

MAPPING THE INTELLECTUAL STRUCTURE OF SUPPLY CHAIN DISRUPTION AND DIGITALIZATION RESEARCH: A BIBLIOMETRIC ANALYSIS

Asst. Prof. Haldun ÇOLAK (Ph.D.)^{*} 

ABSTRACT

The aim of this study is to reveal the development trends, conceptual structure, and research gaps of the literature on supply chain disruptions and digitalization. Therefore, bibliometric methods have been employed to systematically analyze the intellectual structure of the literature. Studies obtained from Web of Science and Google Scholar databases were evaluated within the scope of the research according to the PRISMA approach and a total of 66 articles were included in the analysis. The study applied bibliometric performance analysis, thematic mapping, conceptual structure mapping, and factor analysis techniques. The results show that the literature is mainly focused on the themes of resilience, risk management, collaboration, dynamic capabilities and performance. Furthermore, emerging research areas in the literature were identified as themes, including blockchain, technology adoption, sustainability, human capital, and additive manufacturing. Factor analysis revealed that the literature is divided into five main thematic clusters. It was observed that future research is needed, particularly on the impacts of sustainability, human capital, and advanced digital technologies on operational performance.

Keywords: Supply Chain Disruptions, Digitalization, Bibliometric Analysis, Topic Dendrogram.

JEL Codes: M11, M19, M20.

1. INTRODUCTION

The concept of supply chain disruptions (SCD) refers to the interruptions in the normal flow of products, services, materials, and currencies that occur as a result of specific events and can sometimes be anticipated but can lead to problems if not properly managed (Alvarenga et al., 2023). The importance of managing SCD and the impact of uncertainty on supply chains (SCs) have increasingly gained significance in the field of supply chain risk management (Orji and Dominic, 2024; Tian and Cui, 2025). This importance has been further emphasized since the onset of the COVID-19 pandemic, as sectors have witnessed significant changes. On the other hand, due to the ongoing pandemic and the resulting

* Anadolu University, Faculty of Economics and Administrative Sciences, Eskişehir/Türkiye, E-mail: halduncolak@anadolu.edu.tr

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global health crisis, supply chains have faced significant disruptions due to stockpiling and panic buying (Hu, 2022; Khan et al., 2022). Therefore, the SCs play a significant role in analyzing the movement of critical assets within the context of risk management. However, there is a strong consensus that operational measures or traditional risk management practices alone are insufficient in today's complex supply chain networks (Hald and Coslugeanu, 2022; Sathiya et al., 2023). This situation has led researchers and practitioners to seek new solutions.

At the center of these solution-seeking efforts is digitalization. Considering digitalization and SCD, the literature suggests that firms need to develop technology-based capabilities to enhance the flexibility of supply chains and increase agility against disruptions (Vongurai, 2022; Dubey et al., 2023). Accordingly, the current literature demonstrates the integration of new technologies such as blockchain (Nguyen et al., 2023), Industry 4.0 technologies (Ali et al., 2021), and additive manufacturing (Priyadarshini et al., 2022) to highlight the role of digitalization in alleviating SCD-related challenges. Additionally, it is acknowledged that the implementation of Industry 4.0 technologies, along with supply chain collaboration and shared responsibility (Duan et al., 2025), is crucial for achieving a sustainable future (Joshi and Sharma, 2022). Research also shows that the degree of use of digital technologies has a positive impact on a company's ability to withstand and recover from challenges, in other words, supply chain resilience (Zhao et al., 2023; Chen et al., 2025b). Resilience is related to providing an adequate level of security, promoting good collaboration among supply chain partners, and having the capacity to detect inconsistencies, bottlenecks, and security vulnerabilities (Matysek-Jędrych et al., 2024; Chen et al., 2025a).

Although the academic interest in the SCD topic is growing, most of the current work is still fragmented, with specific technological solutions or limited resilience strategies, and not enough attention is paid to the broader interconnected digital ecosystem. Studies mostly concentrate on specific solutions to specific types of risks, such as demand, supply, or operational risks (Yang et al., 2023), and do not integrate digital technologies as an integrated approach to resilience (Xu et al., 2020; Agrawal and Jain, 2022). On the other hand, when we look at theoretical studies, it seems that the attention given to the relationship between SCD and digitalization is rather insufficient. Most of the studies focus on disruption risks (Bier et al., 2020; Xu et al., 2020); some studies also consider supply chain resilience (Agrawal and Jain, 2021; Gupta et al., 2021). These studies are useful in the general knowledge of SCD mitigation strategies and provide insight into redesigning the supply chain processes to build a more robust structure. However, much of the research is limited to specific technologies or application fields (Andiappan et al., 2021; Benabdellah et al., 2024) and does not address the interrelations between concepts such as digitalization, resilience, dynamic capabilities, sustainability, and human capital from a holistic viewpoint. In other words, even with the growing literature, an integrative review of the conceptual structure, thematic development, and core research directions of the field is still lacking.

There are two reasons why the need is particularly important. First, the digital transformation journey is not only about technology investments. These provide a multidimensional construct that has to be assessed in conjunction with organizational capabilities, human capital, and collaboration mechanisms (Dubey et al., 2023; El Baz and Ruel, 2024; Patel et al., 2026). Secondly, the complex and systemic nature of supply chain disruptions requires understanding the interconnections between various research themes. Therefore, systematic analysis of the existing body of knowledge is important for both identifying the direction of theoretical development and discovering opportunities for future research.

The aim of this study is to reveal the intellectual and conceptual structure of the literature on supply chain disruptions and digitalization, identify key research themes, and determine future research areas. To address the research problem, a systematic literature review is conducted utilizing bibliometric analysis techniques. Accordingly, thematic mapping, multiple correspondence analysis (MCA), conceptual structure mapping, and topic dendrogram analyses were used to examine thematic clusters, research trends, and conceptual relationships in the literature.

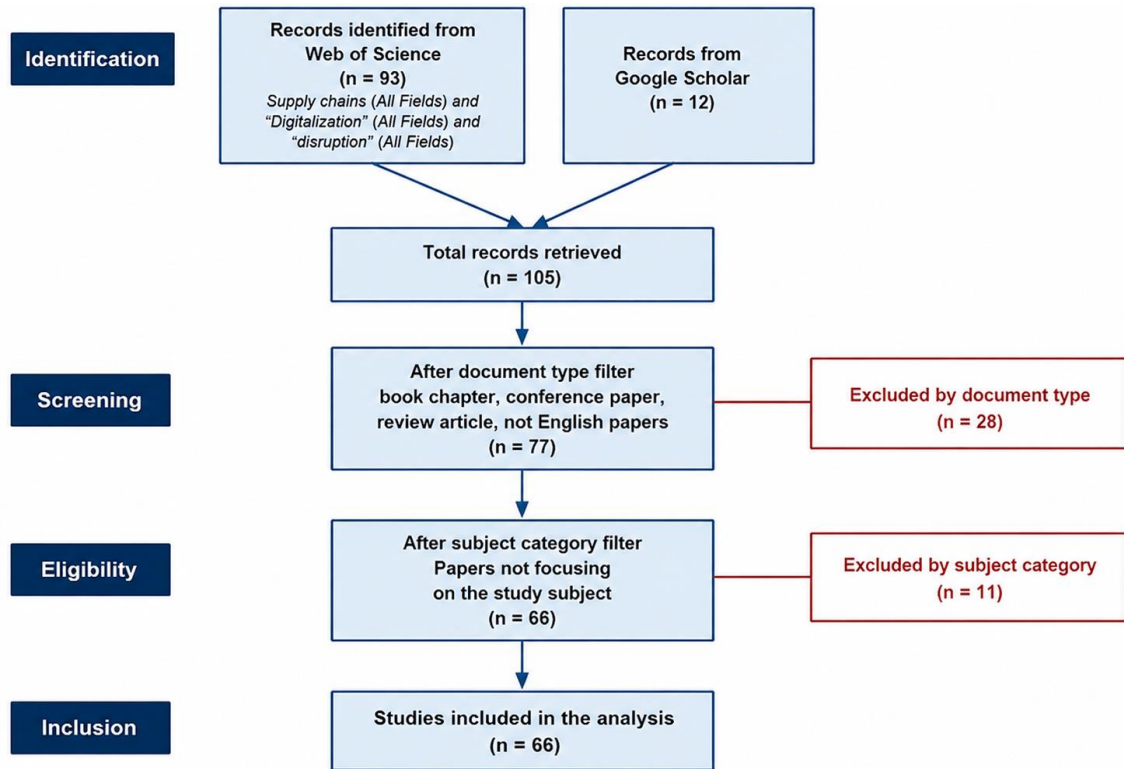
The study offers three main contributions. First, it systematically evaluates the intellectual structure of the literature by presenting a holistic map of the knowledge base in the field of supply chain disruptions and digitalization. Secondly, it presents a comprehensive framework for the conceptual development of the field by identifying the prominent themes in the literature and the relationships between these themes. Finally, it proposes a research agenda for future studies by identifying emerging research areas and existing research gaps.

2. METHOD

The aim of this study is to reveal the conceptual structure of the literature, identify development trends, and detect research gaps. In line with the relevant objective, a systematic literature review (SLR) was conducted in this study. On the other hand, the conceptual structure of the literature was examined using bibliometric analysis and thematic mapping techniques, and the prominent research themes and the relationships between these themes were identified. SLR allows for a comprehensive evaluation of the existing literature by revealing the fundamental themes, conceptual relationships, and the developmental direction of knowledge accumulation in a specific research field (Tranfield, 2003). Thematic mapping, on the other hand, offers researchers the opportunity to identify gaps in the academic literature and develop suggestions for future research agendas. Additionally, thematic mapping allows for the systematic examination of prominent themes in the research field and the relationships between these themes (Thukral and Jain, 2021). In this context, thematic networks are used as an important tool to reveal the connections between the themes in the strategic diagram and other research topics that shape the development of the field (Cobo et al., 2011). Therefore, in the study, clustering analysis based on a topic dendrogram was utilized to examine the MCA-based conceptual structure mapping and the hierarchical structure of the themes.

In the current study, the approach presented by Tranfield et al. (2003) was adopted to design the entire research, taking into account the methodological foundations. Accordingly, the literature review phase was conducted in accordance with the PRISMA protocol (Moher et al., 2009), which is widely used in SLR studies and includes the processes of *identification*, screening, *eligibility*, and *inclusion* that help researchers in various fields harmonize different perspectives (Thukral and Jain, 2021). Additionally, the provision of more comprehensive and consistent findings by PRISMA to ensure transparency and objectivity in source selection has strengthened the choice of this protocol (Mühl and Oliveira, 2022). Figure 1 shows the entire process based on the PRISMA protocol.

Figure 1. PRISMA flow diagram



In the first step, the identification phase, keywords were determined to reach the studies that would form the dataset, and the Web of Science (WoS) database was used. Zupic and Čater (2015) state that WoS is the dominant database preferred by academics, especially in the field of management. WoS facilitates straightforward access to research in the social sciences, generating an extensive data repository, with datasets readily available in suitable file formats (Ozturk, 2021), thereby allowing for the incorporation of detailed information, including citation counts. In line with the research objective, a search query including "supply chains*" and "digitalization*" and "disruptions*" was created. To ensure conceptual precision, the search strategy focused on three core concepts: supply chain, digitalization, and disruption. As emphasized by Tranfield et al. (2003), systematic literature reviews should employ clearly defined search strategies that are consistent with the research objectives. Similarly, Zupic and Čater (2015) argue that bibliometric analyses should prioritize conceptual

relevance and methodological consistency over the mere expansion of the dataset. A broad keyword approach was avoided to create a conceptually coherent dataset that directly addressed the intersection of these constructs. More specific concepts like Industry 4.0, blockchain, and artificial intelligence were excluded as they pertain more to technological manifestations of digitalization than to the primary research domain, consistent with the recommendations of Aria and Cuccurullo (2017). Such an approach allows the conceptual structure of the field to emerge from the bibliometric analysis itself. Indeed, these concepts naturally emerged in the MCA-based conceptual structure map, thematic map, and hierarchical clustering results, demonstrating that the selected search strategy successfully captured the intellectual structure of the field without artificially constraining the thematic landscape. The relevant literature review was conducted between April 12, 2026, and May 28, 2026.

In the identification phase, a total of 93 articles were reached in accordance with the aforementioned procedure. In addition, to identify studies that may be relevant to the research topic but are not indexed by WoS, further search was conducted on Google Scholar, resulting in 12 more articles. As a result, a total of 105 studies were identified during the identification phase. Although Web of Science served as the primary data source, Google Scholar was consulted as a supplementary database to reduce the risk of omitting highly relevant studies. Since Google Scholar does not provide standardized bibliographic metadata comparable to Web of Science, all retrieved records were subsequently searched and verified within the Web of Science database. Only those studies that were indexed in Web of Science and satisfied all predefined inclusion criteria were included in the final dataset. This procedure helped improve the comprehensiveness of the review while maintaining the consistency and reliability of the bibliographic dataset.

The *screening* phase was carried out by applying specific inclusion and exclusion criteria. Conference proceedings, book chapters, review articles, and texts authored in languages other than English have been omitted. The emphasis has been on complete articles published in prestigious SSCI, SCI-E, and ESCI-indexed journals within the domains of management and business. According to the specified criteria, 28 articles were removed from the dataset, and the next stage proceeded with 77 articles.

In the next step, the content of the documents was examined to determine whether they were relevant to the main topic. To assess *eligibility*, the abstracts of the articles and the authors' keywords were checked. This check is recommended, as keywords can sometimes lead to a focus on unrelated items and cause bias issues in the data (Cobo et al., 2011). As a result of the evaluation, a total of 11 studies that focused solely on the technical features of digital technologies or specific application areas and were not directly related to the context of supply chain disruptions were removed from the dataset, and a dataset was created with the remaining 66 studies. Although the study comprises 66 articles, this amount is deemed suitable as it targets a conceptually homogeneous dataset on supply chain disruptions and digitalization. Strict inclusion and exclusion criteria were applied to enhance internal consistency

and minimize irrelevant publications. Previous bibliometric studies support the notion that quality, relevance, and conceptual consistency are more crucial than sheer quantity in revealing the intellectual structure of a research field (Zupic & Čater, 2015; Aria & Cuccurullo, 2017).

2.1. Data analysis

For data analysis, a web-based data processing tool called "Bibliometrix," supported by the "Biblioshiny" application, has been used. This software, processed by the R Studio program, offers greater flexibility due to its graphical and statistical capabilities (Aria and Cuccurullo, 2017). Bibliometrix offers a comprehensive analysis opportunity, particularly including co-citations, trend analysis, publication performances, MCA-based factor analysis, and topic dendrograms (Biancone et al., 2020).

In this study, "Multiple Correspondence Analysis" (MCA) was used to reveal the conceptual structure of the literature. MCA allows for the determination of the conceptual structure of the research field by visualizing the relationships between keywords used together in a two-dimensional space (Aria and Cuccurullo, 2017). Additionally, thematic map analysis has been utilized to evaluate the development and centrality levels of the prominent themes in the literature (Cobo et al., 2011).

To determine the hierarchical relationships between the themes, a clustering analysis based on a subject dendrogram has been applied. The dendrogram is a graphical representation of the hierarchical structure within a dataset, determined by the inertia of the item groups (Karna and Gibert, 2022). The purpose of hierarchical clustering is to minimize the inertia that represents the conceptual closeness of the elements within a cluster. Accordingly, high inertia values of a set or any member within the set indicate that the relevant concept or theme, while related to other themes, occupies a conceptually different position. In other words, low inertia values indicate a strong thematic proximity between concepts, while high inertia values show that the related themes are positioned more independently or in different research axes. Thus, the fundamental research clusters in the literature and the relationships between these clusters have been revealed.

3. FINDINGS

Considering the 66 publications used in the dataset, some bibliometric characteristics stand out, showing the general performance. The annual publication growth rate is 37.8%. There are only five articles written by a single author. The global authorship rate is 53.03%, with an average of 3.97 co-authors per document. The total number of authors in the dataset is 249. On the other hand, Table 1 shows the number of publications by year, the year ranges in which the publications fall, the most productive journals, and the most influential authors based on total citations. Accordingly, the time range of the published articles covers the years 2018 to 2026. Considering some performance indicators, the journal "Sustainability" ranks first with 8 publications. However, when considering the total citations, it is seen that the most influential journal is the "International Journal of Information Management."

Queiroz, MM., and Wamba, SF., are the two most influential authors when considering the total citations. When looking at the number of articles published over the time period, 79% of the articles were published between 2022 and 2026, indicating an increasing interest in the subject.

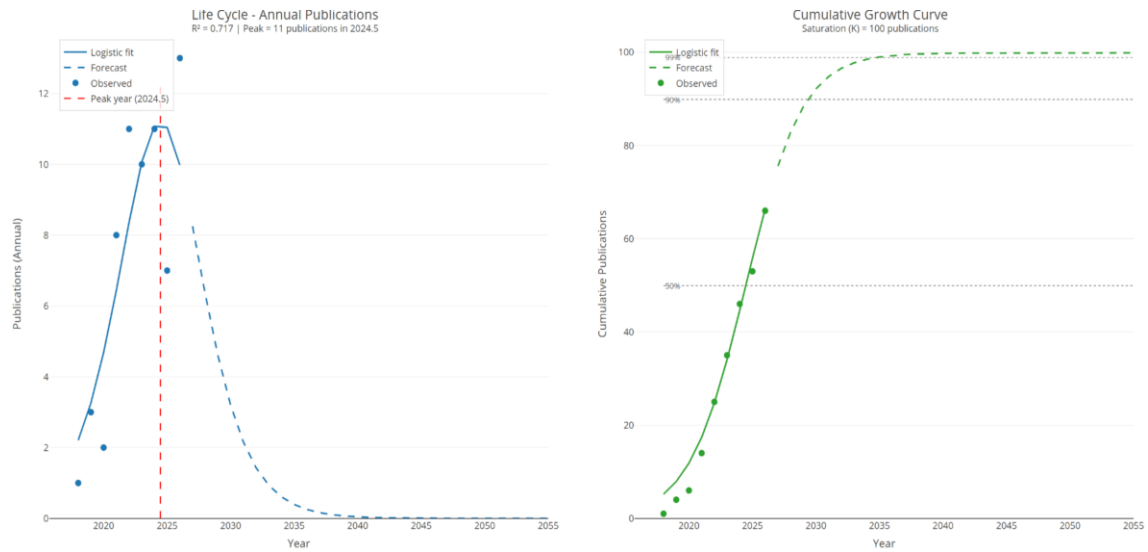
Table 1. Some key performance indicators across the sample.

N. of Annual Publications		Most Productive Journals			Authors' Impact	
<i>Years</i>	<i>Publications</i>	<i>Journal</i>	<i>N.of Publications</i>	<i>Total Citation</i>	<i>Authors</i>	<i>Total Citation</i>
2018	1	Sustainability	8	119	Queiroz MM.	964
2019	3	International Journal of Production Economics	6	764	Wamba SF.	729
2020	2	IEEE Transactions on Engineering Management	5	254	Zhao N.	430
2021	8	Computers and Industrial Engineering	4	184	Hong J.	408
2022	11	Operation Management Research	3	156	Lau KH.	408
2023	10	The International Journal of Logistics Management	2	83	Bryde DJ.	307
2024	11	Socio-Economic Planning Sciences	2	28	Dubey R.	307
2025	7	International Journal of Information Management	2	847	Dwivedi YK.	307
2026	13	Technological Forecasting and Social Change	2	73	Foropon C.	307
Total	66	Other Journals	32	-	Gary G.	307

In Figure 2, the results of the life cycle analysis of the publications are presented. The results of the life cycle analysis indicate that the number of publications in the fields of supply chain disruptions and digitalization has significantly increased, especially after 2020. The cumulative growth curve indicates that the literature is still in the development stage and that the research field has not yet reached saturation. This situation indicates that the field remains current and is open to new research in the future. The literature on supply chain disruptions and digitalization has gained significant momentum, especially after the COVID-19 pandemic, and has become an emerging research area that continues to develop. On the other hand, the left side of the graph provides detailed information about annual publications. Here, the blue dots represent the actual number of publications (1 in 2018 and 13 in 2026), while the solid blue line shows the overall trend. The red line indicates the peak year, while the dashed blue line points to the projected future trend. In summary, the left side of the graph shows a rapid increase in publications after 2019, indicating that the field has gained significant momentum, particularly due to topics such as COVID-19, digitalization, resilience, and Industry 4.0. The right side of the graph in Figure 2 shows the overall development curve. Here, while the total publication accumulation is shown, it is also understood that the curve is still rising steeply. From this, it can be understood that the field related to movement is still developing, research interest in the field continues, the literature has not yet reached saturation, and new themes are emerging. It should be noted that the publication trend projection presented in Figure 2 is automatically generated by the Bibliometrix/Biblioshiny software using its built-

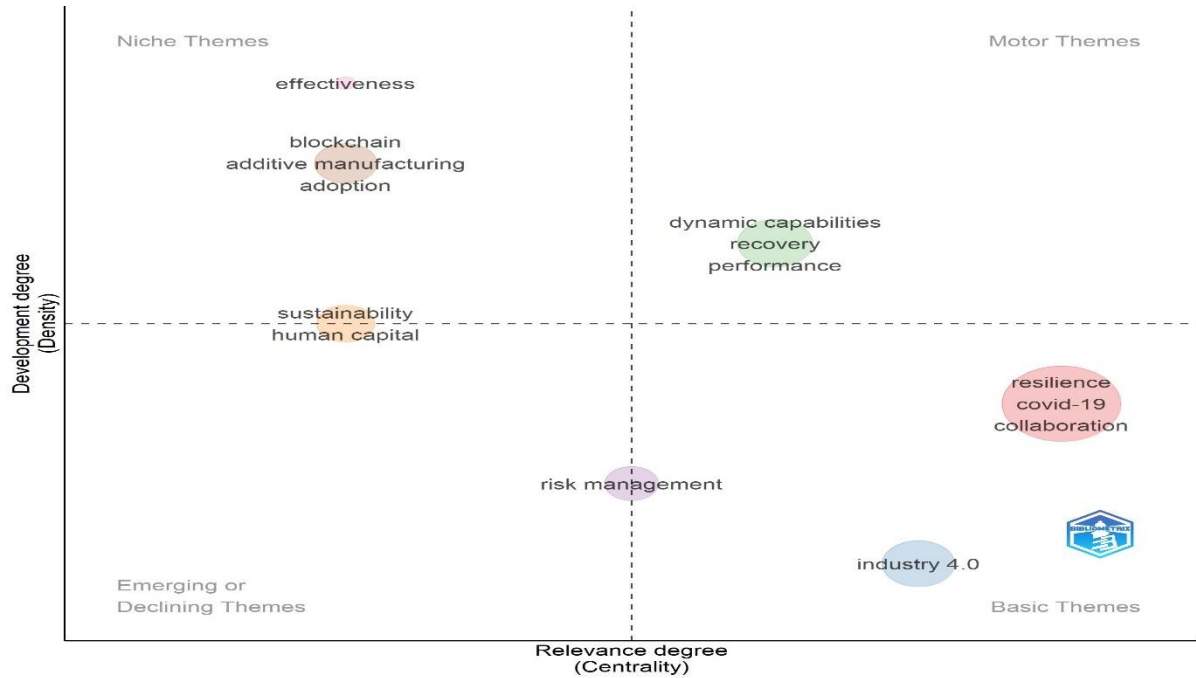
in regression algorithm. Therefore, the forecast should be interpreted as an indicative visualization of the publication trend rather than as an exact prediction of future publication output.

Figure 2. Life cycle analysis of publications.



A thematic map (also known as a strategic diagram) is a two-dimensional visualization technique that classifies research themes based on their centralities (importance within the field) and densities (internal coherence of the theme). Developed by Cobo et al. (2011), this map provides a comprehensive snapshot of the thematic landscape of a scientific field. In Figure 3, the thematic map resulting from the dataset used in the current study is shown. The X-axis (centrality) represents the proximity to the literature, and as one moves to the right, the relevant theme approaches the center of the literature. This means that the relevant theme is more connected to other themes, more related to the core framework of the research field, and, therefore, the relevant theme is critical in terms of the field. On the other hand, as one moves up the Y-axis (Density) section, the relevant theme becomes more developed and mature within itself. In other words, it is understood that the conceptual infrastructure of the relevant theme is strong, it has a well-established literature, and the studies are more interconnected with each other. As can be seen in Figure 3, there are four planes representing different aspects of the themes. Niche themes refer to specific but highly popular research terms. Core/basic themes encompass the main and most important topics of the field. Motor themes are candidates to be among the core themes because they are receiving increasing interest. Centrality indicates that these themes are of considerable interest to researchers and are likely to be placed among the core themes. However, over the years, considering their interest in the main topic and ongoing appeal, they can also be distributed to any other level (Cobo et al., 2011).

Figure 3. Thematic map



The thematic map further indicates that some themes are positioned close to the intersection of the centrality and density axes. For instance, risk management is located right on the X-axis and sustainability and human capital clusters upon the Y-axis. The positioning of risk management suggests that this theme functions as basic or transversal theme, maintaining strong connections with other research areas while still undergoing conceptual development (Cobo et al., 2011). The positioning of the sustainability and human capital clusters, on the other hand, indicates that these themes exhibit a relatively balanced level of centrality while maintaining a comparatively high level of internal development. Their proximity to the centrality axis indicates that these themes are increasingly interacting with the broader supply chain disruption literature, although they have not yet achieved the same integrative role as resilience or risk management. In addition, themes located in the upper-right quadrant (dynamic capabilities, recovery, and performance) exhibit the characteristics of motor themes, and the proximity of these themes to the Y-axis indicates that they will become important research topics in the field.

Figure 4 presents the conceptual structure map of the keywords obtained from the MCA analysis. There are two dimensions explaining approximately 80% of the main topic and a total of five different clusters. The blue cluster consists of supply chain risk management, resilience, operational efficiency, collaboration, the Covid-19 pandemic, and Industry 4.0 themes. The red cluster, on the other hand, consists of themes such as dynamic capabilities, recovery capacity, and performance. Additive manufacturing alone constitutes the green cluster. While the themes of blockchain technology and

technology adoption form the pink cluster, the themes of human/human capital and sustainability represent the yellow cluster.

Figure 4. Conceptual structure map-method: MCA.

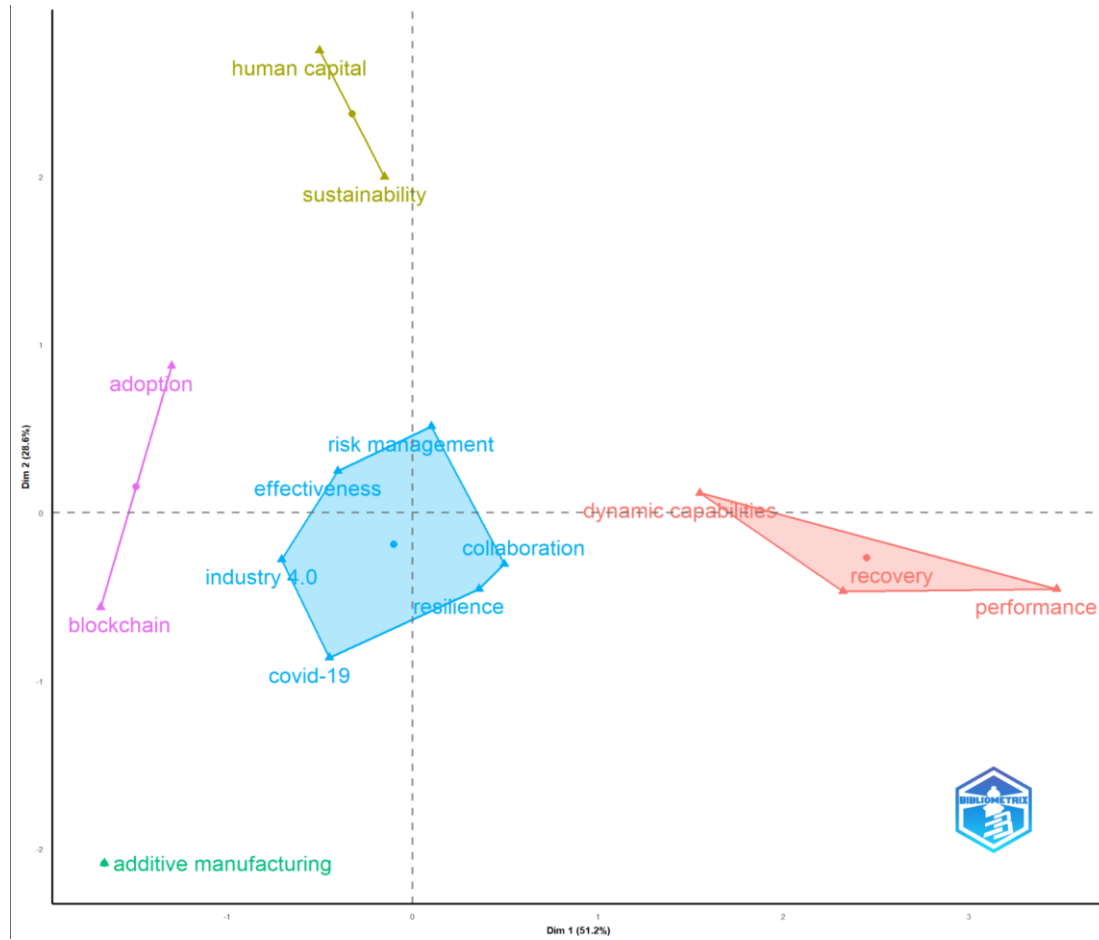
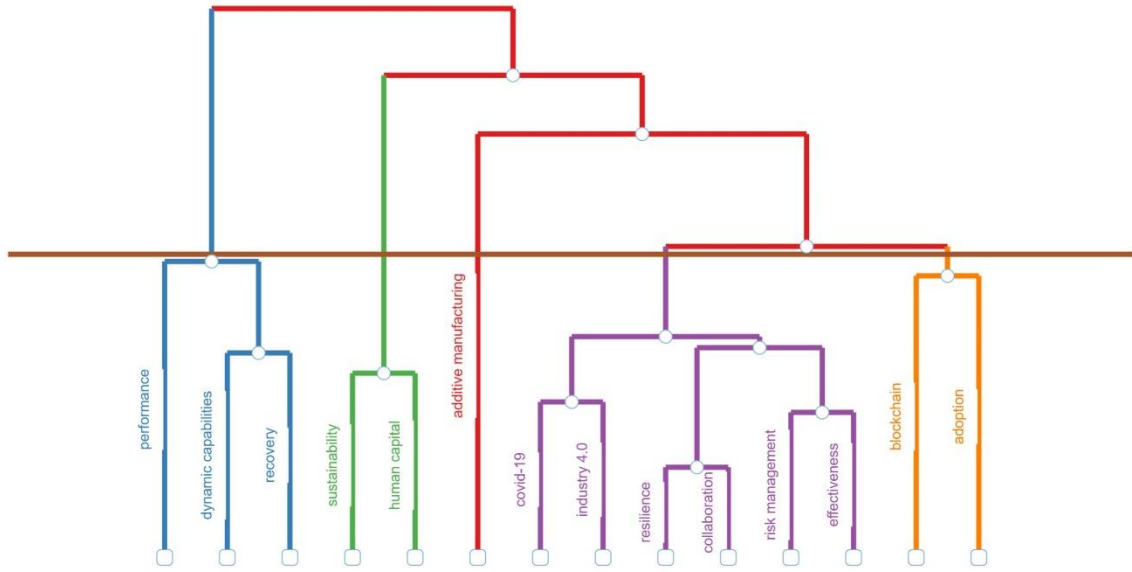


Figure 5 illustrates the hierarchical structure and interrelations among concepts identified using hierarchical clustering in a dendrogram. The dendrogram visually depicts the internal structure of the dataset, grounded in the inertia of element grouping (Karna and Gibert, 2021). The graph allocates a weight to each element by analyzing the clusters and assessing the interrelationships among them (Abbas et al., 2022). Each item comprises a collection of terms pertinent to the notions of supply chain resilience and the digital age. The purpose of hierarchical clustering is to reduce the inertia that expresses the proximity of items within a cluster. The inertia values used in dendrogram analysis indicate the thematic proximity level between the concepts. Low inertia values indicate that the concepts are frequently considered together in the literature and have a strong conceptual relationship, while high inertia values indicate an increase in the thematic distance between the concepts. Measuring the clustering distance with a metric reveals an ultra-metric structure in the dendrogram and ensures that subsequent merging operations consistently increase the level index (Karna and Gibert, 2021). Overall, inertia determines the selection of cluster heads and the formation of clusters (Choudhary et al., 2021).

Figure 5. Topic dendrogram



As a result of hierarchical clustering analysis, it is observed that the literature is shaped around five main thematic clusters (Fig. 5). The horizontal incisions in the upper sections of the tree yield a variety of categories that correlate to the overarching classifications. When situated at the tree's base, horizontal cuts yield a considerable number of classes that reflect distinct categories, characterized by fewer samples and increased homogeneity (Karna and Gibert, 2021). The *first cluster* (inertia: 1.58) consists of the themes of performance, dynamic capabilities, and recovery capacity. This cluster represents studies focusing on the impact of digitalization on businesses' ability to maintain performance and enhance recovery capabilities. Especially the inclusion of the dynamic capabilities in this cluster indicates that the ability of businesses to sense changing environmental conditions, reconfigure their resources, and adapt to crises is considered critical in terms of supply chain performance (Benabdellah et al., 2024; El Baz and Ruel, 2024; Liu et al., 2025).

The *second cluster* (inertia: 0.83) consists of the themes of sustainability and human capital. This structure demonstrates that in the literature, digital transformation is not limited to technological infrastructure investments but is also addressed in conjunction with human-centered elements such as employees' knowledge, skills, and adaptability (Vivas et al., 2024). Especially in studies on sustainable supply chain management, the impacts of digital technologies on environmental and social performance are increasingly being researched (Joshi and Sharma, 2022; Patel et al., 2026). However, the role of human capital in digital transformation processes has been addressed in relatively few studies so far. This situation suggests that the themes of sustainability and human capital are emerging but still maturing research areas.

The *third cluster* (inertia: 2.43) consists solely of additive manufacturing. This situation indicates that additive manufacturing is considered a unique and relatively independent research field in the

literature. Especially in the post-COVID-19 period, with the visibility of supply chain vulnerabilities, interest in additive manufacturing technologies that provide advantages such as localized production, rapid prototyping, and flexible capacity creation has increased (Queiroz et al., 2021; Priyadarshini et al., 2022). However, the limited number of studies examining the relationship of additive manufacturing with other themes such as resilience, performance, and sustainability indicates that this area is still an emerging research axis in the literature.

The fourth cluster (inertia: 1.08) of concepts includes resilience, collaboration, risk management, Industry 4.0, COVID-19, and effectiveness. This cluster is the primary research domain of the literature. The low inertia values between the concepts suggest that these themes are often talked about together. Researchers have demonstrated that digital technologies improve supply chain visibility, improve risk management processes, and create resilience through collaboration among stakeholders, especially following the COVID-19 pandemic (Queiroz et al., 2021; Zhao et al., 2023; Tian and Cui, 2025; Kumaresan et al., 2026). Likewise, the results have been found that Industry 4.0 applications enhance supply chain agility and operational efficiency (Ali et al., 2021; Tiwari et al., 2024; Qiu et al., 2026). Therefore, this cluster shows that the link between digitalization and resilience is the main research axis in the literature.

The final cluster (inertia: 1.49) includes the topics of blockchain and adoption. The clustering of these two concepts implies that the literature has predominantly studied blockchain technology in terms of the adoption process, usage intention, and implementation barriers. Specifically, some research has highlighted the important advantages of blockchain, such as transparency, traceability, and reliable data sharing (Queiroz and Wamba, 2019; Nguyen et al., 2023). Nonetheless, the above studies also identified organizational and technological issues that need to be resolved to promote the application of the technology extensively. The relative distinctiveness of this cluster from others suggests that blockchain studies have not yet fully integrated into the broader research fields of performance, resilience, and sustainability.

4. RESEARCH GAPS and FUTURE RESEARCH AGENDA

When the topic dendrogram and conceptual structure analyses are evaluated together, it is observed that the literature on SCD and digitalization has significantly developed in recent years. However, the emerging thematic clusters indicate that some research areas in the literature have not yet matured sufficiently and that there are various research gaps. Especially, it is noteworthy that the themes of blockchain, human capital, sustainability, additive manufacturing, and dynamic capabilities are relatively new research axes in the literature. This situation presents significant opportunities for future research. To point out such opportunities, this study also proposes related research questions for a future research agenda. The suggested research questions were created directly from the thematic groups identified using the hierarchical clustering technique. Isolated clusters signify inadequately examined

study areas, while densely interconnected clusters present prospects for theoretical expansion and comparative empirical analysis.

4.1. Blockchain-adoption gap

The fact that the themes of blockchain and technology adoption are in the same cluster indicates that existing studies largely focus on the adoption process of blockchain technology. Blockchain, an innovative and transformative technology, has the potential to reduce supply chains' sensitivity to disruptions (Zhao et al., 2023). Blockchain serves as a repository of information that facilitates secure and efficient information sharing among supply chain actors (Zhang, 2026). Blockchain also provides a distinctive resource that offers operational benefits to companies by ensuring data integrity and reducing the risk of disruptions (Ghobakhloo et al., 2025). However, supply chains must be ready to adopt this technology (Tiwari et al., 2024), as research has highlighted the impact of emerging technology on sustainability in terms of chain disruptions (El Baz and Ruel, 2025). Additionally, Queiroz and Wamba (2019) stated that the use of a blockchain-based supply chain management system could enhance the level of transparency in traceability, thereby ensuring the provision of high-quality goods within the supply chain system while also protecting data privacy and security. Although the literature has comprehensively examined the barriers to the use of blockchain technology, adoption intentions, and implementation challenges (Marzantowicz et al., 2020; Nguyen et al., 2023), empirical evidence regarding the long-term effects of this technology on supply chain resilience, recovery capacity, and operational performance remains limited (Rapaccini et al., 2022). In addition, according to Resource-Based View (RBV), digital technologies yield enduring competitive advantage solely when they are converted into valuable, scarce, unique, and organizationally integrated resources (Nandi et al., 2021). While blockchain is progressively acknowledged as a vital digital asset, current research primarily focuses on its implementation rather than investigating how blockchain-facilitated capabilities enhance resilience and operational efficacy. Consequently, subsequent research ought to extend beyond technical acceptance and explore blockchain as a strategic organizational asset that might generate enduring competitive advantage.

Finally, the blockchain cluster's somewhat isolated placement in the hierarchical dendrogram, coupled with its notably greater inertia value, suggests that blockchain research has developed primarily as a distinct research avenue with minimal conceptual incorporation into the wider discourse on supply chain resilience and operational efficacy. This disintegration implies that further research ought to extend beyond the deployment of technology and explore how blockchain enhances organizational capabilities and resilience. Consequently, the subsequent research question is put forth:

RQ1. Does the level of adoption of blockchain technology function as a transformative mechanism in the relationship between supply chain resilience and operational performance?

4.2. Sustainability- human capital gap

Sustainability is important due to its long-term impact on the efficiency of the supply chain. Due to the climate crisis, pandemics, social instabilities, and changing demographics and standards, sustainability has become one of the most important issues in corporate enterprises (Benabdella et al., 2024; Zhang et al., 2026b). On the other hand, RBV posits that human capital is a pivotal resource that fosters enduring competitive advantage (Patel et al., 2026), but Dynamic Capabilities Theory (DCV) contends that firms need to perpetually enhance employees' knowledge and digital skills to thrive in swiftly evolving contexts (Benabdellah et al., 2024). The simultaneous presence of sustainability and human capital in the same cluster indicates that forthcoming studies ought to explore not only technological investments but also the ways in which organizations convert human capital into dynamic capabilities that enhance sustainable supply chain performance. Although interest in the relationship between sustainable performance and digital supply chains has increased in recent years (Joshi and Sharma, 2022; Hervani et al., 2022), the effects of employees' digital competencies, organizational learning processes, and human capital on resilience have not been sufficiently researched (Klumpp and Loske, 2021). It is recommended that future studies particularly examine the relationships between human capital development, digital skills, and sustainable supply chain performance.

Despite sustainability and human capital constituting an integrated thematic group, their somewhat marginal status suggests that they have not been thoroughly included into the prevailing theoretical discussions around digital transformation and supply chain resilience. This insight underscores a chance to explore the structural mechanisms connecting such concepts. Consequently, the subsequent research inquiry is put forth:

RQ2. Does human capital development play a mediating role in the relationship between digital transformation and sustainable supply chain performance?

4.3. Performance-capabilities-recovery gap

The cluster consisting of performance, recovery capacity, and dynamic capabilities highlights the importance of organizational capabilities in digital transformation processes. In recent years, it has been argued that digitalization strengthens dynamic capabilities, thereby increasing the resilience levels of businesses (Dubey et al., 2023; Benabdellah et al., 2024). Supply chains need to have information technology-enhanced capabilities (Zhao et al., 2022) to obtain accurate data and minimize the extent of information distortion, as well as innovative strategies (He et al., 2023; Chen et al., 2025a) to provide better resilience. For example, it has been found that the capabilities of big data analytics were effective in providing firms with a competitive advantage by enabling more resilient and sustainable processes during COVID-19 (Song et al., 2022). However, a significant portion of the existing studies focuses on specific sectors or countries. The number of comparative studies examining how digital capabilities develop in different sectors and corporate environments is quite limited. Additionally, the examination

of causal relationships between digitalization, dynamic capabilities, and business performance through longitudinal studies constitutes one of the significant gaps in the literature.

RQ3. Do the effects of dynamic capabilities investments on recovery capacity vary by sector?

4.4. Additive manufacturing gap

It is noteworthy that the theme of additive manufacturing is positioned relatively independently from other clusters. Additive manufacturing, also known as 3D printing, is an innovative technology with the potential to bring significant changes for different parties depending on their current roles in the supply chain (Hopkins, 2021). Additive manufacturing can help manage risk and thereby enhance a company's supply chain resilience, while also reducing the spread of the ripple effect in the supply chain in the event of a disruption (Priyadarshini et al., 2022). From a theoretical perspective, additive manufacturing may be viewed as a strategic organizational competency rather than only a production technique. Aligned with the RBV and DCV, localized production, adaptable manufacturing, and swift reconfiguration abilities may serve as significant organizational assets that empower firms to effectively address supply chain disruptions (El Baz and Ruel, 2024). Academics have shown interest in additive manufacturing and have even pointed out that various challenges in its implementation could potentially lead to supply chain vulnerabilities and negative outcomes (Hervani et al., 2022). Findings indicate that although additive manufacturing technologies are seen as a potential tool for managing supply chain disruptions, they have not yet taken center stage in the literature. Current studies primarily focus on the technical advantages of additive manufacturing and production flexibility (Priyadarshini et al., 2022). However, there are significant research opportunities regarding the impact of additive manufacturing on resilience, sustainability, carbon emissions, and operational performance. Especially during times of crisis, the contribution of localized production strategies to supply chain resilience can be examined in more detail in the future.

The isolated nature of additive manufacturing suggests that this topic has evolved independently from the prevailing research trends noted in the literature. The distinction between resilience, performance, and sustainability groups indicates that contemporary research is predominantly focused on technology rather than theoretical frameworks. Consequently, further studies need to incorporate additive manufacturing into wider discussions regarding supply chain disruption and sustainable digital transformation. Consequently, the subsequent research question is suggested:

RQ4. How do additive manufacturing practices create a balance between resilience and sustainability goals in the transition from global supply networks to localized production networks?

4.5. Covid 19- Industry 4.0 gap

Finally, it is observed that the themes of resilience, collaboration, risk management, and Industry 4.0, which are at the center of the literature, have largely been shaped in the post-COVID-19 period (Vanany et al., 2021; Birkel et al., 2023; Tiwari et al., 2024). Instead of viewing resilience merely as an internal organizational strength, the RBV highlights that enduring competitive advantage arises from interorganizational cooperation, information exchange, trust, and the integration of complementary resources. The strong connection between collaboration, resilience, Industry 4.0, and risk management suggests that resilience increasingly relies on relational competencies that transcend organizational limits. Resilience can be defined as an organization's capacity to effectively manage and recover from significant challenges or adversities. Therefore, it is stated that post-disruption management is closely related to building resilience to reduce the negative impacts on supply chain performance (Chen et al., 2019; Rao et al., 2021). Industry 4.0 technologies enable businesses to effectively address the challenges of outsourcing by using sensors and other digital devices that enhance the control of production and supply chain management operations (Cozmiuc and Petrisor, 2018; Shashi, 2023). Industry 4.0 technologies are expected to help reduce the negative impacts of disruptions (Ali et al., 2021; Fauzdar et al., 2022). *Collaboration* means the joint resource-sharing action carried out to share investments in capacity among supply chain members and to sustain the supply chain's goals (Li et al., 2023). The lack of collaboration among supply chain participants is a primary cause of functional deficiencies within the supply chain (Treber et al., 2021), and businesses have begun to promote collaboration through new methods such as the implementation of blockchain technology (Hopkins, 2021). According to the research, collaboration yields superior results when evaluating supply chain sustainability with appropriate technology choices (Benabdellah et al., 2024). *Risk management* is a rapidly growing field focused on identifying and mitigating risk areas within supply chains. Supply chains should be equipped with additional resources and infrastructure to effectively address and mitigate disruptions and risks; therefore, a more comprehensive and balanced approach to risk management should be adopted (Tian et al., 2026). Accordingly, studies considering digitalization support the idea that the integration of digital technologies and innovation capacity are possible ways to affect the resilience of a company's logistics competence and that risk management plays a beneficial role in mitigating this impact (Song et al., 2022). The concept of *effectiveness* included in this cluster shows that digitalization is not only a tool for reducing the impacts of disruptions but also a strategic element that enhances the degree to which supply chain activities achieve their targeted outcomes (Alesiuniene et al., 2021). In the literature, effectiveness is associated with outcomes such as maintaining service levels, sustaining delivery performance, responding to customer demands in a timely manner, and ensuring operational continuity (Hald and Coslugeanu, 2022; Song et al., 2022). Especially the increasing research on the relationship between resilience and efficiency in recent years indicates that businesses are focusing not only on

recovering from disruptions but also on maintaining their performance during crisis periods (Matysek-Jędrych et al., 2024; Nath and Sulthana, 2025).

In contrast to the more isolated clusters, this cluster holds a pivotal position within the conceptual framework, signifying its function as a fundamental research avenue. The advent of new-generation disruptions indicates that current understanding must be broadened beyond pandemic-specific scenarios. In the future, it is necessary to investigate the impacts of new generation risks such as climate change, energy crises, geopolitical risks, cyber-attacks, and AI-driven transformations on supply chain resilience. Especially the role of digital twins, AI-supported risk prediction systems, and big data analytics applications in disruption management has not yet been sufficiently clarified (Gao and Zhao, 2026; Zhang et al., 2026a; Shin et al., 2025). Consequently, the ensuing research question is put forth:

RQ5. What is the role of the AI-enabled risk prediction systems and digital twin technologies in strengthening supply chain resilience to impending disruptions such as climate change, cyber-attacks, and geopolitical risks?

Overall, it is observed that the literature is evolving from technology-focused explanations toward the axis of organizational resilience, sustainability, and strategic capabilities. However, the divergences that emerge among thematic clusters indicate that the relationships between digital technologies and organizational outcomes are still being examined in a fragmented manner. Therefore, future studies adopting interdisciplinary approaches that address digitalization, resilience, sustainability, and human capital within an integrated framework will significantly contribute to the development of the supply chain disruptions literature.

5. DISCUSSION and CONTRIBUTIONS

This study was performed to reveal the conceptual and intellectual structure of literature on supply chain disruptions and digitalization. The results obtained from the bibliometric analyzes show that the research area has grown considerably in recent years and has diversified quickly, especially since COVID-19. The findings suggest that digitalization is now seen as a strategic capability for improving supply chain resilience as well as a tool for operational efficiency. These findings are consistent with previous studies that emphasize the role of digital technologies in resilience (Birkel et al., 2023; Zhao et al., 2023; Chen et al., 2025b).

The topic dendrogram results have shown that the literature consists of five major thematic clusters. One of the most striking things about the findings is the grouping together of concepts of resilience, collaboration, risk management, and efficiency. This result is in line with the increasing popularization of the “digital resilience” approach in the literature over recent years. In particular, the post-COVID-19 studies show that digital technologies increase visibility (Ambrogio et al., 2022; Qian et al., 2025), improve risk management, ease information sharing (Wang et al., 2026), and enhance coordination among stakeholders (Vanany et al., 2021; Li et al., 2023; Nath and Sulthana, 2025). Thus,

resilience can be considered to be perceived nowadays not only as the ability to respond to crises but also as a proactive organizational property developed through digital capabilities.

Another great result that is revealed is that the themes of sustainability and human capital are clustered together. Although the relationship between sustainable supply chain management and digital transformation is gaining more attention in the literature, there is relatively limited research concerning the role of human capital in this process (Joshi and Sharma, 2022; Hervani et al., 2022; Patel et al., 2026). The results show that digitalization is not possible only through technological investments, but the knowledge, skills, and adaptability of employees are also decisive in this process (Rodrigues et al., 2021; Ragazou et al., 2026). This situation indicates that the human-centered side of the digital transformation-sustainability relationship needs to be studied more in the future.

It is also important to note that blockchain and technology adoption themes are in the same cluster. This finding suggests that the blockchain literature is still largely framed around adoption, usage intention, and implementation barriers (Wang et al., 2024). While it has been argued that blockchain technology provides important advantages such as transparency and traceability (Queiroz and Wamba, 2019; Nguyen et al., 2023), few empirical studies seem to analyze the impacts of the technology on performance, resilience, and sustainability. This situation shows that the process of blockchain research maturing is still underway.

Finally, the fact that the additive manufacturing theme is relatively independent from other clusters indicates that this research area has not yet become central in the literature. However, the visibility of supply chain vulnerabilities after COVID-19 has led to the observation that additive manufacturing technologies are gaining increasing importance due to their advantages such as localized production, flexible capacity, and rapid response (Priyadarshini et al., 2022; Kumar et al., 2023). Therefore, the number of studies on the relationship between additive manufacturing and resilience and sustainability is expected to be increased in the future.

5.1. Theoretical contributions

This study offers three fundamental contributions from a theoretical perspective. First, it provides a holistic framework for the intellectual development of the research field by systematically outlining the conceptual structure of the literature on supply chain disruptions and digitalization. While existing studies in the literature mostly focus on specific technologies or particular organizational outcomes, this study demonstrates how these themes are interconnected. Secondly, the findings indicate that the relationship between digitalization and resilience has become a central research axis in the literature. This result supports the importance of the resource-based view and dynamic capabilities theory in the supply chain literature (Dubey et al., 2023; Benabdellah et al., 2024; Tortorella et al., 2025). It is particularly understood that digital technologies do not create value on their own; rather, these technologies are transformed into performance through organizational capabilities. Thirdly, the

emergence of themes such as sustainability, human capital, blockchain, and additive manufacturing as separate clusters indicates that new research areas are developing in the literature. This situation indicates that the research field should be examined not only from the perspective of resilience but also from the perspectives of sustainability and human-centered transformation.

5.2. Practical contributions

Research findings indicate that digitalization should not be viewed merely as a technological investment. In order to achieve the expected benefits of digital transformation, businesses need to develop employee competencies, support organizational learning, and strengthen collaboration among supply chain stakeholders. This situation shows that the effectiveness of digital technologies is largely dependent on organizational capabilities. The findings also reveal that the concepts of resilience, risk management, collaboration, and efficiency are closely interconnected. Therefore, it is important for managers to consider investments in digital visibility, data sharing, and risk monitoring systems not only as tools for operational improvement but also as strategic elements that enhance supply chain resilience and performance. Finally, technologies such as blockchain, additive manufacturing, and artificial intelligence stand out as emerging research areas in the literature. Considering the potential of these technologies to enhance supply chain visibility, provide resilience against disruptions, and support sustainability goals, it is recommended that businesses approach their digital transformation strategies from a long-term competitive advantage perspective.

6. CONCLUSION

This study has several limitations. First, the research relies solely on a dataset created using the Web of Science (WoS) database and a limited number of additional studies accessed via Google Scholar, which were manually verified. Including publications from different databases in the analysis could contribute to a broader perspective on the literature. Second, a very narrow search strategy was adopted to ensure conceptual integrity. While this approach strengthened the research focus, it is possible that some relevant studies accessible using different keywords were not included in the dataset. Finally, while bibliometric analyses are powerful tools for revealing the intellectual and conceptual structure of the literature, they do not offer the opportunity for in-depth evaluation of the content of the studies. Therefore, in future research, supporting bibliometric analyses with methods such as systematic content analysis, meta-synthesis, or meta-analysis will contribute to a more comprehensive interpretation of the findings.

The present study applied systematic literature review and bibliometric analysis to unveil the conceptual structure of the literature on supply chain disruption and digitalization. The results reveal that the research area is grounded on five primary themes: performance, dynamic capabilities, and recovery capacity; sustainability and human capital; additive manufacturing; resilience, cooperation, risk management, and Industry 4.0; and blockchain and technology adoption. The results show that

digitization is seen not just as a technology tool in coping with supply chain interruptions, but also as a strategic factor to promote resilience and performance. It has also been found that developing research areas such as blockchain, human capital, and additive manufacturing have evolved.

Finally, the importance of digitization in supply chain management is shown to be increasingly strengthening. Yet, resilient and sustainable supply chains will be feasible not only by technology investments but also by strong organizational competencies and a competent workforce. Future investigations with alternative databases and approaches are expected to contribute to the literature.

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