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Bibliometric and Narrative Review Analysis of Additive Manufacturing's Impact on Supply Chain Resilience

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Abstract

Additive manufacturing (AM) has emerged as a transformative force, reshaping traditional manufacturing methodologies and fostering agility and efficiency to respond effectively to disruptions and fluctuating demands. The research landscape has witnessed a surge in interest and exploration of AM, encompassing diverse applications such as automotive spare parts, electronics, medical accessories, and fashionable consumer goods. The fundamental objective of AM is to establish seamless collaboration within manufacturing functions, particularly in the face of disruptive events, by facilitating the rapid availability of required products or components through the concept of digitally holding inventory. The integration of AM has engendered substantial improvements in the resilience of supply chains, although it has also introduced unique challenges and implications. This review paper aims to provide a comprehensive overview of studies conducted in the past two decades, elucidating the transformative impact of AM on supply chain resilience within manufacturing organizations. This study employs a bibliometric analysis to identify prominent trends and thematic patterns within this research domain. Furthermore, a narrative review analysis is presented, examining the framework of AM processes across specific industries and delineating how AM has revolutionized traditional manufacturing procedures. The study highlights the tangible benefits of AM implementation and sheds light on the challenges encountered during its adoption. By offering a comprehensive review, this paper seeks to contribute to the existing knowledge base and serve as a foundation for future research endeavours in this evolving field.

Keywords
Additive manufacturing, Supply chain resilience, Manufacturing, Bibliometric analysis, Narrative review

1. Introduction

Contemporary supply chain networks are progressively evolving into intricate structures, necessitating the inescapable integration of digital enablers across all operational domains within the network. As depicted in Figure 1, digital technology enablers are employed in supply chain management practices within modern organisations to optimise their capabilities to meet customer satisfaction at the highest level (Attaran 2020). Digital enablers offer a range of advantages for supply chain management functions, including heightened network visibility, enhanced stakeholder collaboration, optimized inventory management, efficient customer order fulfilment, and increased scalability and flexibility. However, with these benefits, adopting digital enablers can also give rise to negative implications. These include data privacy and security concerns, environmental considerations, ethical and legal ramifications, workforce and skill disruptions, and social and cultural impacts. Consequently, organizations must make informed decisions regarding how much they integrate digital enablers into their operations to avoid disturbing the delicate equilibrium (Taghipour et al. 2022).

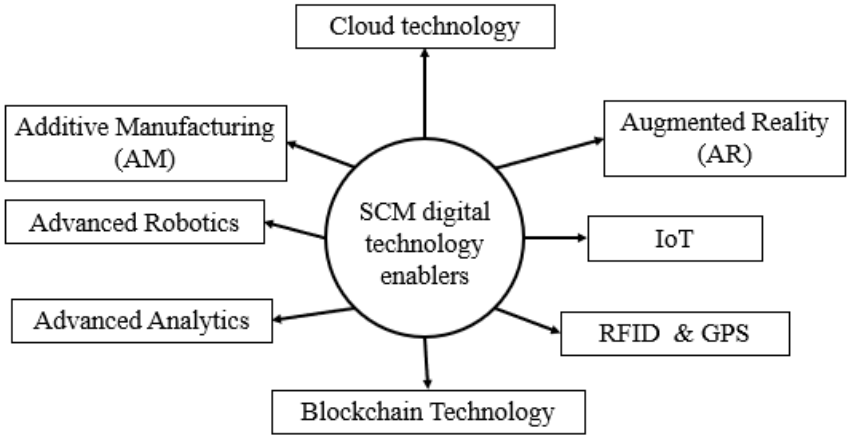

Figure 1. Digital technology enablers for supply chain management

Additive manufacturing (AM) has garnered considerable attention, propelling a paradigm shift towards more agile and lean processes within the conventional manufacturing realm. The terms 3D printing, rapid prototyping, Direct Digital Manufacturing (DDM), layered manufacturing, digital fabrication, and Solid Freeform Fabrication (SFF) are often used interchangeably in the industrial context to denote AM. Fundamentally, AM encompasses the fabrication of three-dimensional structures by employing computer-guided layer-by-layer material deposition orchestrated in accordance with digital models compared to conventional manufacturing, which typically involves subtractive processes, where raw material is selectively removed or shaped to create the desired object (Sonar et al. 2022).

1.1 Achieving Supply Chain Resilience through AM technology

Supply chains' increasing complexity and interconnectedness expose them to more significant vulnerabilities, both from external disruptions and internal factors. As a result, there is a rising need for researchers and practitioners to develop resilient supply chains capable of effectively responding to and recovering from various shocks. Supply chain resilience is a concept that has been defined in multiple ways, emphasizing its multi-level and multidimensional nature. Resilience manifests at different organizational levels, encompassing individuals, groups, and the organization (Adobor 2019).

Supply chain resilience is characterized as an innate attribute of a supply chain that enables it to endure, adapt, or transform in the face of diverse disruptions. Engineering resilience captures the concept of persistence, which is evaluated by quantifying the rate at which the supply chain restores stability after a disturbance. On the other hand, social-ecological resilience encompasses the capacity to adapt and transform, measured by assessing the magnitude of disturbance the supply chain can tolerate before necessitating structural modifications. Both manifestations of resilience encompass the fundamental notion of responsiveness, which reflects an organization's proficiency in mobilizing resources and initiating proactive measures in response to external changes. Time to recovery is the metric to gauge engineering resilience, whereas time to change is employed to assess social-ecological resilience. It is important to note that the ability to persist can also be attained without an active response, denoted as robustness.

Robustness can encompass either the structural integrity of the supply chain or the duration for which the supply chain can meet demand after a disruption (Wieland & Durach 2021).

AM technology presents a viable and substantiated alternative to conventional production methods, reinforcing supply chain (SC) operations' resilience. When examined within the context of manufacturing environments, the integration of AM technology yields multifarious advantages, particularly when scrutinized from the supply chain management standpoint. Naghshineh and Carvalho (2022) shed light on the benefits of implementing AM technology in manufacturing settings. These benefits encompass the reduction of production lead time, the augmentation of production scheduling flexibility, the capacity to scale production output, operational agility, the amelioration of production capacity slack, the mitigation of delivery time, a diminished susceptibility to disruptions in the distribution channel, and the facilitation of prompt information sharing among all relevant stakeholders. It is essential to recognize that the magnitude of these benefits is subject to variation contingent upon the industry sector in question and the specific configurations that define the organization's supply chain structure. Figure 2 (Adapted from Naghshineh & Carvalho 2022) shows the identified SC capabilities due to the implementation of AM technology regarding SC resilience. Moreover, it lists the subcategories of capabilities that facilitate the SC operations' responsiveness and resilience.

Adopting and implementing additive manufacturing (AM) within an organizational context are accompanied by various barriers, challenges, and limitations that directly and indirectly influence its integration (Muhammad et al., 2022). These barriers and limitations can be classified according to different factors. Notably, technology is a significant barrier that impedes the full realization of AM capabilities. Factors contributing to this include limitations associated with the limited build envelope, imprecise 3D scanning, limited options for automation, and the inherent instability of AM processes (Durach et al. 2017). Consequently, these technological barriers can result in restricted production capacity, increased instances of scrap and rework, challenges in scaling parts per size, and low throughput levels. Moreover, the literature identifies additional barriers to different dimensions, such as quality-related (Chekurov et al. 2018), cost-related (Victor Verboeket & Krikke 2019), regulatory, market-related, and firm-related (Afshari et al. 2020). These encompass a range of issues and constraints that further impede the widespread adoption of AM. Figure 3 visually represents the various barriers to AM adoption, their underlying causes, and the resulting effects.

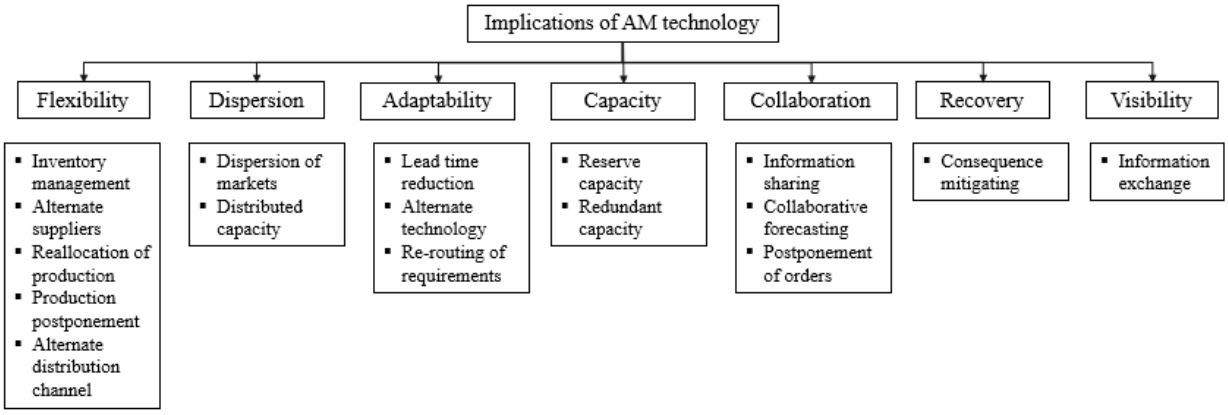

Figure 2. Implications of AM technology from a SC capability perspective

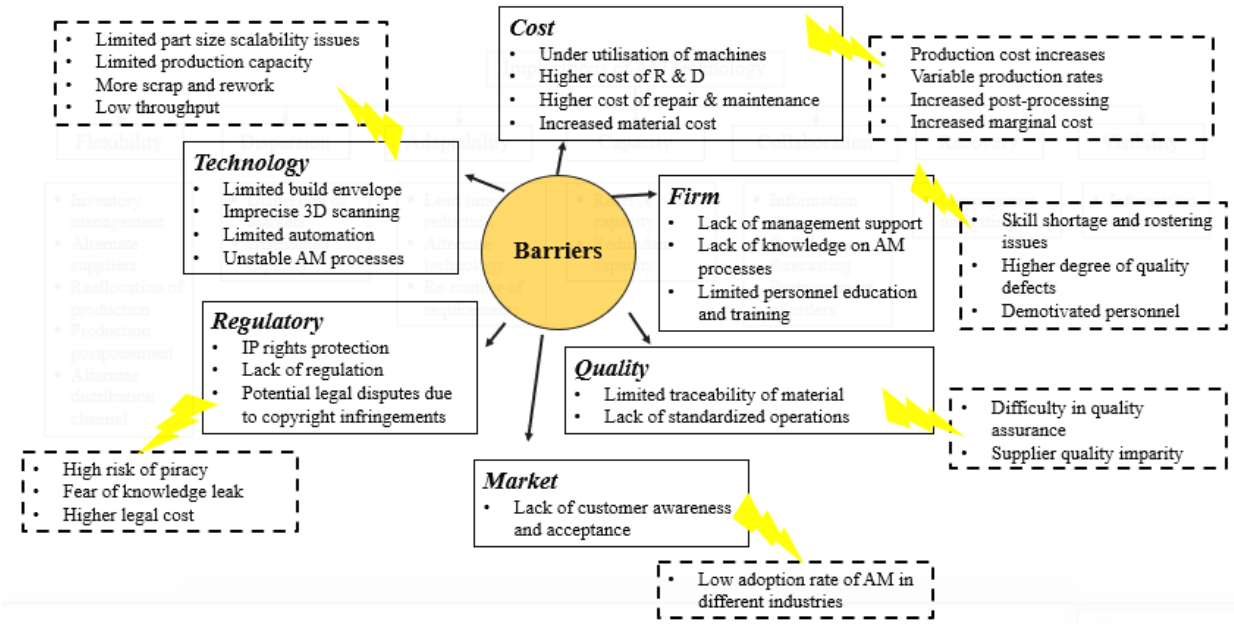

Figure 3. Barriers to adopt AM and their effects

1.2 Scholarly Contributions of this study

The research study provides a scholarly contribution by conducting a comprehensive narrative review and bibliometric analysis of AM and SC resilience publications from 2002 to 2022. The study uncovers emerging research trends by systematically analyzing the literature, identifying key themes, and highlighting knowledge gaps. These findings provide valuable insights for researchers, practitioners, and policymakers, enhancing the understanding of the intricate relationship between AM and SC resilience at a technical level.

The rest of this paper are organized as follows. Section 2 delineates the research methodology employed in this study, explaining the approach and procedures undertaken. Section 3 presents the descriptive results derived from the bibliometric analysis conducted on the surveyed publications and the outcomes of the narrative review conducted on the selected papers. Finally, Section 4 encapsulates the concluding remarks, summarizing the key findings and implications of the study.

2. Research Methodology

This study adopted a research methodology inspired by the approach utilized by Sbahieh et al. (2022) in a cognate research domain, with the primary objective of conducting a comprehensive analysis of studies about the intersection of additive manufacturing (AM) and supply chain (SC) resilience. A judicious selection of keywords, in conjunction with appropriate binary operators, was employed to maximize the inclusion of relevant studies within the field. To this end, the research databases Scopus, Google Scholar, and Science Direct were identified as primary sources for acquiring pertinent literature.

The research methodology entailed an initial screening process to eliminate duplicate entries across the selected databases. Subsequently, a second round of screening was conducted to identify studies that adhered to specific publication timelines and language criteria. Notably, this study focused on English-language papers published between 2002 and 2022. Abstracts of the selected papers were meticulously examined to ascertain their alignment with the emphasis on the implications of AM technology for SC resilience, ensuring their inclusion for further analysis.

A bibliometric analysis was then conducted using specialized software, namely VOSviewer and Biblioshiny, to discern prevalent trends, themes, and the evolutionary trajectory of the surveyed studies. A narrative review approach was employed to comprehensively analyze the most recent papers published within the past five years. This phase aimed to identify the industrial scope of AM technology, elucidate its associated benefits and challenges, and explore its

implications for enhancing SC resilience within organizational contexts. The employed research methodology is visually depicted in Figure 4.

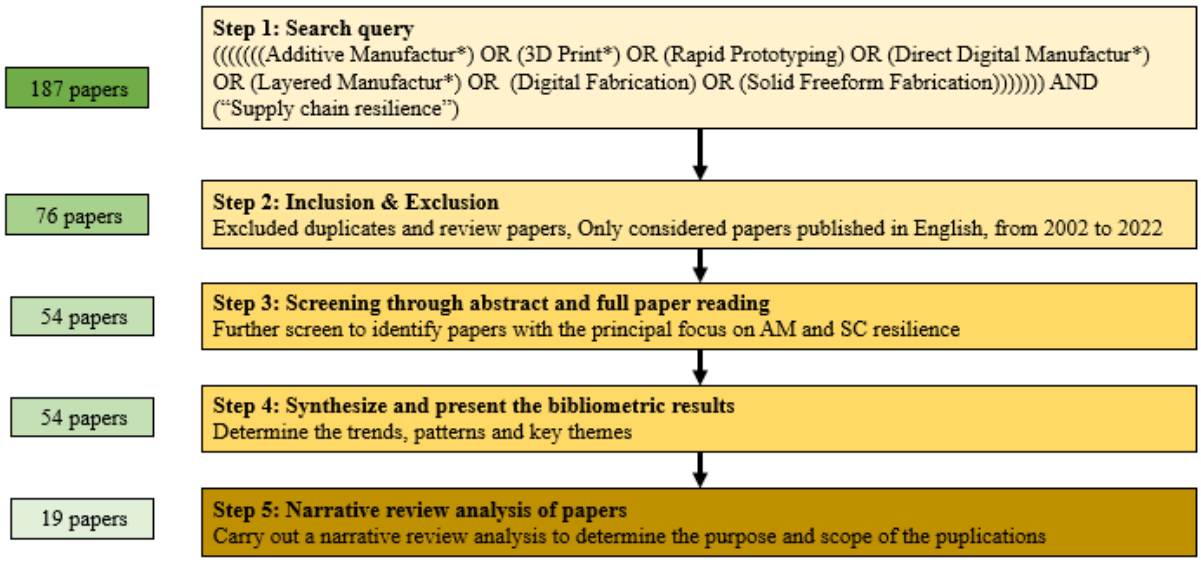

Figure 4. Employed research methodology

3. Results and Analysis

This section presents the findings from the bibliometric analysis and comprehensive analysis conducted on the surveyed publications. By synthesizing these research findings, this section offers a detailed and comprehensive overview of the bibliometric analysis results and the key themes that emerge from the surveyed publications.

3.1 Bibliometric analysis of surveyed publications

The bibliometric analysis examines the publication count over time, shedding light on the temporal distribution of research output. Additionally, an exploration of the most prominent journals publishing within the domain of additive manufacturing (AM) and supply chain (SC) resilience is provided. A co-occurrence network and a dendrogram were employed to uncover key themes prevalent in the surveyed publications. These analytical techniques facilitated the identification of interconnected clusters of citations, unveiling the underlying thematic structure within the body of literature.

Figure 5 depicts the annual distribution of publications, revealing a significant surge in published works in recent years. For instance, 2022 saw approximately 20 publications in the surveyed field. Additionally, Figure 6 presents a comparative analysis of the yearly publication counts across different journals. Notably, select journals, namely Computers and Industrial Engineering, International Journal of Production Economics, and IFIP Advances in Information and Communication Technology, emerge as prominent hubs for AM and SC resilience research studies.

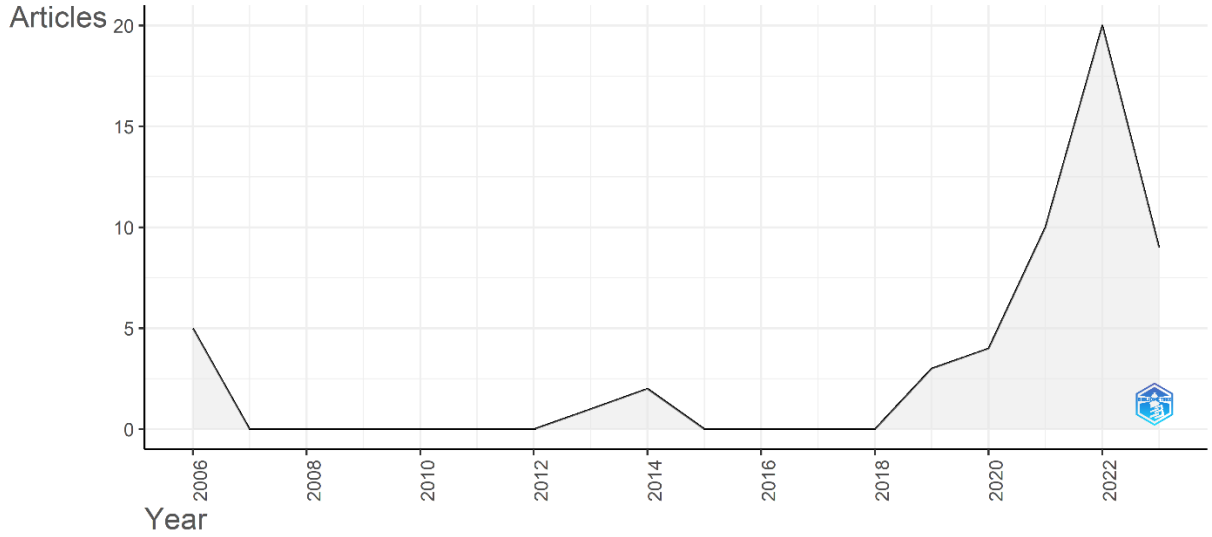

Figure 5. Yearly distribution of publications

The preceding graph illustrates that the annual publication count has consistently averaged between 1-2 from the mid-2000s to 2016. However, there has been a notable surge in scholarly interest in recent years, increasing to an average of 5-6 publications per year. This upward trend reflects the heightened attention given by the research community towards the application of AM in the context of SC resilience.

Figure 6. Additive manufacturing & Supply chain resilience journal popularity (2002-2022)

A co-occurrence network analysis was employed to identify the prevalent keywords within the publications and their interconnections. In this network, the size of each circle corresponds to the frequency of occurrence of the respective keyword. Meanwhile, the thickness of the connections indicates the extent of co-occurrence between keywords across publications. Additionally, the network incorporates distinct colour-coded clusters, representing different thematic areas within the scope of the study. Figure 7 displays the co-occurrence network generated using VOSviewer software, visually representing the relationships between keywords in the analyzed corpus.

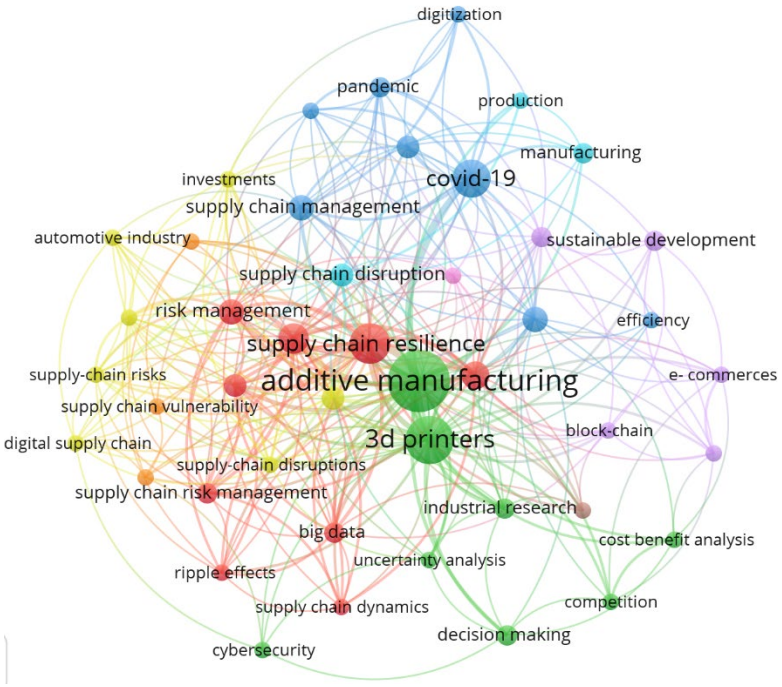

Figure 7. Co-occurrence network analysis: Additive manufacturing and supply chain resilience (2002-2022)

Figure 8 illustrates the dendrogram generated using the Biblioshiny application. This dendrogram visualizes the outcomes obtained through hierarchical clustering, an analytical technique employed to group similar entities of interest or data points with similar attributes or characteristics based on their proximity or similarity in the surveyed publications.

In the given dendrogram, a cluster depicted in red colour demonstrates a close relationship between themes such as epidemic, pandemic, and COVID-19, which are interconnected with themes such as 3D printing, e-commerce, and risk management. Moreover, another cluster involving the investment theme exhibits connectivity with themes such as supply chain disruptions, risk, digital supply chain, and industrialization 4.0. These patterns and associations provide valuable insights for identifying trends and relationships between various themes within AM and SC resilience research area.

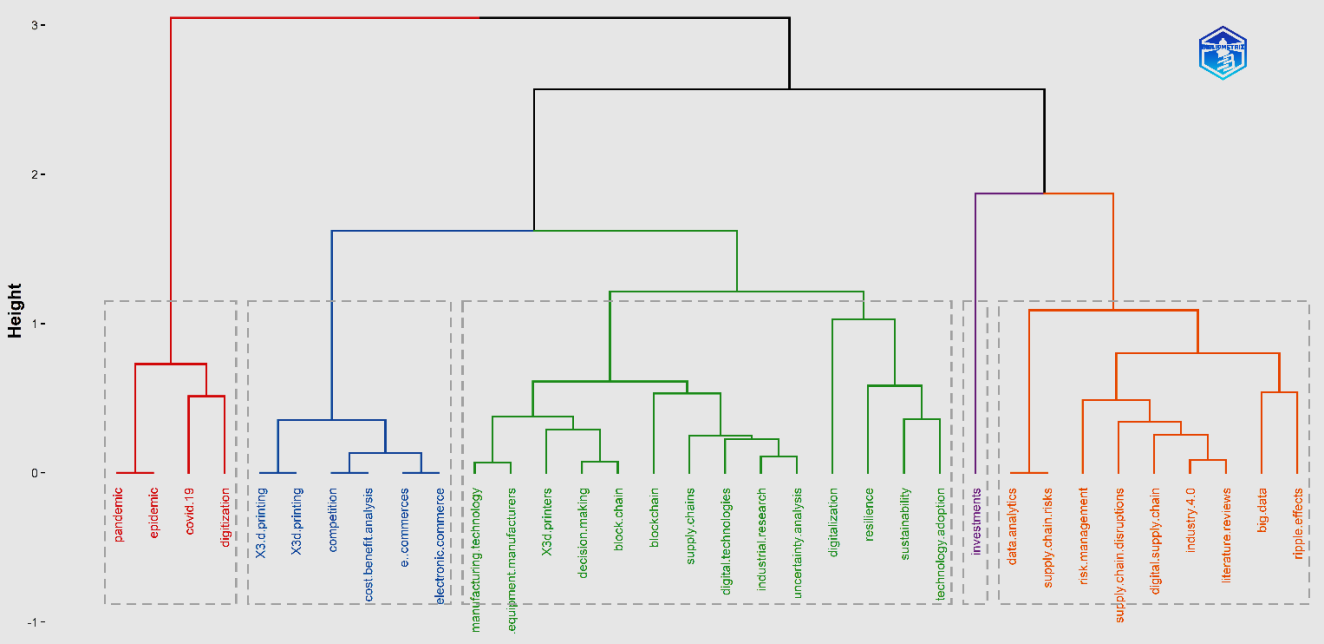

Figure 8. Dendrogram of surveyed publications

3.2 Narrative review analysis of surveyed publication contents

This section presents a narrative review analysis of the publications surveyed over the past five years. As detailed in Table 1, the analysis offers valuable insights into the purpose, scope, and industries of interest examined in the surveyed publications.

Table 1. Narrative review analysis of surveyed publications

Reference	Scope	Industry/area of study
Tosello et al. (2019)	The study demonstrates that applying AM in the injection of moulding of polymer tool inserts yields significant economic advantages, evidenced by a remarkable reduction in production costs and lead time.	Plastic products manufacturing
Tiwari et al. (2020)	This paper presents an innovative design-sharing scheme for the digital thread, utilizing video streaming technology to effectively mitigate the concerns related to intellectual property (IP) theft and tampering and to improve the cyber-resilience of digitized SC.	OEM manufacturers
Salmi et al. (2020)	This study highlights the existence of a gap in the supply chain related to the unregulated aspects of medical certification and Intellectual Property Rights (IPR) when employing AM in the manufacturing of medical supplies.	Medical supply
Verboeket et al. (2021)	This study adds to the comprehension of the key factors influencing the decision-making process regarding the suitability of centralized or localized supply chain configurations for AM production of medical parts.	Medical supply
Boehme et al. (2021)	This research investigates the emergence and growth of a geographical cluster that effectively addresses the PPE supply crisis by leveraging AM technology. The study explores this cluster's specific actions, strategies, and outcomes in utilizing AM to respond to the supply challenges in the PPE market.	Medical PPE
Dev et al. (2021)	This paper investigates the impact of two strategies on enhancing the resilience of supply chains in managing disruptions related to the diffusion of green	Reverse logistics

	products. Specifically, the study examines the effects of recovery speed through promotional investment and the implementation of distributed production using AM.	
Tan & Choong (2021)	This study shows that Adopting AM technology in producing medical PPE has experienced significant growth. However, a persistent challenge still needs to be addressed the inadequate adoption of standards and regulations for AM implementation, particularly in the context of rapid emergency responses and addressing disruptions in supply chains.	Medical PPE
Dartnell & Kish (2021)	This study offers an initial analysis of the impact of the 2020 coronavirus pandemic on consumer behaviour and the response of peer-to-peer (P2P) manufacturing and 3D printing communities. The study presents the potential implications for a sustainable shift in production and consumption patterns over the long term.	Medical PPE
Spieske & Birkel (2021)	This study presents a holistic literature review that combines perspectives from the field of Industry 4.0 and SC resilience. Additionally, it presents a comprehensive framework that elucidates the relationship between Industry 4.0 and the resilience of supply chains.	Automotive
Rahman et al. (2021)	This study introduces a comprehensive framework to evaluate the cyber resilience of an AM supply chain. The objective is to safeguard the supply chain against potential cyber intrusions, thus ensuring its robustness and securing competitive business advantages.	Manufacturing
Naghshineh & Carvalho (2022)	This study investigates the relationship between specific obstacles to the adoption of AM technology and the vulnerabilities that can emerge within the SC. It aims to understand how these vulnerabilities can impact the resilience of the SC.	OEM manufacturers
S. Gupta et al. (2022)	This empirical study aimed to examine the potential of AM in mitigating risks and enhancing a firm's SC resilience. It sought to investigate the role of AM in minimizing the propagation of the ripple effect within the SC in the event of disruptions.	Manufacturing firms across all industries
Belhadi et al. (2022)	This study aims to investigate the role of AM technology in facilitating the development of ambidextrous dynamic capabilities. It explores how AM can contribute to balancing SC resilience and efficiency. Multiple case studies from various industries within the African continent were utilized.	Healthcare, food processing, automotive, energy and aerospace
Gupta et al. (2022)	This study aims to identify obstacles that impede the adoption of innovative digitalization technologies and hinder the digital transformation of SC logistics, particularly during a pandemic. Furthermore, it proposes strategies to address and overcome these barriers.	Food, steel, Energy, Automobile, logistics services
Meyer et al. (2022)	This research examines the contrasting concepts of behavioral and technical solutions in addressing a pandemic situation. It offers valuable insights into the comparative advantages of AM and explores the causes and effects of AM on enhancing supply chain robustness and agility.	Public service organizations
Bhattacharyya et al. (2022a)	This research investigates the effects of integrating AM into procuring spare parts, mainly focusing on its implications for enhancing SC resilience and optimizing spare parts inventory management.	Spare parts
Zhen Yong et al. (2022)	This paper reexamines a previously proposed framework to assess the appropriateness of utilizing AM for obsolete parts. The objective is to determine if the framework is equally effective in accurately identifying non-obsolete parts for AM implementation.	Spare parts
Meyer et al. (2022b)	This study explores the impact of various configurations of AM on supply availability. By examining a healthcare supply chain, the study demonstrates the efficacy of AM as a risk-mitigation strategy during disruptions in the supply chain.	Healthcare

Priyadarshini et al. (2022)	This study provides a framework for organizations to make strategic decisions regarding adopting AM technology. The objective is to enable firms to develop antifragility within their supply chains, thereby safeguarding themselves from adverse consequences in disruptions.	Education, automotive, dental service
Muhammad et al. (2022)	This study concentrates on integrating AM within the procurement stage of the automotive SC. The objective is to leverage AM technology for the local production of automotive components within the manufacturing facilities of automotive firms to address and mitigate disruptions within the automotive SC.	Automotive

4. Conclusions

AM has emerged as a transformative and disruptive technology, revolutionizing traditional manufacturing approaches by enabling agility and efficiency in response to disruptions and dynamic demands. This study presents a comprehensive bibliometric and narrative review analysis of the literature on additive manufacturing and its impact on supply chain resilience.

The analysis reveals a substantial growth in publications on additive manufacturing and supply chain resilience, particularly in the post-Covid-19 era. Integrating digital supply chain concepts with AM technology has gained significant attention to enhance supply chain networks' resilience. Additionally, disruptions arising from geopolitical instabilities and natural disasters have motivated researchers and practitioners to explore the potential of AM technology in mitigating the ripple effects of such disruptions.

Nevertheless, the implementation of AM technology in manufacturing organizations faces numerous technological, legal, economic, and social barriers. These barriers vary across industries, posing unique challenges for adopting AM technology. Furthermore, the integration of AM with other digital supply chain enablers, such as those associated with Industry 4.0, is still in its early stages. This presents a promising opportunity for further research to explore the integration of AM with digital supply chain technologies, aiming to enhance supply chain resilience in organizations. In conclusion, this review highlights the transformative potential of AM technology in bolstering supply chain resilience. While acknowledging the existing barriers, it underscores the need for continued research in integrating AM with other digital supply chain enablers to unlock the full benefits of enhanced supply chain resilience for organizations.

References

Adobor, H., Supply chain resilience: a multi-level framework. *International Journal of Logistics Research and Applications*, vol. *22* no. 6, pp. 533–556, 2019.

Afshari, F., Sözen, A., Khanlari, A., Tuncer, A. D., & Şirin, C., Effect of turbulator modifications on the thermal performance of cost-effective alternative solar air heater. *Renewable Energy*, vol. *158*, pp. 297–310, 2020.

Attaran, M., Digital technology enablers and their implications for supply chain management. *Supply Chain Forum: An International Journal*, vol. 21 no. 3, pp. 158–172, 2020.

Belhadi, A., Kamble, S. S., Venkatesh, M., Chiappetta Jabbour, C. J., & Benkhati, I., Building supply chain resilience and efficiency through additive manufacturing: An ambidextrous perspective on the dynamic capability view. *International Journal of Production Economics*, vol. *249*, 2022.

Bhattacharyya, S. S., Kulkarni, O., & Mishra, A., Study of emerging avenues in supply chain resilience; the case of integration of additive manufacturing with spare parts procurement. vol. 15, no.3, pp. 156-168, 2022.

Boehme, T., Aitken, J., Turner, N., & Handfield, R., Covid-19 response of an additive manufacturing cluster in Australia. *Supply Chain Management*, vol. *26*, no. 6, pp. 767–784, 2021.

Chekurov, S., Metsä-Kortelainen, S., Salmi, M., Roda, I., & Jussila, A., The perceived value of additively manufactured digital spare parts in industry: An empirical investigation. *International Journal of Production Economics*, vol. *205*, pp. 87–97, 2018.

Dartnell, L. R., & Kish, K., Do responses to the COVID-19 pandemic anticipate a long-lasting shift towards peer-to-peer production or degrowth? *Sustainable Production and Consumption*, vol. *27*, pp. 2165–2177, 2021.

Dev, N. K., Shankar, R., Zacharia, Z. G., & Swami, S., Supply chain resilience for managing the ripple effect in Industry 4.0 for green product diffusion. *International Journal of Physical Distribution and Logistics Management*, vol. *51*, no. 8, pp. 897–930, 2021.

Durach, C. F., Kurpjuweit, S., & Wagner, S. M., The impact of additive manufacturing on supply chains. *International Journal of Physical Distribution & Logistics Management*, vol. *47*, no. 10, pp. 954–971, 2017.

Gupta, H., Yadav, A. K., Kusi-Sarpong, S., Khan, S. A., & Sharma, S. C., Strategies to overcome barriers to innovative digitalisation technologies for supply chain logistics resilience during pandemic. *Technology in Society*, vol. *69*, 2022.

Gupta, S., Bag, S., Modgil, S., Beatriz Lopes de Sousa Jabbour, A., & Kumar, A., Examining the influence of big data analytics and additive manufacturing on supply chain risk control and resilience: An empirical study. *Computers and Industrial Engineering*, vol. 172*,* 2022.

Meyer, M. M., Glas, A. H., & Eßig, M., Learning from supply disruptions caused by SARS-CoV-2: use of additive manufacturing as a resilient response for public procurement. *Journal of Public Procurement*, vol. *22*, no. 1, pp. 17–42, 2022.

Meyer, M. M., Glas, A. H., & Eßig, M., Using additive manufacturing in supply chains: a simulation-based analysis of supply resilience. *International Journal of Integrated Supply Management*, *15*(3), 304–328.

Muhammad, M. S., Kerbache, L., & Elomri, A. (2022). Potential of additive manufacturing for upstream automotive supply chains. *Supply Chain Forum*, vol. 23, no. 1, pp. 1–19, 2022.

Naghshineh, B, & Carvalho, H., Exploring the interrelations between additive manufacturing adoption barriers and supply chain vulnerabilities: the case of an original equipment manufacturer. *Journal of Manufacturing Technology Management*, vol. *33*, no. 8, pp.1473–1489, 2022.

Naghshineh, Bardia, & Carvalho, H., The implications of additive manufacturing technology adoption for supply chain resilience: A systematic search and review. *International Journal of Production Economics*, vol. *247*, no. 108387, 2022.

Priyadarshini, J., Singh, R. K., Mishra, R., & Bag, S., Investigating the interaction of factors for implementing additive manufacturing to build an antifragile supply chain: TISM-MICMAC approach. *Operations Management Research*. vol.22, no. 59, 2022.

Rahman, S., Hossain, N. U. I., Govindan, K., Nur, F., & Bappy, M., Assessing cyber resilience of additive manufacturing supply chain leveraging data fusion technique: A model to generate cyber resilience index of a supply chain. *CIRP Journal of Manufacturing Science and Technology*, vol. *35*, pp. 911–928, 2021.

Salmi, M., Akmal, J. S., Pei, E., Wolff, J., Jaribion, A., & Khajavi, S. H., 3D printing in COVID-19: Productivity estimation of the most promising open source solutions in emergency situations. *Applied Sciences (Switzerland)*, vol. *10, no.*11, 2020.

Sbahieh, S., Tahir, F., & Al-Ghamdi, S. G., Environmental and mechanical performance of different fiber reinforced polymers in beams. *Materials Today: Proceedings*, vol. *62*, pp. 3548–3552, 2022.

Sonar, H., Khanzode, V., & Akarte, M., Additive Manufacturing Enabled Supply Chain Management: A Review and Research Directions. *Vision*, vol. *26*, no. 2, pp. 147–162, 2022.

Spieske, A., & Birkel, H., Improving supply chain resilience through industry 4.0: A systematic literature review under the impressions of the COVID-19 pandemic. *Computers and Industrial Engineering*, vol. *158,* 2021.

Taghipour, A., Lu, X., Derradji, M., & Sow, A. D., The impact of digitalization on supply chain management: a literature review. *Proceedings of the 12th International Conference on Information Communication and Management*, pp. 75–78, 2022.

Tan, H. W., & Choong, Y. Y. C., Additive manufacturing in COVID-19: recognising the challenges and driving for assurance. *Virtual and Physical Prototyping*, vol. *16*, no. 4, pp.498–503, 2021.

Tiwari, A., Narasimha Reddy, A. L., & Bukkapatnam, S. T. S., Cybersecurity assurance in the emerging manufacturing-as-a-service (MaaS) paradigm: A lesson from the video streaming industry. *Smart and Sustainable Manufacturing Systems*, vol. *4, no.* 3, 2020.

Tosello, G., Charalambis, A., Kerbache, L., Mischkot, M., Pedersen, D. B., Calaon, M., & Hansen, H. N., Value chain and production cost optimization by integrating additive manufacturing in injection molding process chain. *The International Journal of Advanced Manufacturing Technology*, vol. 100, pp. 783–795, 2019.

Verboeket, V, Khajavi, S. H., Krikke, H., Salmi, M., & Holmstrom, J., Additive Manufacturing for Localized Medical Parts Production: A Case Study. *IEEE Access*, vol. *9*, pp. 25818–25834, 2021.

Verboeket, Victor, & Krikke, H., The disruptive impact of additive manufacturing on supply chains: A literature study, conceptual framework and research agenda. *Computers in Industry*, vol. *111*, pp. 91–107, 2019.

Wieland, A., & Durach, C. F., Two perspectives on supply chain resilience. In *Journal of Business Logistics* vol. 42, no. 3, pp. 315–322, 2021.

Zhen Yong, Y., Cardeal, G., Silva, A., Ribeiro, I., & Leite, M., Assessing suitability of parts for additive manufacturing. *Materials Today: Proceedings*, vol. *70*, pp. 492–498, 2022.

Biographies

Mohamed Amjath successfully obtained his doctoral degree in Logistics and Supply Chain Management from Hamad Bin Khalifa University in Doha, Qatar. Prior to this, he earned a Master of Science degree in Maritime Affairs, specializing in Shipping Management and Logistics, from the esteemed World Maritime University in Malmo, Sweden. Additionally, he holds a Bachelor of Science degree in Transport and Logistics Management from the University of Moratuwa, where he graduated with first-class honours. Currently, Mohamed Amjath is engaged in research focused on the utilization of queueing network applications for optimizing material handling systems.

Laoucine Kerbache is currently serving as a Full Professor and a founding faculty member of the Engineering Management and Decision Sciences Division at Hamad Bin Khalifa University in Doha, Qatar. Further, he has been Full Professor of Operations and Supply Chain Management at HEC Paris in France for the last twenty-two years. During this tenure period, beside managing many international academic programs, he has also served as Associate Dean of the HEC Paris PhD Program (5 years) and then as Dean and CEO at HEC Paris Qatar (4 years). For over thirty years of academic, research, and consulting activities, he has been very active in his areas of expertise, Operations and Supply Chain Management. He has published over 120 papers in international journals and has been guest speakers at numerous international events. He holds a PhD, an MSc, and a BSc in Industrial Engineering and Operations Research (IEOR) from the Mechanical and Industrial Engineering Department, University of Massachusetts, Amherst, USA. Further, he has an "Habilitation to Direct Research (HDR)" from the University of Nantes (France) and a certification from the "International Teachers Program" from IMD Lausanne (Switzerland).

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