

# EGE AKADEMİK BAKIŞ

EGE ACADEMIC REVIEW

Ekonomi, İşletme, Uluslararası İlişkiler  
ve Siyaset Bilimi Dergisi

Journal of Economics, Business Administration,  
International Relations and Political Science



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# Bibliometric Analysis of Performance Measurement in Digital Supply Chains

Melisa ÖZBİLTEKİN PALA<sup>1</sup> 

## ABSTRACT

Performance measurement is crucial for digital supply chains to stay competitive and optimize operations. Digital supply chains are more complex and involve global operations compared to traditional ones. This study identifies current research gaps and highlights the need for further scholarly investigation into performance measurement in digital supply chains. Despite the importance of the topic, bibliometric analysis using VOS Viewer reveals a lack of studies in this area. The research also suggests potential directions for future exploration and aims to contribute to the existing literature on the understanding and application of performance measurement in digital supply chains.

**Keywords:** Digitalization; Supply Chain Management, Performance Measurement, Bibliometric Analysis, VOS viewer.

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## INTRODUCTION

Performance measurement make a difference business accomplishing productivity, viability, and competitiveness in their supply chain operations (Zekhnini et al., 2021). Performance measurement permits businesses to screen different angles of the digital supply chain (DSC), for example, arrange preparing times, stock levels, and shipping costs. By checking these measurements, organizations can distinguish inefficiencies/bottlenecks and empower them to create data-driven choices to kill squandering by optimizing the supply chain (Brau et al., 2023). Also, Performance measurement in DSCs permits companies to track conveyance times and arrange precision and item accessibility (Ye et al., 2022). Moreover, DSCs create endless sums of information, and performance measurement gives real-time perceivability into organizations' operations.

Observing supply chain performance (SCP) in DSCs is essential for businesses to identify cost-saving opportunities. With precise performance measurement, companies can analyze information on transportation, stock carrying costs, and provider measurement to recognize ranges where they can diminish costs without compromising quality (Brau et al., 2023). Also, performance measurement makes a difference in identifying vulnerabilities and potential dangers within

the supply chain, permitting businesses to execute hazard moderation techniques and increment supply chain flexibility (Zekhnini et al., 2021). Performance measurement in businesses incorporates handling checking and guarantees persistent advancement. In outline, performance measurement has numerous benefits for DSCs.

The issue of performance measurement in DSCs may be a subject that's too inquired about within the writing and gives distinctive points of view. With the effect of digitalization, assessing supply chain measurement is more comprehensive than conventional measurements. However, it is done more comprehensively and dynamically through data analytics, artificial intelligence (AI), and other digital tools. In this setting, different research studies, in expansion to measuring variables such as straightforwardness, speed, adaptability, and proficiency within the supply chain, offer diverse approaches to how digital innovations can be coordinated into measurement assessments. These differences provide analysts with diverse perspectives to better understand the dimensions of DSCs and to develop performance measurement criteria suited to continuously evolving technologies. Also, the significance of performance measurement in DSCs has expanded altogether, particularly after the widespread COVID-19. The pandemic has caused critical disturbances

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and instabilities in supply chains, highlighting the requirement for supply chain supervisors to set up more adaptable and strong frameworks (Ye et al., 2022). In this setting, digital advances play an essential part in checking the measurement of supply chains in genuine time, responding rapidly in times of emergency, and minimizing dangers. Therefore, in the post-pandemic era, improved approaches and tools for performance measurement of DSCs are essential to increase operational efficiencies, make supply chain networks more robust, and prepare better against future uncertainties.

Although performance measurement has been an ongoing issue for years, since DSCs are a concept that has emerged recently, they differ from traditional supply chains in the issue of performance measurement. Therefore, this study provides an understanding of performance measurement in DSCs, thereby expanding both practical and theoretical knowledge. Hence, this study aims to conduct a detailed literature review to examine performance measurement studies in DSCs and to reveal the research gap.

First, a literature review of performance measurement in DSCs is provided. Then, the research methodology is explained in detail in Section 3. Then, implementation and results are given. Future research trends are discussed in Section 5, and a conclusion is provided.

## **LITERATURE REVIEW OF PERFORMANCE MEASUREMENT in DSCS**

As mentioned, many studies on performance measurement in traditional supply chains exist. Be that as it may, with globalization and quick advancements in digital technologies (DT), supply chains have gotten more complex and delicate. Supply chains have become dynamic frameworks that work locally and universally, including numerous stakeholders and information streams. This change has driven the insufficiency of conventional strategies in performance measurement and the need to create unused, more modern approaches. At the same time, companies have begun to receive the DSC concept and hone to ensure the resiliency of their supply chains and survive within the competitive environment.

Worldwide emergencies, particularly the widespread COVID-19, have emphasized the significance of advanced advances to guarantee supply chains' versatility and survival within the competitive environment. Companies have started to embrace the advanced supply chain concept and hone to extend operational effectiveness, minimize dangers, and make their supply chains more

adaptable and resilient. DSCs give focal points such as real-time execution observing, proactive decision-making, and quick adjustment by advertising coordinates frameworks bolstered by information analytics, fake insights, and robotization. These modern approaches not only increment the effectiveness of supply chains but also empower businesses to pick up a competitive advantage and be more resilient in times of emergency.

When the studies in the literature are examined, literature review studies on performance measurement in DSCs come first (Büyükoğkan & Göçer, 2018; Rasool et al., 2022; Zekhnini et al., 2021; Ageron et al., 2020). When primary studies, such as those of Büyükoğkan and Göçer (2018), are examined, fundamental limitations and expectations in the DSC are defined, and research gaps in the literature are identified. Ageron et al. (2020) conducted a literature review examining current developments, research opportunities, and challenges in DSC management. Rasool et al. (2022) conducted a detailed literature study to understand current practices in DSCs and reveal research gaps.

In addition to systematic literature evaluations, numerous studies have been discovered to identify the variables influencing DSC performance or to establish the connection between digitalization and performance. Among the applications made, there are methods such as the structural equation model (Choudhury et al., 2021), exploratory factor analysis (Ye et al., 2022), case study (Liu et al., 2022), multi-criteria decision-making techniques (Mubarik and Khan, 2024), survey (Sharma et al., 2022). If the studies are examined chronologically, Ukko et al. (2020) studied the basic relational mechanisms of performance measurement in DSCs. AlMulhim (2021) examined the connection between business performance and smart supply chains. Fernando and colleagues (2021) study aimed to investigate the connection between DSC performance and business-based intelligent operations.

Saryatmo and Sukhotu (2021) aimed to investigate the impact of the DSC's operational performance on quality, productivity, and cost reduction. Similarly, Sharma et al. (2022) surveyed to investigate whether DSC networks affect sustainability performance in manufacturing companies. Liu et al. (2022) aimed to investigate the factors affecting smart supply chain innovation performance and provide technology recommendations to improve smart SCP. As a result of the multiple case analysis, it was found that the cost of technology implementation affects the performance of smart supply chains. It has been revealed that improvements at the management level will also improve the performance of smart supply chains.

Ye et al., in 2022, aimed to investigate whether firms with digital technology asset allocation achieved better SCP during COVID-19 than firms with lower levels. Lee (2022) surveyed to determine the relationship between DSC, SCP, and organizational performance. This research revealed that the independent variables of the DSC (digitalization, supply chain management, and technology implementation) positively affect organizational performance.

Shahadat et al. (2023) surveyed to explore the potential of DTs to increase SCP. Moreover, Lee and colleagues (2024) paid Particular attention to operational performance in relation to the function of smart technologies. The findings showed that smart technologies fully mediate the relationship between performance and digital transformation, emphasizing the need for manufacturing companies to focus on supply chain integration of smart technology to enhance operational performance.

As mentioned before, although performance measurement in DSCs is a relatively new topic, this field has serious research potential. Therefore, identifying the common points in these studies is likely helpful as a reference for future research. In this context, bibliometric analysis was carried out for performance measurement in DSCs.

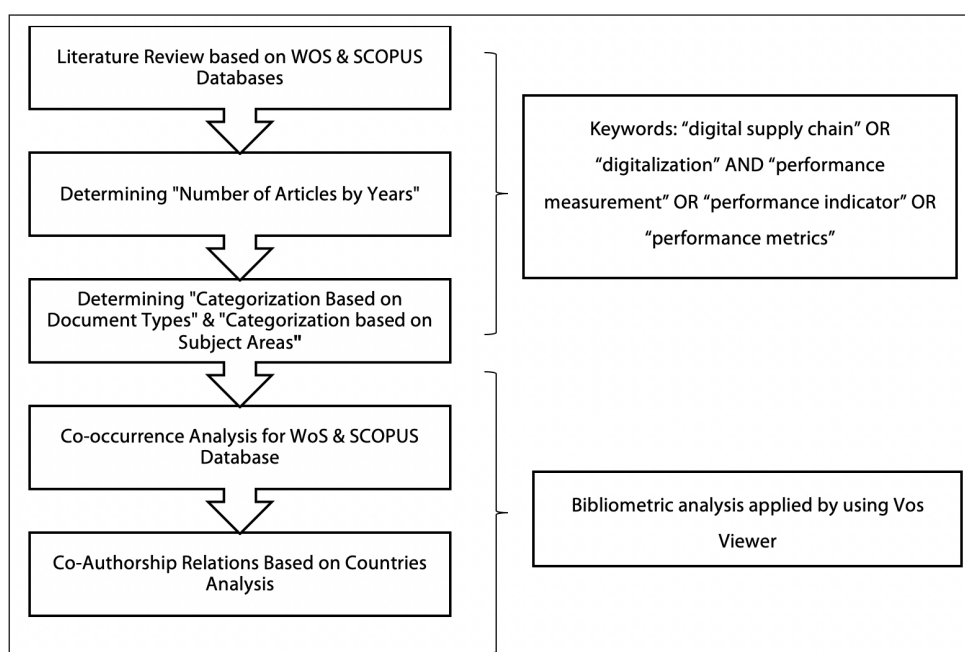
## RESEARCH METHODOLOGY

A thorough literature review was conducted to investigate the studies on DSCs in the literature. This literature review, which was carried out in WOS and SCOPUS databases, covers the 2020-2024 period, when the

importance of DSCs increased, especially after COVID-19, and the research volume in this field expanded. Starting from 2020, the pandemic has led to the acceleration of digital transformation and the emergence of new performance measurement methods in DSCs, making the literature in these periods particularly valuable. Therefore, studies conducted in 2020 provide up-to-date and critical information in evaluating the performance of DSCs.

In the implementation phase of the study, as shown in Figure 1, searches were carried out in WOS and SCOPUS databases in accordance with the keywords presented in the next section. The literature review resulted in results regarding "number of articles by years," "categorization by document types," and "categorization by subject areas."

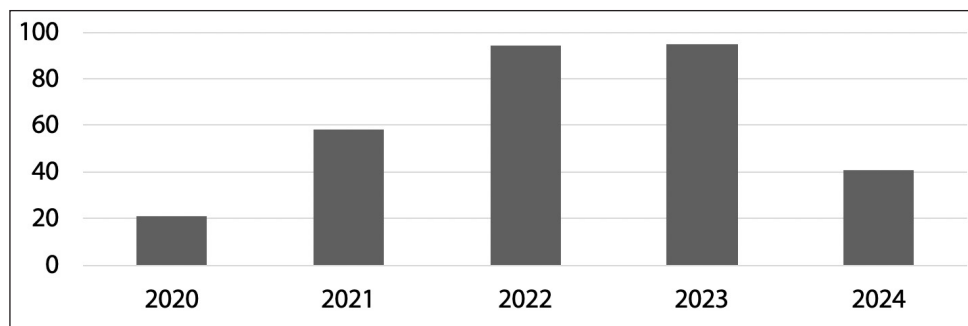
The VOS Viewer program performed bibliometric analysis in the next stage. Bibliometric analysis provides a systematic examination of data in academic literature and thus guides understanding of scientific developments, trends, and relationships (Arruda et al., 2022). This type of analysis is usually performed using software such as VOS Viewer. VOS viewer is a particularly effective tool for visualizing relationships between scientific articles, authors, and keywords (Kumar et al., 2024). The software visualizes data using network graphs, clustering methods, and time series, making it easy to identify important connections and trends in research areas (Arruda et al., 2022). For example, relationships between keywords in the literature and collaborations between authors can be revealed through VOS viewer. Lastly, future research directions on performance measurement in DSCs are suggested based on the results obtained.



**Figure 1.** Flow of Research Methodology

## IMPLEMENTATION and RESULTS of the CURRENT RESEARCH TRENDS

The keywords were determined as “digital supply chain” OR “digitalization” AND “performance measurement” OR “performance indicator” OR “performance metric.” Studies conducted in English were scanned using the title, abstract, and keywords. 308 studies were found in the SCOPUS database and 16 in the Web of Science database. Duplications that emerged when two databases were compared were eliminated. After eliminating duplications, 318 studies were found, including WOS and SCOPUS databases. The distribution of these studies by years is shown in Figure 2.



**Figure 2.** Number of Studies Conducted on Performance Measurement in DSC by Years

When the type of studies conducted as a result of the literature review were examined, it was seen that studies in the form of papers, articles, review articles, book chapters, early editions, et al. (technical notes, letters to the editor) were conducted for WOS and SCOPUS databases (Figure 3).

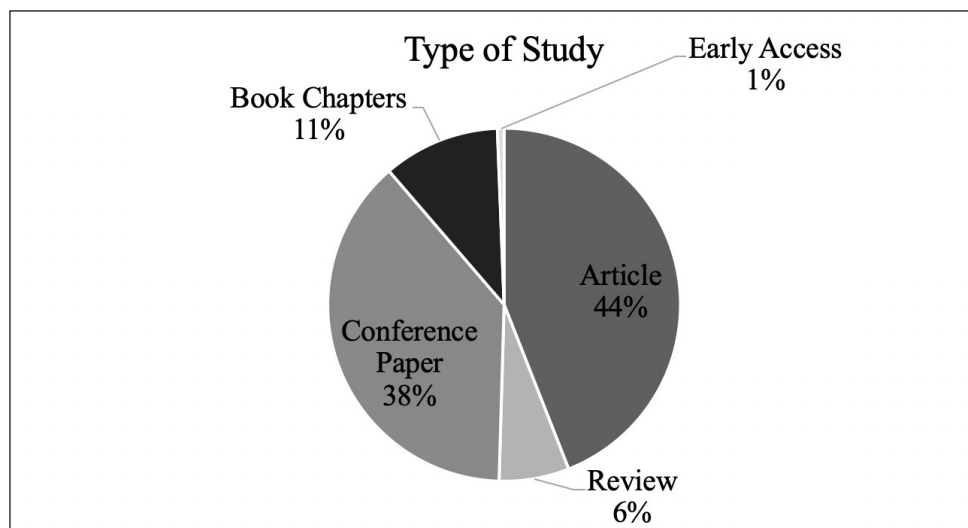
In addition, when the field of studies on this subject is considered, it is seen that most studies are in engineering, second in business, management, accounting, and

finance, and third in computer science (Figure 4). The remaining areas of work are environmental science, social sciences, management science, decision sciences, mathematics, operations research, and other (telecommunications, arts, biotechnology, applied microbiology, energy fuels, information science, library science, music, optics, transportation, chemistry, physics, materials science).

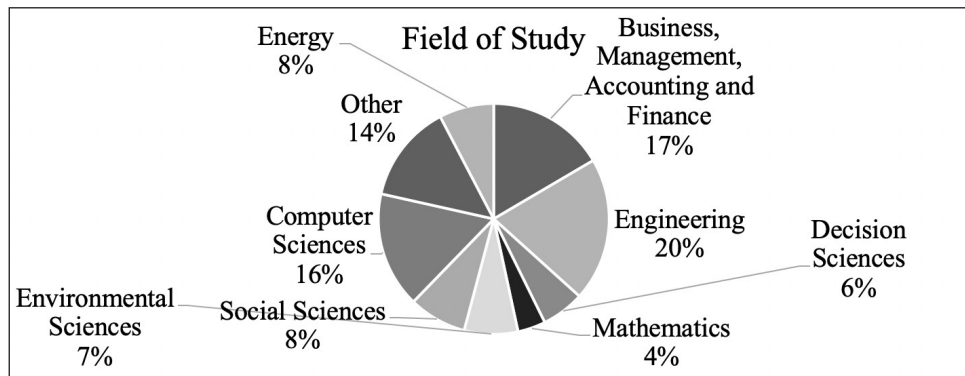
As mentioned before, bibliometric analysis is a method that involves quantitatively measuring and evaluating academic publications. This analysis aims to provide information about scientific research's prevalence, impact, and trends. VOS viewer is software used to

perform such analyses and was used in this study. The Vos viewer map illustrated in Figure 5 was generated using 20 of the most significant co-occurrences selected from the 1006 keywords identified across the 318 studies. Table 1 shows 12 keywords with occurrences and total link strengths.

This map shows keywords as circles, and colors indicate clusters representing closely related items (Arruda et



**Figure 3.** Types of Studies Conducted on Performance Measurement in DSC



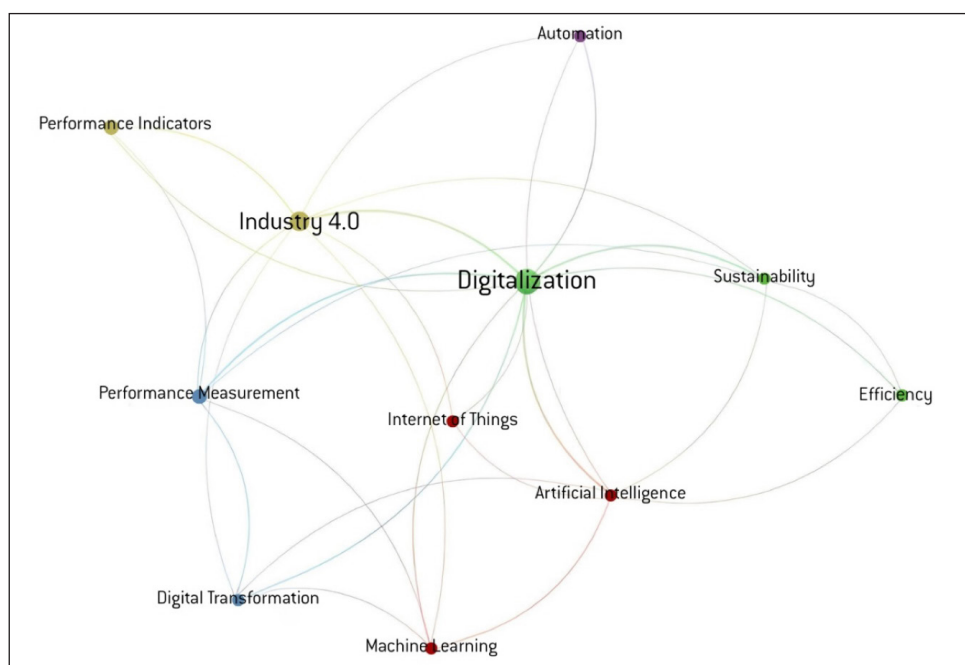
**Figure 4.** Areas of Studies Conducted on Performance Measurement in DSC

**Table 1.** Occurrences and Total Link Strengths of Selected Keywords

| Keywords                | Occurrences | Total Link Strength |
|-------------------------|-------------|---------------------|
| Digitalization          | 69          | 44                  |
| Industry 4.0            | 31          | 21                  |
| Performance Measurement | 23          | 19                  |
| Artificial Intelligence | 10          | 15                  |
| Digital Transformation  | 14          | 13                  |
| Sustainability          | 11          | 10                  |
| Machine Learning        | 11          | 9                   |
| Efficiency              | 8           | 7                   |
| Automation              | 5           | 6                   |
| Performance Indicators  | 7           | 7                   |
| Reliability             | 6           | 5                   |
| Internet of Things      | 5           | 3                   |

al., 2022). The size of each circle reflects the keyword's weight, while the lines between the circles show their interrelationships. The closeness of the circles to each other indicates the strength of these relationships (Kumar et al., 2024).

As shown in Figure 5, keywords are separated into five clusters: red, blue, green, yellow, and purple. The weakest cluster is purple, with one item. The crowded clusters are green and red, with three items of each. Moreover, the strongest cluster is green.



**Figure 5.** Co-occurrence Analysis for Selected Keywords

By considering each cluster, the purple cluster consists of an “automation” item, and it is directly related to “Industry 4.0” and “digitalization.” Moreover, the blue cluster covers “performance measurement” and is directly related to “performance indicators,” “digitalization,” “Industry 4.0,” “machine learning,” “sustainability,” and “digital transformation.” Secondly, in the blue cluster, the “digital transformation” item is related to “machine learning,” “digitalization,” “Industry 4.0,” “artificial intelligence,” and “performance measurement.”

The yellow cluster comprises “performance indicators” and “Industry 4.0” items. These items generally relate to digitalization and DTs: the Internet of Things (IoT), machine learning, etc. Moreover, the red cluster covers DTs and tools like machine learning, AI, and the IoT. They are directly related to the digitalization process. Lastly, the green cluster is the strongest with the highest interactions’ “digitalization” item. This cluster has critical links to performance measurement under the digitalization process.

When considering the co-authorship relations based on countries, organized in a way that there are 10 studies and 10 citations per country, 12 countries out of 82 countries have conducted joint studies on the specific subject of the study.

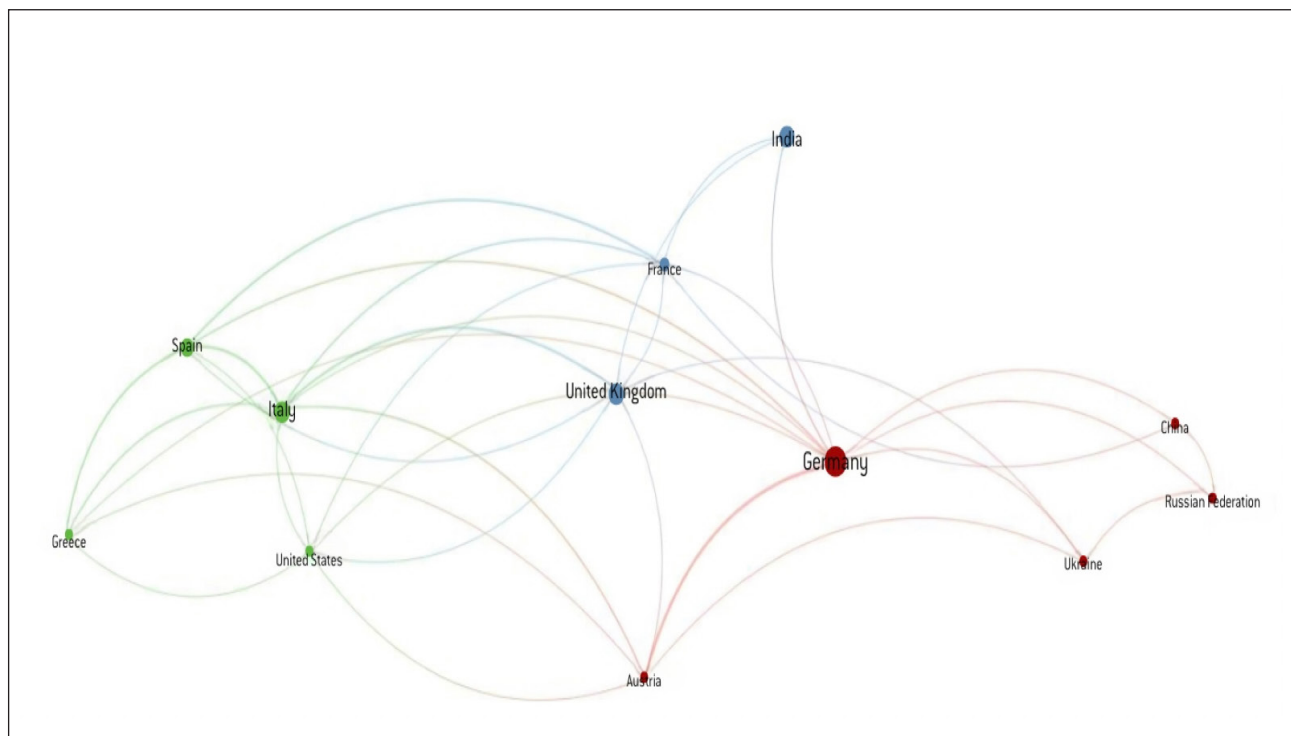
As shown in Figure 6, the Russian Federation has the most significant number of papers about this issue. Then, Germany, Italy, India, and the United Kingdom

followed the Russian Federation. Moreover, according to the number of citations, the order is reorganized: India, Italy, United Kingdom, Germany, etc. However, according to the total link strength, Germany has more links for collaboration with other countries.

The data obtained show that since performance measurement and digitalization have become extremely important worldwide and almost every country has an opinion on this issue, it is a subject that provides excellent opportunities for joint work between countries. However, when the studies conducted in recent years are examined, performance measurement issues in DSCs should be given more importance, both in terms of the number of studies and the content of the studies. The subsequent section explores potential future research directions derived from these findings.

## DISCUSSIONS & CONCLUSION

Recently, the rapid development of DTs and the increasing complexity of supply chains have increased the importance of performance measurement. Effective performance measurement systems are needed for companies to gain competitive advantage, maximize operational efficiency, and meet customer expectations. With the concept of DSCs, traditional chains have been left in the background, and DSCs have started to include more complex operations. This has also led to the emergence of performance measurement. To ensure sustainability in a competitive environment, companies



**Figure 6.** Co-Authorship Relations Based on Countries

must progress in performance measurement in DSCs.

In this context, studies in the literature emphasize the importance of performance measurement in terms of DSCs. For example, Büyüközkan and Göçer (2024) emphasize that performance measurement is essential for DSCs. Similarly, Gopal et al. (2024) argue that digital technology and tools can create a domino effect on SCP. In addition, Dixit et al. (2024) state that performance measurement plays a critical role in overcoming the challenges in DSCs. However, this study goes a step further by identifying significant gaps, such as the lack of in-depth research on the impacts of DTs like AI and data analytics on performance measurement, a point also emphasized by Gopal et al. (2024) and Dixit et al. (2024). In other words, although DSCs and especially performance measurement in these processes are critical, the lack of detailed studies in this area is striking. Therefore, it aims to reveal the need for academic studies on performance measurement in DSCs by revealing research gaps. As a result of the bibliometric analysis carried out with Vos Viewer, it has been revealed that the subject is vital, but the studies conducted are limited. In addition, when the content of the studies conducted is examined, new research areas are suggested for future studies.

As a research gap, when the studies on performance measurement in DSCs are examined, it is observed that there are no studies in the current literature that deeply examine the effects of DTs and the deficiencies in the detailed connections of these studies with the supply chain; this gap requires further research to understand the effects of technologies such as data analytics and AI on performance measurement, especially in DSCs. In addition, there needs to be more information on global perspectives and the resilience of DSCs during crisis periods, indicating the need for more comprehensive studies in these areas. Finally, more comprehensive analyses of the effectiveness and accuracy of performance measurement metrics are important to improve existing methods and obtain more accurate results.

In detail, some critical future research areas are suggested as follows:

*Impacts of DTs:* Studies need to be conducted that examine the impacts of DTs on supply chains in depth. In particular, the impacts of data analytics, artificial intelligence, and other digital tools on performance measurement have yet to be sufficiently investigated. This disparity shows that more in-depth study is

required to comprehend how DTs affect supply chains' overall performance, adaptability, and efficiency. For instance, greater details are required on how artificial intelligence boosts supply chains' predictive capabilities or how data analytics enhances decision-making procedures.

*Shortcomings in Supply Chain Connections:* Existing studies have failed to adequately detail the connections of DTs with various components of supply chains. More in-depth analyses are required to understand the impacts of DTs on different stages and functions of supply chains. In specific, more research is vital on the connections between different stages of the supply chain and digital interactions in these stages.

*Global Perspectives and Crisis Periods:* Limited information is available on the resilience of DSCs during crises on a global scale. For example, larger and more comprehensive studies should be conducted to understand better the impact of major global crises, such as pandemics, on the resilience and flexibility of DSCs. Such analyses can reveal how supply chains are managed during crises and what role DTs play in these processes.

*Performance Measurement Metrics:* More extensive analyses should be conducted on the effectiveness and accuracy of performance measurement metrics. Developing more effective and reliable performance measurement methods requires detailed evaluations of the adequacy and accuracy of existing metrics. This may require new metrics or revisions of existing metrics to more accurately evaluate and improve the performance of supply chains.

In addition to this, to enhance the practical relevance of the study, it is crucial to offer specific policy and practical implications that can guide both policymakers and stakeholders in the implementation of effective performance measurement systems in DSCs. Policymakers can play a pivotal role by encouraging investment in digital technologies such as AI and data analytics, which are essential for improving the adaptability and efficiency of supply chains. Governments can also foster public-private partnerships to facilitate the exchange of knowledge and best practices in integrating these technologies. Additionally, policies that promote the standardization of performance measurement metrics across industries can ensure a more cohesive and accurate evaluation of DSCs globally. From a business perspective, organizations should focus on adopting

and continuously refining performance measurement tools that capture real-time data across all stages of the supply chain, enabling better decision-making and crisis management. Businesses can also benefit from engaging in cross-sector collaborations to address challenges such as global disruptions and supply chain resilience. By aligning policy efforts with business practices, stakeholders can build more robust, flexible, and sustainable DSCs that are equipped to thrive in a rapidly evolving digital landscape.

In summary, DSC performance metrics must be considered, a holistic view must be addressed, and potential gaps must be analyzed to understand them. Furthermore, aligning various DTs and tools involved in performance measurement in DSCs is extremely important. This study aims to broaden the business perspective and conduct a study that can provide insights into related literature.

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