Sosyal Bilimler
EKEV**AKADEMİ**
d e r g i s i

BIBLIOMETRIC ANALYSIS OF DIGITAL TECHNOLOGY-DRIVEN LOGISTICS COMPETITIVENESS: RESEARCH TRENDS FROM THE WEB OF SCIENCE (WOS) AND SCOPUS DATABASE

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Abstract

The competitiveness of digital technology-driven logistics is directly related to the ability of nations to adapt to digital transformation processes. In this context, digital technologies such as the Internet of Things (IoT), big data analytics, artificial intelligence, blockchain, and automation enable greater transparency in logistics processes, improved operational efficiency, and a faster and more effective response to customer demands. The competitiveness of technology-focused logistics competitiveness logistics has emerged as a significant area of research in recent years, garnering attention across various sectoral applications. In this study, bibliometric analysis was employed to reviewed the technology-focused logistics competitiveness utilizing data from the WoS and Scopus databases. The analysis, performed using Bibliometrix and Vosviewer software, examined 3,519 publications. The findings indicate a growing interest in this subject in recent years. Key topics highlighted in logistics-focused reviews include machine learning, blockchain, artificial intelligence, sustainability, the IoT, and Industry 4.0. Studies within these thematic frameworks identified China, the United States, and the United Kingdom as the leading countries. Additionally, the analysis of international collaborations revealed the importance of geographical and political proximity among these nations. The results of this study can be visually depicted to highlight key insights beneficial for policymakers, academicians, and businesses.

Keywords: *Digital Technology, Logistics, Competitiveness, Bibliometrics.*

Jel Code: *A30, C10, L90*

Dijital Teknoloji Odaklı Lojistik Rekabet Gücünün Bibliyometrik Analizi: Web of Science (WoS) ve SCOPUS Veritabanından Araştırma Trendleri

Öz

Dijital teknoloji odaklı lojistik, ulusların dijital dönüşüm süreçlerine uyum sağlama yeteneğiyle doğrudan ilişkilidir. Bu bağlamda, Nesnelerin İnterneti (IoT), büyük veri analitiği, yapay zekâ, blok zinciri ve otomasyon gibi dijital teknolojiler, lojistik süreçlerinde daha fazla şeffaflık, iyileştirilmiş operasyonel verimlilik ve müşteri taleplerine daha hızlı ve etkili yanıtlar sağlar. Teknoloji odaklı lojistiğin rekabet gücü, son yıllarda çeşitli sektörel uygulamalarda dikkat çeken önemli bir araştırma alanı olarak ortaya çıkmıştır. Bu çalışmada, WoS ve Scopus veri tabanlarından elde edilen veriler kullanılarak teknoloji odaklı lojistik rekabet gücü incelenmiştir. Bibliometrix ve Vosviewer yazılımları kullanılarak gerçekleştirilen analizde 3.519 yayın incelenmiştir. Bulgular, son yıllarda bu konuya olan ilginin arttığını göstermektedir. Lojistik odaklı incelemelerde vurgulanan temel konular arasında makine öğrenimi, blok zinciri, yapay zekâ, sürdürülebilirlik, IoT ve Endüstri 4.0 yer almaktadır. Bu tematik çerçeveler içindeki çalışmalar, Çin, Amerika Birleşik Devletleri ve Birleşik Krallık'ı lider ülkeler olarak belirlemiştir. Ek olarak, uluslararası iş birliklerinin analizi, bu uluslar arasındaki coğrafi ve politik yakınlığın önemini ortaya koymuştur. Bu çalışmanın sonuçları, politika yapıcılar, akademisyenler ve işletmeler için yararlı olan temel içgörüleri vurgulamak amacıyla görsel olarak tasvir edilebilir.

Anahtar Kelimeler: *Dijital Teknoloji, Lojistik, Rekabetçilik, Bibliyometrik*

Jel Kod: *A30, C10, L90*

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1. **Introduction**

International trade has recently experienced significant changes due to globalization and the increasing competitiveness of regions that were once less prominent on the global stage. This development has dramatically impacted logistics, a critical component in facilitating product mobility, ensuring security and speed, and reducing costs as trade between countries expands (Özmen, 2019). The effectiveness of a logistics network is primarily determined by the services, investments, and policies implemented by the government, significantly influencing a country's success in global trade. On a macro level, the government plays a crucial role by investing in transportation infrastructure and setting regulatory standards that improve logistics operations. These improvements promote economic growth and enhance the nation's competitiveness. Additionally, a country's efficiency in logistics directly impacts its global trade performance (Kabak et al., 2020). Assessing logistics competitiveness is critical for effectively evaluating and targeting trade and transport facilitation policy initiatives over time and across various countries. When a nation achieves a competitive advantage in logistics performance, it bolsters its international trade, opens new markets, and promotes business growth. A country-specific evaluation of logistics performance offers valuable insights into its relative position. It highlights areas that require focused improvement, such as infrastructure, services, procedures, and regulations, to enhance logistics effectiveness. Companies with access to high-quality, cost-efficient logistical capabilities can often outsource specific logistics tasks, enabling them to allocate fewer internal resources to these functions (Ekici et al., 2016). Implementing well-informed strategies and effectively utilizing advanced logistics tools is imperative to achieving competitiveness in the contemporary global landscape (Erceg & Sekuloska, 2019).

In today's highly competitive global markets, enhancing a company's operational efficiency hinges on creating a marketing and logistics system that aligns with the latest technological advancements and trends. This system is essential for advancing strategic business goals and objectives. A company's competitiveness is fundamentally tied to a practical marketing-logistics framework, which underpins the entire production chain of goods and services. Continuous improvements to this system, driven by digital technologies, are crucial for sustaining long-term success (Al-Ababneh et al., 2023). Moreover, logistics services have played a pivotal role in the international market as an essential mechanism for enhancing business efficiency. The contemporary challenges posed by the global economy increasingly spotlight issues related to international supply chains, thereby raising expectations for the quality of logistics services. Simultaneously, improving the quality of these services can only be achieved through integrating modern digital technologies. Such technologies enable enterprises to prosper in the international market by facilitating more profitable operations, attracting new customers, and optimizing production and sales costs through advanced information, analytics, and effective decision-making processes. The significance of implementing digital technologies in logistics has been further underscored by the COVID-19 pandemic, which profoundly impacted the sale of resources and goods through intermediaries and highlighted the critical need for enhanced logistics practices (Verbivska et al., 2023). The digital economy is transforming transportation by enhancing efficiency, improving transparency and traceability within logistics chains, and mitigating negative externalities such as accidents, environmental harm, road damage, congestion, and dependence on oil that arise from certain logistical activities (Merenkov, 2018). While new technologies present various opportunities, digitization poses significant challenges for numerous logistics operations in terms of sustaining the competitiveness of structures that, by their inherent nature, are situated within specific territories and cater to their respective supply chains (Remondino & Zanin, 2022).

Bibliometric analysis has increasingly established itself as a robust and effective methodology for investigating and reviewing literature in the social sciences (Öztürk et al., 2024). This approach

systematically examines various published materials, including books, journal articles, datasets, and blogs, along with pertinent metadata such as abstracts, keywords, and citations. By employing statistical methods, bibliometric analysis uncovers the relationships among various published works (Ninkov et al., 2021). Researchers leverage this approach to identify emerging trends in the performance of articles and journals, examine collaboration patterns, and assess different research components. This methodology enables a comprehensive understanding of the intellectual structure within specific areas of existing literature. Moreover, bibliometric analysis serves as a valuable tool for interpreting and mapping the accumulation of scientific knowledge and tracing the evolution of established fields (Donthu et al., 2021). In recent years, significant research has been conducted in various logistics fields, employing bibliometric analysis to gain insights into research trends and identify areas for improvement (Kazemi et al., 2019; Rejeb et al., 2021; Özekenci, 2023; Wang et al., 2023; Zrelli & Rejeb, 2024; Augusto et al., 2025). Numerous bibliometric studies have explored various aspects of logistics; however, there remains a significant gap in research specifically focused on Digital Technology-Driven Logistics Competitiveness. To the best of the author's knowledge, this is the first study to analyze research trends related to Digital Technology-Driven Logistics Competitiveness using the WoS and SCOPUS databases, covering the period from 2000 to 2024. This study aims to address this gap by employing two advanced visualization tools, VOSviewer and Bibliometrix, to systematically analyze relevant scholarly publications from these databases during the specified timeframe. Additionally, the focus will be on constructing visual knowledge maps to illuminate prominent research trends and patterns. To achieve this, the study will address the following research questions:

- What is the distribution of publications on Digital Technology-Driven Logistics Competitiveness in the WoS and SCOPUS database from 2000 to 2024?
- Which keywords are most frequently used in publications related to Digital Technology-Driven Logistics Competitiveness in the WoS and SCOPUS database.
- Which countries have the highest number of publications on Digital Technology-Driven Logistics Competitiveness in the WoS and SCOPUS database.
- How is the cooperation between countries on Digital Technology-Driven Logistics Competitiveness in the WoS and SCOPUS database.
- Who are the researchers with the most co-authored works on Digital Technology-Driven Logistics Competitiveness in the WoS and SCOPUS database.
- Which researchers have the highest publication counts on Digital Technology-Driven Logistics Competitiveness in the WoS and SCOPUS database.
- Which countries and publications are most cited in the WoS and SCOPUS database on Digital Technology-Driven Logistics Competitiveness.
- How are the Digital Technology-Driven Logistics Competitiveness in the WoS and SCOPUS database publications distributed among various journals?
- What are the relationships in the co-occurrence network of keywords in publications on Digital Technology-Driven Logistics Competitiveness in the WoS and SCOPUS database?
- What is the trend topic of keywords in publications on Digital Technology-Driven Logistics Competitiveness in the WoS and SCOPUS database?

The remainder of this paper is organized as follows: Section two offers an overview of previous research conducted in the relevant field. Section three outlines the materials and methods used in the study, detailing the research design, data sources, and methodologies employed. Section four presents the key findings from the analysis, which are critically examined and interpreted in the context of existing literature and theoretical frameworks. The final section summarizes the main findings and their

broader implications, emphasizing the study's contributions to the field, discussing potential policy and practical applications, and offering recommendations for future research.

2. Literature Review

2.1. Importance of Logistics Technologies

Technology will play a pivotal role in the future of logistics. Technologies such as autonomous vehicles, the Internet of Things (IoT), artificial intelligence (AI) and drones are essential for the development of new business models in this sector. They will also be crucial in improving the efficiency and sustainability of logistics processes. In particular, autonomous vehicles and drone technologies are expected to transform last-mile delivery processes. These technologies are also expected to contribute significantly to reducing carbon emissions, increasing efficiency and lowering costs (Akalan, 2025). In this context, technology-based applications such as digital twins, blockchain and process optimisation are also strategically important (Özkan, 2025; Şener et al., 2025).

Tümenbatur (2025) highlights the importance of Logistics 4.0 in modern logistics systems. Industry 4.0 has brought about fundamental changes in many sectors, including logistics. In this technology-driven transformation process, the concepts of 'digital transformation' and 'smart logistics' have emerged as pivotal factors. Integrating these concepts into logistics applications is bringing about structural changes across the sector (Şahin et al., 2025). In this context, businesses that can effectively implement smart logistics technologies are expected to increase their operational efficiency and become more competitive on a global scale (Genç & Çakan, 2025). To grow, businesses in the logistics sector must use technology effectively. To succeed with technological applications, logistics companies must adopt an innovative approach and organisational structure that embraces change. Otherwise, sticking to traditional methods could negatively impact companies' competitiveness. In this regard, businesses embracing digital transformation must systematically implement supporting applications. A comprehensive analysis of the process is crucial for maximising the effectiveness of digitalisation strategies. Therefore, logistics businesses should carefully plan their transition to Industry 4.0 after thoroughly evaluating their current situation (Dindarık & Fidan, 2025; Yeşilyaprak & Akıncı, 2025).

As discussed in the above literature, the concept of digital, technology-driven logistics competitiveness is important due to the rapid reshaping of today's logistics sector through digital transformation. This process necessitates the use of technological tools and the redefinition of business models, processes and competitive strategies. Digital technologies such as autonomous vehicles, AI, the IoT, drone technology, digital twins and blockchain are making logistics processes more efficient, transparent and traceable, while also making them more sustainable. Effective use of these technologies provides a range of tangible benefits, including shorter delivery times, reduced costs, lower carbon emissions and increased customer satisfaction. In the highly competitive logistics sector, companies that invest in digital technologies and approach digital transformation strategically gain a significant competitive advantage. In contrast, traditional and innovation-averse companies struggle to keep up with changing market dynamics and risk losing their competitive edge. Therefore, researching logistics competitiveness in the context of digital technology is important from both an academic and a sectoral perspective. Such research helps logistics companies analyse their level of digitalisation, identify areas for improvement, and develop sustainable competitive strategies.

2.2. Technology-Focused Logistics Competitiveness

In the contemporary landscape, the logistics industry has experienced a significant transformation fuelled by advancements in digital technologies. Incorporating emerging technologies such as AI, big data analytics, IoT, blockchain, and automation has fundamentally redefined logistics operations, enhancing efficiency, competitiveness, and customer satisfaction (Wang & Sarkis, 2021;

Chung, 2021; Gupta & Singh, 2024). The growing dependence on digital tools within logistics is crucial for establishing value chains that are not only efficient but also adaptable and resilient in the face of global challenges (Kazancoglu et al., 2023).

In recent years, many studies utilizing bibliometric analysis have focused on logistics. For example, Müßigmann et al. (2020) conducted a comprehensive literature review examining blockchain technology in logistics and supply chain management. They gathered data from various databases, including Scopus, WoS, Google Scholar, Springer, IEEE Xplore, and Taylor and Francis. Likewise, Ren et al. (2020) performed an extensive review of global literature on green and sustainable logistics, aiming to assess the current state of the field, identify research hotspots and trends, and develop a classification system for knowledge in green and sustainable logistics. Rejeb et al. (2021) also analyzed publications related to blockchain technologies in logistics and supply chain management through bibliometric methods. Atzeni et al. (2021) conducted a bibliometric analysis of collaborative robots within Logistics 4.0 environments using the Scopus database. Bigliardi et al. (2021) provided a comprehensive review of the scientific literature related to Industry 4.0 as applied to logistics, also based on the Scopus database. Pozzo et al. (2022) examined trends in the logistical literature of 4.0, offering an overview of current publications by employing bibliometric mapping techniques from both Scopus and WoS databases. Cano et al. (2022) executed a bibliometric analysis and literature review to identify publications, key topics, and recent trends regarding the sustainability of logistics operations in e-commerce settings. Joshi et al. (2023) investigated publications concerning the application of AI within the logistics sector. Admoko et al. (2024) performed a cluster-based bibliometric analysis of the evolving technological landscape in logistics, utilizing Vosviewer as their analytical tool. Zrelli and Rejeb (2024) delved into the IoT knowledge domain in logistics and supply chain management by analyzing co-citation patterns and networks of keyword co-occurrence. Bhowmik et al. (2024) employed bibliometric analysis to extract significant research statistics about AI-centric reverse logistics, reviewing 2,929 articles from the past three decades. Valenzuela-Cobos et al. (2025) explored the role of Industry 4.0 in logistics management in Latin America through a bibliometric review incorporating various databases, including Scielo, Scopus, and Science Direct.

Despite an increasing body of literature investigating the impact of digital technologies on logistics competitiveness, there is still a significant lack of comprehensive studies that systematically analyze research trends in this area. Bibliometric analysis, utilizing databases such as the WoS and SCOPUS, offers a valuable method for examining the evolution of this field and identifying key publications, leading authors, and emerging research topics (Zupic & Čater, 2015). This study uses bibliometric tools to clarify the evolution of research on logistics competitiveness influenced by digital technology. It also provides valuable insights into current trends and suggests potential directions for future research.

3. Research Methodology

3.1. Methodology

In this study, bibliometric analysis was employed to reviewed the technology-focused logistics competitiveness utilizing data from the WoS and Scopus databases. Bibliometric analysis refers to the quantitative assessment of bibliographic resources, providing a comprehensive overview of a particular research domain through the examination of scholarly papers, authors, and journals. This field has attracted considerable interest within the scientific community, primarily due to the rapid advancements in computing and information technologies (Merigó & Yang, 2017). The data gathered from the WoS and Scopus databases. On March 12, 2025, a search was conducted in the WoS database utilizing the keywords "Logistics" (Topic) AND "Technology" (Topic) OR "Digitalization" OR "Automation" AND

"Competitiveness" OR "Efficiency" OR "Performance" (Topic). The initial search yielded 4,957 publications. The publications obtained were filtered based on specific criteria. Only studies written in English, categorized as articles, available as open-access, and included in one of the Web of Science indexes (SCI-E, SSCI, and ESCI) were evaluated. Furthermore, the research period was constrained to the years 2000 to 2024. Following the filtering process, a total of 1,453 publications were incorporated into the scope of the research. On the same date, a search was conducted in the Scopus database using keywords identical to those used in the WoS search. This search was performed across the "article title, abstract, and keywords" fields, resulting in 13,561 publications. The filtering criteria utilized for the WoS database query were also applied to the Scopus query. Consequently, the filtering process yielded 2,964 publications that fell within the scope of this research. Next, the datasets from WoS and Scopus were compared using the R programming language, allowing for the removal of duplicate records (898 duplicate records). Following this step, 3,519 unique records were identified and included in the research analysis (Figure 1).

Figure 1

Data Acquisition Model
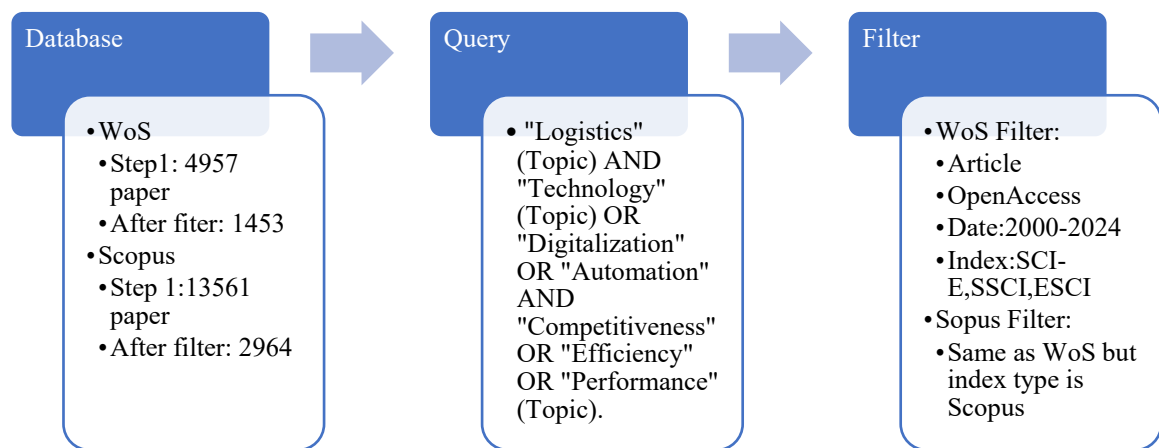
3.2. Research Ethics

The data used in this study were obtained from the publicly accessible academic databases WoS and Scopus. The data does not contain any personal or confidential information. Throughout the research process, plagiarism and ethical violations were avoided, and all sources were cited correctly in accordance with academic writing conventions.

4.Results and Discussion

4.1. Key Statistics

Table 1 shows the basic statistics of the study. There are a total of 3.519 publications for the years 2000-2024 and the average age of these publications is calculated to be 4.23 years. This shows that the field has become more popular in recent years. In addition, there is an annual increase of 7.43%, which indicates that interest in the subject continues. A total of 12,291 researchers were involved in the studies analysed, which shows that this is an area of intense academic interest. On the other hand, the fact that only 231 studies have a single author shows that teamwork is at the forefront of research in this area.
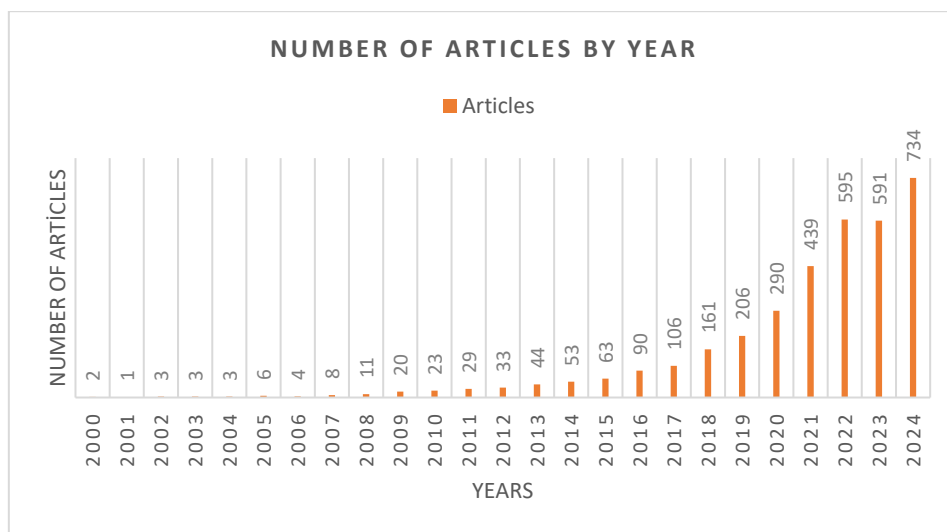
Table 1

Key Statistics

Description	Results
Timespan	2000:2024
Sources (Journals, Books, etc)	1492
Documents	3519
Annual Growth Rate %	7,43
Document Average Age	4,25
Average citations per doc	19,4
Keywords Plus (ID)	14372
Author's Keywords (DE)	10620
Authors	12291
Single-authored docs	231
Co-Authors per Doc	4,63
International co-authorships %	13,55

Source: Created by the author using Bibliomerix

4.2. Number of Articles by Year

Figure 2 shows the distribution of publications by year. 734 studies published in 2024 represent 21% of the total publications. 591 and 595 publications were produced in 2023 and 2022 respectively, representing 17% of the total publications in both years. It can be seen that about 55% of the total publications have been published in the last three years. This result shows that the field of research has grown rapidly in importance in the recent period and that academic interest has increased significantly.

Figure 2

Number of Articles by Year

Source: Created by the author using WoS and Scopus data

4.3. Most Frequent Keywords

Table 2 shows the top 10 most frequently used keywords in the publications. Analysis 1 was carried out without any grouping of synonyms and without excluding any words from the analysis. Analysis 2 was then carried out using the synonym list, examples of which are given in Appendix 1. The synonym list used in the second analysis was created by taking into account the popular words identified in analysis 1. According to the results of the analysis, it is seen that the most frequently used keywords in publications are generally related to software technologies, supply chain and logistics, Industry 4.0 and technology-oriented concepts.

Table 2

Most Frequent Keywords

Analysis 1		Analysis 2	
Words	**Occurrences**	**Words**	**Occurrences**
Machine Learning	299	Logistics	626
Logistics	204	Supply Chain	397
Blockchain	122	Machine Learning	345
Artificial Intelligence	103	Blockchain	173
Supply Chain Management	102	Internet of Things	146
Sustainability	101	Sustainability	128
Internet of Things	93	Artificial Intelligence	123
Logistic Regression	84	Industry 4 0	104
Supply Chain	84	Logistic Regression	84
Industry 4 0	71	Deep Learning	77

Source: Created by the author using Bibliomerix

4.3.1. Information Technologies and Logistics Performance

Digital technologies play a pivotal role in intensifying competition within the logistics sector. These technologies enhance operational efficiency by enabling businesses to streamline their processes. Furthermore, they elevate the quality of internal operations, ultimately leading to increased revenue (Daškevič & Burinskiene, 2024). Research focused on technology-driven logistics competitiveness emphasizes the importance of information technologies, particularly software solutions. As noted by Kálmán and Tóth (2021), advancements in information technologies can significantly enhance the logistics performance of nations, rendering these developments strategically crucial for competitiveness. The insights presented in Table 2 should be viewed in this context. Countries need to formulate innovative and targeted policies to bolster their logistics competitiveness with the technologies highlighted in the table above.

The transition from offline to online trade has accelerated significantly in the wake of the Covid-19 pandemic. This shift and the burgeoning volume of e-commerce have created an urgent demand for a larger workforce to manage logistics operations effectively. The ability of this workforce to oversee logistics processes efficiently and accurately is intrinsically linked to digital transformation. The timely and precise delivery of logistics services heavily depends on the proficient use of digital technologies (Lam et al., 2024). On a broader scale, implementing digital technologies at every stage of the supply chain is crucial for fostering sustainable business growth and enhancing resilience against commercial challenges. Moreover, digital technologies are essential for companies seeking to improve customer

experience and overall performance. In this context, company leaders must prioritize the digital transformation process and undertake strategic initiatives to progress in this area (Bui et al., 2024).

4.3.2. Technologies Featured in Research Examining Technology-Focused Logistics Competitiveness

By leveraging optimization algorithms and the security features of blockchain technology within AI, logistics companies can effectively prevent fraud, enhance efficiency, boost customer satisfaction, and improve data accuracy. The integration of these technologies significantly contributes to operational success by enhancing the security and efficiency of logistics processes (Ran et al., 2024). Numerous technologies are linked to technology-driven logistics competitiveness, and some examples of these technologies are provided below:

- AI holds transformative potential in supply chain management, offering substantial enhancements in key areas such as logistics, demand forecasting, and inventory management. By facilitating advanced decision-making processes, AI technologies enhance operational efficiency and deliver significant cost advantages. However, adopting these technologies is not without challenges, including fostering collaboration between businesses, scalability issues, and the need for improved data quality. Despite these obstacles, integrating blockchain and IoT technologies with AI is set to play a crucial role in shaping the future of the global supply chain (Danach et al., 2024).

- Implementing blockchain technology enables the creation of more efficient, secure, and transparent trade ecosystems. This advancement presents significant opportunities for customs administrations, regulatory bodies, and industry stakeholders. Additionally, it improves the traceability and verifiability of trade processes (Rahman et al., 2024).

- The significance of IoT technologies in the logistics sector cannot be overstated. For instance, IoT technologies can enhance the manufacturing sector's flexibility and efficiency in transporting consumables. This integration optimizes transportation processes, reduces operational costs, and simplifies logistics operations (Kvak & Straka, 2024). As the trend of adopting IoT technologies in logistics continues to grow, the combined use of blockchain and IoT becomes crucial for ensuring system security, data privacy, and heightened operational efficiency (Ugochukwu et al., 2024).

- The implementation of autonomous systems in logistics processes offers numerous advantages. For example, integrating autonomous robots into production lines significantly reduces error rates and operational costs while enhancing the efficiency of business processes. In this context, autonomous systems are crucial in achieving sustainability objectives, as they contribute substantially to economic effectiveness (Kubasáková et al., 2024). Fundamentally, AI-driven autonomous systems enable the efficient and flexible transportation of goods (Raamets et al., 2024).

- The use of smart glasses in warehouse operations, compared to traditional handheld scanners, has been shown to reduce product search time by around 89%. These wearable technologies are essential for improving warehouse processes' efficiency and overall operational performance (Epe et al., 2024).

4.4. Countries' Scientific Production

Table 3 shows the number of publications by country and shows a clear leadership by China. Among the G7 countries, the USA, the UK and Germany take the first three places. This is in line with

these countries' investment in scientific research and their economic prospects. It can be seen that most of the countries following China are in the class of economically developed countries. However, another country that stands out in this group is India. Like China, India occupies a prominent position in terms of number of publications and achieves a remarkable level of scientific productivity.

One of the most striking results among the top 10 countries is that of Saudi Arabia, which ranks ninth. This reflects the fact that the country has increased its investment in academic research in recent years and significantly improved its scientific productivity.

Among the G7 countries, it is worth noting that Japan is ranked twenty-fifth. Canada's eighteenth place is also a notable result among the G7 countries.

Table 3

Countries' Scientific Production and High-technology Exports

SN	Country	Freq	SN-HT Export	SN	Country	Freq	SN-HT Export
1	China	1234	1	26	Portugal	51	38
2	USA	583	6	27	South Africa	50	45
3	UK	349	15	28	Austria	41	26
4	India	226	-	29	Norway	40	36
5	Germany	194	3	30	Vietnam	40	8
6	Italy	179	19	31	Greece	39	43
7	South Korea	162	5	32	Slovakia	39	32
8	Spain	146	22	33	Bangladesh	36	-
9	Saudi Arabia	124	-	34	Denmark	34	29
10	Australia	119	33	35	Czech R.	33	18
11	Brazil	110	34	36	Mexico	33	13
12	France	98	10	37	Jordan	32	78
13	Poland	98	24	38	Egypt	30	61
14	Netherlands	94	11	39	Ireland	29	12
15	Malaysia	86	7	40	Switzerland	29	14
16	Indonesia	81	-	41	Thailand	28	17
17	Sweden	81	25	42	Belgium	27	16
18	Canada	77	23	43	Colombia	27	57
19	Iran	76	-	44	Lithuania	27	41
20	Finland	73	37	45	Slovenia	26	39
21	Pakistan	73	68	46	Russia	25	-
22	Ukraine	69	56	47	Serbia	22	53
23	Turkiye	68	35	48	Kazakhstan	21	40
24	Hungary	54	27	49	Morocco	21	51
25	Japan	53	9	50	Romania	20	31

Source: Created by the author using WoS, Scopus and Worldbank data

Table 3 compares the ranking of countries in publication production with their ranking in high-tech exports (high-tech exports - current US$). The data on high-tech exports are taken from the World Bank and cover the year 2022. The year 2022 is preferred because, when analysing data for more recent years, it was found that there were missing data for important countries such as South Korea.

The relationship between digital performance and competitiveness can be assessed as being directly related to high-tech exports. In this context, it can be observed that most of the countries in the top 50 for broadcasting production are also in the top 50 for high-tech exports. However, there are some exceptions. For example, Jordan, which ranks 32nd in publications production, is ranked 78th in high-tech exports. On the other hand, it is noteworthy that China, which produces the highest number of publications, also ranks first in high-tech exports. Countries such as the United States and Germany also support this trend.

4.4.1. China

China is recognized as the leading producer of publications in this field of research. Consequently, a literature review focused on the country's agenda. This section presents examples of studies that explore technology-oriented logistics competitiveness in China, highlighting several prominent themes that emerge from these analyses:

- It is essential to optimize the utilization of information technologies within ports and to develop advanced smart port infrastructures. Enhancements in port infrastructure, along with systems integrated with digital technologies, will facilitate logistics activities that offer higher added value (Xie & Hu, 2024).

- The positive impacts of digital transformation on product delivery processes in the agricultural sector are noteworthy. Specifically, analyses of the integration of advanced technologies such as big data analytics, AI, IoT, and machine learning in distribution processes show that these innovations significantly enhance product circulation efficiency. By enabling real-time monitoring of goods and optimizing inventory management, these technologies markedly improve the overall effectiveness of logistics operations (Zheng, 2024).

- The healthcare sector in China is an emerging field that heavily relies on imports. Optimizing supply chain processes is essential to facilitate sustainable growth within this sector. Adopting advanced digital technologies and massive data analytics holds significant importance in this context. Digital transformation is crucial for enhancing the healthcare sector's competitiveness and ensuring its continued growth (Xiao & Khan, 2024).

- There are several challenges associated with overseas third-party logistics (3PL) operations in China. Among these challenges are the lack of dependable business partnerships between 3PL companies, compromises in quality standards throughout logistics processes, and uncertainties surrounding delivery times and costs, which are particularly significant. Additionally, bureaucratic burdens arising from regulatory requirements, delays caused by cultural and language differences, insufficient expertise, and complications related to information technology competencies adversely impact the logistics process. To establish a successful and sustainable logistics framework, businesses must collaborate and align strategically to navigate these challenges (Su et al., 2024).

4.4.2. India

India shares its borders with China and has garnered significant attention due to its competitive stance in recent years. Consequently, this section provides a concise overview of India's logistics sector and its ongoing digital transformation.

- To successfully restructure the modern postal system in India, it is crucial to utilize technologies that support digital transformation effectively. The success of this initiative hinges on the systematic and sustainable allocation of essential resources. In particular, directing resources toward online platforms can significantly improve user experience and operational efficiency. In today's landscape, leveraging technology to reduce costs has become a necessity rather than an option. Implementing automation systems for repetitive processes facilitates more efficient resource utilization, allowing organizations to concentrate on activities that add more excellent value. Furthermore, innovative strategies like "last mile delivery" have recently gained prominence in the logistics sector. In this context, logistics companies must swiftly adapt to these innovations and continually refine their business practices (Saha & Sarma, 2024).

- While the transportation sector in India is experiencing significant growth, it is not progressing at a pace comparable to that of more developed markets like the United States and the European Union. As a result, the sector heavily relies on road transport. To address the existing challenges in India's transportation sector, it is essential to enhance investments in railway infrastructure. Additionally, embracing digital transformation is crucial. Implementing software solutions, particularly in vehicle routing, can substantially improve efficiency and reduce operational costs in the industry (Sahu et al., 2022).

- In the oil transportation sector in India, industry representatives must prioritize information technologies over mere profit-sharing. Rather than viewing these technologies solely as monitoring tools, representatives should embrace them as essential components that enhance business efficiency and improve process effectiveness (Malik et al., 2021).

4.5. Collaboration Network of Countries

Figure 3 illustrates the network of cooperation between countries. In Annex 2 parameters have been used to construct the network.

Figure 3

Collaboration Network of Countries
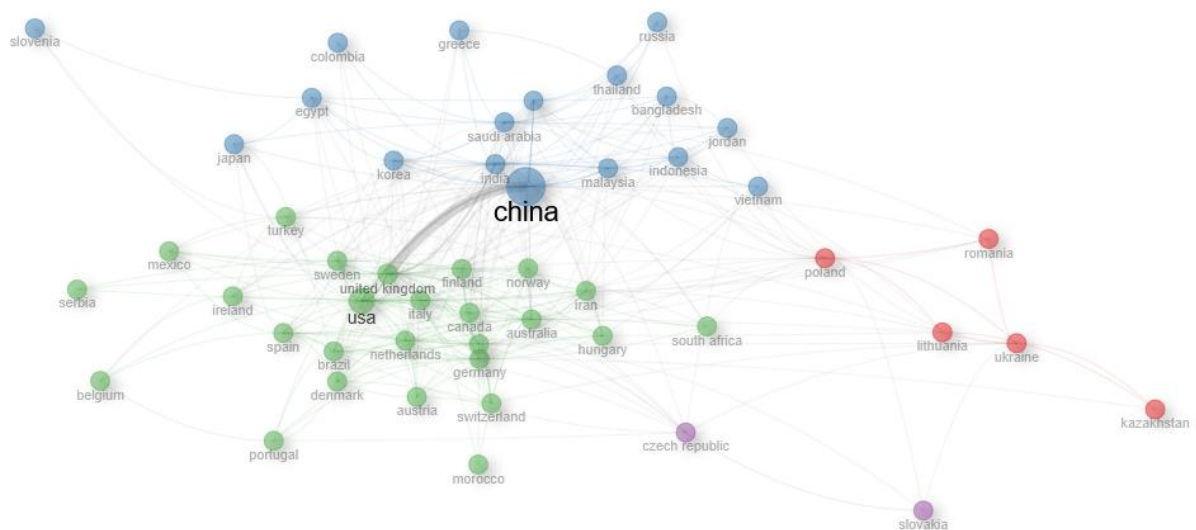
Source: Created by the author using Bibliomerix

It can be seen that there are four different groups in the network of cooperation between countries:

- The first group consists of five countries, with Poland having the highest betweenness value (44.468). This group consists mainly of Eastern European countries.
- The second group consists of seventeen countries, with China having the highest betweenness value (182.639). China is followed by India with a betweenness of 72.467. Although this group is made up of countries from Far Asia, it also includes countries closer to Europe, such as Greece.
- The third group consists of twenty-six countries, with the United Kingdom and the United States being the most prominent countries in this group. This group consists mainly of the so-called Western countries.
- The fourth group is the smallest and consists of two countries (Slovakia and the Czech Republic).

China, the United Kingdom, India and the United States appear to be the most active countries in the network of international cooperation. Although there are exceptions, cooperation between countries is generally linked to geographical and political proximity. Some interesting findings in the context of country cooperation are as follows:

- Russia is in the same cluster as China but is not as influential as China.
- China and India, which are in political competition with each other, have strong academic cooperation with similar countries.
- Iran, which is in political competition with Western countries, is in the same group as Western countries in terms of academic cooperation.
- Greece, a European country, is in the same group as Asian countries.
- These results show that academic cooperation is not completely independent of political relations but is also influenced by geographical and economic factors.

4.6. Authors' Co-authorship Network

Figure 4 illustrates the co-authorship network among authors. In this analysis, the thresholds for filtering were set at a minimum of five documents and one citation per country. Consequently, it was found that the 152 prominent authors were organized into 12 distinct clusters.

Figure 4

Authors' Co-authorship Network
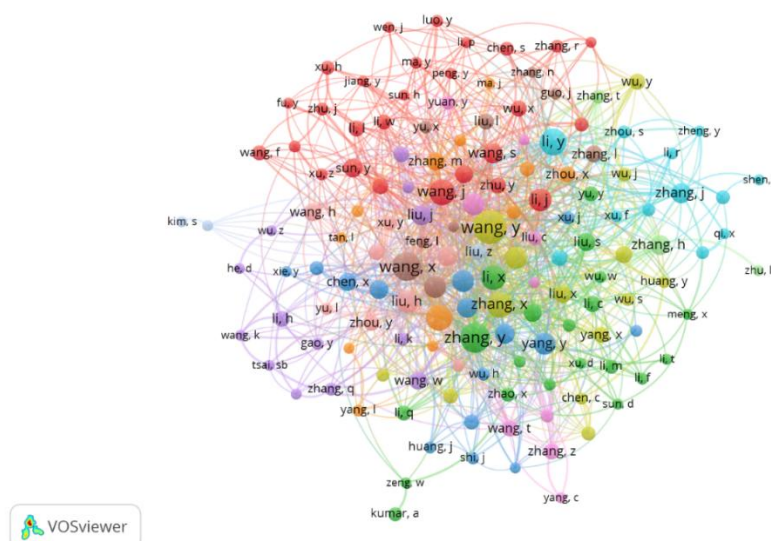
Source: Created by the author using Vosviewer

4.7. Most Relevant Authors

Table 4 lists researchers who have published 20 or more works on the topic. Notably, Wang Y. emerged as the researcher with the highest number of publications. Furthermore, it was observed that most of the authors leading in publications hail from the Far East. This finding aligns with the information in Table 3, which indicates that China has the highest total of publications on the subject.

Table 4

Most Relevant Authors

SN	Authors	Articles	Articles Fractionalized	SN	Authors	Articles	Articles Fractionalized
1	Wang Y	58	12,58	12	Wang S	26	7,37
2	Wang X	46	8,86	13	Yang Y	25	5,41
3	Zhang Y	43	8,30	14	Liu J	23	3,90
4	Wang J	36	8,49	15	Wang L	23	5,75
5	Liu Y	35	6,13	16	Wang H	22	5,64
6	Chen Y	34	6,58	17	Yang J	22	3,86
7	Zhang X	34	8,65	18	Zhang J	21	4,40
8	Li Y	32	8,96	19	Chen Z	20	3,90
9	Li X	31	6,45	20	Liu X	20	3,79
10	Li J	28	5,31	21	Wang C	20	4,46
11	Liu H	26	6,81	22	Wang Z	20	3,93

Source: Created by the author using Bibliomerix

4.8. Most Cited Countries and Publications

Table 5 highlights the most frequently cited studies, revealing a strong emphasis on research within health, technology, and software fields. The effectiveness of a robust health system is fundamentally connected to the implementation of a well-structured supply chain management system and an integrated logistics information system (Mekonen et al., 2024). Furthermore, digital transformation is essential for developing a "smart" supply chain (Mutambik, 2024). Within this framework, it is clear that big data, deep learning technologies, AI, and digital transformation have become critical focal points in the most cited literature.

Table 5

Most Cited Publications and Countries

| Paper	Topic	Total Citations	TC per Year	Normalized TC
(Jha et al., 2009)	Digital health records	1155	67,94	9,76
(Ciang et al., 2008)	Wind turbine system	781	43,39	5,44
(Mullen et al., 2015)	Neuroimaging and cognitive monitoring	542	49,27	10,08
(Fenton et al., 2007)	Computer-aided detection (mammography)	502	26,42	4,54
(Lehman et al., 2015)	Mammography	501	45,55	9,32
(Roodbergen & Vis, 2009)	Automated storage	501	29,47	4,23

(Bien et al., 2018)	Deep-learning-assisted diagnosis	493	61,63	12,88
(Benzidia et al., 2021)	Big data analytics and AI on green supply chain process	398	79,60	18,60
(Grant et al., 2008)	Applying new technology	395	21,94	2,75
(Waheed et al., 2020)	Big data using deep learning models	365	60,83	11,31

Source: Created by the author using Bibliometrix

Figure 5 illustrates the results of the citation analysis organized by country. In conducting this analysis, the threshold for the "minimum number of documents from a country" was established at 5, while the "minimum number of citations from a country" was set at 1. Based on these criteria, 76 out of the 136 countries were grouped into 11 distinct clusters.

Figure 5

Most Cited Countries
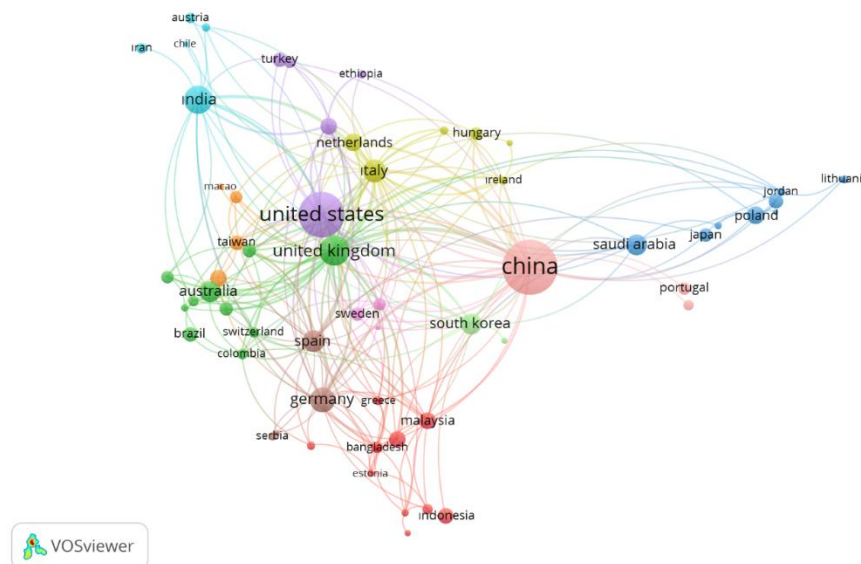
Source: Created by the author using Vosviewer

In the analysis of citations, several countries emerge prominently, including China, the US, the UK, India, Germany, Spain, South Korea, Australia, and Italy. Notably, China maintains close relationships with all these nations. The US, the UK, Italy, South Korea, and Spain demonstrate a similar network structure, establishing robust citation relationships among themselves. In contrast, no citation connection between India and Germany indicates a lack of association between these two countries. Australia's primary connections are with China, the UK, India, and Spain, although its link with the US appears weak. Additionally, it is noteworthy that South Korea does not have a citation connection with Spain despite being among the prominent countries. Overall, the findings from this analysis reflect the relationship network within the academic studies among these nations, highlighting that economically developed countries tend to exhibit close citation relationships with one another, albeit with some exceptions.

4.9. Most Prominent Journals

The bibliometric analysis has identified the most prominent journals on digital technology-driven logistics competitiveness research. Table 6 presents the most prominent journals ranked by their volume of publications.

Table 6

Most Prominent Journals

SN	Sources	Articles	SN	Sources	Articles
1	Sustainability	143	11	International Journal of Advanced Computer Science and Applications	25
2	IEEE Access	113	12	Applied Sciences (Switzerland)	24
3	Sustainability (Switzerland)	71	13	Mathematics	24
4	Plos One	52	14	Logforum	21
5	Sensors	50	15	Computational Intelligence and Neuroscience	20
6	Applied Sciences-Basel	36	16	Acta Logistica	18
7	Logistics-Basel	32	17	Applied Mathematics and Nonlinear Sciences	18
8	Energies	30	18	Journal Of Medical Internet Research	18
9	Scientific Reports	27	19	International Journal of Environmental Research and Public Health	17
10	Heliyon	26	20	Mathematical Problems in Engineering	17

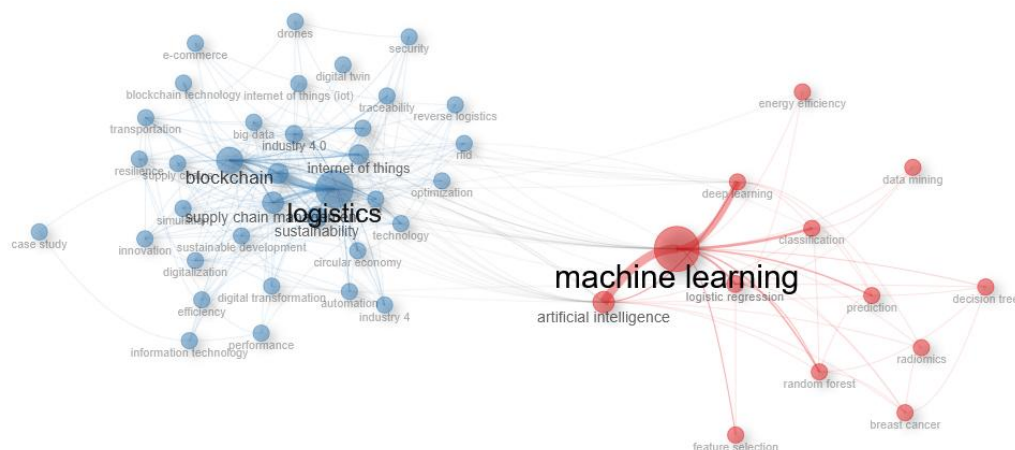**Source:** Created by the author using Bibliometrix

Table 6 shows the journals with the highest publication rates in the field of digital technology-driven logistics competitiveness research, along with the distribution of their publications. Sustainability stands out with 143 publications, making it the leading journal in this field. It is followed by the IEEE Access, which has published 113 articles, and Sustainability (Switzerland), contributing 71 publications.

4.10. Co-occurrence Network

Figure 6 illustrates the results of the co-occurrence network analysis of author keywords. This cluster analysis is based on the data presented in Appendix 2, and the value of zero (0) is not treated as an individual statement within the analysis.

Figure 6

Co-occurrence Network

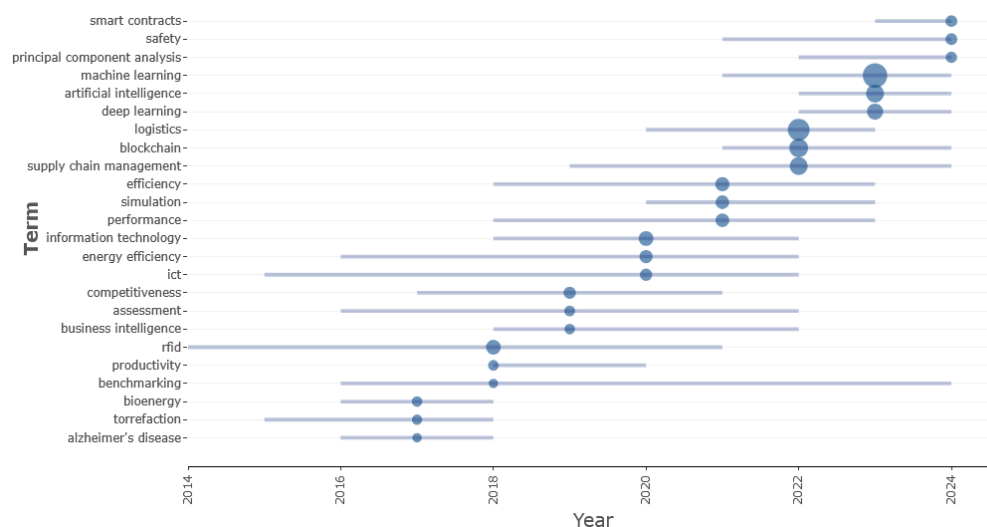**Source:** Created by the author using Bibliometrix

It has been observed that the author's keywords are organized into two distinct groups. In the first group, the term "machine learning" prominently features a betweenness value of 255.517, indicating a strong connection to concepts such as AI and deep learning. In the second group, "logistics" stands out with the highest betweenness value of 300.485. This term is closely associated with concepts such as blockchain, supply chain, supply chain management, Industry 4.0, and IoT. Furthermore, it has been noted that these concepts represent some of the most significant expressions within the group.

4.11. Trending Topic in Keywords

Figure 7 illustrates the key keywords and trending topics in publications focused on logistics competitiveness within digital technology. Notable phrases that have gained popularity in recent years include "smart contracts," "safety," and "principal component analysis." Additionally, it has been observed that software-driven technologies, such as AI, have increasingly come to the forefront. These findings underscore the need for researchers, industry representatives, and policymakers to align their future strategies with these emerging trends, ensuring they remain current and relevant. Conversely, once popular topics, such as "bioenergy" and "torrefaction," have diminished in importance over the past few years, outpaced by newer, more innovative subjects linked to digital transformation. This trend indicates a shift in sector priorities, driven by ongoing technological advancements reshaping current landscapes.

Figure 7

Trend Topics in Keywords

Source: Created by the author using Bibliometrix

5. Conclusion, Discussion, and Recommendations

According to the Susitha et al. (2024), digital technology and supply chain-related processes constitute significant areas of theoretical study, overlapping with broader paradigms such as strategy, innovation and organisational theory. These areas, which include agility, technology integration, and performance optimisation, present significant opportunities for academic research. The findings of this study highlight similar approaches. Andaloussi (2024) emphasises the transformative potential of digital technologies in supply chain processes. The author also emphasises the importance of interdisciplinary collaboration within the academic community, as evidenced by this research. Like this research, the Iftikhar et al. (2024) considers technologies such as big data analytics, IoT, Industry 4.0, blockchain and

AI to be of critical importance to supply chain processes. Similarly, Lyu et al. (2023) reveals that digital technologies are closely linked to the logistics sector and play a key role in enhancing its efficiency.

This study seeks to examine the competitiveness of digitally-focused logistics. To achieve this, a thorough literature review was conducted utilizing the WoS and Scopus databases on March 12, 2025. The retrieved publications were filtered according to specific criteria, culminating in the inclusion of 3,519 publications in the analysis. The findings from this analysis are outlined below:

- 3,519 studies published between 2000 and 2024 have been drawn from 1,492 academic publications. This illustrates a robust interest in digitally focused logistics competitiveness from diverse publishers, providing an optimistic outlook for researchers in this domain. An analysis of author profiles shows that 12,291 researchers participated in these works, with 13.55% of them engaging in publications through international collaboration. This data reflects a significant level of global academic interaction within the field (Table 1).

- During the reviewed period, the number of publications significantly increased. The publication count reached double digits in 2008 and soared to triple digits by 2017. In 2024 alone, 734 publications were recorded. This upward trend reflects a growing academic interest in digitally focused logistics competitiveness, underscoring the increasing importance of this subject over time (Figure 2).

- Upon examining the keywords utilized by the authors, it becomes evident that concepts directly related to the subject, such as "logistics" and "supply chain," are prominently featured. Furthermore, software-based technologies, including "artificial intelligence" and "machine learning," stand out. Additionally, terms like "sustainability," "IoT" and "Industry 4.0" frequently appear among the keywords. These findings illuminate the fundamental dynamics of the field and offer valuable insights into the future directions of the logistics sector. In this context, researchers, industry representatives, and policymakers need to align their strategic planning with these trends to enhance sectoral efficiency and competitiveness (Table 2).

- In that order, the leading contributors to publication production are China, the United States (USA), and the United Kingdom (UK). Notably, according to data from 2022, China also ranks first in high-tech exports, while the US holds the sixth position, and the UK is ranked fifteenth in the same category. Moreover, only four of the top 50 countries in publication production do not appear among the top 50 in high-tech exports (Note: 2022 high-tech export data for six countries is not available, as reported by the World Bank). This suggests a potentially significant correlation between academic publication output and high-tech exports (Table 3).

- When examining the international collaboration networks reflected in academic publications, it becomes evident that geographical proximity and established political relationships play a crucial role. For instance, China has notably fostered academic partnerships with geographically nearby nations, particularly Japan and South Korea. However, this trend has notable exceptions, such as China's collaboration with Greece. Similarly, while the United States primarily engages with European countries in its research efforts, it also has some unexpected connections based on geographical proximity, such as its relationship with Mexico. This illustrates that international academic collaborations are influenced by physical distance and economic, political, and strategic factors (Figure 3).

- According to the co-authorship network analysis, it is assumed that the central and influential authors within the network predominantly hail from the Far East. This observation aligns with the fact that China leads the world in publication production,

highlighting the significant role that regional researchers play in enhancing digitally focused logistics competitiveness (Figure 4).

- It was found that the researchers who published the most on the topic were Wang Y., Wang X., and Zhang Y. This observation aligns with the profiles of Far Eastern researchers, who occupy central positions and possess strong connections within the co-authorship network analysis. Consequently, there appears to be a correlation between individual publication performance and structural positioning within the network (Table 4).

- The analysis revealed that the most frequently referenced studies focused on health and software themes. Advanced technologies, considerable data analysis, and deep learning have attracted significant attention in academic literature, underscoring their increasing importance in digitally oriented logistics competitiveness and their influence on research directions. A review of citations by country shows that nations such as China, the United States, and the United Kingdom are particularly prominent, indicating that economically developed countries are mainly represented among those with high citation counts. This trend suggests a more vigorous academic output in digitally focused logistics competitiveness in countries with advanced economies (Table 5 and Figure 5).

- It has been established that the three leading journals for publications in this area are Sustainability, IEEE Access, and Sustainability (Switzerland). These journals are instrumental in the sector and significantly shape the literature surrounding digitally focused logistics competitiveness (Table 6).

- The reviewed publications noted that the primary themes revolved around logistics and software learning. Within the logistics domain, significant agenda items included supply chain management, blockchain technology, Industry 4.0, and the IoT. On the software front, advanced technologies such as machine learning, AI and deep learning emerged as key discussion topics. These findings indicate that advancements in logistics and software are interconnected and collectively contribute to shaping innovative trends within the sector (Figure 6).

- In recent years, it has become evident that software-related topics occupy a significant position among the trending subjects. Conversely, concepts such as RFID, bioenergy, and business intelligence have diminished in relevance within popular trends. This shift indicates that digital transformation and software-driven technologies are gaining prominence while new trends are supplanting older technological approaches (Figure 7).

5.1. Contribution of the Research to Literature

A review of 3,519 studies on digitally focused logistics competitiveness conducted between 2000 and 2024 clearly demonstrates both the growing academic interest in this field and the impact of digital transformation on the sector. Data from 1,492 publications reflects substantial global academic contributions from 12,291 researchers. With an international collaboration rate of 13.55%, the field exhibits a global academic interaction. The number of publications has increased over the years, peaking at 734 studies in 2024. This demonstrates that digitalisation is becoming an increasingly important aspect of the logistics sector, attracting the attention of the academic community. Key terms frequently used in these studies include "logistics", "supply chain", "artificial intelligence", "machine learning", "sustainability" and "Industry 4.0". These terms emphasise the pivotal role of digital technologies and sustainability in enhancing logistics competitiveness. The fact that China, the USA and the UK are at the forefront of publishing production and also rank highly in terms of technological advancement suggests a meaningful relationship between the two. Additionally, international collaborations are influenced by geographical proximity and strategic relationships. Consequently, the field of digitally

technology-based logistics competitiveness is developing rapidly, with software-based approaches such as AI and machine learning shaping the sector's future. Research in this area informs strategic decision-making.

5.2. Policy Recommendations

The proposed policy measures to enhance the competitiveness of digital-focused logistics are crucial for accelerating digital transformation within the sector and improving overall efficiency. Firstly, there is a need for increased investments in infrastructure related to digital technologies. Such investments will facilitate the digitalization of logistics processes and enhance efficiency across the sector. Additionally, promoting data sharing among businesses will lead to more effective supply chain management and enable better integration with digital solutions. Another vital policy recommendation is to develop the education system in accordance with current technological needs. This approach will equip the logistics workforce with essential digital competencies. Encouraging businesses to adopt innovative technologies will further expedite their digital transformation journeys. Furthermore, supporting sustainable logistics practices will not only help mitigate environmental impacts but also enhance the efficiency of logistics processes. Moreover, updating the legal framework in tandem with technological advancements is essential. Regulations in the sector should be refined to address data security and the emerging risks associated with digitalization. By fostering innovation activities, we can empower businesses to achieve global competitiveness, thereby strengthening the position of local companies in the international market. Finally, incorporating digital transformation processes into crisis management strategies will enhance the logistics sector's resilience and adaptability in the face of potential global crises.

5.3. Limitations of the Study

The current paper recognizes several limitations. First, the current paper could be reproduced by modifying the filters used in this research. Exploring additional databases and languages may provide a broader perspective. Moreover, the research depth could be improved by integrating more keywords on a more specific area of focus.

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Appendices

Appendix 1. Synonym Word List

Word	Synonym Word
machine learning	machine learning (ml), machine learning algorithms, …
logistics	reverse logistics, logistics management, logistics 4 0, city logistics, …
blockchain	blockchain technology, blockchains, blockchain adoption, …
artificial intelligence	artificial intelligence (ai), artificial intelligence technology, …
supply chain	supply chain management, supply chains, supply chain performance, …
sustainability	environmental sustainability, business sustainability, corporate …
internet of things	internet of thing, IoT
industry 4 0	industry 4.0, industry 4
deep learning	deep learning (dl), …

Appendix 2. Analysis Parameters

- Network Layout: Automatic

- Clustering Algorithm: Walktrap

- Normalization: Association

- Number of Nodes: 50

- Repulsion Force: 0.1

- Remove Isolated Nodes: Yes

- Minimum Number of Edges: 1