



IMPACT OF IMPLEMENTATION OF ICT (INFORMATION COMMUNICATION TECHNOLOGY) ON THE LOGISTICS INDUSTRY: LITERATURE REVIEW

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Abstract: Logistics is very important sector for modern businesses as it plays crucial role in economic development and business growth. Integration of Information and Communication Technology into logistics has changed the complete dimensions by providing transparency, accuracy and flexibility in business enabling faster deliveries with real time data sharing, optimal routing, load sharing resulting not only in cost reduction but also in reduced carbon footprints. This study is focused on reviewing ICT research in logistics sector.

Bibliometric analysis was carried out to discover developments in ICT research in the logistics sector. By using exclusion and inclusion criteria, 50 studies were identified, the dataset from 2018 to 2023 was considered using bibliometric analysis techniques. Analysis is performed using VOS viewer program. Key findings of this study show that Information and Communication Technology has enabled better communication amongst stakeholders of supply chain (Real time information sharing and tracking), improved operational efficiency (improvement in SLA, KPI) resulting in improved decision making, better service quality and efficiency.

Keywords - Information and communication technology; Logistics; Literature review; Bibliometrics Analysis

I. INTRODUCTION

In recent years, including during COVID-19, ICT has enabled civilization to survive at home with a supply of groceries and necessities [1]. The two adaptable industries of logistics and information technology (IT) are largely responsible for the world's survival today [2]. It is concerning for global social and economic situations. For individuals and businesses to survive, either their needs must be met, or they must meet their needs. In any case, it entails moving the needs, so ICT and logistics deliver the greatest results by making products available to customers. It is said that the Industrial Revolution occurred in the 18th and 19th centuries, technical intervention and multimedia inventions occurred in the 20th century, and medical and ICT solely occurred in the 21st century [3][4]. As a result, the current age has been characterized as pushing the industry to unprecedented heights. The globe is now a "global village" as a result.

The development of the globe was significantly influenced by logistics almost 5000 years ago [5]. Often, the transition to a new historical and economic era has been based on intelligent logistical solutions [6]. One of the creative service systems that has witnessed this basic advancement so far in the 20th century is the construction of enormous to very big cargo ships on the oceans and seas [3]. Both are essential components of the globalization situation that exists today. By implementing technology, the company or organizations have taken several steps to lessen this confusion [7]. However, this is insufficient to examine the type of reliance that exists in this industry. Some businesses have made technological adaptations mandatory, such as using GPS to track their automobiles. However, there are still a lot of things to consider in the same subject [8].

The growth of ICT in the logistics sector presents several difficulties for businesses as well [9][10]. Its functions include lowering transportation costs, enhancing supply chain visibility and finance, streamlining customer business processes, adhering to legal requirements, and promoting sustainability. Information management is the ability to transform information into data and information into information to enhance corporate decision-making [11]. The main duties of suppliers are to reduce purchase costs, improve product quality, and shorten delivery and stock periods. The establishment of automatic orders to suppliers, the combination of charging requirements with carrier accessibility, standardization of information through similar selection standards, and auto-billing from consumption are all made possible in this logistical process by the electronic transfer of information with reliable connections between suppliers and consumers [12],[13]. To maintain the planning of a company's whole supply network in sync, forecasting is used to estimate future demand for a product [14]. As a result, the supply chain's information flow is improved, which in turn gets the company's divisions ready for future operations [15].

The ICT logistics method includes investments in networks, hardware, software, and design to make data processing and interchange easier [16]. Future logistics companies may be directly impacted by a decrease in formal structure and an increase in expert networking. Many company executives have concluded that complete internal control over every aspect of operations is no longer required [17]. Improved communication and cross-border partnerships with trading partners can help execute logistics plans and achieve performance targets [18]. Since the introduction of ICTs into logistics, commodities have been managed, controlled, and continuously monitored at different stages of storage or at different phases of transit, from the manufacturing or origin site to the point of final consumption [19][20]. ICTs reduce potential mistakes during data processing, some of which are human-caused, and enhance the effectiveness and speed of the procedures involved in logistical actions.

1.1 Problem Statement and Research Gap

The logistics industry is undertaking a significant alteration determined by the implementation of advanced ICT, including IoT, blockchain, artificial intelligence, and Industry 4.0 solutions. These technologies promise to enhance operational efficiency, transparency, and sustainability across logistics operations, from real-time tracking to optimized multimodal transport networks. However, despite the growing body of research, the effective integration and implementation of ICT in logistics remain inconsistent. Studies by Rejeb et al. [21] and Sun et al. [26] reveal challenges such as data interoperability, cybersecurity risks, and the complexity of scaling these technologies across diverse supply chains. Similarly, while blockchain and AI are gaining attention, their potential to support trust, agility, and sustainability [23][30] is not fully realized due to policy barriers and technological immaturity. Abdullahi and Mohamud [28] further highlight the lack of comprehensive research on ICT's impact on long-term supply chain sustainability and competitive advantage. Additionally, the fragmented focus of existing studies on specific technologies or industries has created a gap in considering the holistic impact of ICT on the logistics ecosystem. By investigating the effects of ICT implementation on the logistics sector, this study seeks to close this gap.

This study has been created as follows. Section 2 offers an overview of the literature on the use of ICT in the logistics sector. Section 3 then designates the methodology of research. Section 4 presents the analysis's findings. In Section 5, the study's results and research implications are covered. The paper accomplishes a review of the study's limitations and contributions.

II. LITERATURE REVIEW

A huge amount of research shows how supply chain management (SCM) and logistics are becoming revolutionized by new technologies like blockchain, Industry 4.0, and IoT. A bibliometric examination of 807 publications published over 20 years was carried out by Rejeb et al. [21], who identified important themes such as RFID technology, Industry 4.0, and reverse logistics. The study underscores that IoT has attracted substantial attention from SCM and logistics communities, with applications across industries including food, retail, construction, and pharmaceuticals. Similarly, Zrelli and Rejeb [29] extended this research, highlighting the transition from experimental IoT applications to mature implementations in SCM. Their findings emphasize the interplay between IoT, AI, and blockchain, showing how these technologies improve security, traceability, and communication efficiency while also driving innovation in food supply chains and digital transformation across industries.

The literature also highlights the importance of supply chain blockchain, predominantly its potential to enhance sustainability and operational efficiency. Rejeb et al. [23] analyzed 628 blockchain-related publications, observing that interest in blockchain technologies surged after 2017, especially in China, India, and the United States. Their research points to blockchain's role in promoting supply chain sustainability, agility, and intellectual property protection, predominantly in perishable food chains. Similarly, the findings by Chung [24] focus on smart technologies (STs) in logistics and transportation. Chung's review of publications between 2010 and 2020 stresses the need for executive awareness of AI's importance and highlights environmental concerns tied to smart logistics, indicating that technological optimism must be balanced with practical implementation strategies. Several studies have examined the intersection of sustainability and technological innovations in logistics. Sun et al. [26] analyzed the effect of technologies of Industry 4.0 on social, eco-friendly, and economic performance within the logistics sector, although they caution about trade-offs and technological maturity challenges. Cano et al. [27] further explored sustainability within e-commerce logistics, identifying emerging trends such as last-mile delivery, urban logistics, electric vehicles, and crowd-shipping solutions. Their results emphasize the growing position of environmental policies, as well as modes of operation like parcel lockers and micro-depots, which are becoming critical to improving delivery efficiency and reducing congestion in urban areas.

Other studies focus on how ICT improves the management of the supply chain. Abdullahi and Mohamud [28] analyzed research between 2018 and 2023, identifying ICT as a key enabler of competitive and sustainable SCM strategies. Their findings align with those of Fareed et al. [30], who investigated multimodal logistics systems since 2005. Fareed's study emphasizes the need to overcome policy barriers while identifying AI, machine learning, and blockchain as essential technologies for enhancing the sustainability of multimodal logistics. Overall, these studies offer a nuanced understanding of the dynamic nature of logistics and supply chain control, where advanced technologies play a pivotal role in optimizing operations, ensuring sustainability, and navigating new challenges in a rapidly changing environment. Based on the earlier studies summarized, here is a structured review table 1:

Table 1. Review studies

Article	Method of Review	Database(s) Used	Sample	Period	Type of Reviewed Publications
Rejeb et al. [21]	Bibliometric + Content Analysis	Multiple	807	2000–2020	Journal articles, Conference papers
Armenta-Medina et al. [22]	Bibliometric	Scopus	2633	1994-2018	Journal articles
Rejeb et al. [23]	Bibliometric + Visualization	WoS, Scopus	628	2016–2020	Journal articles, Conference papers
Chung [24]	Systematic Literature Review (SLR)	Web of Science	-	2010–2020	Journal articles

Lagorio et al. [25]	SLR	Scopus, WoS	152	2010-2018	Journal articles
Sun et al. [26]	SLR Quantitative Analysis	Multiple	115	2012–2020	Journal articles
Cano et al. [27]	SLR Bibliometric	Scopus	99	2021–2022	Journal articles, Conference papers
Abdullahi & Mohamud [28]	Systematic Review	Scopus, Emerald, Sage, etc.	10	2018–2023	Journal articles
Zrelli & Rejeb [29]	Bibliometric Thematic Analysis	Scopus	2680	2000-2023	Journal articles
Fareed et al. [30]	Systematic Review	Multiple	52	2005–2024	Journal articles, Conference papers

III. METHOD AND DATA

A bibliometric review of the literature is a highly helpful method for summarizing the most recent research on any given subject. The quantity of secondary data included in a bibliometric review gives its reader fresh ideas and helpful bibliographic scientific knowledge. A survey of research, the bibliometric review makes it simple to critically assess, examine, and condense the findings of any given field of study [31]. The foundation of this bibliometric review study is the identification of pertinent prior research on ICT in the logistics industry. Thus, for any bibliometric assessment, the PRISMA (Preferred Reporting Items for Systematic Assessments and Meta-Analyses) guidelines, which consist of four stages of activities to incorporate the research items in the bibliometric review identification, screening, eligibility, and inclusion, should be adhered to [32]. The bibliometric review process is illustrated in Fig. 1 below, which lists the five implementation processes that comprise all the PRIMSA guidelines: identifying research questions, searching the database system for pertinent data, screening data, and evaluating data for results.

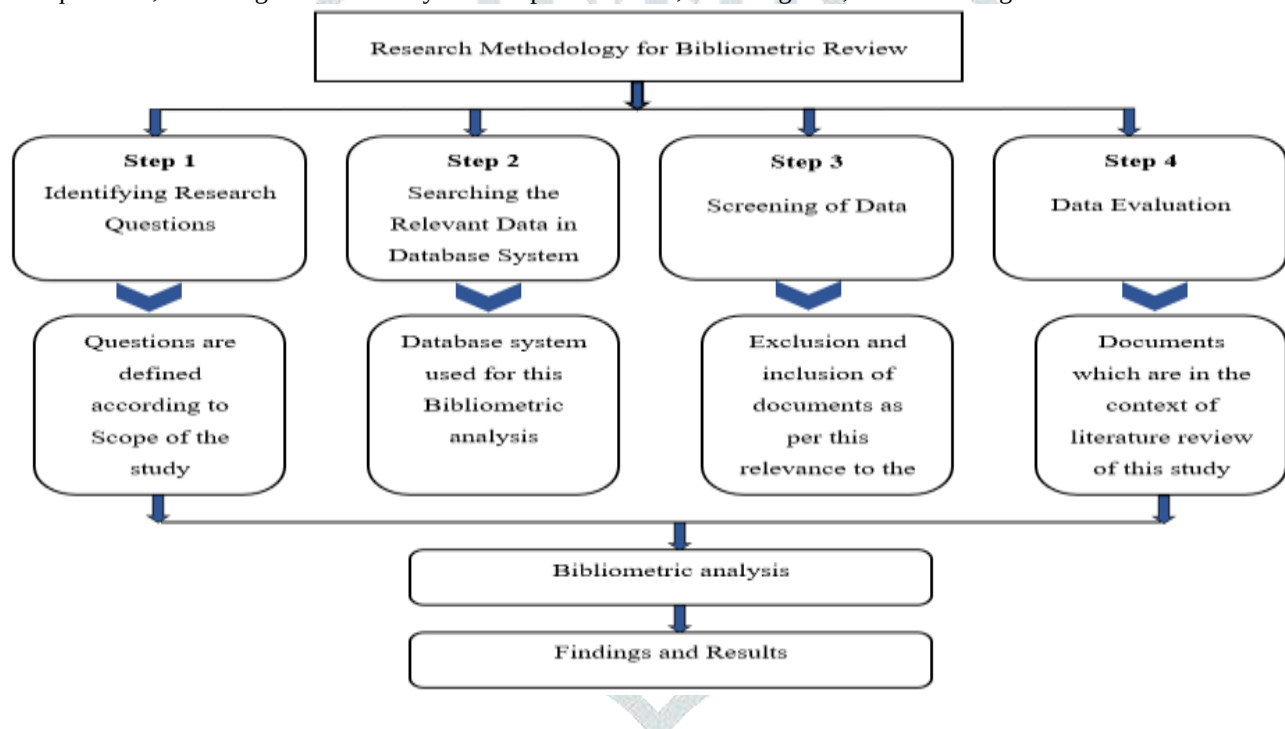


Figure 1: Research Methodology for Bibliometric Review

3.1 Step 1: Research Questions Identification

A bibliometric review must have well-defined research questions to provide greater clarity while analyzing the data. This study's primary goal is to evaluate the literature on ICT use in logistics. More precisely, the subsequent research questions (RQ) are addressed by this study:

RQ₁: How have scholarly publications on (ICT) in logistics and supply chain evolved over the period?

RQ₂: What is the network of collaboration among countries, journals, and citations in ICT and logistics research?

RQ₃: What are the most influential themes and emerging trends in research related to information and communication technologies (ICT) in logistics and supply chain management?

3.2 Step 2: Searching for relevant data in the database system

The selection of data processing techniques and resources is the most crucial stage in the research process. Scientific publishing information may be found through online databases. Bibliometric research frequently uses major databases such as WoS, Medline, Google Scholar, and Scopus [33]. This study's data came from Google Scholar Collections. Google Scholar was selected because it guarantees access to outstanding data and covers a broad variety of notable academic data sources.

The subsequent phase of the research involved a focused keyword search for "ICT and logistics" to identify reputable academic journals indexed on Google Scholar, including platforms such as Elsevier, Emerald, IEEE, MDPI, Springer, Wiley, and Taylor & Francis specifically within the publication timeframe of 2018 to 2024. This keyword emerged as particularly significant, yielding the highest number of associated publications compared to other terms, thereby highlighting its critical relevance in the evolving landscape of supply chain and logistics. The keyword search method utilized a carefully constructed query string: TITLE-ABS-

KEY ("ICT" OR "information communication technology" OR "smart logistics" OR "digital transformation" OR "technology adoption") AND (LIMIT-TO (SUBJAREA, "BUSI")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (PUBSTAGE, "final")). This approach was meticulously designed to capture articles that included these keywords in their titles, abstracts, or keywords, thereby establishing clear criteria for the search process. By leveraging this systematic strategy, the research aimed to synthesize insights into how ICT tools are integrated into logistics operations, enhancing efficiency and driving innovation within the supply chain framework. This aligns seamlessly with the thematic clusters discussed earlier, particularly those related to smart logistics and the impact of technologies on modern supply chains.

3.3 Step 3: Screening Data

In this phase, the papers are thoroughly reviewed and then included for analysis and final results; studies that are unrelated to the stated study questions or the range of the works of literature review are excluded. The database criteria for searching are compiled in Table 2, which distinguishes between inclusion and exclusion criteria. By using this approach, the study was able to gather many scholarly articles, research results, and publications that offer a complete knowledge of the impact of digital technology on modern logistics operations. As a result, 50 titles out of the 85 articles that the first search turned up met the requirements listed below and were further investigated.

Table 2: Exclusion and Inclusion Criteria

Type	Criteria
Inclusion	• Empirical research-based studies • Studies on technology adoption, smart logistics, and information and communication technologies • Peer-reviewed works of literature • Research pertaining to any population • Research conducted between 2018 and 2024 • Composed in English
Exclusion	• Non-empirical investigations • Short documents • Workshops • Documents that are still in process • Chapters of books

3.4 Step 4: Data Evaluation

In this stage, PRISMA standards have been used to identify and include documents for data evaluation. The selection of this study using the PRISMA approach is shown in Fig. 2 [34]. The papers selected for data evaluation play a crucial role in the literature study's categorization and analysis.

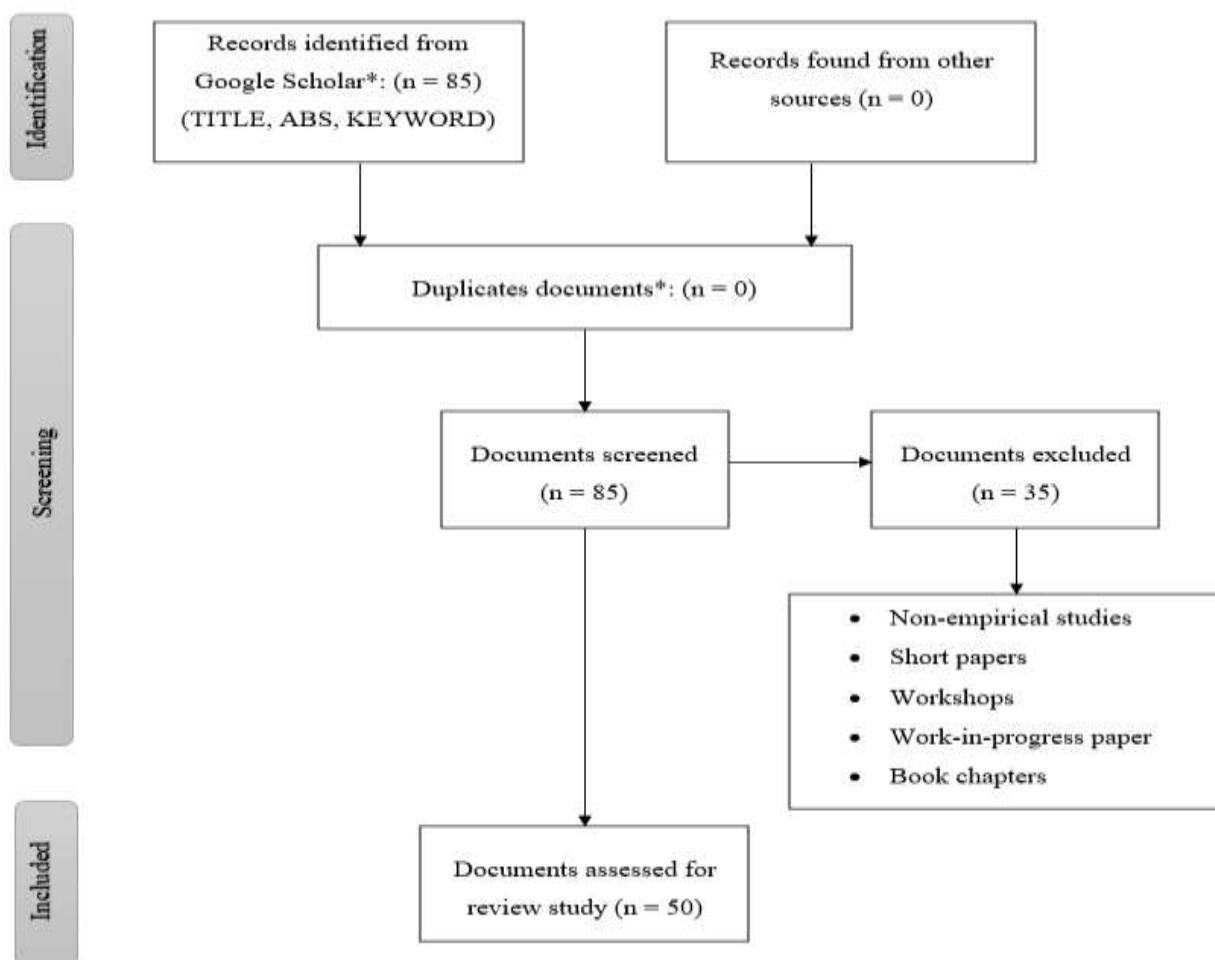


Figure: 2: Publication selection using the PRISMA approach

IV. BIBLIOMETRIC ANALYSIS

The 50 publications chosen for these research investigations were analyzed descriptively based on various perspectives, including document types in the database, journal contributions, research subjects, paper publication trends over time, and citation patterns. Bibliometric techniques have become popular as a quantitative method for systematically examining bibliographic data, simplifying the categorization and organization of material. By using bibliometric evaluation, researchers can gain a comprehensive view of a specific study area [35]. This study analyzed ICT research from the Google Scholar database using bibliometric analysis. Key analytic units included papers, sources, authors, institutions, countries, and author keywords, facilitating studies such as co-authorship, co-citation, and co-occurrence assessments [33]. VOSviewer (version 1.6.19) was employed to streamline the creation and visualization of bibliometric maps [36].

4.1 Publication of documents overtime

An increasing interest in studying the use of ICT in the logistics sector is shown in the number of articles from 2018 to 2024. The data shows a gradual increase in publications, starting with just 2 papers in 2018, followed by 4 in 2019. In 2020 and 2021, the number of studies increases to 6 and 10, respectively, accelerating this upward trend. This is probably due to the growing use of digital solutions in response to the COVID-19 pandemic, which highlighted the necessity of robust and effective supply chains. While there is a minor decline in 2022, with just 6 publications, interest increases once more in 2023 and 2024, with 10 and 12 articles published, respectively. This return indicates that scholars are paying greater attention to the use, difficulties, and effects on logistics of technologies like IoT, blockchain, and AI as they develop. The steady growth over the years highlights the evolving relevance of ICT in addressing logistical complexities and points toward an ongoing research momentum in exploring innovative solutions to enhance supply chain efficiency and sustainability.

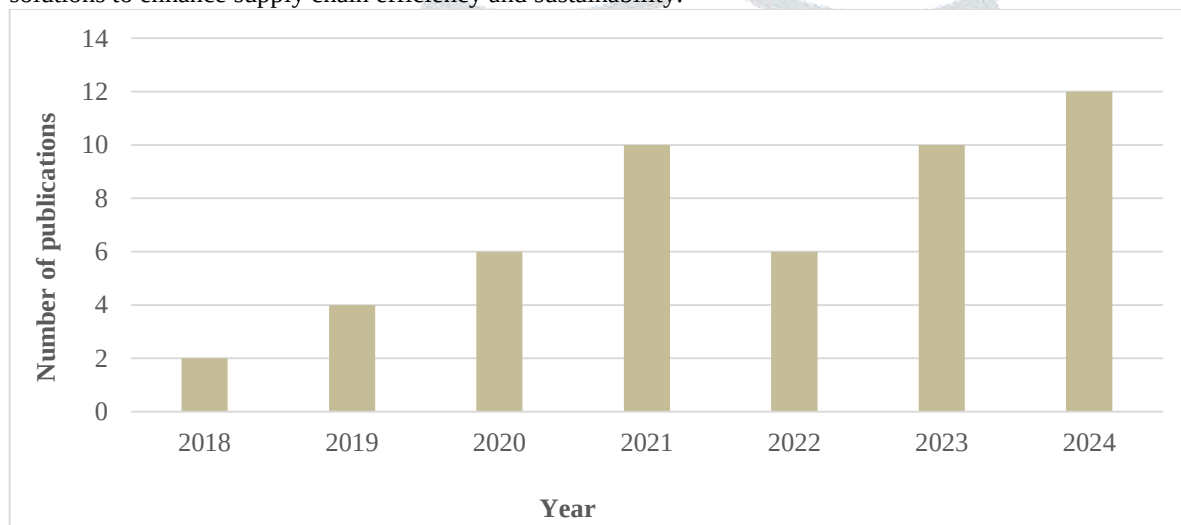


Chart 1: Distribution of research published over the years

4.2 Distribution of publications in various journals

The distribution of papers across journals highlights a wide range of research outlets focusing on logistics, sustainability, and technology, which is indicated in Table 3. The International Journal of Logistics Management and Sustainability lead with 6 papers each, indicating a strong interest in both logistics management and sustainable practices. Several other journals, such as IEEE Access, Heliyon, and the International Journal of Logistics Research and Applications, contributed 2 papers each, reflecting interdisciplinary research across logistics, technology, and business management. A diverse set of journals, including Transportation Research Part E, Production Planning & Control, and Journal of Enterprise Information Management, published one paper each, showcasing the broad relevance of logistics and ICT across different fields. This variety of journals suggests that ICT in logistics is not only a technical subject but also intersects with management, sustainability, and social sciences, emphasizing the growing importance of integrated, cross-disciplinary research in this domain.

Table 3: Distribution of papers across journals

Journal	No. of Papers
Sustainability	6
The International Journal of Logistics Management	6
IEEE Access	2
Heliyon	2
International Journal of Logistics Research and Applications	2
Cogent Business & Management	2
Cleaner Logistics and Supply Chain	2
Kybernetes	2
Annals of Operations Research	2

4.3 Documents by Subject Area

Chart 2 shows the distribution of papers by subject area and illustrates the interdisciplinary nature of the research on ICT and logistics. **Business Management** leads with 45% of the publications, underscoring the focus on strategic integration, operational improvements, and managerial aspects of ICT in logistics systems. Journals like The International Journal of Logistics Management

and Supply Chain Forum contribute significantly to this category. **Engineering** accounts for 15% of the papers, highlighting the importance of technological and infrastructural developments. Journals such as IEEE Access focus on innovations like IoT and blockchain. **Social Sciences** represent 12.5%, reflecting the societal and human aspects of logistics, including ethics and policy, with contributions from journals like the Asian Journal of Business Ethics. **Environmental Science** covers 10% of the research, emphasizing sustainability, with journals like Sustainability and Cleaner Logistics and Supply Chain. **Computer Science** contributes 7.5%, focusing on software and IT infrastructure that enable logistics operations. Lastly, **Other Areas** (10%) include publications related to economics, finance, and planning frameworks, showing the growing relevance of interdisciplinary approaches in logistics research. Journals like Socio-Economic Planning Sciences and the Journal of Risk and Financial Management align with this category. This distribution indicates that ICT adoption in logistics spans multiple disciplines, involving both technical and managerial considerations.

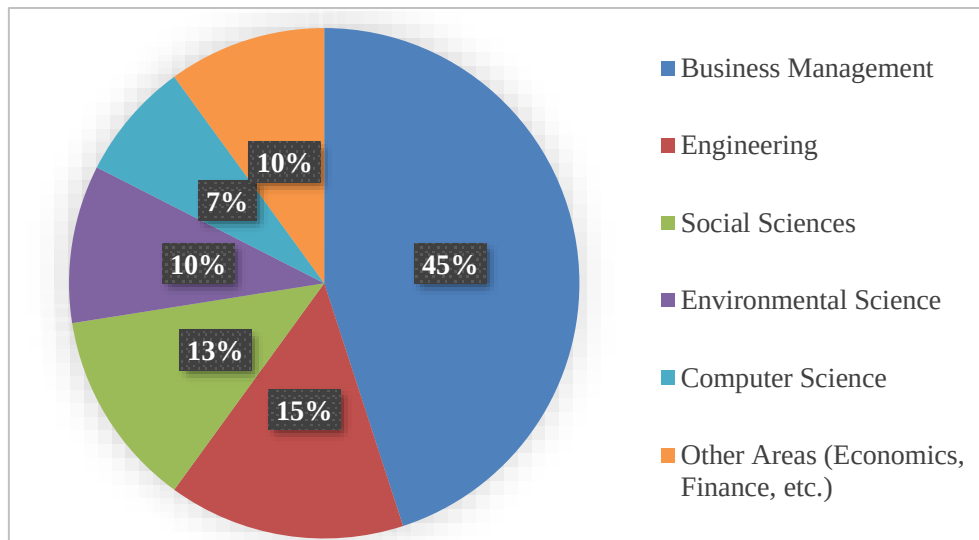


Chart 2: Distribution of Papers by Subject Area

4.4 Country Analysis

The database provides a summary of the articles that any country or region has generated and published. Even though it has been noted that many published papers are the product of many writers from different nations working together, the documents may still be shared by determining the nationality of the relevant author. The country analysis of the papers chosen for this assessment is shown in Fig. 4. The data also shows that these ten nations are the most active in the world when it comes to ICT research in logistics. The distribution reveals that China (13.8%) and India (12.8%) dominate the publications, reflecting these countries' growing influence in logistics and ICT research. The United Kingdom also features prominently (10.6%), showing strong academic involvement. Spain (9.6%) has notable representation, followed by Morocco (6.4%) and France (5.3%), suggesting regional interest in logistics. Other countries like Malaysia, Italy, and Germany each hold 4.3%, indicating cross-regional contributions. Some countries, including Portugal, South Africa, and Saudi Arabia, are present with moderate mention (2.1% each). Finally, Vietnam, Thailand, and Serbia reflect emerging research interests, even though they appear less frequently. The globally recognized dimension of ICT and logistics research is shown by the variety of participating countries, with developed as well as developing nations making substantial contributions.

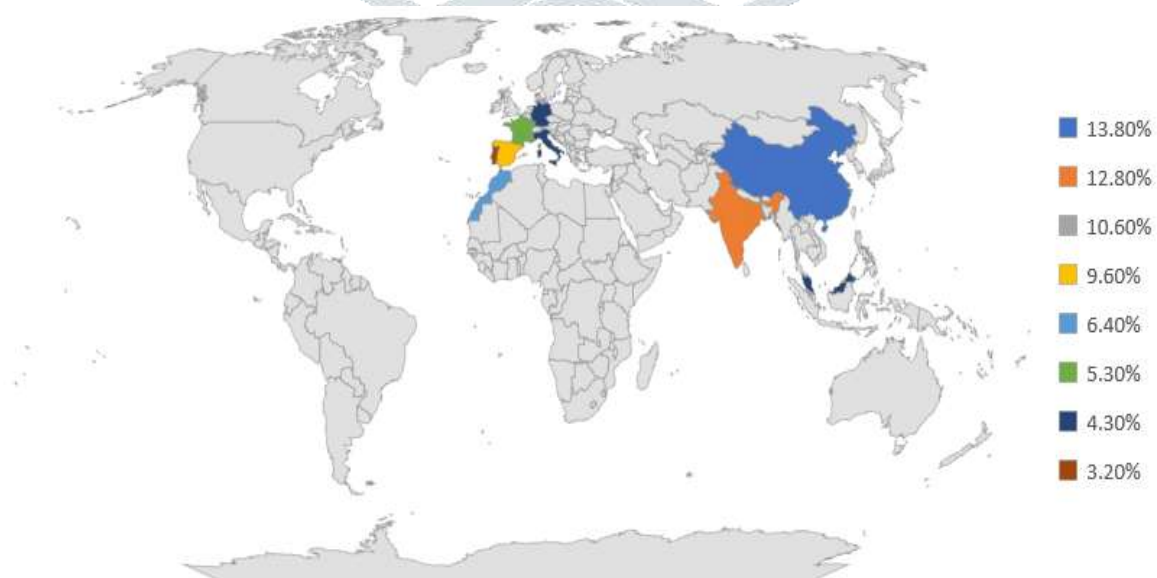


Figure 4: Distribution of Papers by Country

4.6 Co-occurrence Keyword Analysis

Author keywords can be used to determine current themes and research trends in a particular field. The VOS viewer software was used in this research to conduct a bibliometrics evaluation and visually represent the keywords gathered from 50 publications on ICT in the logistics field.

An outline of the main issues and research themes that have been thoroughly surveyed and settled in the use of ICT in the logistics sector is given by the term clustering. For this study, 30 of the 174 research article keywords meet the requirements. Figure 5 illustrates how a co-occurrence keyword analysis generates a network mapping of the author's terms. The VOSviewer visualization's clusters and links highlight important topics in the fields of logistics, digital technology, and management of the supply chain. Every color-coded cluster illustrates a distinct yet connected facet of how innovations, practices, and information technologies affect supply chain ecosystems and logistics.

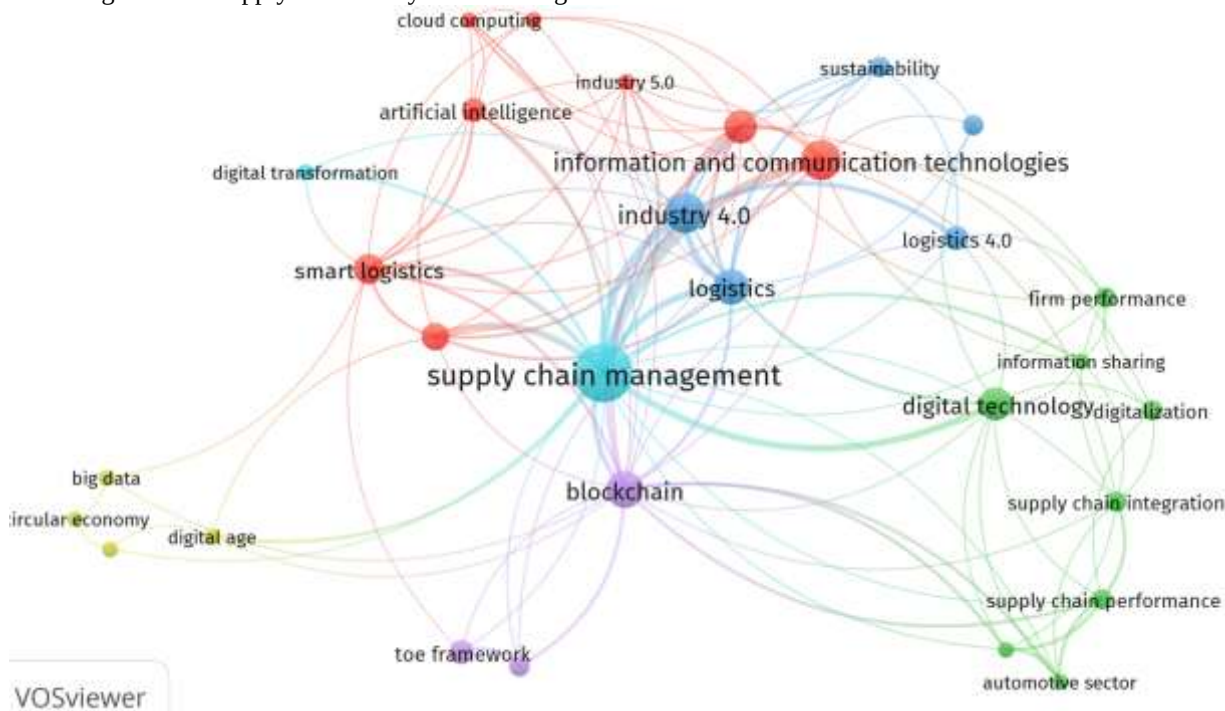


Figure 5: Co-occurrence analysis of keywords

Cluster 1 (Red): Technology Integration for Smart Logistics and Supply Chains

This cluster concentrates on how supply chains and logistics are being revolutionized by emerging technologies including the use of cloud computing, artificial intelligence (AI), the IoT, and Industry 5.0. The adoption of these technologies reflects a transition toward smart logistics—where automation, real-time data, and predictive analytics optimize processes [40][47]. AI enables forecasting and route optimization, while IoT sensors monitor goods and assets in transit, improving traceability and control. Cloud computing serves as the backbone for seamless data exchange among stakeholders, fostering cross-border collaboration. The concept of Industry 5.0, emphasizing human-technology collaboration, also plays a key role in making supply chains more responsive and adaptive to market changes. As businesses aim to build resilient and efficient supply chains, the integration of ICT tools is becoming essential to reduce downtime, streamline operations, and enhance overall service quality [48].

Cluster 2 (Green): Digitalization, Integration, and Business Performance

The supply chain's performance, firm competitiveness, and sustainable business practices are all examined in this cluster. The automotive sector is highlighted as a leading industry, using digital technologies to improve production efficiency and logistical coordination [49]. Topics such as supply chain incorporation and information sharing reflect the growing interdependence among stakeholders, facilitated by digital platforms. Integration enables firms to align strategies with partners, share real-time information, and respond to disruptions swiftly [50]. Additionally, digitalization helps achieve economic sustainability by cutting operational costs and improving productivity [51]. The ability to leverage digital tools ensures better supply chain performance, contributing to long-term business growth. The cluster demonstrates how businesses need to integrate technological solutions with business models to maintain competitive advantage, while also meeting customer expectations for speed, transparency, and sustainability.

Cluster 3 (Blue): Industry 4.0 and Innovation in Logistics

The blue cluster revolves around industry 4.0 technology used in logistics, including robots, automated processes, and cyber-physical networks. This cluster emphasizes the rise of logistics 4.0, which refers to using advanced technologies to automate warehousing, transportation, and inventory management [52]. Innovation is central to these developments, as firms experiment with new ways to enhance productivity, improve customer experience, and reduce environmental impact [53]. Sustainability remains a key consideration, with firms adopting eco-friendly logistics practices to reduce carbon footprints and promote green supply chains. This cluster also highlights how innovation within logistics aligns with broader business strategies to achieve efficiency and resilience, particularly in response to dynamic market demands [54]. Next-generation supply chains, which are not only efficient but also flexible and sustainable, are being made possible by Industry 4.0 technology.

Cluster 4 (Yellow): Circular Economy and the Role of Big Data

This cluster is primarily concerned with the circular economy and the role that big data analytics play in creating a sustainable supply chain. In order to reduce waste and advance long-term sustainability, the circular economy seeks to establish a system in which resources can be recycled, renewed, or reused. Big data plays a pivotal role by providing insights into consumer behavior, supply chain bottlenecks, and opportunities for optimization [55]. Data analytics allows firms to forecast demand accurately, optimize production schedules, and reduce excess inventory [56]. Additionally, the cluster highlights the identification of critical success factors for achieving sustainable operations, ensuring that firms can align their practices with environmental goals. As

supply chains become more data-driven, companies can effectively measure and enhance their sustainability efforts while improving profitability.

Cluster 5 (Purple): Blockchain and Technology Adoption Frameworks

This cluster focuses on the logistics industry's use of blockchain technology and TOE (Technology-Organization-Environment) frameworks. By establishing a decentralized database of transactions, the blockchain system improves supply chains' openness, accountability, and trust [57]. This is especially critical for industries like pharmaceuticals and food, where product authenticity and traceability are paramount. Blockchain also streamlines contract management and payment processes, reducing disputes and enhancing collaboration. In the meanwhile, the TOE framework offers an organized method for comprehending how different elements affect the uptake of technology such as blockchain, artificial intelligence, and the IoT [58]. The cluster emphasizes the importance of aligning technology adoption with organizational strategies and environmental contexts to ensure smooth digital transformation.

Cluster 6 (Teal): Digital Transformation and the Evolution of Supply Chain Management

The teal cluster focuses on how digital technology is revolutionizing supply chain management. To improve agility and resilience, digital transformation entails a thorough rethinking of business processes rather than just implementing new technology [59]. This cluster reflects how firms are leveraging digital tools to build end-to-end visibility and streamline operations across global supply chains [60]. Technologies such as digital platforms and automation tools enable real-time tracking, faster decision-making, and improved customer service. As digital transformation accelerates, the role of supply chain management has evolved from merely coordinating logistics to driving innovation and strategic growth. This cluster highlights how firms must adapt continuously to stay relevant, leveraging digital innovation to respond effectively to both market demands and disruptions.

V. CONCLUSION AND DISCUSSION

This bibliometric study offers a wide-ranging overview of the evolving research landscape on ICT and digital alteration in the logistics industry. The analysis reveals significant growth in publications from 2018 to 2024, indicating that the logistics sector is rapidly adopting digital tools such as Industry 4.0, blockchain, smart logistics, and artificial intelligence. The increasing focus on these technologies highlights the growing recognition of their potential to improve supply chain performance, integration, and sustainability (Attaran, 2020). The emphasis on sustainability and digitalization also aligns with global trends that promote eco-friendly supply chains and data-driven decision-making (Lai et al., 2018). The clustering of keywords such as smart logistics, digital transformation, and firm performance demonstrates how interconnected these themes are in shaping the future of logistics operations.

Moreover, the geographical distribution of research reveals that China, India, the USA, and the United Kingdom are leading contributors to this field. The involvement of both developed and emerging economies suggests that digital transformation in logistics is a global priority, with countries seeking to improve their supply chains to meet increasing consumer demands and enhance global competitiveness [41]. This global collaboration is reflected in cross-country partnerships, indicating the importance of shared knowledge and innovation. However, the data also reveals regional imbalances, with limited contributions from African and South American countries, pointing to an opportunity for future studies to explore context-specific logistics challenges in these regions.

The study shows that research in the field is highly interdisciplinary, spanning areas like logistics, supply chain management, technology, business management, and sustainability. This trend suggests that logistics operations are no longer seen in isolation but are increasingly linked to technological advances, environmental concerns, and business strategies. For instance, the widespread interest in blockchain and digitalization frameworks highlights the need for transparency, efficiency, and traceability across global supply chains. Meanwhile, research clusters related to cloud computing, AI, and the IoT indicate a shift toward the adoption of real-time data analytics and automation in logistics processes [45].

5.1 Implication of the Study

The implications of this bibliometric study are important for both researchers and practitioners in the logistics industry. By highlighting the rapid growth and interdisciplinary nature of research on ICT implementation, the study highlights the critical role of digital technology in altering logistics operations and enhancing supply chain performance. Practitioners can leverage insights into emerging technologies like AI, blockchain, and smart logistics to drive innovation and improve efficiency, ultimately fostering more sustainable practices. Moreover, the identification of regional disparities in research contributions signals an opportunity for stakeholders in less-represented areas to engage in collaborative efforts, addressing unique challenges and promoting inclusive growth in digital logistics. For researchers, the identified gaps and trends serve as a foundation for future inquiries, particularly in underexplored areas such as urban logistics and regulatory frameworks. Overall, the study emphasizes the significance of continued exploration and adaptation in a rapidly evolving landscape, encouraging a proactive approach to harnessing digital tools for a competitive edge and sustainability in the logistics sector.

5.2 Limitation and Future Research Scope

This bibliometric study has several limitations. Firstly, the reliance on published literature may overlook valuable insights from industry reports, white papers, and case studies, which could offer a more understanding of ICT implementation in logistics. Additionally, the focus on specific keywords may have excluded relevant studies that discuss related themes but do not explicitly use the identified terms, potentially narrowing the scope of the analysis. Future research should aim to adopt a more holistic approach, incorporating qualitative methods to capture practical experiences and challenges faced by industry practitioners. Furthermore, as emerging technologies like AI and blockchain continue to evolve, there is a need for longitudinal studies that assess their long-term impacts on supply chain performance and resilience. Expanding research efforts into underrepresented regions, particularly in Africa and South America, could provide insights into context-specific logistics challenges and solutions, enhancing the global discourse on sustainable logistics practices. Finally, examining the role of policy frameworks and regulatory environments in facilitating digital transformation in logistics, especially in developing economies, represents a promising avenue for future exploration.

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