National Higher School of Technology
Department of Industrial Engineering & Maintenance

Advances in data transfer technologies (EDI, IOT, blockchain) in supply chain management: selective research review and future directions

Master's thesis in
Industrial engineering

Abdelhak kADI,

Advisor:
Dr. Hamza BOUDHAR

Academic year:
2022-2023

Abstract: The integration of supply chain activities and the utilization of associated technologies have become essential for maintaining competitiveness across various industries. There is a clear trend towards increased adoption of supply chain technologies. As highlighted by a manager, in a world where technological advancements occur daily in all aspects of business, organizations must synchronize their operations by adopting and implementing new electronic commerce and supply chain technologies. This is crucial not only to protect market share but also to enhance market penetration. This article examines the advantages and challenges associated with information technologies such as Electronic Data Interchange (EDI), the Internet of Things (IoT), and block-chain. These technologies enable automated data transfer and have a significant impact on supply chain management. The article highlights key factors that influence the adoption of these technologies in businesses, including company size, organizational structure, integration of supply chain strategy, partner pressure, and environmental factors.

Key-words: Supply chain management,adoption technologies, electronic data interchange (EDI), internet of things (IOT), block-chain, organizational structure

Proceedings of M. F. I. M. - 2022/2023

Contents

1 Introduction 2
2 A Selective Literature review on EDI, Block-chain and IOT :advantages and challenges on supply chain management : 3
3 Discussion of a Selective papers on Literature review : 8
4 Adoption and integration of Data transfer technologies (EDI, IOT and block-chain) in the supply chain management : 8
5 Conclusions 9
A Appendix A 11

1. Introduction

digital transformation and the use of advanced technologies have revolutionized the way companies manage their supply chain. Indeed, the digitization of the supply chain has made it possible to efficiently manage the flow of materials, information and capital, thereby reducing costs, increasing productivity and improving customer service [1]. However, implementing this transformation is not without risk. Companies face new challenges such as data security, cyber security, supply chain resiliency and complexity management. In this context, it is critical for companies to develop a digital supply chain transformation strategy that takes into account risks and opportunities to improve their performance and competitiveness in the market.

until a relatively recent date, many organizations have considered the information system as a support function to the essential activities of the organization, even though the success of supply chain management (SCM) is largely based on the sharing of information that circulates in two directions (suppliers to customers/customers to suppliers)[2], and this is what we can see through Remy Le Moigne's definition[3] and (Zekhniniet al)[4] of the supply chain "the supply chain is a network of organization (suppliers, factory, distributors, customer .....etc), which participates in the manufacture and sale of a product to a customer. These organizations exchange products, money and of course information such as orders, invoices, sales forecasts and delivery notes" .
Before the advent of information technology, supply chain management (SCM) was often chaotic and uncoordinated. Companies had difficulty tracking products throughout their journey from suppliers to customers. Errors in supply chain management were common and could lead to late deliveries, stockouts, and reduced product quality. Companies often used manual methods to manage their supply chain, making coordination and collaboration difficult like the "bullwhip effect", which is the amplification of demand fluctuations along the supply chain. The causes of bullwhip effect cost are multiple and can include inaccurate forecasts, bulk orders and non-flowing communication.[5][6].

The first technologies is Electronic Data Interchange (EDI) it's been around since 80s and there are many definitions of this technology that are remarkably similar:

- according to (Rochester 1989) EDI is the computer-to-computer exchange of standard business documents between trading partners, including the company's suppliers, its customers, and its bank [7].
- (Crum et al. (1998)) describes EDI (electronic data interchange) as direct computer-to-computer communication of business-to-business and business-to-consumer business documents in a standard machine-readable format[8].
- EDI is defined as the computer-to-computer transmission of standardized business transactions (Craig A et al 2002) [2].

According to all these definitions,(Yunitarini et al) [9] define EDI (Electronic Data Interchange) as an electronic process for exchanging business data between different organizations. It allows direct communication between companies' computer systems, facilitating the fast and efficient transmission of standardized business documents such as orders, invoices and delivery confirmations.

The second technologies, we are interested on the Internet of Things (IoT) which appeared in the 2000s[10] it offers greater flexibility, and real-time data collection compared to (EDI) it is defined as physical devices that are connected to the Internet and collect and exchange data.it allows to collect data, analyze them and make autonomous decisions based on these data (Mohamed Ben-Daya et al) [11] .

Despite the advantages of these two previous technologies, there is another technology that has been gaining momentum lately, namely block-chain, which is a decentralized distributed ledger technology that allows untrusted parties to conduct secure, transparent and verifiable transactions without the need for a centralized intermediary to record and validate the transactions. The block-chain uses consensus and cryptographic algorithms to ensure the integrity and security of data recorded in the distributed ledger. Transactions are recorded in blocks of data that are cryptographically linked to each other, forming a block-chain [12]. This technology offers many potential benefits for supply chain management, such as increased transparency and traceability, reduced costs, and improved data security [13].

In this study, we will look broadly at how information

Proceedings of M. E. E. G. I. M. - 2022/2023

technology influences the way companies manage their supply chain and more specifically at how the aforementioned data transfer technologies can be used to improve companies' performance and competitiveness in the market, and the challenges companies face when implementing digital transformation of their supply chain, which we will find out in the next headlines of our research.

2. A Selective Literature review on EDI, Block-chain and IOT :advantages and challenges on supply chain management :

In this section, we will present a state of the art of information technologies used in the supply chain, we will also discuss the benefits and challenges of using information technologies in supply chain management, including operational efficiency, flexibility and security.We will also examine emerging trends in the use of IT in the supply chain, such as Electronic Data Interchange (EDI), the Internet of Things (IoT) and block-chain.

this state-of-the-art provides a comprehensive and up-to-date overview of trends and advances in this field. Using search engines such as Google scholar, direct sciences and others to gather the most recent and relevant information on information technology and its impact on the supply chain we will select 6 articles from 19, which we cite in this research from oldest to newest.

We start with the first article by (Patterson et al) [14] who examines how Companies can adopt new technologies to improve their supply chain management,
The authors first explain that adopting new technologies can help businesses improve their operational efficiency, flexibility, responsiveness to customer demands, and coordination with supply chain partners, which they define as a series of processes that involve the flow of products, information, and funds between suppliers, manufacturers, distributors, and customers. Effective supply chain management is essential to business success as it can help reduce costs, improve product quality, speed up deliveries, and increase customer satisfaction.
According to (Patterson et al)[14], businesses can adopt several types of technologies to improve their supply chain management, including information and communication technologies, automation, traceability, and scheduling. However, adopting new technologies can be costly and complex, and may require employee training and education to ensure successful adoption, with emphasis on organizational and environmental factors that can influence this adoption decision and may vary depending on the context and technology in question. The article [14] bases this on a classification of variables identified in previous studies on innovation and technology adoption, with the authors focusing on the latter two factors (organizational and environmental) that can influence the adoption of many supply chain technologies.

In addition,(Patterson et al)[14] also highlight the importance of factors such as organizational culture, resource availability, competitive pressure, regulation, and strategic partnerships while giving examples of companies that have overcome these challenges and successfully implemented new technologies in their supply chains. For example, they cite Procter Gamble, which used traceability technology to track products throughout the supply chain. This technology allowed the company to quickly identify and resolve quality issues, improve sales and operations planning, and optimize inventory.

thereafter, article [14] emphasizes the importance of adopting a strategic approach to the adoption of new technologies in supply chain management. Businesses must consider the potential benefits of each technology, evaluate the associated costs and risks, and develop a plan for successful technology implementation.

Finally,the authorsof the paper [14] explain the importance of employee training and education to ensure successful adoption of new technologies in the supply chain. Businesses must provide appropriate training to employees who will use the technology to ensure they understand how to use it effectively and get the most out of it.

The second article talk about the Use of electronic data interchange for supply chain coordination in the food industry by (Craig A et al) [2]. The main objective of the article is to analyze how EDI can help improve supply chain coordination in the food industry and to examine the potential benefits and challenges of its use.

In the introduction, the authors explain that supply chain coordination is essential for the food industry

Proceedings of M. F. E. G. I. M. - 2022/2023

as it ensures the quality, safety, and traceability of food products throughout the supply chain. However, supply chain coordination can be challenging due to the complexity and fragmentation of the food industry. The author proposes that EDI can help overcome these challenges by enabling effective communication among the various actors in the supply chain. (Craig A et al) [2] go on to explain the potential advantages of using EDI in the food industry, such as:

- The fast and accurate transmission of information between the actors of the supply chain (suppliers, producers, distributors, and retailers). The fast and accurate transmission of information between the actors of the supply chain (suppliers, producers, distributors, and retailers).
- Reduction of communication costs.
- Improvement in the speed and quality of decisions made throughout the supply chain.

However, the article [2] also highlights the challenges associated with the adoption of EDI in the food industry. One of the main challenges is the lack of common standards and protocols(UCS II) for EDI use, as this can lead to compatibility issues between the different information systems used by companies . Indeed, if each company uses different standards and protocols, it can make it difficult to exchange data between the different actors in the supply chain, which can compromise the efficiency and coordination of the supply chain. In addition, (Craig A et al) [2] discuss other challenges such as:

- Privacy concerns may arise when exchanging sensitive information such as product details, pricing, and delivery schedules.
- Implementation and maintenance costs, as the implementation of EDI systems may require significant investments in terms of infrastructure, training, and personnel.

On the other hand, (Craig A et al) [2] explain that these challenges can be overcome by using a gradual approach to implementing EDI and involving all supply chain actors in EDI planning and implementation.

Finally, the authors of this article examine several case studies that demonstrate how EDI has been successfully used in the food industry to improve supply chain coordination. For example, a case study shows how the use of EDI allowed a fruit and vegetable producer to improve traceability of its products throughout the supply chain, which contributed to improving the quality and safety of its products.

the third article examine The impact of electronic data interchange on reducing bullwhip effect and supply chain inventory costs by (José A et al) [15]. This paper is a research that explores explores the role of Electronic Data Interchange (EDI) in reducing the bullwhip effect and inventory costs in the supply chain. The article begins by discussing the bullwhip effect, which is a phenomenon where small changes in customer demand can cause significant fluctuations in the supply chain. The bullwhip effect can lead to increased inventory costs, decreased efficiency, and decreased customer satisfaction. The authors argue that EDI can play a significant role in reducing the bullwhip effect and improving supply chain performance.

the paper [15] then provides a detailed explanation of EDI, including its history, components, and benefits. (José A et al) [15] describe EDI as a computer-to-computer exchange of business documents in a standard electronic format between business partners, exactly like the definition we have already seen in the previous article about EDI [2] . (José A et al) [15] explain that EDI can provide significant benefits to businesses, including improved speed, accuracy, and efficiency in transactions, as well as reduced paperwork, data entry errors, and communication costs.
thereafter,the authors discuss how EDI can be used to reduce the bullwhip effect and improve supply chain performance. They explain that Electronic Datas interchange (EDI) can help reduce the bullwhip effect by providing accurate and timely information about customer demand and inventory levels throughout the supply chain. This information can be used to improve forecasting accuracy, reduce lead times, and better match supply with demand. The authors also argue that EDI can help reduce inventory costs by improving inventory management, reducing stockouts, and minimizing the need for safety stock. To support their argument, the authors provide several case studies that demonstrate the effectiveness of EDI in reducing the bullwhip effect and improving supply chain performance. For example, they discuss a case study involving a large grocery retailer that used EDI to improve its supply chain efficiency and reduce costs. The retailer used EDI to share information about product demand and inventory levels with its suppliers, which allowed suppliers to better match

Proceedings of M. E. E. G. I. M. - 2022 / 2023

supply with demand and reduce lead times. The result was a more efficient and responsive supply chain that reduced inventory costs and improved customer satisfaction.
to finish, (José A et al) [15] point out some of the challenges associated with implementing EDI, such as the need for standardized formats and protocols, as we have also seen in the previous article (Craig A et al)[2], as well as the costs and time required to implement EDI systems. (José A et al) [15] suggest that these challenges can be overcome through careful planning and coordination among supply chain partners, as well as using third-party EDI providers.

the next and the fourth article entitled "Internet of Things (IoT) and Supply Chain Management (SCM): a literature review" by (Mohamed Ben-Daya et al)[11] is a synthesis of various academic works published on the topic of Internet of Things (IoT) and supply chain management (SCM). The paper discusses the various ways in which IoT can be used to improve the efficiency and transparency of SCM, as well as the challenges and opportunities associated with this technology.

The paper begins with an introduction to the basic concepts of IoT and SCM. It explains how IoT can be used to connect physical objects to the internet, allowing companies to collect real-time data on products and production processes. SCM, on the other hand, is defined as the set of activities required to produce and deliver a product or service, from raw material acquisition to delivery to the end customer , as also defined in the paper of (Patterson et al) [14].
The authors of this article [11] list the various applications of IoT in SCM and highlight the potential benefits they can offer companies whether it be in relation to:

- Inventory management: internet of things (IoT) can be used to monitor inventory levels in real time and send alerts when levels are low, allowing companies to maintain optimal inventory levels and avoid stock-outs.
- Logistics: internet of things (IoT) can help optimize delivery routes, track vehicles in real time, and monitor environmental conditions of products during transport.
- Product quality and safety: internet of things (IoT) can help companies monitor and control the environmental conditions of products during production, storage and transportation, which can reduce the risk of spoilage, contamination or theft.
- Supply chain traceability and transparency: internet of things (IoT) can enable companies to track products from their point of origin to their final destination, providing detailed information about their provenance, quality and status.

(Mohamed Ben-Daya et al) [11] also examine the challenges and opportunities associated with IoT in SCM. They acknowledge that there may be additional costs associated with the adoption of this technology, including initial investment, maintenance, and staff training. In addition, collecting and analyzing large amounts of data can pose cyber security and privacy challenges. The authors also emphasize the importance of a collaborative approach and effective governance to ensure coordination and compatibility among the different actors in the supply chain.

Finally, the paper concludes by highlighting the importance of future research on IoT and SCM. They call for further study of business models and governance practices related to IoT in SCM, as well as analysis of the social and environmental impacts of this technology.

The fifth article [12] examines the potential of block-chain technology in supply chain management based on a literature review where it defines block-chain as a distributed ledger technology that allows transactions to be securely stored in a decentralized network. It is increasingly being used in various industries, including supply chain management.

The authors begin with an introduction that outlines the challenges of supply chain management, including transparency, traceability and security. It then outlines the benefits of block-chain in this area, including transparency, immutability, decentralization, and security, they also point out that block-chain can solve the problems associated with managing supply chain data, which is often fragmented and difficult to share among different actors.

In the second part of the paper [12], the authors review existing research on the use of block-chain in supply chain management. The results of this review show that block-chain can be used to improve transparency, traceability and security in the supply chain. Technol-

Proceedings of M. F. E. G. I. M. - 2022/2023

ogy can also help solve trust issues between different actors in the chain, enabling more effective collaboration. The authors point out that block-chain can be used to improve the management of supply chain assets, such as raw materials and finished goods, and it can help to solve problems related to product quality and safety management by enabling better product traceability throughout the supply chain.

In third part, this article [12] examines the challenges of using block-chain in supply chain management, beginning with , the technical complexity of block-chain which can make it difficult to implement, especially for small businesses that do not have the resources to invest in the required infrastructure and training, coordination between different actors in the supply chain, especially if they use different systems and have different protocols for data exchange where the implementation of a block-chain requires close collaboration between the different actors, which can be difficult to achieve if trust relationships have not yet been established, and finally the governance of the block-chain, which can also be a challenge for companies, as there are not yet universal standards for the organization and regulation of block-chains. It is therefore important for companies to establish clear and transparent rules for the management of their block-chain, ensuring that all stakeholders in the supply chain are involved in the governance process.The authors point out that there may also be issues related to the privacy and security of block-chain data.

Ultimately, the successful implementation of block-chain in supply chain management will depend on the ability of companies to overcome these challenges and collaborate to develop standards and regulations that ensure the security, efficiency and transparency of the technology. The potential benefits of block-chain in supply chain management are significant, and it is clear that continued research and development of the technology will play a key role in improving supply chain management in the coming years.

in this regard the sixth and last article by(Shuchih E et al)[13] develops the ideas of the previous article[12].

this paper "When Block-chain Meets Supply Chain: A Systematic Literature Review on Current Development and Potential Applications" [13] is a comprehensive analysis of how block-chain is being used in the supply chain. The paper reviews the different types of block-chain, the benefits and challenges of using block-chain technology in the supply chain, and potential applications.

the paper explains that block-chain technology is based on a distributed and decentralized database that can be used to store transactions. There are two types of block-chain, namely public block-chain and private block-chain or The authors note that public block-chain is better suited for non-commercial uses, while private block-chain is more suitable for businesses. Subsequently, The article discusses the benefits of using block-chain technology in the supply chain, which are:

- transparency: the block-chain is a distributed, decentralized database where every transaction is recorded and verified by all nodes in the network. This means that there is no single point of control, and all parties can access the same information in real time.
- Security: Because all transactions are encrypted and the database is distributed, it is much more difficult for malicious parties to alter or falsify data.
- Traceability: The technology allows a product to be tracked throughout the supply chain, from manufacturing to final delivery. Companies can have a complete view of the product's history, including its origin, quality, delivery dates, storage conditions and transportation conditions
- Cost reduction: by reducing the cost of storage, processing and verification or by eliminating unnecessary intermediaries and inefficiencies in the supply chain.

Challenges related to the use of block-chain technology in the supply chain are also discussed in the article, such as high upfront costs especially for small businesses that have limited budgets to invest in new technology, compatibility issues between existing systems which can make it more difficult to implement the technology, privacy and security issues despite the fact that the technology is renowned for its security but it is not immune to data breaches and cyber-attacks, as well as issues related to governance.

Finally, the article concludes by pointing out that block-chain technology has the potential to revolutionize the supply chain. However, it is important that companies carefully evaluate the benefits and challenges of using block-chain in their supply chain before deciding to implement the technology.

Proceedings of M. F. E. G. I. M. - 2022/2023

To summarize this section, we have synthesized the findings of our literature review in the following table, which highlights the key advantages and challenges of each data transfer technology in the context of supply chain management. By carefully examining the selected articles, we have identified and presented the main benefits and challenges associated with each technology:

Technologies	Articles	Advantages	challenges
EDI	[2]	+Improved product traceability. +cost reduction and productivity improvement. +better supply chain coordination.	+Major investments. +complexity of implementation. +need for coordination between all actors in the supply chain.
	[15]	+Improving the accuracy and speed of business transactions +Reduced communication costs and administrative workload. +Reduced data entry errors and delays in order processing. +Improved customer satisfaction through shorter delivery times and better product availability.	High upfront implementation and staff training costs. +The need for standardized communication standards and protocols between supply chain partners. +The need for close coordination among supply chain partners to ensure effective use of EDI . +Confidentiality and data security issues associated with the electronic transmission of sensitive business data.
IoT	[11]	+Improved supply chain visibility. +improved data quality and accuracy. +reduced costs, improved efficiency and productivity. +improved traceability and security.	+data security, connectivity, system compatibility and interoperability. +high cost of technology investment. +privacy issues, complexity of data analysis. +the need to train staff to use technology
Block-chain	[12]	+Improved traceability. +Reduced cost of verification and validation of information in the supply chain. +Improved security through cryptography and decentralization. +Reduced lead times by eliminating intermediaries and manual processes.	+lack of clear standards and regulations which limits its adoption in supply chain management. +Limited interoperability. +The transparency of blockchain can pose confidentiality issues for some supply chain information.

Proceedings of M. I. E. G. I. M. - 2023/2023

	[13]	+Advanced encryption protocols to secure transactions, which can reduce the risk of fraud and cyber attacks. +block-chain can be used to automate certain supply chain tasks, such as contract and payment management. +Reduced costs such as verification and certification costs.	+Technological complexity:the need to integrate block-chain with other existing technologies and systems. +Costs associated with implementing , especially for small and medium-sized businesses. +Block-chain raises governance and regulatory issues that must be resolved before widespread adoption in the supply chain .

Table 1: advantages and challenges according to the previous work

3. Discussion of a Selective papers on Literature review :

These scientific articles all address the topic of supply chain management and explore how the adoption of new technologies can improve the efficiency and profitability of this chain. Specifically, all these articles explore the use of technologies such as EDI, IoT, and block-chain to improve coordination, visibility, and transparency of the supply chain. Additionally, all these articles are based on existing literature reviews or empirical studies to support their arguments and conclusions.

Some articles explore the impact of new technologies on supply chain management, focusing on information and communication technologies. The article [14] offers a global perspective and compares the advantages and disadvantages of different technologies, as does the article [11], which discusses the advantages and disadvantages specific to the Internet of Things (IoT) technology. However, these two articles lack empirical data and do not provide concrete case studies of the application of these technologies in practice.

In contrast, article [2] provides concrete examples of the application of electronic Data interchange (EDI) in practice, specifically for supply chain coordination in the food industry. However, the article does not sufficiently discuss the limitations and potential challenges associated with using EDI, such as the complexity of implementing this technology for small businesses, data security issues, and high implementation costs , which was also discussed by (Sriram Narayanan et al) [16] and(Vladimir Klapita)[17]. Similarly, for articles that examine the potential of block-chain technology [12] and current developments and potential applications of this technology in supply chain management [13], they provide concrete examples of the application of block-chain in practice to support their conclusions. However, the articles do not sufficiently discuss the potential challenges associated with using block-chain technology.

In conclusion, the six articles analyzed in this review offer a rich and insightful exploration of contemporary technologies in the field of supply chain management. However, it is important to acknowledge that each article has its own set of limitations that warrant careful consideration in their practical application. Despite these limitations, the collective body of work presented in these articles presents a valuable resource for researchers and practitioners alike, offering valuable insights, empirical evidence, and theoretical frameworks to guide the successful integration and utilization of these technologies within supply chain management practices. By critically examining and synthesizing the findings from these articles, professionals in the field can gain a deeper understanding of the opportunities, challenges, and potential impacts that these technologies bring to the dynamic landscape of supply chain management.

4. Adoption and integration of Data transfer technologies (EDI, IOT and block-chain) in the supply chain management :

Information technologies such as EDI, IoT, and block-chain have the potential to improve supply chain coordination, reduce inventory costs, and enhance transparency and security in supply chain management. However, companies may prefer one technology over

Proceedings of M. G. I. M. - 2022/2023

another based on their specific needs and priorities. For example, EDI may be preferred for its established track record in supply chain coordination[2] and [16], while IoT may be preferred for its real-time tracking and monitoring capabilities[11] and [10]. Block-chain, on the other hand, may be preferred for its ability to provide secure, tamper-proof transactions and greater transparency throughout the entire supply chain [12] [13]. While it is possible to adopt all three technologies simultaneously, it would likely require significant investment and resources, as well as careful planning and implementation [18] and [14].

In addition, the adoption of these technologies within the supply chain can depend on several key elements. According to (Patterson et al)[14] and (Yunitarini et al)[9] as shown in the figure 1 below, among these key elements are the availability and accessibility of technologies, which are critical factors for the adoption and integration of technologies such as the Internet of Things (IoT) or block-chain.

Availability refers to the presence and availability of the equipment and resources necessary for the implementation of these technologies. For example, the adoption of IoT in the supply chain may require the installation of sensors and connected devices, as well as access to appropriate communication infrastructures [11][10]. Similarly, the adoption of block-chain may require specific equipment and technical skills to establish and manage the technology.[13] [19]

Accessibility refers to how easily supply chain actors can access and implement the technologies. This may include considerations such as the cost of technologies, the availability of reliable suppliers, and the ability of supply chain actors to acquire the necessary skills to effectively use these technologies.

It is worth noting that Electronic Data Interchange (EDI) is a simpler and less costly technology compared to IoT or block-chain. However, even for EDI, successful adoption and integration depend on collaboration among different supply chain partners. This means that all actors must be willing to transparently and reliably share data, establish common protocols and standards, and harmonize their processes to ensure smooth integration of EDI into their operations [9].

In summary, the adoption and integration of technologies such as IoT, block-chain, or EDI in the supply chain depend on the availability of necessary equipment and resources, as well as the accessibility of these technologies for supply chain actors. Close collaboration among supply chain partners is also essential to ensure successful adoption and integration of these technologies, whether it be EDI, IoT, or block-chain.

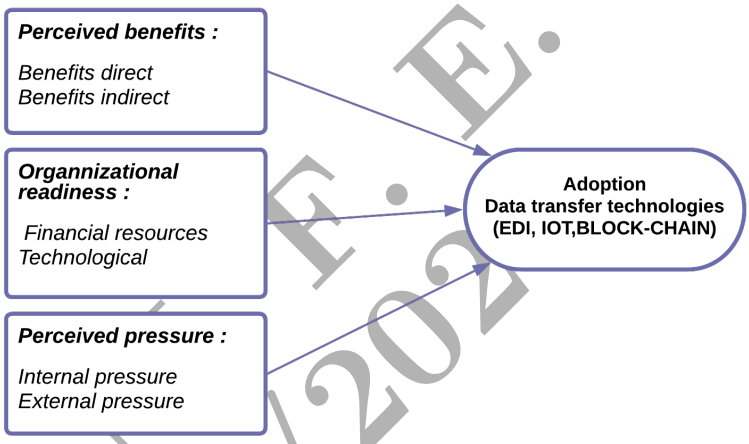


Figure 1: standard model factors Data transfer technologies Adoption influences[9]

5. Conclusions

In conclusion, this comprehensive examination of the literature on data transfer technology adoption in supply chain management reveals valuable insights into the diverse range of technologies and their impact on organizational processes. The articles selected demonstrate the significant potential of technologies such as Electronic data interchange (EDI), block-chain, and Internet of Things (IOT) in improving coordination, visibility, and efficiency within the supply chain.

However, it is crucial to recognize that implementing these technologies is not without challenges. The articles highlight the need to address issues such as implementation costs, security concerns, and interoperability among different systems. Organizations must carefully evaluate the specific requirements and constraints they face to select the most suitable technology for their unique supply chain context.

Furthermore, it is essential for companies to conduct a thorough assessment of the benefits, limitations, and challenges associated with each technology, taking into account their long-term objectives and available resources. By doing so, they can make informed decisions and develop effective strategies for integrating and leveraging technology to optimize their supply

Proceedings of I. F. E. G. I. M. - 2022/2023

chain performance.

Ultimately, the insights provided by these articles empower organizations to make informed choices regarding technology adoption, enabling them to enhance their competitiveness, responsiveness, and overall supply chain performance. By embracing the right technologies and addressing associated challenges, companies can position themselves for success in the rapidly evolving landscape of supply chain management.

References

[1] Craig A Hill, G Peter Zhang, and Gary D Scudder. An empirical investigation of edi usage and performance improvement in food supply chains. *IEEE Transactions on Engineering Management*, 56(1):61–75, 2008.

[2] Craig A Hill and Gary D Scudder. The use of electronic data interchange for supply chain coordination in the food industry. *Journal of operations management*, 20(4):375–387, 2002.

[3] R. Le Moigne. *Supply chain management: Achat, production, logistique, transport, vente*. Dunod, 2017.

[4] Kamar Zekhnini, Anass Cherrafi, Imane Bouhaddou, Youssef Benghabrit, and Jose Arturo Garza-Reyes. Supply chain management 4.0: a literature review and research framework. *Benchmarking: An International Journal*, 28(2):465–501, 2020.

[5] Vincent Giard and Mustapha Sali. L'effet coup de fouet dans la chaîne logistique: une littérature contingente et incomplète. 2012.

[6] CW Craighead, JW Patterson, PL Roth, and AH Segars. Enabling the benefits of supply chain management systems: an empirical study of electronic data interchange (edi) in manufacturing. *International Journal of Production Research*, 44(1):135–157, 2006.

[7] Paula MC Swatman and Paul A Swatman. Edi system integration: A definition and literature survey. *The Information Society*, 8(3):169–205, 1992.

[8] Don Lim and Prashant C Palvia. Edi in strategic supply chain: impact on customer service. *International Journal of Information Management*, 21(3):193–211, 2001.

[9] Rika Yunitarini, Purnomo Budi Santoso, et al. A literature review of electronic data interchange as electronic business communication for manufacturing. *Management and Production Engineering Review*, 9, 2018.

[10] Tharaka de Vass, Himanshu Shee, and Shah Jahan Miah. Iot in supply chain management: Opportunities and challenges for businesses in early industry 4.0 context. *Operations and Supply Chain Management: An International Journal*, 14(2):148–161, 2021.

[11] Mohamed Ben-Daya, Elkafi Hassini, and Zied Bahroun. Internet of things and supply chain management: a literature review. *International Journal of Production Research*, 57(15-16):4719–4742, 2019.

[12] Amulya Gurtu and Jestin Johny. Potential of blockchain technology in supply chain management: a literature review. *International Journal of Physical Distribution & Logistics Management*, 2019.

[13] Shuchih E Chang and Yichian Chen. When blockchain meets supply chain: A systematic literature review on current development and potential applications. *Ieee Access*, 8:62478–62494, 2020.

[14] Kirk A Patterson, Curtis M Grimm, and Thomas M Corsi. Adopting new technologies for supply chain management. *Transportation Research Part E: Logistics and Transportation Review*, 39(2):95–121, 2003.

[15] Jose AD Machuca and Rafael P Barajas. The impact of electronic data interchange on reducing bullwhip effect and supply chain inventory costs. *Transportation Research Part E: Logistics and Transportation Review*, 40(3):209–228, 2004.

[16] Sriram Narayanan, Ann S Marucheck, and Robert B Handfield. Electronic data interchange: research review and future directions. *Decision Sciences*, 40(1):121–163, 2009.

[17] Vladimír Klapita. Implementation of electronic data interchange as a method of communication between customers and transport company.

Proceedings of M. F. E. G. I. M. - 2022/2023

Transportation Research Procedia, 53:174–179, 2021.

[18] Şemsettin ÇİĞDEM. From edi to blockchain: A bibliometric analysis of digitalization in supply chains. *Gaziantep University Journal of Social Sciences*, 20(2):657–677, 2021.

[19] Maciel M Queiroz, Renato Telles, and Silvia H Bonilla. Blockchain and supply chain management integration: a systematic review of the literature. *Supply chain management: An international journal*, 25(2):241–254, 2020.

A. Appendix A

A.1. lead times :

"Lead time" is a term commonly used in supply chain management to describe the elapsed time between when an order is placed and when it is received. It represents the time required for products or materials to be produced, delivered, or made available.

A.2. UCS II

"UCS II" is a computer standard that represents Unicode characters using 16 bits, allowing for a larger set of characters to be encoded compared to previous encodings such as ASCII.

A.3. Cryptographic algorithms :

"Cryptographic algorithms" are mathematical procedures or algorithms used in cryptography to secure data and communications. These algorithms are designed to ensure confidentiality, integrity, authentication, and non-repudiation of information. They involve the use of cryptographic keys and various operations, such as encryption, decryption, hashing, and digital signatures.

A.4. Public Block-chain:

"public block-chain" is a decentralized and transparent ledger that is open to anyone and can be accessed and participated in by anyone. It operates on a distributed network of computers, often referred to as nodes, where each node maintains a copy of the entire block-chain. Public block-chains are typically permissionless, meaning anyone can join the network, participate in the consensus mechanism, and validate transactions.

A.5. Private Block-chain:

"private block-chain" also known as a permissioned block-chain, is a block-chain network that is restricted to a specific group of participants who have been granted permission to access and participate in the network. Unlike public block-chains, private block-chain have restricted access and are typically operated by a centralized entity or a consortium of organizations.

A.6. gradual approach

"The gradual approach" is a method or strategy that involves making incremental and progressive changes towards a desired outcome. Instead of implementing sudden or drastic transformations, the gradual approach focuses on gradual, step-by-step modifications.

Proceedings of M. F. E. G. I. M. - 2022/2023