Artificial intelligence and logistics services: a systematic literature review

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Abstract — **The objective of the study is to identify the artificial intelligence tools used and their impact on logistics services, for this a systematic review of the scientific literature was carried out. Fifteen articles were selected from the Proquest and Scopus databases using the terms: artificial intelligence AND Logistics AND contracts OR provision OR services, the use of Blockchain, IoT, smart contracts, deep learning, and computer software for logistics services was found. It is concluded that digitalization implies the incorporation of artificial intelligence in logistics services, highlighting the use of IoT. At the same time, deep learning is not as common in this context compared to other technologies. Artificial intelligence tools impact logistics services, optimizing the supply chain, helping identify products, tracking them more rigorously, and making contracting and transportation processes more effective. The AI trend in logistics services is developing in Europe, Asia, and the United States of North America, which is why it is recommended that companies providing logistics services in Latin America adopt the use of artificial intelligence tools to improve the service they provide.**

Keywords—Logistics, management, network technologies, IoT, supply chain.

I. INTRODUCTION

The problems of logistics services that most industries suffer, such as storage, handling time, transportation, and cargo monitoring, among others, not only generate large economic losses for the business but also make products more expensive for the end user due to the high costs of the logistics process; However, in a context marked by artificial intelligence (AI) and digital transformation in the business field, as well as the adoption of digital business models, the logistics industry is no exception. [1] We should ask ourselves: What AI tools are being used and how do they impact logistics services?

Different digital processes play a crucial role in this digital transformation by trying to integrate all processes in a unified system, or crucial parts of important relevance due to the cost of the process, such as Blockchain [2], Deep Learning [3], Internet of Things (IoT) [4], Smart Contracts [5]and specialized Software [6].

The objective of the study is to identify the AI tools that are used and their impact on logistics services, through a systematic review of the literature.

II. METHODOLOGY

The study is theoretical research based on a systematic review of the literature on artificial intelligence tools used and their impact on logistics services. From June 15 to September 18, 2023, the search for articles was carried out in the Scopus and Proquest databases with the terms Artificial intelligence AND Logistics AND contracts OR provision OR services. 90,778 articles were obtained. By limiting the search for the thematic area of social sciences, 11,445 articles were left, of which all articles belonging to the thematic areas of medicine and others that did not correspond to the search were excluded. There were 2,259 documents left, which were examined based on the recurring keywords, leaving 629 articles; after limiting the selection only to those articles with open access, there were 157 articles to review, which were evaluated by titles, keywords, and summaries, leaving 76 articles that after being read 61 articles were excluded because they were not relevant to the study; Finally, the 15 articles that have been analyzed for this study were selected.

TABLE I. INCLUSION AND EXCLUSION CRITERIA

| Inclusion criteria	Exclusion criteria
IC1: Magazine articles and conferences.	EX1: Web pages, books, speeches.
IC2: Thematic area of logistics sciences, internet of things, social sciences.	EX2: Medical subject area, environmental engineering, mathematics, psychology, arts and humanities, human medicine, physics.
IC3: Keywords Logistics AND contracts OR provision OR services.	EX3: Keywords that were not related to the topic of analysis were excluded.
IC4: Access only open.	EX4: Excluded due to lack of relevance to the study.

a. Elaboration own method prism.
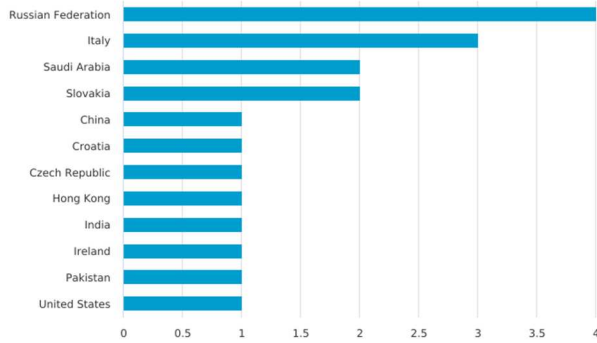
Fig. 1. Publications by country

According to Figure 1, the publications come from Russia, Italy, Saudi Arabia, Slovakia, China, Croatia, Czech Republic, Hong Kong, India, Ireland, Pakistan and the United States.
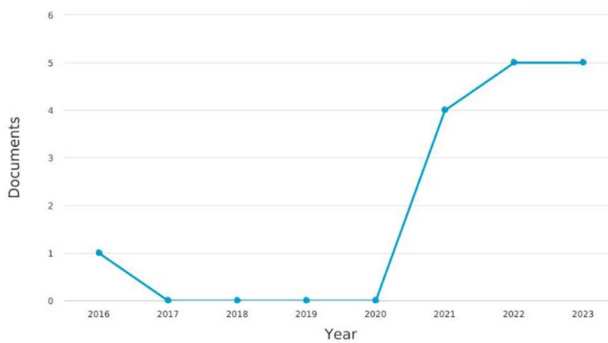

Fig. 2. Publications by year.

Figure 2 shows that in 2016 there was one publication, during the years 2017 to 2020 no publications were found; In the year 2021 4 publications were found, and in the years 2022 and 2023 5 publications were found for each year.

TABLE II. ARTIFICIAL INTELLIGENCE TOOLS USED IN LOGISTICS SERVICES

No.	Authors	Blockchain	Deep learning	internet of things	Smart contracts	Specialized software
1	Nanda et al (2023)	1		1	1	1
2	Alqarni et al (2023)	1		1	1	
3	Philipp et al (2019)	1			1	
4	Lou et al (2021)	1			1	
5	Alzahrani and Asghar (2023)		1	1		
6	Wu et al. (2023)		1	1		1
7	Mohsen (2023)	1		1		1
8	Nocerino et al (2016)			1		
9	Giuffrida et al (2021)	1		1		
10	Barykin et al. (2021)			1		
11	Cempírek et al (2021)			1		
12	Ulitskaya et al (2022)					1

13	Calabrò et al (2022)					1
14	Jucha and Corejova (2021)			1		1
15	Gaponenko and Hvoevskaya (2022)			1		1
Total		6	2	11	4	7

a. Own elaboration

From Table 1 it can be seen that 11 authors have investigated the IoT, which, by having a large number of interconnected devices, allows sending and receiving data through the Internet, because IoT devices can detect information from their environment or perform tracking certain data and then transmitting it over the web [2]; The second most researched tool for logistics services are specific computer applications that play a fundamental role in efficient logistics management and can address a variety of functions and tasks. [2]. In the third order of research is the Blockchain, analyzed in 6 of the 15 articles reviewed, which indicates that this digital registration technology plays a relevant role in logistics services since the Blockchain consists of a chain of connected blocks, where each block stores transaction data and is linked to the previous block guarantees the integrity and security of the data, likewise, each transaction has a unique identifier that allows it to be tracked, and the technology is resistant to failures, which means that even If some network nodes fail, the information remains safe [7]. Smart contracts and deep learning have been investigated in 4 and 2 of the reviewed studies respectively. It is worth mentioning that smart contracts are based on blockchain, while deep learning is not as common in this context compared to other technologies.

TABLE III. IMPACT OF ARTIFICIAL INTELLIGENCE TOOLS ON LOGISTICS SERVICES

No.	Authors	Supply chain optimization	Product identification	Product tracking	Hiring process	Product transportation
1	Nanda et al (2023)		1	1	1	1
2	Alqarni et al (2023)	1	1	1	1	
3	Philipp et al (2019)				1	
4	Lou et al (2021)			1	1	
5	Alzahrani and Asghar (2023)	1				
6	Wu et al. (2023)	1	1			
7	Mohsen (2023)	1		1		
8	Nocerino et al (2016)					1
9	Giuffrida et al (2021)	1		1		1
10	Barykin et al. (2021)	1				
11	Cempírek et al (2021)					1
12	Ulitskaya et al (2022)	1				1
13	Calabrò et al (2022)	1				
14	Jucha and Corejova (2021)	1		1		1
15	Gaponenko and Hvoevskaya (2022)	1				1
Total		10	3	6	4	7

When analyzing the impact of AI tools in logistics services, it was found that in 10 publications AI was applied as a tool for supply chain management (SCM); 7 studies indicate its application for the transportation of products; In 6 studies the application is oriented to product monitoring, in 4 to contracting processes and 3 to product identification.

IV. DISCUSSION

A. About AI tools and logistics services

According to the results found in the scientific literature, it can be stated that although 2016 the use of AI in logistics services was already investigated; This did not show evolution until 2021, when 4 publications were found, which indicates that digital platforms in the logistics industry have been a marked trend in the last three years, these platforms can transform into digital ecosystems. open that allows easy integration of a wide range of services without losing their identity or their subscriber base.

Various studies highlight the importance of the Internet of Things for supply chain optimization [8], including Giuffrida et al. [9]developed a prototype of a cooperative communication platform to address, make visible, track, and monitor in real-time the entire intermodal transportation process, allowing different actors to access relevant information and play their specific roles in the process. Blockchain technology provides a decentralized, secure, fraud-resistant, immutable, and transparent record of all documents and data related to the procurement process [10].

Smart contracts are composed of scripts that have a unique address, facilitate the validation and traceability of transactions, reducing the need for human interaction and minimizing network delays, are autonomous and execute specific actions when certain predefined conditions are met, are programs computer systems in a blockchain network that automate and ensure the execution of agreements and transactions, reducing the need for intermediaries and providing reliability and transparency to operations on the network [2].

B. AI and its impact on logistics services.

The supply chain (SCM), understood as the strategic coordination of business functions, aims to improve the long-term performance of the company; uses Bluetooth Low Energy (BLE) to detect the locations of people in the supply chain [6], involves the collaboration and coordination of processes across companies and benefits from various technologies to share information and make more informed decisions, such as reducing costs and increasing customer satisfaction through efficient management of product flows [11]. Information technology (IT) is important in logistics and supply chain management, highlighting that they are impossible without the use of computers and electronic devices [3].

Eco-friendly mobility (electric bicycles, electric scooters, e-cargo trikes, electric cargo bikes) generates new business opportunities and at the same time the creation of an electronic logistics platform as a marketing investment [4]Likewise, the intelligent transportation system, such as that of Singapore and other similar systems, which use digital technology to monitor and manage traffic and other aspects related to transportation,

are based on the collection and transmission of data from sensors and devices. connected [12].

For its part, the blockchain can be used to certify sustainability in environmental, social, and corporate terms throughout the supply chain. [7], even blockchain technologies are projected for smart contracts like Ethereum [5], Tela Hyperledger, and Quorum; It is also used to create a decentralized and secure platform that allows the tracking of health products from the manufacturer to the customer [2]. Finally, supply chain management has a global reach and can benefit from Blockchain by improving product tracking, reducing counterfeiting, and speeding up recall operations in case of health or safety risks [3].[9]

The application of a logistics approach based on digital principles in the management of energy services of ESCO companies refers to the importance of using digital tools and approaches to improve the efficiency and management of the logistics chain in that context [13]. Good delivery has become a major challenge due to customer expectations of fast and reliable delivery, IoT plays a favorable role in optimizing delivery logistics by enabling real-time monitoring of delivery vehicles. and tracking the location of packages through connected devices [14].

The use of smart contracts is used to verify the origin of smart raw materials, and products, and to monitor and control environmental conditions in transit, ensuring the provenance and traceability of materials [7]; Automation through smart contracts can reduce the likelihood of disputes between the parties involved and speed up the payment process [10], well, smart contracts notify owners and consumers if changes occur during transportation [2], and blockchain facilitates automation and decision making, in the same way for the development of the blockchain-based supply chain framework (SescfDapp) [5].

Alzahrani and Asghar [8]sought to evaluate the effectiveness and generalization of the proposed model (CNN+BiGRU). comparing its performance with other established classifiers, describing the experimental setup, model building, performance evaluation measures, and verification of the proposed DL model using various classifiers, while Wu et al.[6] used deep learning approaches to identify the unusual static state of what is being transported.

Software as a Service (SaaS) plays a vital role in making real-time decisions, integrating, and sharing information, and conducting practical operations. [6]. While the formation of an optimal route network in the region and the introduction of elements of the MaaS (Mobility as a Service) system in public passenger transport, although software is not explicitly mentioned, reference to digital systems and data processing suggests that software plays an important role in the management and operation of urban public passenger transport, which involves the use of applications and computer programs [15]. On the other hand, an agent-based simulation model (ABM) is used to analyze and optimize the process of on-demand last-mile package deliveries, although they do not analyze the software as such [16]. In other words, companies use software to track, plan delivery routes, manage inventories, and coordinate logistics operations [14], likewise, digital platforms in the transportation industry rely heavily on software to

function and coordinate a variety of services. and functions, contribute to the development of digital services and applications within these digital ecosystems [12].

V. CONCLUSIONS

It is concluded that digitalization implies the incorporation of artificial intelligence in logistics services, highlighting the use of the IoT, specific computer applications, Blockchain, smart contracts, and deep learning, it is specified that smart contracts are based on blockchain, while deep learning is not as common in this context compared to other technologies.

Artificial intelligence tools impact logistics services, optimizing the supply chain, helping identify products, tracking them more rigorously, and making contracting and transportation processes more effective. Various authors have reaffirmed that each area of Artificial intelligence has had a significant and positive impact on the logistics services projects in which it was applied.

The AI trend in logistics services is developing in Europe, Asia, and the United States of North America; Which invites us to wonder why AI is not yet implemented in Latin America to optimize logistics services? The question that must be resolved in a future investigation.

Finally, based on the findings, it is recommended that companies providing logistics services in Latin America adopt the use of artificial intelligence tools to improve the service they provide.

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