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DIGITAL SUPPLY CHAIN: A SURVEY OF THE LITERATURE

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ABSTRACT

Purpose: The purpose of this study is to present the body of existing knowledge on the digital supply chain (DSC) and to open up possibilities for further study. **Design/Methodology/approach:** In this study, 109 peer-reviewed articles from the year 2018 to 2022 are reviewed in the literature. The articles have been examined with an emphasis on technology enablers, research methodology, limitations and research of literatures, and descriptive analysis of the findings. The paper identifies the primary technological enablers for digitalization and transformation of the supply chain. **Findings:** The study concludes that technologies, digitalization, integration, collaboration, and coordination frameworks are the primary drivers behind the development of the digital supply chain. According to the research, 57.32% of the publications did not discuss any theoretical underpinnings. As a result, the review provides a solid theoretical framework for the conceptualization and development of a unified theory of the digital supply chain. According to the analysis, review-type research accounted for 31.71 percent of all research methods used, making it the most prevalent. This study analyzes existing research articles identifies information gaps and highlights significant DSC constraints and opportunities by outlining the benefits, drawbacks, and restrictions of various methodologies. The study's findings suggest that qualitative case studies (Conceptual analysis and validation, Review, Survey) should be used by researchers to empirically analyze the growth of DSC. This could result in the area of DSC developing high-level conceptualization and theoretical frameworks. **Originality/value:** The purpose of

this study is to present the body of knowledge that has been amassed about the digital supply chain from 2018 to 2022. The findings of this study can serve as the groundwork for developing future research on the digital supply chain.

KEYWORDS: Internet of Things, AI, Cloud Technology, Big data analysis, Augmented Reality, Additive Manufacturing, 5G Technology, Blockchain, Digital Supply Chain, Digitization.

1. INTRODUCTION

Digital technologies have significantly changed how individuals interact with their environment and communicate with one another (Büyüközkan & Göçer, 2018). Multiple potentials accompany the need for new methods and reasoning of value generation in supply chain management, necessitating organizational change. Time and effort may be saved throughout entire supply chains by utilizing technological advances in the context of the digital Industry, particularly CPS (Cyber Physical System) and real-time connectivity. However, these techniques need low-cost intelligent automation and connectivity technologies, as well as supply chain uniformity (Müller & Voigt, 2018). Businesses must be able to see items at every level of the supply chain, including their identification, location, and other tracking data. As a result, the deployment of the digital supply chain has been recognized as an essential perspective lens for considering how conventional SCM may be adjusted to meet business objectives (Chauhan & Singh, 2020).

Inter-organizational systems (IOSs) referred to as digital supply chains (DSCs) are used by businesses to digitize the transaction and cooperation processes with their supply chain partners (i.e., upstream suppliers and downstream customers) (Xue et al., 2013). In general, supply chain systems across several industries are being drastically altered by digitalization and electronic commerce. Every company's objective is to have a contemporary and flexible supply chain (SC) since a “digital supply chain (DSC)” is faster, and more automated in the process (receive orders, prepare orders, and deliver to consumers), more adaptable, and transparent. A DSC may also function in dynamic systems and with large amounts of data (Abdirad & Krishnan, 2020). Amazon, for example, processes millions of orders each day, these orders are retrieved and picked up by Amazon robots, who then deliver them to employees who fill them at the appropriate moment (Abdirad & Krishnan, 2020). “DHL is an amazing example of how big data technologies are being used in the field of DSC. Big Data allows for more extensive data analysis than was previously feasible with standard

technologies". By gathering and analyzing huge data from customers, it is feasible to safeguard and improve the supply chain's efficiency while ensuring that the system remains operational and promises to maintain client happiness in the long run.

The following section (Section 2) discusses the background of the DSC describing the technology enablers, as well as the research methodology. The research of the literature is presented in Section 3. Section 4 illustrates the descriptive analysis. Lastly, the final section analyzes the study's methodology and lack of theoretical justification in the conclusion.

2. BACKGROUND

The increase in data volume is opening fresh possibilities for the digital supply chain. Additionally, enabling technologies are to thank for the recent rise in interest in DSC such as the Internet of Things (IoT), Cloud Computing (CC), Big Data Analytics, Simulations, Augmented Reality, Additive Manufacturing (AM), Autonomous Robots, Cybersecurity, 5G Technology, and Blockchain Technology (Iddris, 2018) in conjunction with meeting customer demand as quickly. Supply chain processes are being drastically changed by these technologies. The technologies responsible for the radical change in supply chain operations (Iddris, 2018) are discussed next.

2.1.Supply chain and technology enablers

Internet of Things (IoT): Today, IoT is extensively employed in many areas where automation is required, such as the health sector, government, transportation, manufacturing, supply chain and so on, where things to things, human to things, and human to human create a network inside IoT that is connected to the internet. RFID, WSN (wireless sensor network), SDN, CC, and IoT application software should be used to achieve IoT (Alcácer & Cruz-Machado, 2019). An IoT network typically consists of four key layers (Ben-Daya et al., 2019),

- A layer of sensing that incorporates several "things," such as RFID tags, sensors, and actuators.
- A networking layer supporting data transfer through wired or wireless networks.
- A middleware-based service layer that unifies services and applications.
- A layer that serves as the user's interface and presents information to them while enabling system interaction.

IoT advances supply chain communications by enabling human-to-things communication and autonomous coordination among "things" while they are being held in a facility or being transported between various supply chain organizations.

Cloud Technology: Cloud systems hold large volumes of data gathered from a variety of "business systems, devices, equipment, and sensors on distant servers". Cloud systems allow for real-time retrieving of massive amounts of data (Ghadge et al., 2020). "Improved data sharing across departments within an organization, value chains, sites, and company/organizational borders is required. Cloud computing is continuously growing, resulting in more data-driven and intelligent SC operations" (Alcácer & Cruz-Machado, 2019).

Supply chain management (SCM) procedures and associated enterprise information systems can use cloud computing (CC) services for a number of applications (Jede & Teuteberg, 2015). Due to the decentralized and flexible structure of global SCs and the increasing stability and flexibility of IT operations, cloud computing (CC) offers a number of benefits. Looking at the supplier side, SAP, for instance, already provides eight different Cloud Computing services for IT procedures associated to SC, such as B2B trade, purchasing, and exchange of information (Jede & Teuteberg, 2015).

RFID: RFID refers to the general technological idea of using radio waves to identify items (Angeles, 2005). Microchips and antennas are both present in RFID tags. A unique serial number and other object data are stored on the microchip. The reader converts the data on the RFID tag into a format that can be understood by computers by using the antenna to communicate object information from the microchip to the reader.

RFID tags people, places, and other physical items so they can communicate with computers using single-chip radios (Attaran, 2020). Compared to bar-coding, RFID provides more information. The supply chain and the retail store's inventory management can both be improved with the help of this information. By providing clear insight into consumer purchasing patterns and boosting efficiency and accuracy throughout the supply chain, RFID has the potential to revolutionize how the supply chain fulfills customer expectations. By lowering inventory levels, lead times, stock outs, and shrinkage rates, the technology might significantly enhance supply chain performance. Throughput, inventory visibility, inventory

record accuracy, order correctness, customer service, quality, and cooperation between supply chain participants can all be improved (Attaran, 2012).

Artificial Intelligence (AI): There is a hierarchy in which human intelligence operates. We can recognize patterns because to this layered structure. It is able to match them to a symbol and draw conclusions based on each sign. These patterns are what we refer to as "ideas," and the "knowledge" is the result of these ideas coming together (Ergen, 2019). The development of systems that can carry out tasks that typically require human intelligence falls under the umbrella of artificial intelligence (AI). The goal of artificial intelligence (AI) is to build "thinking machines" that can duplicate, replace, and learn from human intelligence (H. Min, 2010). We use the commonly used definition offered by Marvin Minsky, who founded the MIT Artificial Intelligence Lab: “the science of making machines do things that would require intelligence if done by men” (Pournader et al., 2021).

How fragile the world's supply chains are has been highlighted by the current COVID-19 pandemic. As a result, the stakeholders' demands for resilience, agility, and flexibility have dramatically increased, which necessitates the use of AI-enabled SCM solutions. Almost all AI application fields are used in some aspect of supply chain decision-making (Sharma et al., 2022). Because AI may enhance decision-making abilities, shorten cycle times, and increase overall operational efficiency, it has been widely adopted in SCM. Because of the complexity and volatility that come with global supply chains, businesses all over the world are investing in autonomous AI-enabled technologies to streamline their supply chain operations (Kohtamäki et al., 2019).

Big Data Analytics: Big data can be recorded in organized, semi-structured, and unstructured formats using a variety of data recording tools. The data must be kept in the proper location and examined to add value to it. To allow decision-making based on real-time, data from a range of sources, including manufacturing equipment and systems, and also organizational and customer management systems, will be routinely collected and analyzed (Vaidya et al., 2018). The examined data may be utilized to increase future operations' productivity, as well as to assist management in addressing crucial problems and making decisions. “Velocity, variety, volume, veracity, vision, volatility, verification, validation, variability, and value” are all characteristics of the big data acquired (Abdirad & Krishnan, 2020).

Big data is crucial to the supply chain because it offers analytical capabilities for business intelligence and decision-making. Big data and digital supply chains are essential for organizations to manage volatile, dynamic, and international value networks (Narwane et al., 2021). The use of information and data flows in supply chain management (SCM) is not new, but as technology has advanced, the discipline of SCM is adopting big data and business analytics as a means to enhance information flows and decision-making in situations where large volumes of multi - dimensional data exceed conventional information technologies (Brinch et al., 2018).

Simulation: "The data obtained and processed by big data and cloud technologies may be fed into a virtual simulation to evaluate all conceivable situations in product design, development, manufacturing, and SC network management" (Ghadge et al., 2020). Business models frequently use simulation to take use of real-time data and replicate the working world in a virtual environment.

The fundamental technology that makes it possible to develop a fairly accurate model of the real supply chain- Its digital twin: combines simulation, optimization, and data analytics (Barykin et al., 2020). To manage supply chain risks and make them more dependable and sustainable in the case of any breakdowns, a digital twin is being developed (Barykin et al., 2020). Digital twins interact with people, objects, and other networked digital twins to learn from this information and its contexts as well as to observe their physical environment using a network of sensors that dynamically collect real-time data (Saénz, 2020).

Augmented Reality: "Several services are supported by augmented-reality-based systems, including picking components at a warehouse and delivering repair instructions to mobile devices and sending repair instructions using mobile phones or other remote-control devices" (Vaidya et al., 2018). AR may be utilized in simulation for decision-making and problem-solving in the industrial problems. If it communicates with the sensory organs of humans and enhances efficiency, AR can be deployed on any hardware (Alcácer & Cruz-Machado, 2019).

The food sector is actively debating how augmented reality (AR) may help maintain food supply chains and give businesses a competitive edge as new technology open up new prospects (Rejeb et al., 2021) (Crofton et al., 2019). Numerous industries, including healthcare, military operations, education, manufacturing, and maintenance and repair, have made substantial use of augmented reality (Crofton et al., 2019). The food-tech sector is

predicted to experience exponential growth, and the spread of augmented reality in the food supply chain is contributing to this development (Shan, 2015).

Additive Manufacturing (AM): One of the crucial pillars of Industry 4.0 and the next industrial revolution is additive manufacturing, which includes 3D printing (3DP). 3D printing (3DP) has advanced dramatically in recent years and has become synonymous with clever and better technology, with several uses in sophisticated economies across the world (Sepasgozar et al., 2020). AM is described as the method of creating three-dimensional products by material deposition, layer by layer or drop by drop, with the aid of computer control systems (Alcácer & Cruz-Machado, 2019).

Supply chain (SC) design can be reevaluated by businesses thanks to additive manufacturing (AM), a digital manufacturing technology (Verboeket & Krikke, 2019). It is critical to comprehend the principles of additive manufacturing (AM) technology as well as its possible impacts on the manufacturing sector given the clear impact that AM technology has on production logistics, inventory control, and supply chain management (Araújo et al., 2021). The necessity to assemble numerous components is frequently eliminated by AM technology, which can generate a finished product. As a result, the complexity of the supply chain is reduced. It also lessens the need for replacement parts, streamlines the production process, improves the ability to track the materials utilized, and lowers internal production costs (Araújo et al., 2021).

Autonomous Robots: "Robots are becoming more independent, flexible, and cooperative every day, and it is unavoidable that they will speak with one another and function safely alongside humans, learning from them (Vaidya et al., 2018). An autonomous robot is used to more accurately conduct autonomous manufacturing methods and to work in areas where human employees are prohibited. Autonomous robots are capable of doing tasks accurately and intelligently within a certain time frame, while also focusing on safety, adaptability, versatility, and collaboration".

The International Federation of Robotics announced in 2017 that robotic technologies are gaining ground quickly and that more sales of industrial and service robots are anticipated (Shamout et al., 2022). Based on this prediction, the current study suggests three technological, organizational, and environmental contexts as precondition or critical variables

for the deployment of autonomous robots in the supply chain and logistics sector (Shamout et al., 2022).

Cybersecurity: With the broad deployment of Industry 4.0, cybersecurity risks will almost likely escalate. Cybersecurity is essential for Industry 4.0 systems' long-term survival; as a result, cybersecurity rules should be included in businesses' information technology systems. As a result, secured, dependable communications, as well as advanced machine and user identification and access control, are critical (Vaidya et al., 2018).

The consequent economic, political, and social implications have been brought to light by recent cybersecurity incidents. These occurrences show that supply chain security is increasingly a concern. Given the integrated digital environment that characterizes organizational ecosystems, this should not be surprising (Melnyk et al., 2022). In the logistics and supply chain sector, technological solutions have steadily raised the standard of services (Cheung et al., 2021). However, the attack surface in the Supply Chain environment has grown because to the introduction of internet-based technologies. Such attacks could have a negative effect on supply chain performance in general as well as logistics (Cheung et al., 2021).

5G Technology: With the help of the Internet of Everything, 5G technology makes it possible to link devices end-to-end between organizations, processes and devices in real time at a very granular level and to have complete visibility of such a connection (Dolgui & Ivanov, 2022). Some of the key capabilities of 5G include the ability to connect various sensors and systems, making it possible to swiftly and effectively build a digital supply chain, and managing enormous amounts of information in real time as close to their sources as feasible by leveraging edge computing (Dolgui & Ivanov, 2022).

Due to industrial developments, 5G will likely be a key technology for addressing many problems caused by the rapid digitization of industry. It will offer the networks and platforms needed to power Industry 4.0's digitization and automation of industrial operations (Attaran, 2020). It will facilitate the extensive adoption of crucial communications services and promote the broad deployment of intelligent IoT (Obiodu & Giles, 2017).

Blockchain Technology: A distributed ledger database for permanently and verifiably storing records of transactions between participants is how the Blockchain technology is best

described (Perboli et al., 2018). Blockchain rapidly became a top technological layer for financial applications, but recently, researchers and practitioners' focus has shifted to how Blockchain technologies might be used in other fields, such as the digital supply chain. Blockchain can improve the efficiency, dependability, and transparency of the entire supply chain as well as enhance the inbound operations because it can guarantee data immutability and public access to data streams (Perboli et al., 2018).

Blockchain technology is claimed to be able to resolve the issue of data verification and validity on its own, without depending on the source or origin of the data. As a system that connects all the companies participating in the supply chain, the blockchain application works flawlessly with the digital supply chain (Susilo & Triana, 2018).

2.2. Research methodology

An evaluation of relevant literature, identification of the field's conceptual content, and contribution to the development of theories are all aided by a literature review. A systematic review of the digital supply chain was conducted based on the topic and the body of earlier research in this field, the topic is new and growing very fast, so our study followed other scholars' lead and employed a single keyword strategy to find pertinent literature (Iddris, 2018) (Kamal & Irani, 2014) (Delbufalo & Cerruti, 2012). There are two types of reviews classified by (Webster et al., 2005). First, researchers might initially look into mature topics where a body of knowledge has developed and needs synthesis and analysis. In this situation, the researcher can undertake a thorough review and build a conceptual model that expands and synthesizes previous research. Second, an emergent problem that would profit from exposure to potential theoretical underpinnings can be studied by researchers (Iddris, 2018). The researcher's contribution can be seen in the new theoretical underpinnings of the conceptual model development. Therefore, in order to evaluate the chosen articles, this essay applies the logic of the second category (Iddris, 2018). Following is the formulation of the research questions that served as the research direction

RQ1. Examine the various research methodologies during the current DSC research, what is the leading research methodology?

RQ2. Has the methodology for publishing articles on the digital supply chain changed from the qualitative approach?

RQ3. Is there a significant increase in the number publications of the digital supply chain articles from 2018 to 2022 compared to publications from 2000 to 2017?

RQ4. What conceptual frameworks used in the current DSC research?

RQ5. Examine the various digital technologies employed, what is the leading digital technology during the current DSC research?

2.3.Limitations and research of Literatures

A boundary that clearly delineates the research's scope is necessary for a literature review study. Three significant points are noted in this study

1. The analysis is limited to articles, review articles and early access articles, English-language literature from a variety of fields, including Engineering, Management, Business, Economics, Environmental Sciences, Material Science, Applied Physics, Telecommunication, Computer Science and Artificial Intelligence, Transportation, Food Science Technology, Regional Urban Planning, Chemistry Multidisciplinary etc
2. Papers discussing Applied Mathematics, Psychology, International relations, Sociology, Law, Health Policy Services, Biotechnology and Microbiology, Educational research, Geo-Sciences, Political Sciences, etc in particular were excluded from this study.
3. To assure the article's applicability, the search method only employed the key phrase “digital supply chain”. Additionally, to make sure that papers use the key phrase "digital supply chain" across the Title, Abstract, Author keywords, and All fields.

The Eastern Michigan University and Web of Science e-search library was used for the search. Academic Search Complete, ACM Digital Library, Cambridge Journals, Emerald, IEEE Xplore, JSTOR, Oxford Journals, SAGE Journals Online, ScienceDirect – Elsevier, SpringerLink Journals and E-books, Science Citation Index, Taylor & Francis Online, EMJ, Web of Science, and Wiley online library are among the electronic databases available in the library. Following is the description of the literature survey and analysis content,

- The single keyword "digital supply chain" was entered into the Title, Abstract, Author keywords and All fields search tab of a Web of Science database to begin this review procedure.
- In order to get whole-year publications, the search period was constrained to 2018 to 2022.
- 1826 publications were retrieved by the initial search. They are 1607 Articles, 236 Early Access, 219 Review Articles, 22 Proceeding Paper and 4 Book Chapters.

- After that, the search was restricted to Articles, Early access, Review Articles, Citation Topics Meso, Web of Science Categories and 517 articles were found in the 25 scholarly journals mentioned before.
- Next, Microsoft Excel was used to export the complete record of articles searched with Article Titles, Abstract, Author Keywords, Source Title, Document Type and Publication Year for additional analysis.
- Here, the Titles and Abstract were carefully studied in order to determine which articles were most pertinent to Digital Supply Chain. The 517 items were divided into three lists, A, B, and C, during the analysis process. Studies that were unquestionably pertinent were categorized as "A." Studies classified as "B" were those whose initial significance was ambiguous. Studies classified as "C" were those that either lacked sufficient rigor or had ambiguous study objectives. Articles A=89, were thus pertinent, B=185, were just marginally pertinent, and C=243, were less pertinent. The combined A and B (274) entire texts were then carefully reviewed to determine their substantive relevance. 165 papers were eliminated from the analysis as a result of this method since they were outside the parameters of the research. Thus, 109 publications from 19 distinct scholarly journals were found to address the Digital Supply Chain.
- For the entire set of 109 articles assessed for this study, the full text of the 109 articles that were deemed relevant was exported to Microsoft Excel in the last phase.

3. Descriptive analysis

109 articles make up the identified literature. Fig. 1 depicts the distribution of the articles across the study period (2018–2022). According to the data, a high volume of publications was seen in 2021, with a little reduction seen in 2022. This might be because we already know the information about these publications as of October 2022. In comparison to 2021, there were fewer publications in 2018, 2019, and 2020.

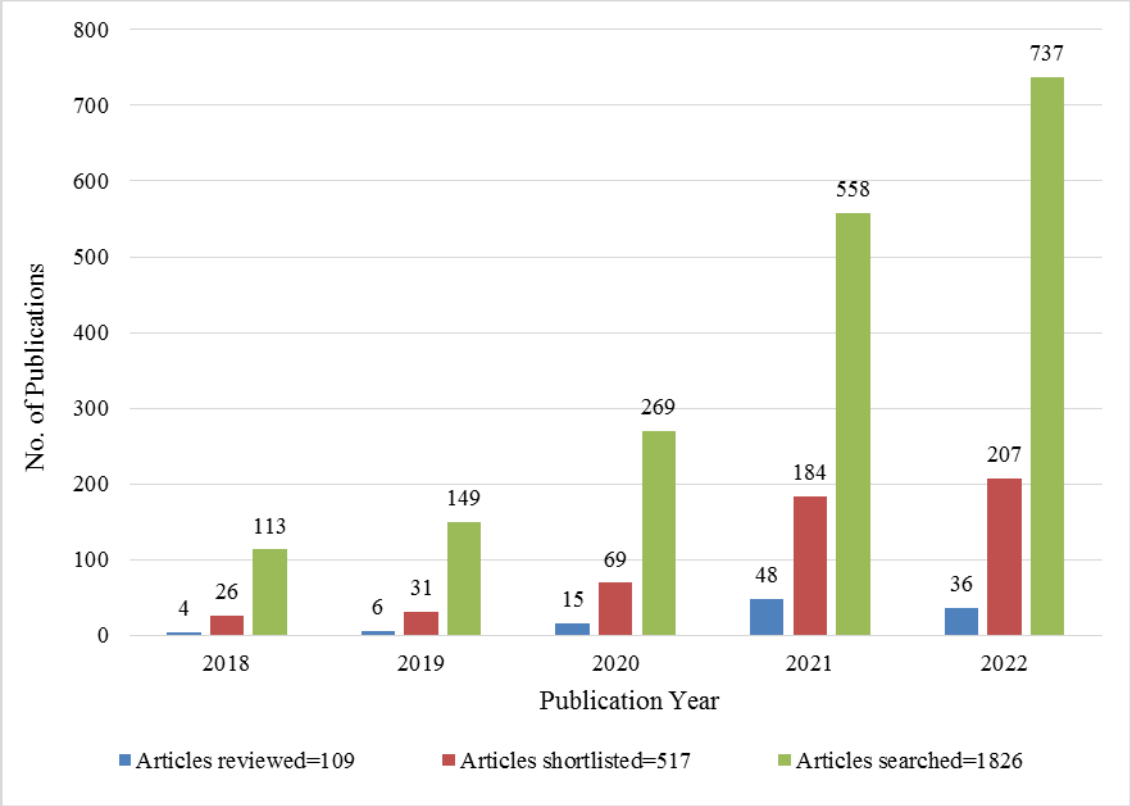


Fig. 1: Distribution of publications per year across the period studied.

3.1.Types of Journal Outlets

In total, 109 articles were chosen, and 19 different types of journal outlets were used to disseminate the research output as shown in the Fig 2. According to the data, Sustainability (Count=27), IEEE Access (Count=16), International Journal of Production Research (Count=9), Journal of Cleaner Production (Count=7), Benchmarking-an International Journal, Logistics-Basel and Supply Chain Management-An International Journal (Count=6), International Journal of Logistics Management and Operations and Supply Chain Management-An International Journal (Count=4), and the remainder are one/ two/ three manuscripts for each journal outlet as shown in Fig.2, were used the most frequently by the authors. Sustainability is the most frequently used Journal.

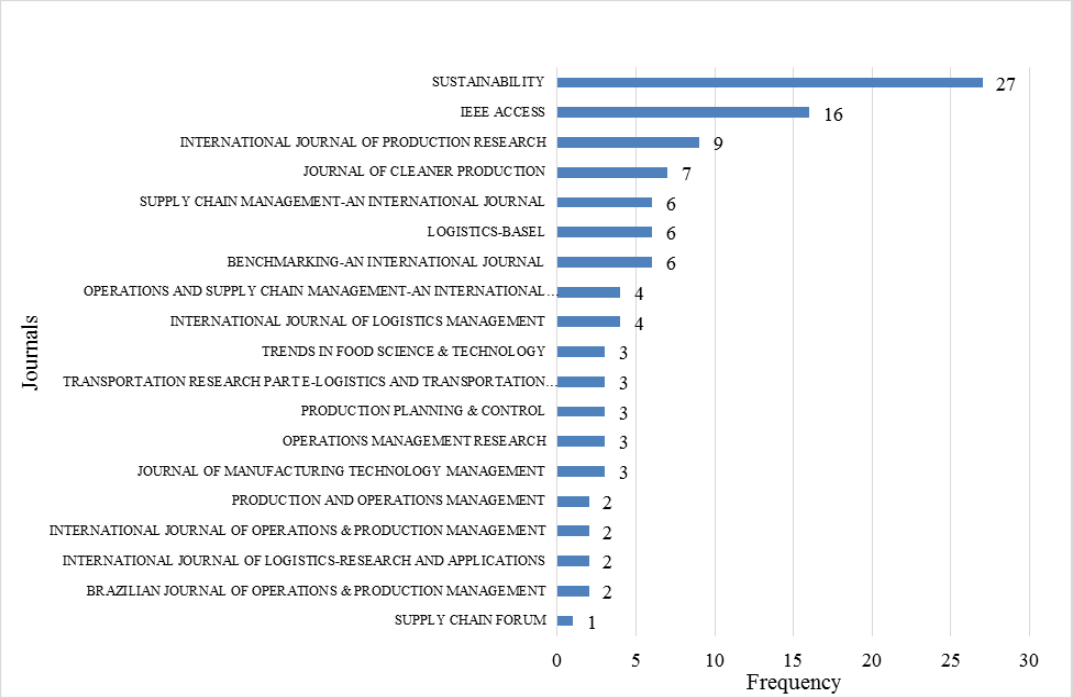


Fig. 2: Types of Journal outlets.

3.2.Number of Countries

The analysis emphasizes the number of articles from 18 different nations (Fig.3). The United Arab Emirates contributed the most papers overall (Count=13), followed by UK and India (Count=11), Germany (Count=9), USA (Count=7), Italy and China (Count=6), Greece (Count=4), Australia, France, Brazil, Korea and Thailand (Count=3), and remainder are one/ two manuscripts from countries shown in Fig.3. The findings make it abundantly evident that the few nations, including the UAE, USA, Italy, UK, India, and Germany account for more than half of all other nations publications in the field of DSC research. The record number of articles around the globe raises crucial questions that supply chain and DSC scholars should investigate, if there is a knowledge gap and bridge the gap with the technological advancements in the digital world. As this review indicates, researchers from various countries collaborate in order to comprehend the knowledge gap and connect ideas using various information sharing channels.

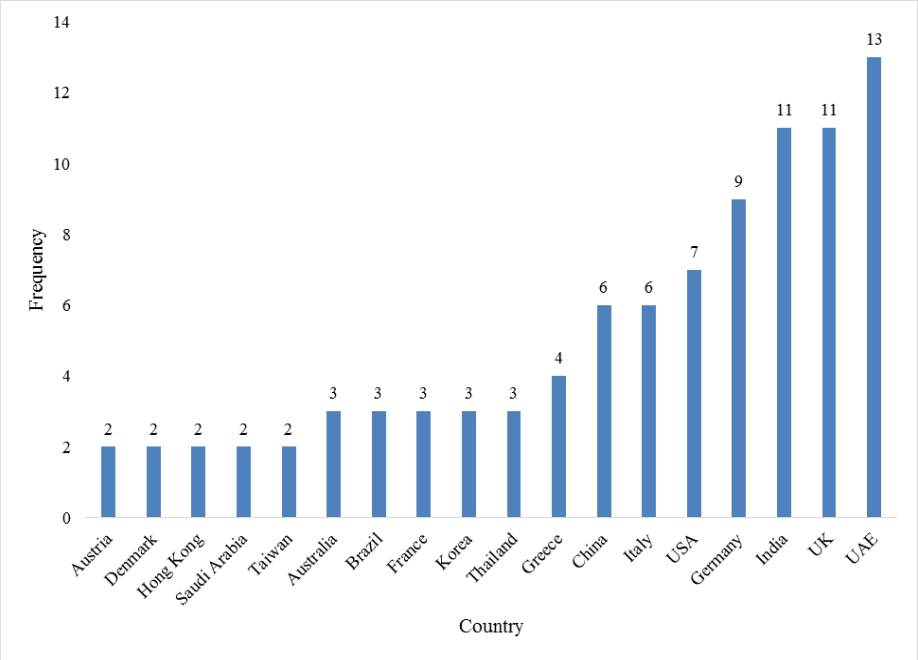


Fig. 3: Number of Countries.

3.3.Research methodologies used in the shortlisted articles

The majority of the articles used the Review type study (Count=44), followed by Conceptual Analysis and Validation (Count=36), Case Study (Count=34), Survey type (Count =21), Simulation (Count=13) and Mathematical Modeling (Count=6) as shown in Fig.4 of the research methodologies used in each publication. Few articles integrate information from multiple research methodologies to produce superior outcomes. We anticipate studies in DSC to use a qualitative case study, review and survey techniques given the field's growing character, as this approach may aid in conceptualization and theory development and also generate fresh concepts.

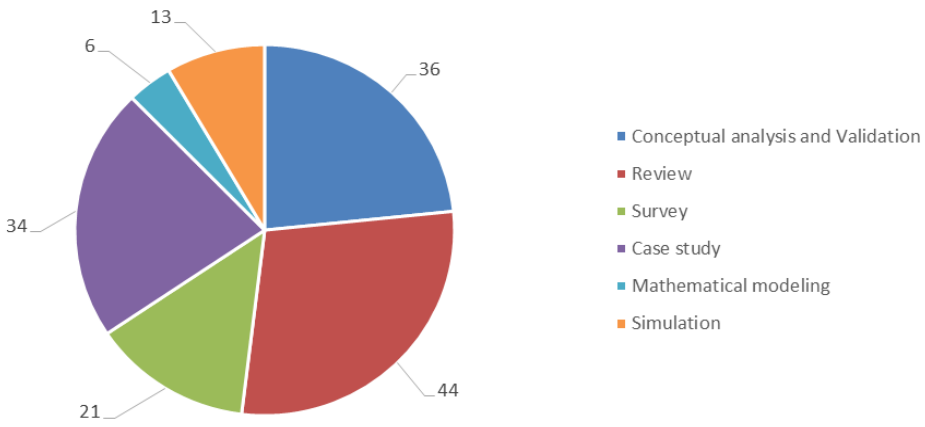


Fig. 4: Research methodologies used in the shortlisted articles.

3.4.Theories used in the shortlisted articles

Identifying the theory supporting a certain study is a crucial part of reviewing the existing literature. To generalize research findings, the theoretical background is helpful. Furthermore, "theories give researchers and practitioners a different "lens" through which to see challenging issues and social problems, focusing their attention on various facets of the data and offering a framework within which to perform their analysis". The topic under examination can therefore be better understood by looking at the ideas that have been deployed (Iddris, 2018). According to the results in Fig. 5, a significant portion of the publications (Count=76) that were reviewed did not mention any theoretical underpinnings.

The lack of hypotheses may be a result of the DSC field's recent development and as a result, the majority of research is descriptive with no theoretical underpinnings. The number of case studies compared to conceptual analysis, review, and survey type research methodologies area less, so authors could be more concerned with finding solutions to real-world issues using case studies than they are with particularly advancing DSC theory.

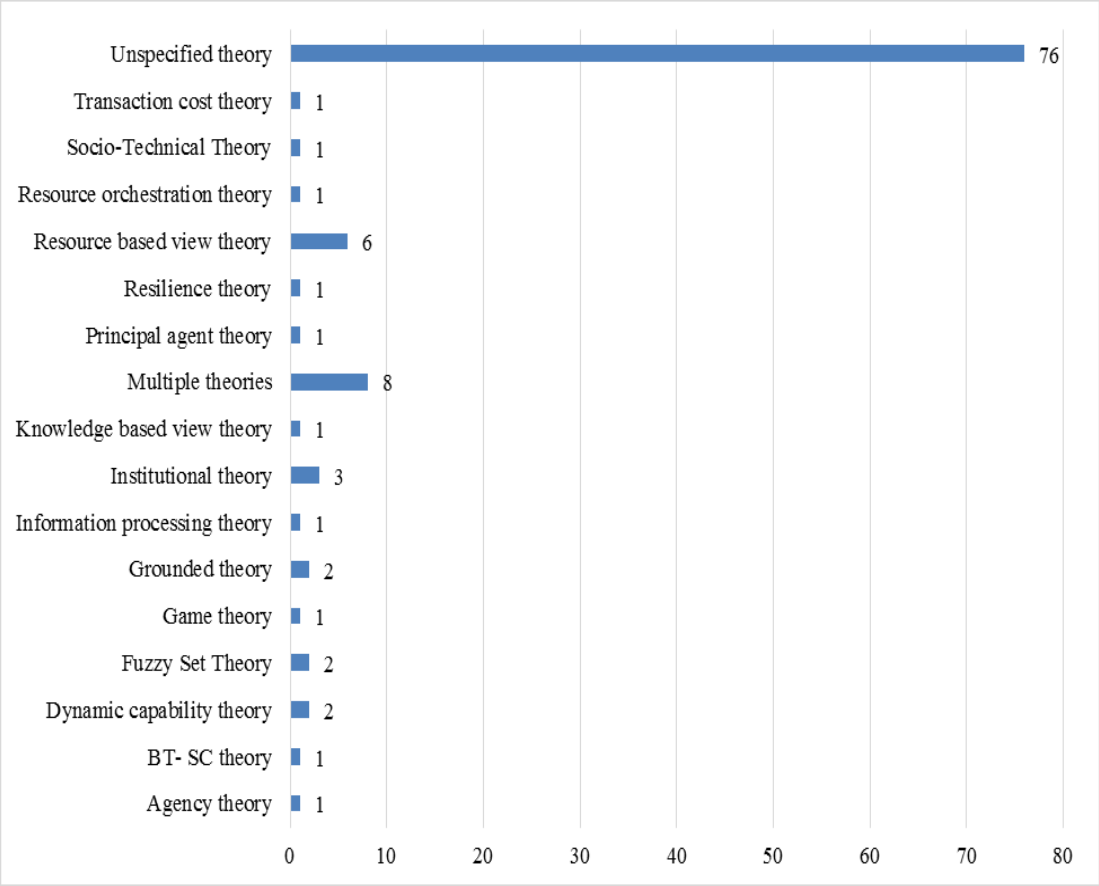


Fig. 5: Supply Chain Theories used in the reviewed papers.

3.5.Drivers of DSC

To determine the primary causes of DSC, we analyzed the whole text of 109 articles. To do this, we deduced the causes from the data, which in this case were the articles. Five key factors are taken into account in this research that comes from the data: Digitization, Integration, Collaboration, and Coordination, Technology. A conceptual framework was developed to highlight the factors that contribute to DSC (Fig. 6).

- **Digitization:** The supply chain's digitalization was only mentioned in (Count= 56) publications that were reviewed. The conversion of non-digital objects or relationships that previously supported socio-technical forms into structures that are mediated by digitized artifacts and relationships (Iddris, 2018). According to (Oswald & Kleinemeier, 2016), nearly every area of conventional supply chain management is being disrupted by new digital technology. A larger digital infrastructure now includes even manufacturing as a crucial component. Since values produced from physical artifacts are rapidly changing to data provided by smart products like mobile phones, wireless devices, and scanners, digitization will continue to play a significant role in managing global supply chains. DSC may thus continue to be driven by digitization (Hofmann et al., 2019).

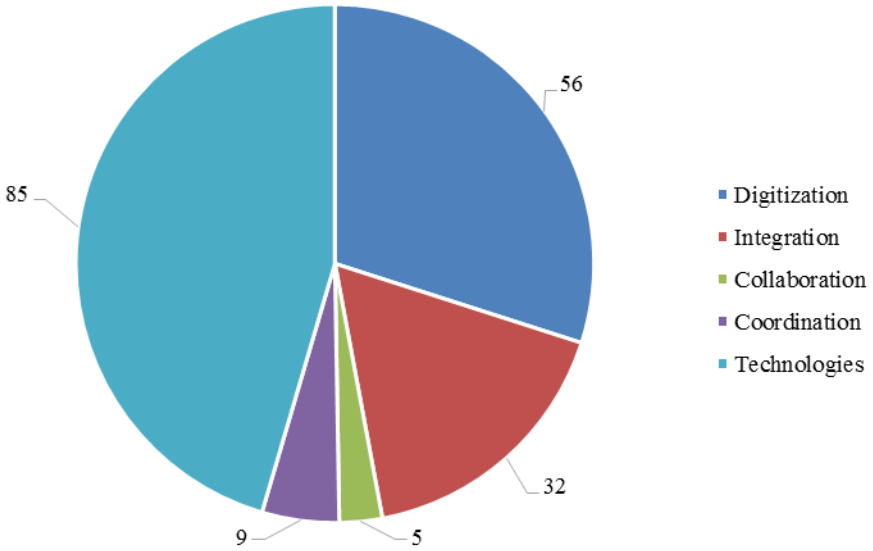


Fig. 6: Divers of Digital Supply Chain.

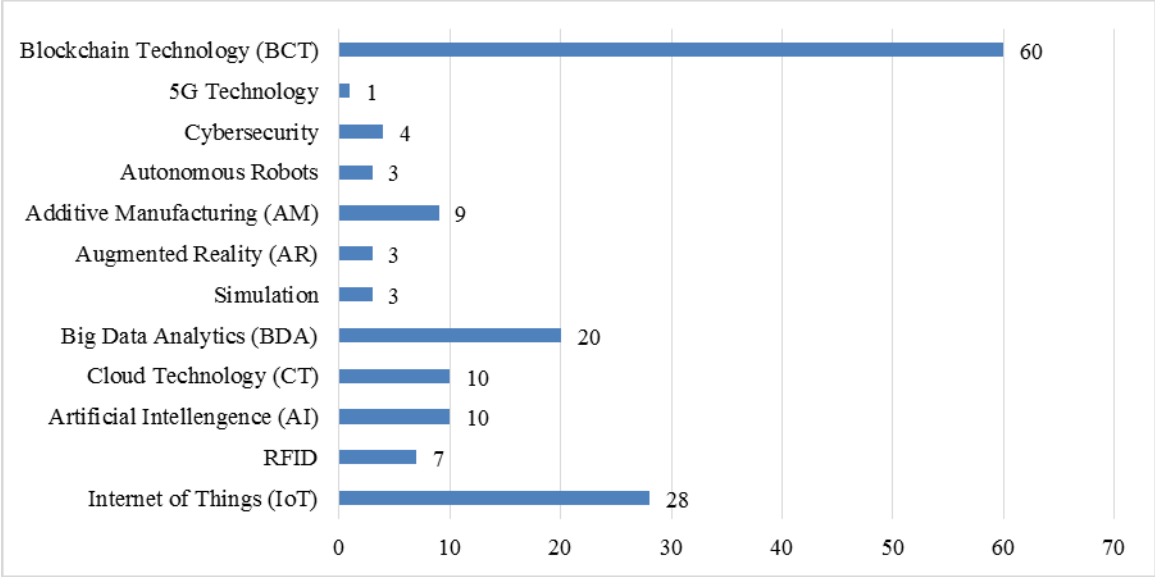
- **Integration:** This was one of the most frequently mentioned elements influencing the digital supply chain (Count=32). E-supply chains' effectiveness and success depend on integration. By enhancing productivity, efficiency, and the ability of the supply chain to deliver quicker and better products/services, as well as by improving the balance between

supply and demand and cost reduction through better coordination and information sharing, organizations can benefit from e-Supply Chain Integration (Iddris, 2018). With the growth of supply chain process integration, businesses can improve their performance, particularly in terms of operational excellence and revenue growth.

- **Collaboration:** The requirement for Collaboration in DSC was mentioned (Count=5) in publications that were reviewed. Collaboration is a procedure in which two or more businesses share the duty of discussing details on shared strategy, management, execution, and performance measurement (Xue et al., 2013). Effective supply chain management is powered by collaboration, which may be the ultimate core competency (S. Min et al., 2005). With the recent exponential rise of digital platforms, businesses need communication both within and across firms. For efficient use of data analytics and information availability throughout the supply chain, collaboration strategies with important supply chain participants are essential (Iddris, 2018).

- **Coordination:** The requirement for Coordination in DSC was mentioned (Count=9) in publications that were reviewed**.** Coordination is the process of controlling how closely related tasks are carried out in order to accomplish a goal (Iddris, 2018). Organizations are finding it difficult to coordinate the various tasks that make up the supply chain, including marketing, logistics, inventory, manufacturing, operations, purchasing, and procurement. Coordination is therefore seen as the key to achieving flexibility, which is required to allow an organization to gradually enhance logistical processes in response to quickly changing market conditions (Simatupang et al., 2002).

- **Technology:** In this paper, technology is the second most frequently cited necessity (Count=85). This is clear given how significantly technology is altering the dynamics of the supply chain. Blockchain technology, Internet of things (IoT), Big Data Analytics, additive manufacturing, and Radio frequency identification (RFID), Artificial Intelligence, Augmented Reality (AR), Autonomous Robots, 5G Technology, Cloud Technology are a few of the technologies included in this article. Supply chain collaboration, traceability, transparency and visibility are provided by the latest blockchain technology, and these technologies can bring about evolutionary change by integrating legacy systems with real-time supply chain management (Büyüközkan et al., 2021) (Chang & Chen, 2020).



4. CONCLUSION

In this analysis, we've tried to study selected number of publications (109 articles) and draw attention, how digital technologies can support to improve the efficiency and effectiveness of future supply chain turning into competitive advantage. Utilizing cutting-edge technologies like Big Data, Cloud Computing, and the Internet of Things, RFID, AI, Augmented Reality, Additive Manufacturing, Autonomous Robots, 5G Technology, Blockchain Technology (BCT) can assist in overcoming the current challenges in the supply chain management. Digitalization will continue to pervade every aspect of corporate operations, notably in the area of supply chain, as a result of the exponential rise of digital technologies (Iddris, 2018). Customers and the competitive environment frequently put strong pressure on enterprises to develop strategies for appropriate coordination, collaboration, integration, digitization, and the use of technology in order to quickly meet customer demand.

- **Insufficient theoretical underpinning:** According to the research, more than 69.72% (76 articles of 109) of the papers did not provide any theoretical underpinnings and majority of the papers employ various theories. Although researchers and practitioners have paid a lot of attention to the emerging discipline of digital supply chain, there is still no development of a unified theory. There can be different reasons for this, since DSC is a new topic, the authors are unsure of the best theories to apply, lack of a mathematical models and underpinning principles. So, for analyzing the future of the digital supply chain, it would be advisable to find quantitative and qualitative research methods.

- **Technology leader in DSC:** This article explored that, Blockchain technology is the dominant technology in the digital supply chain through a systematic examination of selected publications from reputable journals. Blockchain technology has recently gained popularity in a variety of industries, including supply chain sustainability, agriculture and food supply, supply chain performance improvement through the adoption of decentralized distributed ledgers, medical waste management, product recall management in the automotive industry, additive manufacturing traceability and management, and traceability for the supply chain for fishery industry etc.

As a framework for the current DSC research, we have looked at digitalization, integration, collaboration, coordination, and technology. The dominant framework found in this research is Technology.

- **DSC analysis:** According to the analysis, 44 article writings employed literature review type research method, followed by conceptual analysis and validation (36 article writings), Case Studies (34 article writings), Survey-type (21 article writings), Simulation (13 article writings) and Mathematical modeling. We can see from this study that; the study's execution placed more focus on literature review type research study. Qualitative research is the predominant methodology applied in the articles under examination. In order to empirically analyze the development of DSC using mathematical models and simulation with various theories, this paper advises researchers and practitioners to use quantitative and qualitative research in the field of DSC. The total number of articles published between the years 2000 and 2017 are 656 (Iddris, 2018). However, for this paper, we looked up 2816 articles produced in just 4 years, between 2018 and 2022. As a result, there were a ton of articles produced between 2018 and 2022.

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