Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA DOI: 10.46254/NA10.20250289
Published: June 17, 2025

IoT-Enabled Demand Forecasting in Supply Chain Management: A Bibliometric Analysis and Future Directions

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Abstract

The Internet of Things (IoT) is changing how organizations forecast product demand by enabling real-time data collection through connected sensors. Despite growing interest in this area, research on IoT-enabled forecasting remains scattered across multiple disciplines, making it difficult to identify key contributions and overarching trends. To address this gap, a bibliometric analysis was conducted using Biblioshiny software to answer two research questions: (1) Which contributions have been most influential in IoT-based demand forecasting for supply chains? and (2) What emerging topics are likely to shape future developments in the field? The PRISMA methodology was applied to gather and screen articles from the Scopus database. The analysis includes publication trends, leading authors, top journals, highly cited documents, contributing institutions, and countries. Keyword analyses are presented through word clouds, trend-topic maps, conceptual structure diagrams, and thematic evolution plots. The findings offer a structured overview of the field's development and propose future directions, including sustainable forecasting practices and greater interdisciplinary collaboration.

Keywords

Internet of Things, Supply Chain Management, PRISMA, Bibliometric Analysis, Demand Forecasting.

1. Introduction

Modern supply chains face significant challenges in achieving accurate demand forecasting due to increasing market changes, complex global networks, and rapidly changing consumer behaviors. Hussain et al. (2021) noted that traditional forecasting methods, which rely mainly on historical data and statistical models, have proven insufficient

for addressing the dynamic nature of today's supply chains, where demand patterns can change dramatically within short periods. The use of Internet of Things (IoT) technologies has become a promising solution, enabling real-time data collection through connected sensors and devices that provide ongoing visibility into supply chain operations and consumer buying patterns.

Despite important technological advances, supply chain managers continue to struggle with forecasting accuracy, with traditional methods often resulting in significant inventory problems, stockouts, and high carrying costs. Al-Talib et al. (2024) emphasized that the scattered nature of current research on IoT-enabled demand forecasting presents a major knowledge gap, as studies remain spread across different academic fields and publication venues, making it difficult for practitioners and researchers to understand the field's overall development and identify promising research directions. Furthermore, while IoT use in supply chains has shown considerable promise, the lack of comprehensive understanding about which approaches have proven most effective and which emerging technologies hold the greatest potential for future development remains a significant barrier to widespread adoption.

The motivation for conducting a systematic review stem from the urgent need to bring together scattered research knowledge and provide a clear understanding of how IoT-enabled demand forecasting has developed over time. Ugbebor et al. (2024) observed that current literature lacks a comprehensive overview of the field's structure, key contributors, and emerging research directions, which limits both academic progress and practical implementation efforts. Without a clear understanding of research trends, influential contributions, and future directions, organizations struggle to make informed decisions about IoT investment strategies and implementation approaches for demand forecasting applications.

The primary problem addressed by the present research concerns the lack of a systematic review of IoT-enabled demand forecasting literature that can guide future research priorities and practical implementation strategies. Specifically, two important research questions remain unanswered: first, which contributions have been most influential in establishing the theoretical and practical foundations of IoT-enabled demand forecasting within supply chain contexts, and second, what emerging topics and research themes are likely to shape the future development of the field. Sallam et al. (2023) argued that addressing such questions through careful analysis will provide essential insights for advancing both academic understanding and industrial application of IoT technologies in supply chain demand forecasting.

The rest of the paper is organized as follows. Section 2 reviews relevant literature on IoT applications in supply chain management and demand forecasting methodologies. Section 3 presents the research methodology, including the PRISMA approach and bibliometric analysis framework. Section 4 describes the data collection process and search strategy implementation. Results and discussion are presented in Section 5, covering publication trends, author contributions, citation analysis, and thematic evolution patterns. Section 6 concludes the paper and provides future research directions based on the bibliometric findings.

1.1 Objectives

We conduct a systematic bibliometric analysis to address research questions concerning the Internet of Things (IoT) applications in demand forecasting for supply chain management. The two research questions are : (1) Which contributions have been most influential in IoT-based demand forecasting for supply chains? and (2) What emerging topics are likely to shape future developments in the field? Given that current research in the field is spread across many journals and disciplines, identifying the bigger picture and main trends becomes challenging. Through PRISMA methodology and Biblioshiny software for examining Scopus-indexed literature, we map how IoT-enabled demand forecasting has developed by analyzing publication patterns, key contributions, leading authors, and emerging topics. Our main goal involves bringing together research from different areas to provide a clear view of where the field stands today. Additionally, we suggest future directions that can improve forecasting methods while helping researchers from different fields work together better in supply chain management.

2. Literature Review

Modern supply chains operate in a complex and interconnected environment, often struggling with issues such as limited visibility across supplier and customer networks, difficulty in adjusting to changes in demand, and ineffective risk handling (Hussain et al. 2021). In response to these challenges, companies have started adopting technologies such as the Internet of Things (IoT) and blockchain to support better tracking, monitoring, and coordination in their

operations (Al-Talib et al. 2024). IoT technology in particular supports real-time data gathering through devices and sensors, offering tools that help improve operational decision-making and demand predictions.Improving demand forecasting remains a key focus for many supply chains, as it supports inventory planning, production scheduling, and delivery management. Technologies such as RFID, wireless networks, and smart devices are increasingly used to collect data that feeds into forecasting systems, enhancing their reliability and responsiveness (Kian 2022; Sallam et al. 2023). Ugbebor et al. (2024) note that the use of IoT in automated inventory systems has led to better stock accuracy, lower storage costs, and fewer product shortages. In some cases, monitoring systems have improved forecasting accuracy by up to 40% and reduced manual work significantly (Ugbebor et al. 2024).

As these solutions continue to expand, their benefits are being seen in various areas of business. Greater inventory visibility, improved cold chain tracking, and route planning are among the advantages reported in previous studies (Stăncel and Dumitrescu 2021). At the same time, more research is needed to understand how small and medium enterprises benefit from IoT adoption, especially those with a fast inventory turnover (Agidi et al. 2024).
Challenges still exist in applying IoT in full. High implementation costs limited digital skills among staff, and resistance to new systems have been cited as major barriers (Sallam et al. 2023). A comprehensive approach that includes facility redesign and better data systems is needed to move forward (Mathur 2024).

Future studies are expected to look at how IoT can be used in conjunction with other tools such as blockchain and artificial intelligence to support more effective planning and logistics (Shadravan and Parsaei 2023). Supply chain experts also need to work more closely with engineers and IT professionals to build models that reflect real-world operations. Saleha et al. (2023) suggest that well-defined strategies and practical tools will be necessary for the successful adoption of smart technologies in supply chains. Based on the reviewed materials, IoT has a strong potential to support better performance in supply chain operations. Although its benefits are increasingly clear, more effort is required to deal with existing challenges and apply technology effectively in different contexts. Continued collaboration and targeted research can help unlock more value from connected technologies.

3. Methods

Our research follows a four-stage process, as shown in Figure 1. Initially, (1) data acquisition was performed using the PRISMA search method. Subsequently, (2) the raw data file was processed in JABREF software for filtering and de-duplication. The refined file was then (3) uploaded to Biblioshiny, the web-based interface of the Bibliometrics package. The final stage involved (4) analyzing the document to answer the research questions.

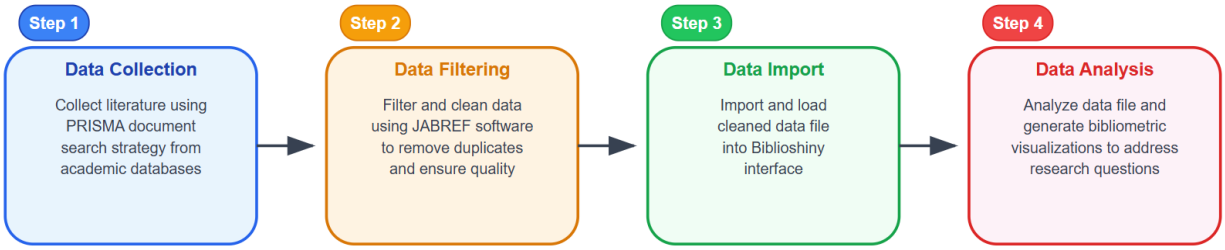


Figure 1. The methodology followed.

The bibliometric method has become a useful approach for exploring research patterns and tracking how academic fields develop over time. Tools that support both technical analysis and easy-to-use features have made this method more accessible to researchers (Markscheffel and Schröter 2021; Goi 2023). In this study, the analysis is carried out using Biblioshiny, the web-based interface of the bibliometrix package, which runs in the R environment for statistical computing and visualization. Biblioshiny allows researchers to examine citation patterns, keyword trends, and topic development through tools such as co-word analysis and thematic mapping (Mejia et al. 2021).

4. Data Collection

This research used the PRISMA method as a document search strategy, which is presented step by step in Figure 2 (Sohrabi et al. 2021). Keywords of interest, such as ("internet AND of AND things" OR "iot") AND ("supply AND chain OR chains AND management") AND ("demand AND forecasting" OR "demand AND forecast"), were searched

in the SCOPUS database. The identification step included all fields of article titles, abstracts, and keywords, covering all types of documents, languages, sources, subject areas, and access types. The number of documents found is denoted by "n." The screening step excluded non-English documents. In the eligibility step, the identified records were not restricted by subject area, allowing for broad thematic coverage. Finally, the inclusion step displays the refined number of documents selected for analysis.

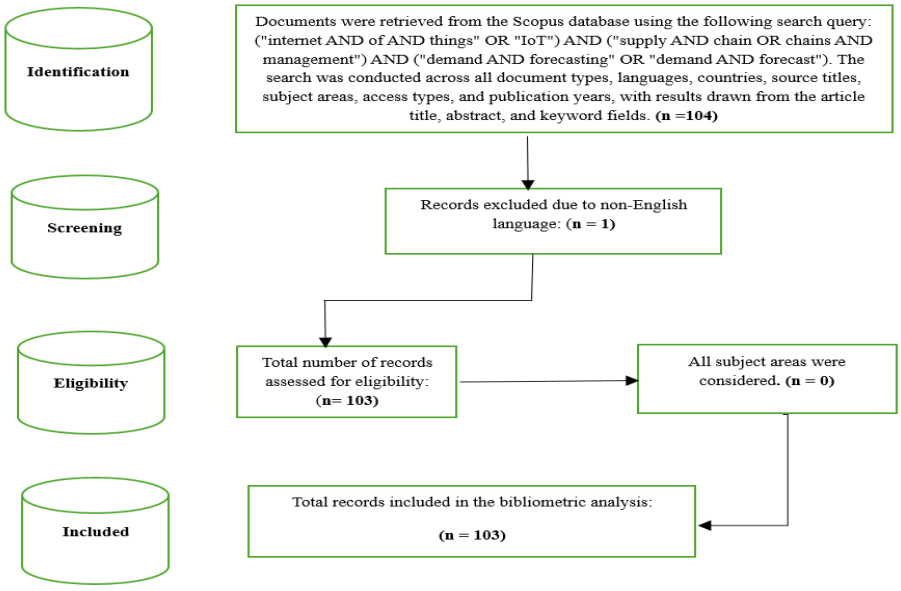


Figure 2. PRISMA method

5. Results and Discussion

Table 1 from the Biblioshiny results summarizes key bibliometric indicators based on 103 documents retrieved from the Scopus database for the timespan 2007–2025. A total of 319 authors contributed to these documents, including 10 single-authored works. The average number of citations per document is 7.922, and the average document age is 2.75 years. There are 85 distinct sources (journals, books, etc.), and the annual growth rate in publications is 17.77%. International co-authorship accounts for 23.3% of the documents, while the average number of co-authors per document is 3.3. Additionally, 312 unique author keywords were identified. No references were listed in the dataset.

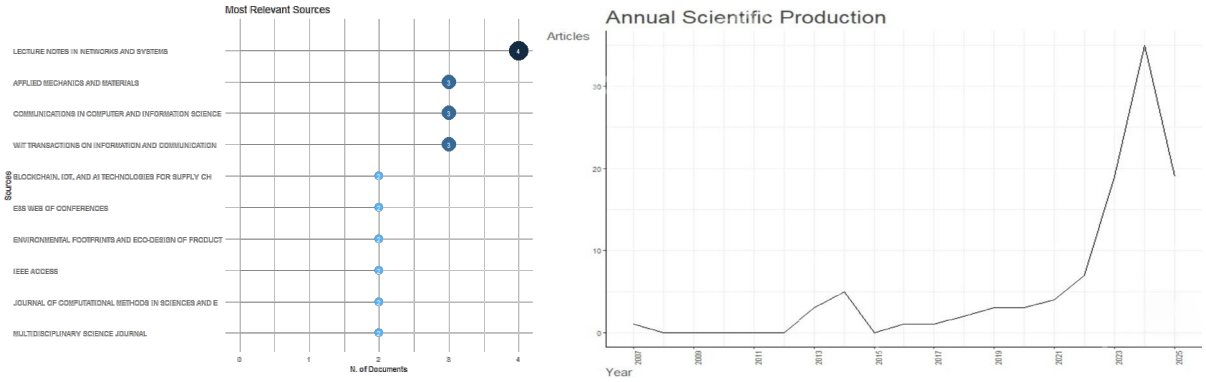
Table 1. Main information

Timespan: 2007:2025	Sources: 85	Documents: 103	Annual Growth Rate: 17.77 %
Authors: 319	Authors of single-authored docs: 10	International Co-Authorship: 23.3 %	Co-Authors per Doc: 3.3
Author's Keywords (DE): 312	References: 0	Document Average Age: 2.75	Average citations per doc: 7.922

5.1 Scientific Production and Source Analysis

Figure 3 presents both the temporal growth of publications and the leading publication outlets in the field. **Subfigure (a)** identifies the most active publication venues. *Lecture Notes in Networks and Systems* leads with four documents, followed by *Applied Mechanics and Materials*, *Communications in Computer and Information Science*, and *WIT Transactions on Information and Communication*, each with three publications. Several other journals and conference proceedings, including *IEEE Access* and *E3S Web of Conferences*, contributed two articles each. The diversity of sources suggests that the topic intersects multiple disciplines, attracting contributions from both engineering and information science perspectives. **Subfigure (b)** shows a sharp increase in the number of articles from 2020 onward, with a significant peak in 2024 (however, 2025 shows a decline due to the date of the search in May 2025), indicating

growing academic interest and relevance of IoT applications in supply chain and demand forecasting. The gradual rise from 2013 to 2020 reflects a foundational phase in which the research community began to recognize the potential of IoT technologies in logistics and operations.

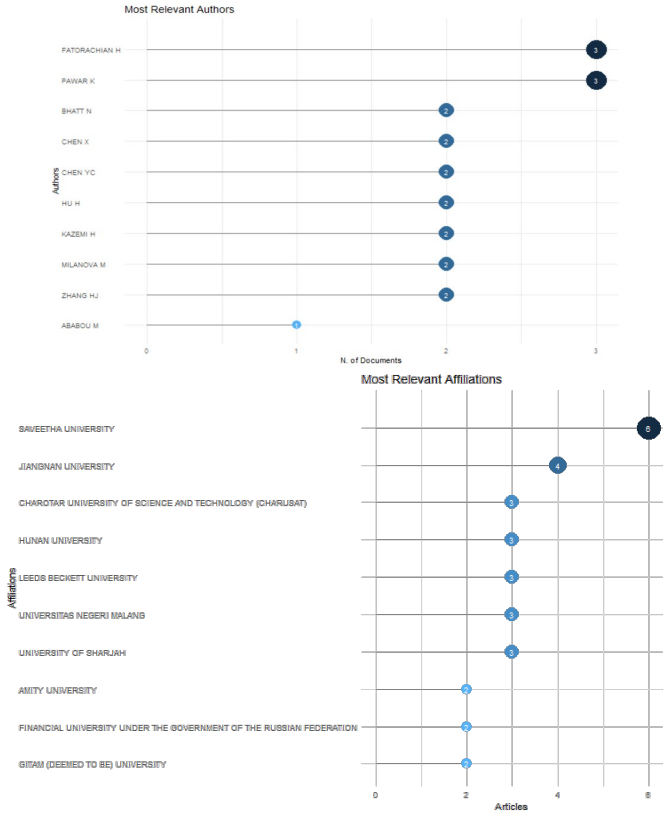


(a). Most Relevant Sources (b). Annual Scientific Production

Figure 3. Research Output and Publication Venues.

5.2 Author and Institutional Contributions

Figure 4 presents the most relevant contributors to the field, highlighting both individual authors and institutional affiliations. In **Subfigure (a)**, the most relevant authors are Fatorachian H and Pawar K, each with three publications. **Subfigure (b)** shows that Saveetha University leads with six articles, followed by Jiangnan University with four, and institutions such as CHARUSAT and Hunan University with three publications each. The distribution of contributions reflects the international and collaborative research presence in the domain of IoT and supply chain forecasting.

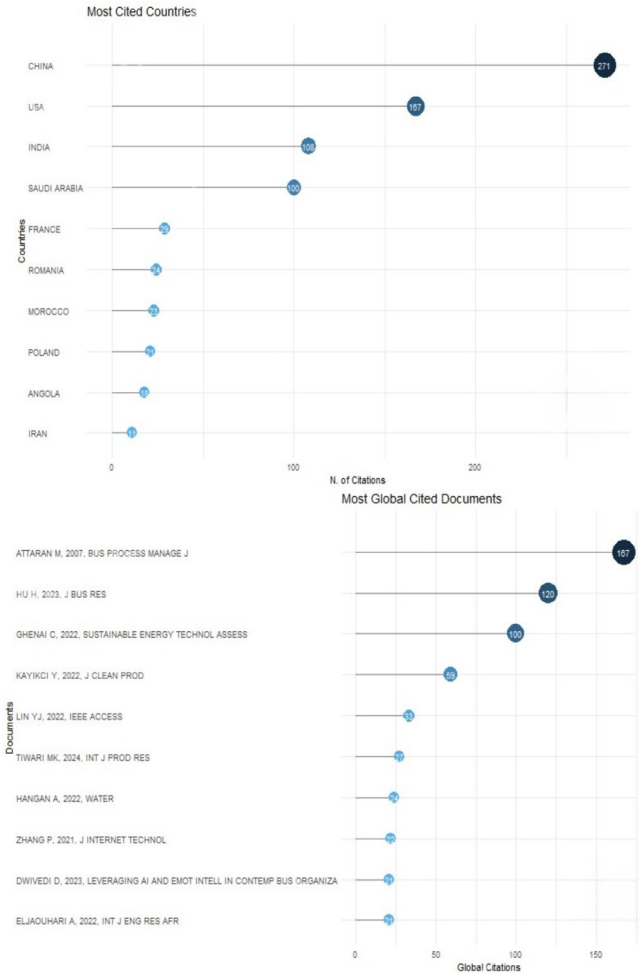


(a). Most Relevant Authors (b). Most Relevant Affiliations

Figure 4. Most relevant authors and institutional affiliations.

5.3 Citation Impact and Geographical Distribution

Figure 5 highlights the most influential contributions and countries based on citation metrics within the domain of IoT-based supply chain and demand forecasting. **Subfigure (a)** illustrates the distribution of citations by country. China leads with a total of 271 citations, followed by the United States with 167 and India with 108. Other contributing countries with notable citation counts include Saudi Arabia, France, and Romania. The geographic spread of citations demonstrates a strong international presence and emphasizes that research on IoT in supply chain forecasting is a globally recognized and relevant topic, attracting attention across diverse economic and technological contexts. **Subfigure (b)** presents the most globally cited documents. The top-cited work is by Attaran M (2007), published in *Business Process Management Journal*, with 167 citations. It is followed by Hu H (2023) with 120 citations and Ghenai C (2022) with 100 citations. These highly cited publications reflect foundational or impactful advancements that have shaped current research directions in the field.



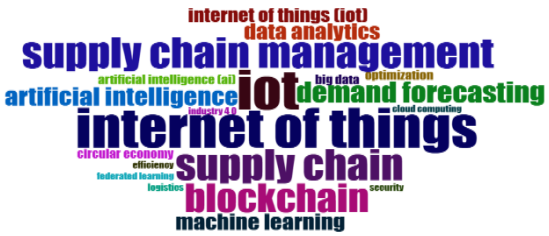
(a). Most Cited Countries. (b). Most Global Cited Documents.

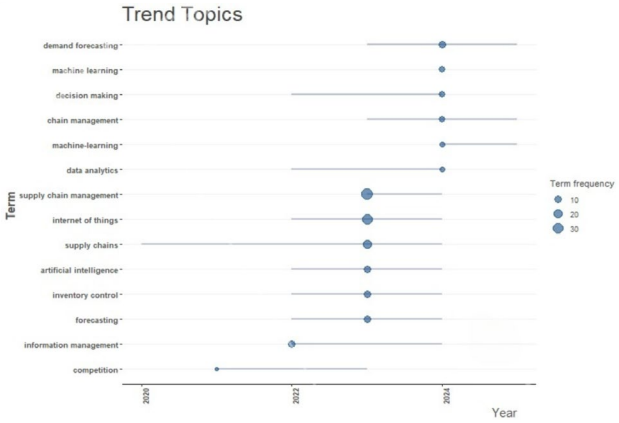
Figure 5. Citation performance

5.4 Keyword Analysis and Emerging Research Trends

Figure 6 illustrates the thematic focus of the literature on IoT-based supply chain and demand forecasting through a keyword frequency analysis and a trend topics timeline. The **subfigure (a)** presents a wordCloud generated from the author keywords, where a larger font size indicates a higher frequency. The prominent terms include the Internet of Things, supply chain management, demand forecasting, blockchain, machine learning, and artificial intelligence. The prominence of keywords reflects the core technologies and concepts that define the field. **Subfigure (b)** shows the temporal evolution of trending topics from 2020 to 2024. Terms such as supply chain management, the Internet of

Things, and data analytics emerged earlier and have remained consistent. More recent topics such as demand forecasting, machine learning, and decision making reflect a growing interest in applying advanced analytics to improve predictive capabilities and operational decisions. The emergence of keywords such as blockchain, artificial intelligence, and inventory control suggests an ongoing diversification of technologies and methods within the domain.



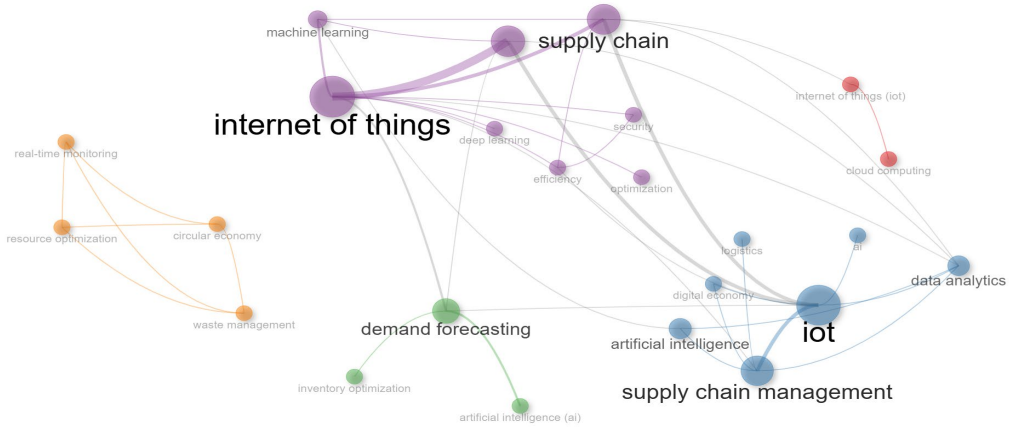


(a). WordCloud (b). Trend Topics

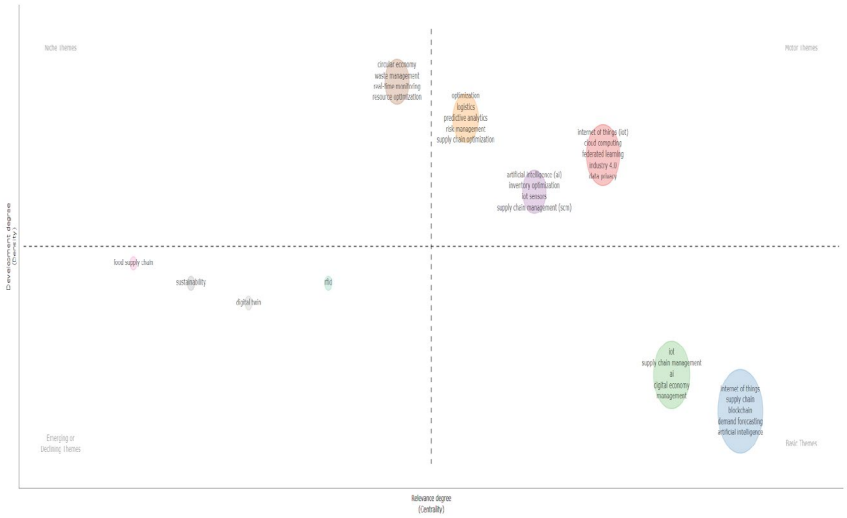
Figure 6. Thematic focus and topic evolution

5.5 Thematic Structure and Keyword Relationships

Figure 7 explores the structure of the research landscape through a thematic map and a co-occurrence network of keywords. **Subfigure (a)** displays the co-occurrence network of keywords, showing how major terms are connected within the literature. Central nodes such as the *Internet of Things*, *Supply Chain*, *IoT*, and *Supply Chain Management* form the core of the network. These are related terms that include *machine learning*, *data analytics*, *logistics*, and *optimization*. Smaller clusters highlight areas like *demand forecasting* and *circular economy*, reflecting more focused but active topics. **Subfigure (b)** presents the thematic map, which organizes topics into four quadrants based on their centrality (relevance) and density (development). Basic themes such as *internet of things*, *supply chain*, *blockchain*, *artificial intelligence*, and *demand forecasting* appear in the lower-right quadrant, indicating foundational concepts that are well-connected but not yet deeply developed. The upper-right quadrant, which represents motor themes, includes topics like *industry 4.0*, *cloud computing*, *data privacy*, and *federated learning*, suggesting active and influential areas of research. Emerging or less developed topics, such as *food supply chain*, *sustainability*, and *digital twin*, are found in the lower-left quadrant. Meanwhile, the upper-left quadrant shows niche topics such as *waste management* and *resource optimization*, which may be more specialized or context-dependent.



(a). Co-occurrence Network



(b) Thematic Map

Figure 7. Thematic development and keyword associations

5.6 Proposed Improvements

Figure 8 shows how research topics have changed over time, using time slicing with two cuts to divide the data into three periods: 2007–2020, 2021–2023, and 2024–2025. The map helps visualize how important themes in IoT-based supply chain and demand forecasting have developed.

In the first period (2007–2020), common topics included *IoT*, *supply chain*, and *supply chain management*. In the second period (2021–2023), there was a shift toward *blockchain*, *demand forecasting*, and *internet of things (IoT)*. In the most recent period (2024–2025), *artificial intelligence* and *demand forecasting* became more frequent, showing increased interest in using smart technologies in supply chain activities.

These changes suggest possible directions for future research. While *IoT* and *supply chain* have remained important across all periods, newer topics such as *AI*, *federated learning*, and *data privacy* are receiving more attention. Meanwhile, some topics like *supply chain management* and *digital economy* appear less often in recent years, which may indicate areas that could benefit from further study.

Based on the patterns in the map, the following areas could be explored further:

- Using both IoT and AI to improve forecasting and decision-making in logistics.
- Studying how blockchain can support openness and coordination in supply chains.
- Creating models that include environmental and ethical factors in tech-based forecasting.

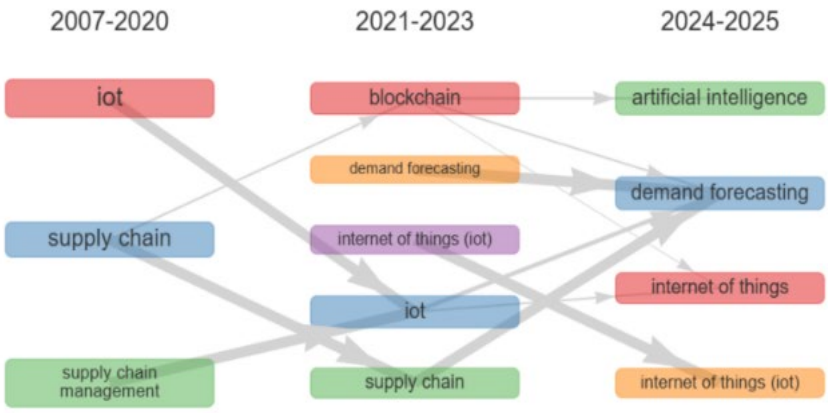


Figure 8. Thematic evolution of key topics (2007–2025).

5.7 Validation

The findings and proposed improvements presented in this study are based on data retrieved from the Scopus database and analyzed using Biblioshiny, a well-established tool for bibliometric analysis. Thematic evolution and keyword co-occurrence patterns were interpreted using multiple visual outputs, including trend topics, thematic maps, and co-word networks, to ensure consistency in the results.

6. Conclusion

A bibliometric analysis of 103 documents from the Scopus database, covering the years 2007 to 2025, was conducted to address research questions concerning the Internet of Things (IoT) in demand forecasting for supply chain management. By identifying major contributions, examining research trends, and mapping emerging topics, the study offers a clearer view of how the field has evolved over time. Research activity has increased steadily, particularly after 2020, with China, the United States, and India standing out in terms of citation impact. Among the most influential publications, the work by Attaran M (2007) remains a foundational contribution. More recent studies reflect a shift toward integrating IoT with artificial intelligence, machine learning, and blockchain to enhance forecasting capabilities.

The analysis was divided into three time periods using a two-cut time slicing method, which made it possible to track changes in research focus. The first period (2007–2020) centered on foundational IoT and supply chain topics. The second period (2021–2023) saw increased attention to blockchain and demand forecasting, while the most recent period (2024–2025) focused more on AI-driven forecasting methods. Keyword mapping also highlighted growing interest in areas such as data privacy, federated learning, and circular economy.

By applying PRISMA-based literature selection and analyzing the data through Biblioshiny, the study provides a structured foundation for future research. Although limited to English-language publications indexed in Scopus, the findings highlight key areas for ongoing investigation. Future work may benefit from focusing on scalable, context-specific, and ethically grounded forecasting models to better meet evolving supply chain demands.

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Biographies

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Dr. Bhutta is an O'Bleness Professor of Operations Management in the Management Department in College of Business, having joined Ohio University in 2008. Dr Bhutta came to OHIO from Nicholls State University in Louisiana having taught there for seven years. He received his Ph.D. in Operations Management from The University of Texas at Arlington and holds an MBA from the Lahore University of Management Sciences and a B.Sc. in Mechanical Engineering from the University of Engineering and Technology, Pakistan. He teaches Operations Management and Supply Chain courses in the graduate and undergraduate programs. Khurum has published several leading journals; International Journal of Production Economics, Supply Chain Management: An International Journal, Journal of International Technology and Information Management, Journal of Small Business and Enterprise Development, Benchmarking an International Journal, International Journal of Entrepreneurship and Small Business, among others. Bhutta has also actively been involved as an academic consultant. He has worked as a developer/reviewer for multiple texts and supplementary materials for business disciplines, including operations management, project management, quality management. He is a member of DSI and POMS institutes.