond what reality simply shows us. Therefore, the mastery of the researched authors helped our creativity, as it was possible to learn what was produced on our object of study and the advances made regarding it.

3. Literature Review

Disruptive technologies in supply chain management, such as Artificial Intelligence (AI) and blockchain, have been the subject of much study and discussion in recent years. These technologies have the potential to transform the way supply chain management is done, providing greater efficiency, transparency, and security. Below are some of the main theoretical concepts and ideas related to these technologies.

3.1. Supply Chain Management

Supply chain management (SCM) refers to the management of the flow of goods and services, including all the processes that transform raw materials into finished products, as well as the associated information and financial flows. The objective of SCM is to create value for customers while optimizing the use of resources across the entire supply chain, from suppliers to end consumers.

SCM is a complex and multifaceted field that involves a wide range of activities, such as planning and forecasting, procurement, production, inventory management, transportation, warehousing, and customer service. Effective SCM requires coordination and collaboration among all the actors involved in the supply chain, including suppliers, manufacturers, distributors, retailers, and customers.

SCM has become increasingly important in today's globalized and interconnected economy, where companies operate in complex and dynamic environments, facing challenges such as increasing competition, shorter product life cycles, and rising customer expectations.

SCM can help companies to improve their performance, reduce costs, increase efficiency, enhance customer satisfaction, and mitigate risks. Supply chain management is the administration of all activities related to the acquisition of goods and services, from identifying needs to receiving materials and incorporating them into production processes. It is a strategic activity as it directly affects the quality of produced goods and services, delivery times, customer satisfaction, and financial success of the company.

According to Ballou (2006), supply chain management involves integrating processes from material and component procurement to delivery of finished products to consumers. Efficient management of these processes can provide a range of benefits, such as cost reduction, improved operational performance, and customer satisfaction. To understand how a supply chain works, it is necessary to understand logistics, considering it is considered part of the supply chain process [2]

Supply chain management is important because it allows companies to optimize their production and delivery processes, reducing costs and improving efficiency. This is achieved through the integration and coordination of all business processes that are part of the supply chain, including supplier management, inventory management, transportation and logistics management, demand management, and order management.

Logistics, according to Ballou (1993), is the continuous study of administration aiming to obtain improvements in the levels of distribution services to customers and consumers through planning, organization, and control. To effectively manage the supply chain, companies need to use advanced data analysis techniques and artificial intelligence to predict demand and control inventory. In addition, collaboration with suppliers and partners is essential to ensure the efficiency of the supply chain [3].

Supply chain management is a constantly evolving system, with companies seeking new ways to improve efficiency and reduce costs. In recent years, the digitization of the supply chain has been a major trend, with the use of technologies such as the Internet of Things (IoT) and Blockchain to increase transparency and traceability throughout the supply chain.

3.2. The Artificial Intelligence (AI)

Artificial Intelligence (AI) is a field of computer science dedicated to the study and development of systems that can perform tasks that are typically associated with human intelligence, such as speech recognition, computer vision, machine learning, logical thinking, among others.

Rometty (2021, p. 15), CEO of IBM, states that "intelligent systems need to be built with a high level of trust, transparency, and accountability in mind, with the understanding that these technologies have the potential to deeply affect society and people on a global scale [4]."

According to Corrêa (2019), AI is a technology that allows machines to learn from data, identify patterns, and make decisions based on algorithms. Nowadays, AI is used in various areas, such as healthcare, finance, transportation, and increasingly in business management. In supply chain management, AI can be used to: predict demand and plan production more efficiently, identify consumer behavior patterns, manage inventory and control stocks, perform risk analysis, and make data-driven decisions [5].

According to Singh et al. (2021, p. 158), "the integration of artificial intelligence (AI) in supply chain management can improve demand forecasting, inventory management, decision-making, operational efficiency, and customer satisfaction [6]."

Moreover, AI can also be used in conjunction with other technologies, such as the Internet of Things (IoT), to enable greater automation and control of logistics processes.

3.3. Blockchain

Blockchain is a technology of distributed records from a database connected in a decentralized network, which enables secure and decentralized storage of information. It was originally developed to support the functioning of cryptocurrencies, but has proven useful in a variety of other applications, including supply chain management.

Blockchain allows for the creation of a shared and immutable digital record, which can be accessed and updated by multiple parties in a secure and transparent manner. This makes it possible to track the history of a product throughout the entire supply chain, from its origin to the end consumer [7].

Carrillo et al. (2020, p. 52) assert that "blockchain technology is a revolutionary tool that has allowed the emergence of new forms of secure and decentralized interaction among individuals and organizations, with possibilities for application in various areas [8]."

Some of the main advantages of blockchain for supply chain management include: increased transparency and trust among the involved parties, greater efficiency in verifying product warranty and identifying fraud, and reduced time and costs associated with auditing and compliance management.

However, the use of blockchain in supply chain management still presents challenges, such as the need for greater standardization of processes and greater collaboration among the involved companies.

3.4. Integration of AI and Blockchain in Supply Chain Management

According to Lambert (1998), managing information across a supply chain is complicated and challenging; it is necessary to identify with whom and how to share information, as well as establish which information should be shared and at what time [9].

According to Sharma et al. (2021, p. 03), "The integration of AI and blockchain in supply chain management can improve the transparency, traceability, and security of the supply chain, as well as increase the efficiency and effectiveness of supply chain operations [10]."

The integration of AI and blockchain in supply chain management can bring benefits to companies. By combining the resources of AI to analyze and process real-time data and blockchain to provide a secure and immutable record of transactions, greater efficiency, and transparency can be achieved throughout the chain.

To Alarifi et al. (2022, p. 05), "The application of blockchain in supply chain management offers opportunities to improve the traceability, transparency, and efficiency of the supply chain. By providing an immutable and shared record of information, the technology can help reduce the delays and errors that occur in communication and coordination between the different participants of the supply chain [11]."

For example, AI can be used to predict future demand and plan production more efficiently, while blockchain can be used to track the origin of materials and products, ensuring compliance with quality and safety standards.

Gao et al. (2018) compare a supply chain to a distributed system that uses its computer systems, is difficult to integrate into a unified platform, and is sensitive to cyber threats. In addition, AI can be used to analyze large volumes of data in real time, identify patterns and anomalies, and make real-time decisions, while blockchain can be used to ensure the security and reliability of data [12].

Kshetri (2018) argues that the technology has the potential to help SCM achieve its strategic objectives, such as reducing costs and risks and increasing quality, speed, reliability, sustainability, and flexibility [13].

It should be noted that the integration of AI and blockchain in supply chain management also presents challenges, such as the need for greater standardization of processes and greater collaboration between the companies involved. In addition, the implementation of these technologies requires a significant investment in terms of financial resources and skilled personnel.

4. Conclusion

At the end of this work, it was possible to verify that disruptive technologies, especially AI and blockchain, have great potential to transform supply chain management. These technologies can bring benefits to companies, such as cost reduction, efficiency improvement, transparency of operations, and sustainability.

It was found that artificial intelligence has been used in various stages of the supply chain, from demand planning and forecasting to logistics and transportation of goods. On the other hand, blockchain has been used to ensure transparency and security of transactions between different actors in the supply chain, such as suppliers, carriers, and customers.

Moreover, it was also observed that the adoption of these technologies is still limited, mainly due to cost and complexity issues. There are also challenges related to the standardization and interoperability of technologies, which can hinder the integration of different systems.

This research indicates that companies must be prepared to deal with the challenges and opportunities that these technologies present. To do so, companies must have developed an understanding that these technologies and their applications in supply chain management provide credits for decision-making and add value to everything they produce, especially to the improvement of the supply chain.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors assure that there is no conflict of interest with the publication of the manuscript or an institution or product mentioned in the manuscript and/or important for the result of the presented study.

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