



Research trends on technologies for logistics management

Tendencias de investigación sobre tecnologías para la gestión logística

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Received: 15 Feb. 2024 | **Accepted:** 24 May. 2024 | **Published:** 10 Jul. 2024

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How to cite this article: Hanco-Mamani, J. I. (2024). Research trends on technologies for logistics management. *Revista Científica de Sistemas e Informática*, 4(2), e755. <https://doi.org/10.51252/rcsi.v4i2.755>

ABSTRACT

This article analyzes research trends on the use of technologies in logistics management, a key area for operational efficiency in organizations and supply chains. The main objective was to identify the most relevant technological advancements, the sources with the highest scientific production, and the international collaborations driving research in this field. A bibliometric approach was employed, based on 11,522 scientific articles extracted from the Scopus database between 2010 and 2020, using a search string focused on logistics and emerging technologies such as Artificial Intelligence, Big Data, and the Internet of Things. The documents were analyzed using the Biblioshiny tool to identify trends and patterns. The results reveal a steady increase in scientific production, particularly since 2016, with journals such as PLOS ONE and Sustainability (Switzerland) standing out as the main sources of publications. The University of California leads institutional production, followed by Huazhong University of Science and Technology. Moreover, frequent terms like "machine learning" and "data mining" reflect a focus on data analysis techniques and artificial intelligence in logistics. The study concludes that logistics management is being transformed by technological innovations and that this research area will continue to grow, driven by international collaboration and the application of emerging technologies to optimize the efficiency and sustainability of logistics processes.

Keywords: machine learning; data mining; big data; internet of things; supply chain

RESUMEN

Este artículo analiza las tendencias de la investigación sobre el uso de tecnologías en la gestión logística, un área clave para la eficiencia operativa de las organizaciones y las cadenas de suministro. El objetivo principal fue identificar los avances tecnológicos más relevantes, las fuentes con mayor producción científica y las colaboraciones internacionales que impulsan la investigación en este campo. Se empleó un enfoque bibliométrico, basado en 11522 artículos científicos extraídos de la base de datos Scopus entre 2010 y 2020, utilizando una cadena de búsqueda centrada en logística y tecnologías emergentes como Inteligencia Artificial, Big Data e Internet de las Cosas. Los documentos se analizaron utilizando la herramienta Biblioshiny para identificar tendencias y patrones. Los resultados revelan un aumento constante de la producción científica, especialmente desde 2016, destacando revistas como PLOS ONE y Sustainability (Suiza) como las principales fuentes de publicaciones. La Universidad de California lidera la producción institucional, seguida de la Universidad de Ciencia y Tecnología de Huazhong. Además, términos frecuentes como "aprendizaje automático" y "minería de datos" reflejan un enfoque en técnicas de análisis de datos e inteligencia artificial en logística. El estudio concluye que la gestión logística se está transformando gracias a las innovaciones tecnológicas, y que esta área de investigación seguirá creciendo, impulsada por la colaboración internacional y la aplicación de tecnologías emergentes para optimizar la eficiencia y la sostenibilidad de los procesos logísticos.

Palabras clave: aprendizaje automático; minería de datos; big data; internet de las cosas; cadena de suministro



1. INTRODUCTION

Logistics management is a key area for the success of any organization, as it encompasses all activities related to the planning, implementation, and control of the efficient flow of goods, services, and information from the point of origin to the point of consumption (Barrantes-Olarte, 2023). With technological advances, logistics management has undergone transformations that have improved process effectiveness (Gutiérrez-Ortiz et al., 2023). Information Technologies (IT) have brought about disruptive changes in areas such as inventory management, transportation, supply chain, and distribution, redefining how companies handle their logistics operations (Liu et al., 2024; Mustafa et al., 2024).

In recent decades, the integration of technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), Big Data, and automation has revolutionized logistics management (Benzidia et al., 2021; Ramasamy et al., 2024; Zamani et al., 2023). These innovations have provided a series of benefits, including the optimization of transportation routes, cost reduction, improved delivery times, real-time supply chain visibility, and enhanced strategic decision-making (Mishra & Mitra, 2024). As a result of these advances, research on the role of these technologies has gained significant importance, as researchers aim to identify both the opportunities and challenges that come with their adoption and implementation (Ahmad et al., 2022).

The existing literature highlights the growing importance of technology in improving the efficiency of logistics processes (Esper et al., 2020). However, research in this field is diverse and multifaceted, covering topics ranging from the optimization of specific processes to the analysis of the strategic and social implications of adopting new technologies (Goldsby & Zinn, 2016). This scenario points to the need for a systematic and thorough analysis of current research trends to understand the advances, approaches, and gaps in the field of technology-based logistics management (Mittal et al., 2024).

A relevant aspect to consider is how companies are adapting their business models and logistics processes to effectively incorporate these technologies (Vernier et al., 2021). In this context, technological innovation not only translates into a competitive advantage but also becomes a necessity to maintain sustainability and resilience in operations (Pech et al., 2021). The adoption of technologies such as blockchain for product traceability, robotics for warehouse automation, and cloud-based supply chain management platforms are examples of how technology is modifying traditional logistics paradigms (Pessot et al., 2023; Watson et al., 2021).

This article focuses on exploring the most prominent research trends on the use of technologies in logistics management. To this end, scientific articles addressing technological applications in areas such as supply chain management, transportation, inventory management, and distribution are analyzed. This approach allows the identification of not only the most widely used technologies and their benefits but also the challenges organizations face when implementing them and the future trends anticipated in the field.

In this sense, the growing digitalization of logistics processes is radically transforming the sector, and research on this topic continues to expand as new technologies and management models emerge (Awashreh et al., 2024). Analyzing current research trends is essential to understand how companies can effectively leverage these technologies to improve their logistics performance and maintain competitiveness in the global market. This study aims to contribute to existing knowledge by providing an overview of technological advances and their implications in contemporary logistics management.

2. MATERIALS AND METHODS

We employed a bibliometric method, which provides techniques to quantitatively analyze the production or impact of scientific research on a particular topic, offering a comprehensive view of the dynamics and trends in the academic field (McBurney & Novak, 2002). The indicators evaluated in this study were: 1)

annual scientific production, 2) most productive sources of publication, 3) institutions with the highest output, 4) most frequently occurring keywords, and 5) collaboration network between countries.

A total of 11,522 scientific articles were analyzed, extracted from the Scopus database between 2010 and 2020, using a search string applied to titles, abstracts, and keywords: ("logistics management" OR logistics) AND (technology OR "information technology" OR "internet of things" OR "artificial intelligence" OR "big data" OR "data mining" OR blockchain). These documents were subsequently exported in CSV format and imported into the Biblioshiny tool developed by Aria & Cuccurullo (2017), which operates with the Bibliometrix package of the RStudio application.

3. RESULTS AND DISCUSSION

Figure 1 reveals a steady increase in scientific production related to the area of study between 2010 and 2020. From 2010 to 2014, the number of published articles shows moderate growth, rising from around 500 to nearly 1,000 articles annually. However, between 2014 and 2016, production stabilizes, indicating a period of sustained interest but without significant changes. From 2016 onwards, a more rapid increase is evident, with a notable rise in the number of publications, almost doubling between 2016 and 2020. The trend demonstrates strong growth starting in 2018, surpassing 2,000 articles by 2020, suggesting renewed interest in the topic.

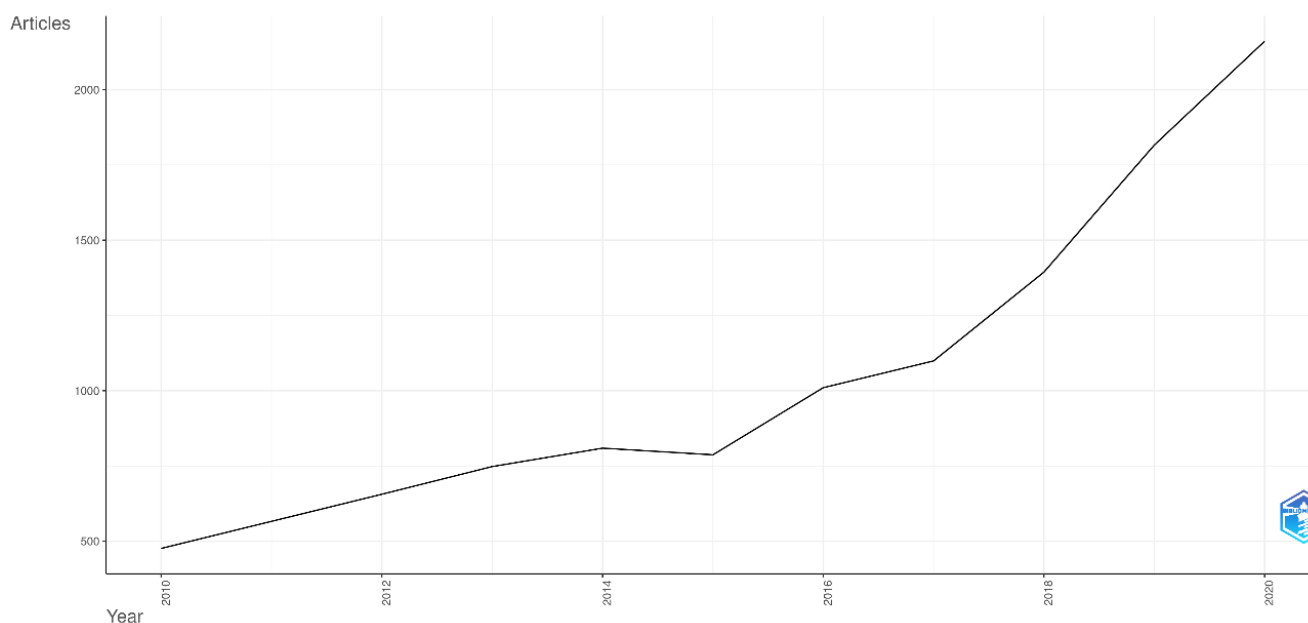


Figure 1. *Scientific production 2010-2020*

Figure 2 presents the top ten sources or journals with the highest number of published documents in the area of study. PLOS ONE leads the list with 154 documents, followed by Sustainability (Switzerland) with 133, and IEEE Access with 111, indicating that these sources play a significant role in disseminating research related to technologies and logistics management. These journals appear to have a broad and multidisciplinary focus, allowing for the publication of a wide range of studies on the topic. Other sources, such as Expert Systems with Applications and the Journal of Medical Internet Research, also contribute a significant number of publications (91 and 71 documents, respectively), indicating a more specific focus on technological applications and intelligent systems within logistics management. In the lower ranks of the list, but still with notable presence, are journals like the Journal of Cleaner Production, the International Journal of Supply Chain Management, and Human Reproduction, each with around 50 documents. This demonstrates that research on technologies applied to logistics encompasses a variety of approaches, ranging from sustainability to supply chain management and other specialized areas.

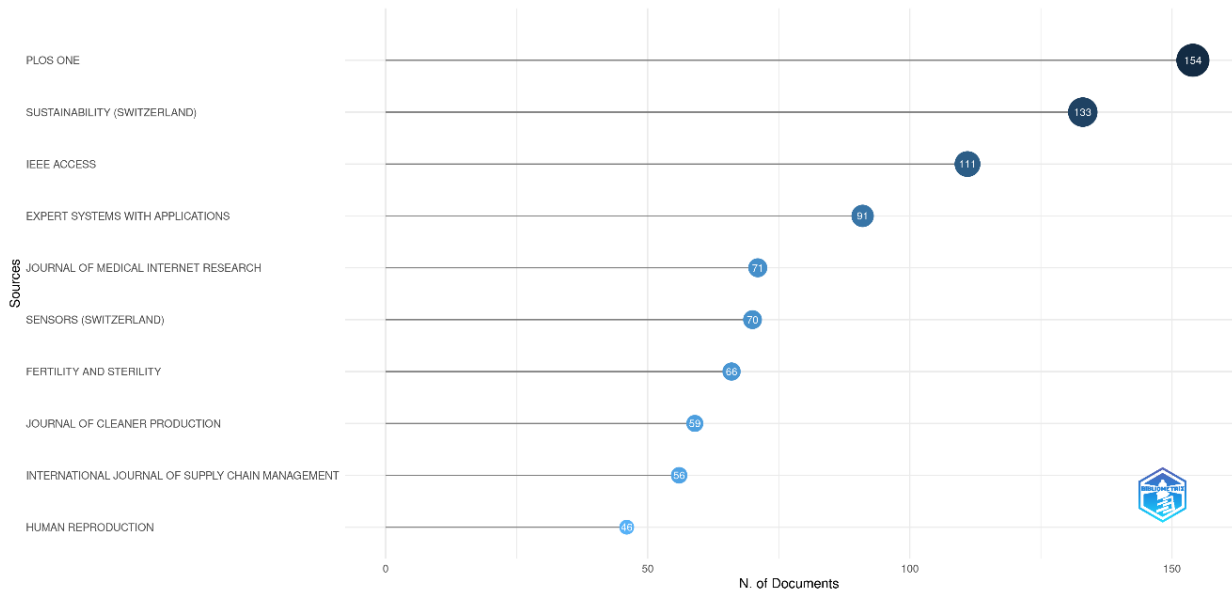


Figure 2. Top 10 most productive sources of publication

Figure 3 shows the institutions with the highest number of published articles related to the area of study. The University of California leads with 339 publications, indicating strong research activity in topics related to technologies applied to logistics management. It is followed by the Huazhong University of Science and Technology with 233 articles, and then Harvard Medical School with 198, highlighting a notable presence of both U.S. and Chinese institutions in this field of research. An interesting aspect is the appearance of "Not Reported" (172 articles), suggesting a significant number of publications without registered institutional affiliation. Other notable universities include the University of Michigan and Fudan University, with 158 and 145 articles, respectively, showing a strong contribution from North American and Asian institutions. Institutions such as the University of Toronto, University of Pennsylvania, Central South University, and the University of Florida complete the list with a smaller but still significant contribution (ranging from 42 to 86 articles).

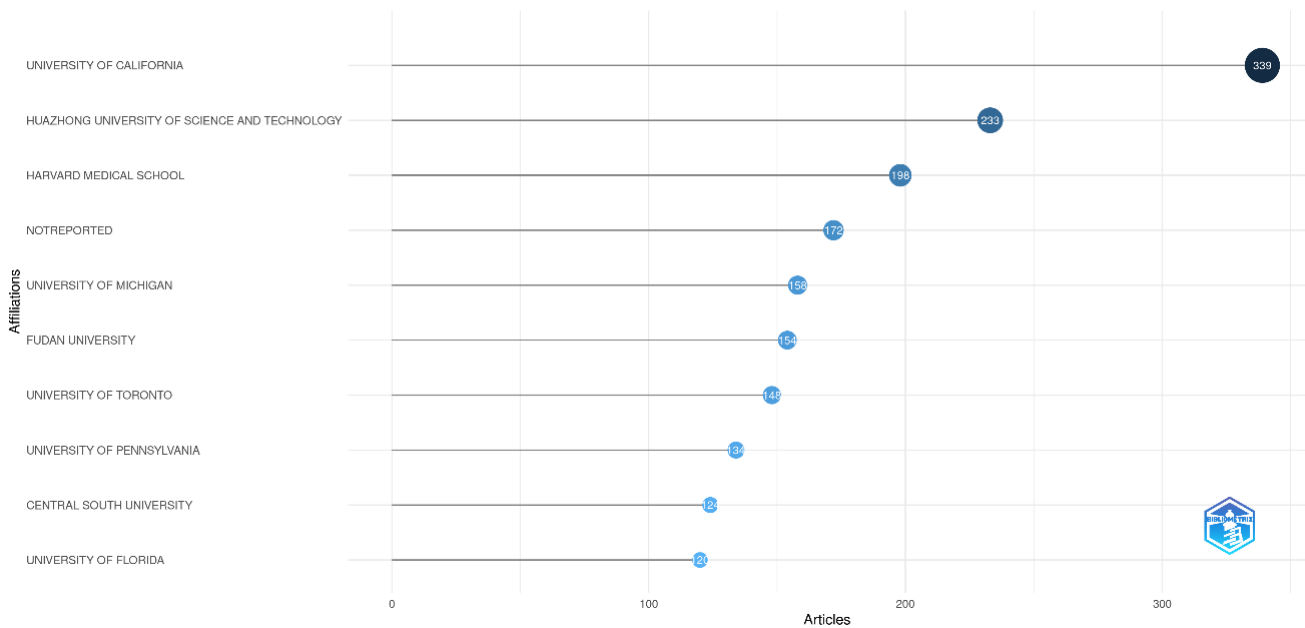


Figure 3. Top 10 institutions with the highest production

The word cloud shows the most frequent terms in the literature on technologies applied to logistics management (Figure 4), where the size of each word reflects its prominence and importance. The most prominent concepts are “logistic regression,” “machine learning,” “data mining,” “logistics,” and “supply

chain management.” This suggests that the application of data analysis and machine learning techniques plays a fundamental role in logistics management, highlighting the importance of predictive analytics and process optimization.



Figure 4. Most frequent keywords

Other relevant words such as "artificial intelligence," "big data," "internet of things," and "technology" indicate that modern technological trends are being widely explored in this context. Terms like "classification," "decision tree," "RFID," and "blockchain" suggest that the literature also addresses specific tools and methodologies used to improve logistics processes, such as inventory tracking, data-driven decision-making, and supply chain digitalization. The variety of terms, which ranges from technological approaches like "deep learning" and "industry 4.0" to more traditional logistics applications, reflects the interdisciplinary nature of the field. This indicates that research in logistics management is highly influenced by advances in artificial intelligence and information technologies, focusing on how these tools can enhance efficiency, visibility, and sustainability within supply chains.

Now, Figure 5 displays an international collaboration network in research on technologies applied to logistics management, where each node represents a country, and its size reflects its level of participation in scientific publications. Notably, China and the United States (USA) stand out, with the largest and most highly connected nodes. This suggests that these countries are the main contributors to scientific production in this area and act as central nodes, establishing multiple collaborations with other countries and leading global research on logistics technologies.

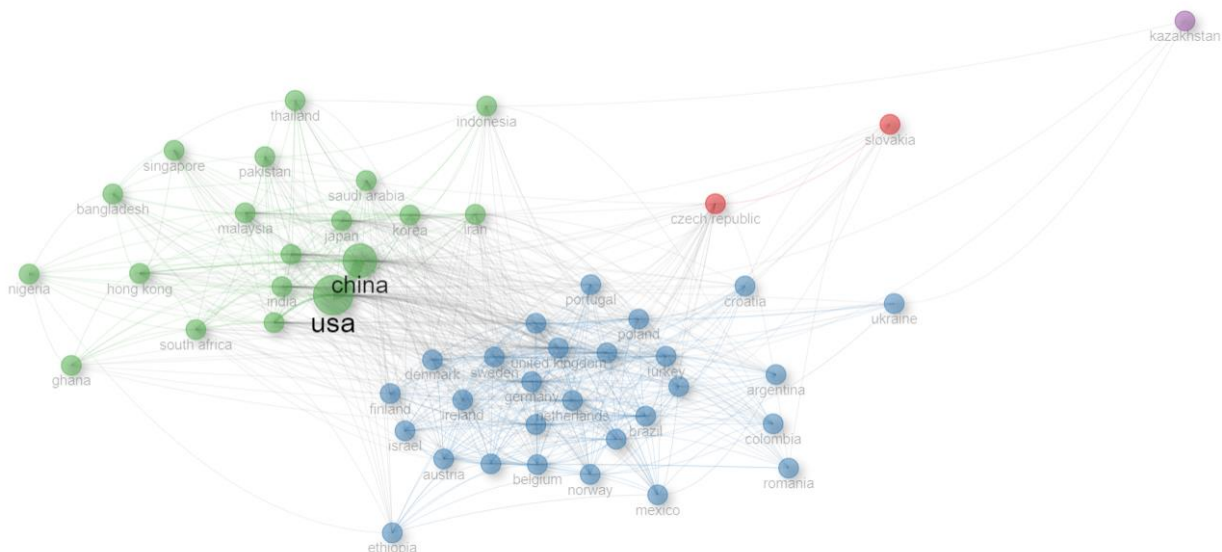


Figure 5. Collaboration network between countries

Different regional collaboration clusters can be identified. On the one hand, the green cluster primarily groups Asian countries like India, Japan, Korea, Malaysia, and others, forming a dense network with China as the main center of collaboration. On the other hand, the blue cluster consists of European countries such as Germany, the United Kingdom, France, and Italy, among others, showing strong scientific cooperation within Europe. The network of connections indicates that both Asia and Europe have active regional collaborative networks, while the United States is connected with countries from multiple continents, reflecting a more global approach.

Some countries are more peripheral or isolated from the main network, such as Kazakhstan and Slovakia, indicating limited or more independent scientific collaborations. The overall structure of the network reveals a balance between regionalization and globalization, with strong internal collaborations within Asia and Europe, and transcontinental connections established by powers like the United States and China. In summary, international collaboration in this field is extensive, with prominent leaders driving research and fostering links across different regions of the world.

CONCLUSIONS

Bibliometric research on technologies applied to logistics management shows significant growth in scientific production over the past decade, highlighting an increasing interest in technologies such as the internet of things, artificial intelligence, big data, and data mining. This development is reflected not only in the number of publications but also in the diversity of topics covered, ranging from the optimization of logistics processes to the analysis of supply chain networks and sustainability. Moreover, international collaborations play a key role in expanding knowledge, with China and the United States leading scientific production and fostering global research networks.

Additionally, the main outlets for disseminating this research are multidisciplinary journals that cover different perspectives, enabling a broad dissemination of technological advances in logistics. The most frequent keywords, such as "logistic regression," "machine learning," and "data mining," clearly point to the use of analytical tools and artificial intelligence to improve the efficiency and effectiveness of logistics processes. Furthermore, the analysis of collaboration patterns between institutions and countries reveals a global approach with regional clusters, emphasizing the importance of cooperation among institutions for the development of innovative solutions in the logistics field.

In conclusion, the analysis of current research trends suggests that the field of logistics management will continue to evolve and benefit from technological advancements. Research in this area will remain relevant to improving supply chain efficiency, reducing costs, and addressing future challenges such as sustainability and operational resilience. The steady growth of scientific production and the variety of approaches indicate that logistics management and its relationship with technology is a dynamic field with great potential for development in the coming years.

FINANCING

The author did not receive sponsorship to carry out this study-article.

CONFLICT OF INTEREST

There is no conflict of interest related to the subject matter of the work.

AUTHORSHIP CONTRIBUTION

Conceptualization, data curation, formal analysis, research, visualization, writing - original draft, writing - proofreading and editing: Hanco-Mamani

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