# Chapter 1
# Supply Chain Strategies and Methodologies—A Bibliometric Review


**Jorge Luis García Alcaraz, Maribel Mendoza Solis, José Roberto Díaz Reza, and Juan Manuel Madrid Solórzano**

**Abstract** Supply chain strategies (SCS) have been gaining increasing interest given the recent disruptive events associated with wars and pandemics, where traditional SCS have proven insufficient. This article presents a bibliometric review of SCSs, analyzing the main trends, authors, institutions, and countries in which they are found, which will allow new SCS scholars to establish direct contact with the literature. PRISMA methodology is used to identify 1430 documents published from 1993 to 2021, and then VOSviewer and Bibliometrix software are used to analyze the information. Findings indicate that the trend of SCS publications is increasing, that its main area of application is Business, Management and Accounting, and that the main authors are Christopher M., Saputra J. and Wang S., who are also the ones who initiated this term two decades ago. Additionally, the publications on the topic are articles, conference papers, and book chapters, indicating that they have undergone a review process. It is concluded that SCS will continue to grow in initiator countries such as the United States of America and the United Kingdom. However, countries such as China and India will start to increase their academic output significantly.

**Keywords** Supply chain strategy · Bibliometric analysis · Trends · Citations

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## 1.1 Supply Chain Strategies

Since the Covid-19 pandemic, supply chain strategies (SCS) have gained more visibility and notoriety, highlighting the importance of using SCS that are flexible enough to adapt to potential regional or global contingencies (Woong and Goh 2021). During 2020 and 2021, the demand for medical and healthcare equipment increased considerably, and many companies stopped production and sent their employees home (Liu et al. 2022). This problem generated shortages of many products in supply chains (SC), which led to new paradigms and strategies to address these problems as the SCs collapsed (Sharma et al. 2022). In addition, the world's population has increased considerably, increasing market demand. Therefore, it is beneficial to use a combination of dynamism and technology in CS to help increase the level of competitiveness of an organization regardless of the environment and special conditions one may have, such as Covid-19 (Wesli 2018; Haseeb et al. 2019). To meet this growing demand and abrupt changes in CS, companies must respond by implementing changes and new paradigms in CS that allow them to bring their finished products to customers; this is known as the SC strategy (Chandra et al. 2019).

Therefore, the CS strategy (SCS) refers to a set of technologies and methods to optimize the production of a product or service for the final consumer. The importance of SCS is that it ensures flexible work dynamics that can effectively respond to the demands of the economic system, ensuring the continuity of production, distribution, and consumption of the company's products, which ensures economic income and stays in the market (Sun et al. 2022). However, all CS strategies must focus on customer satisfaction, wider market coverage, and increasing the organization's competitive advantage (Pothiwan and Yuan 2021).

### *1.1.1 Types of Supply Chain Strategies*

A CS includes the activities, facilities, and distribution methods necessary to carry out the entire product sales process, from the purchase of raw materials to their further processing in machines, production, transport, and delivery, to the final consumer. To achieve this goal, companies implement various SCSs, some of which are listed below, depending on their stage.

#### 1.1.1.1 SCS in the Supply Chain

**Selecting suppliers**. The manufacturer's success depends not only on its production process but also on the raw materials provided by its suppliers. Therefore, selecting suppliers is crucial, focusing on those with quality certifications, a wide reputation in service, and administrative and technological capacity (Ariadi et al. 2021).

**Strengthening relationships**. Relationships between suppliers and manufacturers should be centered on trust in each other, with sufficient information flow in both directions, and if possible, integrate inventory management systems to automate the requisitioning systems (Kussudyarsana et al. 2020; Sabara et al. 2019).

**Manage inventories**. Inventories refer to money in storage, so companies must encourage their CS to rotate inventories, add value, and put them on the market as finished products (Blatherwick 1998). They should also encourage the proper use and handling of products in warehouses, as this is where most waste occurs.

**Track inventory**. **Track inventory** includes knowing how much material is held in warehouses, in what condition, and where it is located, preferably in real-time and through information and communication technologies (ICTs). ICT helps to eliminate errors and increase CS visibility (Nampinyo et al. 2020; Pradhan and Routroy 2018).

**Improve transparency and communication**. A real-time integrated system that identifies warehouse disputes, errors, and losses allow corrective actions, replenishments, and adjustments (Kucheryavenko et al. 2019; Afanasyev et al. 2019).

**Monitor cash flow**. Identifying the associated revenue and cash flow changes is important because purchase terms often affect them. Ignoring cash flow can compromise a company's economic soundness (Qasem et al. 2019).

#### 1.1.1.2 SCS in the Production Process

**Establish a budget**. To correctly manage and control SC, it is important to determine how much to invest in producing a good or service; thus, purchases should be based on accurate information from sales forecasts. This can be done by defining cost rates, monitoring the timing and movement of materials, quantifying inputs and outputs of inputs and energy, and contracting services to manage the production process properly (Sufitrayati and Aliasuddin 2020; Miroshnikova et al. 2019).

**Manage lots and prices from a long-term perspective**. Continuous evaluation of CS helps visualize the organization's future; therefore, as the business grows, pricing is balanced with the possibility of splitting production batches. In addition, small batch production often allows the customization of products to delight customers (Sinurat et al. 2020; Abed et al. 2019).

**Use state-of-the-art technologies**. One strategy to improve CS efficiency is the automation and modernization of production systems with the aim of Industry 4.0. For example, the use of ICT, flexible manufacturing systems, machine learning and the integration of robots provide opportunities to improve planning and find solutions to problems quickly and jointly. Similarly, automation of certain processes avoids accidents, errors, and waste, as reflected in the flow of economic resources (Irfan et al. 2020; Kuei et al. 2002).

#### 1.1.1.3 Supply Chain Strategies in Distribution and Logistics Processes

**Develop a flexible distribution network**. An accurate understanding of how the distribution network allows transport to be adjusted to reduce costs through better routing, prioritization, and delivery times helps improve service. To this end, periodic evaluation and re-planning of distribution routes help understand what dynamics are best for possible contingencies and under what conditions, allowing for flexibility in making deliveries to customers (Sholpanbaeva et al. 2021; Baker 2004).

**Use of a comprehensive planning system**. The cloud platform allows companies to manage large amounts of data and perform the necessary analyses to develop effective transport planning in real-time without delay. In addition, it allows simulations of different scenarios in which disruptive events may occur, enabling the planning and analysis of the interaction between variables and identifying those critical across the entire CS (Sadler and Sohal 2005; Ivanov 2010).

**Real-time monitoring of shipping routes**. Knowing the route of each moving unit is critical for companies to understand the carrier's operation and resolve potential disputes in the shortest possible time together with the customer (McKinney et al. 2014; Awad et al. 2020). In addition, making this monitoring process transparent to customers can reduce uncertainty and increase customer satisfaction as they can visualize and track their deliveries (McPhee et al. 2015).

It is important to mention that no two supply chains are the same because they all have companies with different managers and priorities. Therefore, it should be stressed that the established SCSs are the only guidelines and should be adapted to the needs and objectives of their partners. Thus, each company should identify its needs regularly and review, update, and redesign them to support its financial sustainability.

### *1.1.2 How Can an SCS Be Defined?*

Assuming that each company is different, each SCS is different, so each business starts from a series of premises that come from all the members or partners that are reflected in the actions and the way a company works. Therefore, it is necessary to formalize the common objectives among the partners, define priorities, and reach a certain level of formality, which is established through contracts that each partner is expected to do. The main aspects to be considered when defining SCSs are briefly discussed below.

*Prior research*: Before developing a strategy, it is important to understand the current performance of the supply chain. This means that each of its actions and functions must be recorded and analyzed (Sulaeman et al. 2019; Bakashbayev et al. 2020; Chen et al. 2020; Syahril et al. 2020; Sinurat et al. 2020).

*Structural*: If the strategy is sound, it must be confirmed that the structural aspects are fully functional in all the network parts (Camanzi et al. 2020). For example, the delivery route of the product ensures the maximum throughput of the transport

unit with a low delivery price or ensures the product's availability at the customer's warehouse according to the purchase order.

*Function*: The strategy agreed to be implemented among the CS partners should allow for repeated testing of the performance of each function or operation; that is, tests should be performed continuously to quantify the parameters, to know whether the established function is being fulfilled, and to take corrective actions if needed (Achmad et al. 2021; Gasimova et al. 2020). To avoid such deviations, these parameters must be capable of identifying areas for improvement.

*Implementation*: Implementing SCS requires a change in organizational culture, compliance with all agreements, and all partners fulfilling the activities they are responsible for (Roh et al. 2014; Sillanpää et al. 2013). Often, the implementation of SCS requires awareness-raising among members, as changes are often generated that frequently affect the traditional working habits of some of them. Change management ensures strategic success.

### *1.1.3 Traditional Ways of Improving SCS*

One of the questions a manager asks is how to improve CS and its parameters, which certainly has many answers as it depends on the nature of the business, its needs, and its level of integration with partners. However, it is possible to establish some general guidelines that work, which are listed below; however, as mentioned above, some may apply more than others.

1. Streamlining CS (Tarafdar and Qrunfleh 2017)
   - Respond quickly to customer needs and ensure that all members of the CS are well synchronized; therefore, internal and external factors (partners) must be considered.
   - There must be a balance between agility and costs. High agility means more expensive and unique products that customers often cannot afford.
   - Responding effectively to operational contingencies and environmental, economic, or consumer issues will provide a competitive advantage.
2. The automation of a supply chain (Evers et al. 2007; Ashima et al. 2023)
   - Automated solutions increase a company's production efficiency by minimizing human error.
   - Automating the CS helps solve problems such as peak workload and stock-outs.
   - Automated systems can be reprogrammed to perform various activities and are, therefore, multifunctional.
3. Managing the value chain (Suarez-Barraza et al. 2016; Chen 2010)
   - Audit CS processes on an ongoing basis to ensure their efficiency, identify deviations and take corrective action.

- Identify all the key processes in the CS and, for study and analysis, break them down into smaller components to fully understand how they work and to improve them.
- Defining business operations, making strategic decisions to reduce costs, eliminating waste, and increasing profitability, that is, making decisions with a long-term vision.

4. Standardize key processes (Samal and Pradhan 2019; Naslund and Williamson 2007)
   - Identify the objective of the SCS to align it with business objectives and identify the processes to be standardized, thus ensuring uniformity in the production system.
   - Practices such as order and delivery tracking can be standardized using technologies to facilitate real-time tracking and the dissemination of information among partners.
5. Encouraging dynamic inventory optimization (Wang et al. 2018; Jin 2010)
   - Create a flexible accounting system that allows orders to be fulfilled more quickly.
   - Shortages in certain work areas are prevented by predicting inventory locations and shipping them promptly when shortages are detected.
   - Reducing the delivery time of a product to establish a corporate image increases consumer demand.
   - Finding the proper inventory limits for items and components based on consumer demand dynamically and with real-time warehouse visibility. Preferably, inventory management systems should be integrated among CS members.
6. Have a robust supplier assessment plan (Jajja et al. 2016; Ariadi et al. 2021)
   - Evaluate suppliers according to various criteria and attributes from an economic perspective.
   - Develop supplier assessment and audit plans to help suppliers eliminate and replace waste and, where appropriate, find alternatives.
   - Establishing formal partnership contracts with suppliers, although building on the trust many suppliers have earned, is good.
   - Cost-benefit analysis is implemented regularly to prevent problems after payment to suppliers, that is, to ensure after-sales services.
7. Implement demand planning systems (Haikal et al. 2020; Arribasplata et al. 2018)
   - Use quantitative demand forecasting approaches based on historic data and not only on guesses or assumptions.
   - Avoid miscalculations in inventory forecasts due to under or over-forecasting because they can lead to low inventories or much money invested in raw

materials with low turnover, which means money that is not making money and is simply sitting idle.
- Having the right models to predict material demand ensures that the right products are delivered in the right quantities.
- Focus on demand forecasting for the reducing process; product uncertainty does not increase it. This reduction in uncertainty allows for informed business decisions and improved inventory flow.

8. Prioritizing demand (Hines 2014)
   - Not all products are vital, so some star products or services should be identified, always in stock, and analyzed.
   - In addition, not all products target the same market sector; therefore, analyzing demand segments helps identify areas where the company can improve or risk.
   - Demand-based segmentation helps to manage the entire product lifecycle, accurately forecast demand, and stock the necessary inventory.
9. Increasing data transparency (Skilton and Robinson 2009; Kumar et al. 2016)
   - Transparency is synonymous with visibility; therefore, warehouses should be eliminated as far as possible to minimize differences between the status reported by electronic systems and what is physically held.
   - The integration of information technology enables data transparency among CS partners.
   - The transparency and distribution of data facilitate fast and efficient decision-making, often taken by a group of people simultaneously.
10. Review procedures regularly (Alomar and Pasek 2014; Zubareva and Polukhin 2019; Kunnapapdeelert and Pitchayadejanant 2021)
    - Evaluate the operations and performance of the CS frequently, as this allows for identifying areas of opportunity, trends, and patterns such as late shipments, backorders, poor quality, and recurring problems.
    - Inventory management services, their flow throughout the CS, and the electronic logistics management platform help identify problem areas that can be prevented or resolved quickly.
    - Perform scenario simulations to forecast demand under different conditions and disruptive events to anticipate problems and obtain information to optimize overall performance across the CS.
11. Implement emerging technology (Varchenko Olga et al. 2020; Merzlyakova and Goncharova 2020; Bodrova et al. 2019)
    - Adopt advanced technology such as artificial intelligence, radio frequency systems, and robots for moving heavy materials, among others, to stay competitive in the logistics landscape.

- The future of CS management will continue to include digital solutions that increase efficiency and automate and reduce costs. Comprehensive multi-dimensional automation and logistics systems can help solve operational problems using modern strategies.

12. Start optimization (Kotzab et al. 2003; Durga Prasad et al. 2012)
    - Constantly review the flow of materials through the production system and identify downtimes, delays, and material backlogs to eliminate or minimize them, which may involve redistribution.
    - Identify the key variables of the CS can direct efforts to obtain the best values following the company's needs.
    - Keep in mind that everything that can be measured can be improved, so the first step is to know the situation of the CS and establish new levels in the parameters.

After this introduction on the meaning of SCS and the strategies proposed for its constant business improvement, the various sections of this document continue with a bibliometric review of SCS, analyzing the main trends, authors, institutions, and countries that have most addressed the subject.

### *1.1.4 SCS Research Trends*

The study of SCS is not new; there have been reports since the last century. When reviewing the trends in the number of documents published on SCS, it was observed that it has been increasing. Figure 1.1 shows that the first document that integrates the word "supply chain strategy" appeared in 1993, followed by another in 1994. From 1997 onwards, three documents appeared, an increasing number. A trend line has been added to the data in Fig. 1.1, indicating growth which occurred from 1997 onwards. However, it should be noted that in 2020 and 2021, the period in which the COVID-19 pandemic occurred, the number of documents decreased.

Specifically, many authors have conducted literature reviews regarding the trends in SCS; for example, Stevenson and Spring (2007) reviews these concepts of flexibility as SCS and indicates that it can be applied when there is full integration with customers and suppliers through direct communication, Goldschmidt and Kumar (2016) analyses SCS in cases of disasters and crises in order to be able to respond with a humanitarian supply chain with agility and attention to the population, Pérez-Salazar et al. (2017) reviews the impact of knowledge management as part of the SCS on SCS efficiency rates, which facilitates the management of trained personnel; Routroy and Behera (2017) a literature review of agricultural supply chains and their strategies for transporting perishable products and impacting the health and integrity of consumers; finally, Nabipour and Ülkü (2021) a review analysing the implementation of blockchain technologies as part of SCS, indicating that this is a new trend and that special attention should be paid to it.

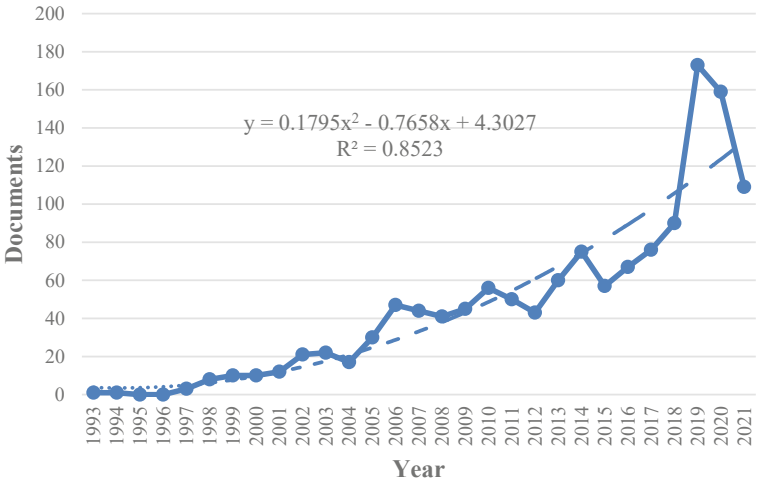



**Fig. 1.1** Research trends in SCS

Therefore, several very specific literature reviews have analyzed the impact of some activities or events on SCS, such as blockchain technologies, agility, or specific industrial sectors. In addition, as seen from the 12 points listed to improve SCS, the factors and activities that affect SCS can vary, as their applications range from the sourcing to the production process and end with the distribution of products. Through this material flow, it is possible to improve SCS, so strategies and methodologies are applied. However, the following questions should be addressed:

1. Is the study of SCS of academic and scientific importance?
2. What are the trends in SCS research?
3. If this topic is important, which institutions and countries are researching it?
4. Who are academics who are most interested in or publish in the SCS?
5. What keywords are most commonly used in such research?
6. What are the most-cited or referenced documents in the SCS?
7. Which journals publish the most in the SCS?
8. What are the most cited countries, institutions, and authors?

As there is no concise answer to these questions, SCS and its methodologies are the focus of this chapter. A bibliometric review was conducted on this topic, which can serve as a basis for students and those interested in identifying the main research groups, trends, and the primary authors and institutions in which research is conducted.

After this introduction, Sect. 1.2 presents the methodology used to answer the questions, Sect. 1.3 presents the results, and Sect. 1.4 presents some general conclusions on SCS.

## 1.2 Methodology

The data analysis was divided into two main activities, which are outlined below.

### *1.2.1 Identification of References*

The PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) methodology is used to identify the papers published about SCSs. It is chosen, as it is defined by Hutton et al. (2016), as a research methodology that enables and facilitates the process of generating bibliometric reviews and meta-analysis reports. In addition, it has been accepted by the scientific community, where several applications of PRISMA can be found. For example, Kim and So (2022) analyzed customer experiences in the tourism industry, and Baarimah et al. (2022) identified methodologies used in rapid response to disasters and used it to study trends, and de Araújo et al. (2022) used to study trends in photodynamic therapies in endodontics, to name a few.

A search was carried out using the equation (TITLE-ABS-KEY (“supply chain strategies”) OR TITLE-ABS-KEY (“supply chain strategy”) OR TITLE-ABS-KEY (“supply chain methodologies”) OR TITLE-ABS-KEY (“supply chain methodology”)) in the SCOPUS database, as it integrates many others (including ScienceDirect). The DIMENSIONS database was also used as a complement to the SCOPUS list of documents. It is important to mention that the analysis was carried out with the number of documents found on October 20, 2022, and that the date readers carry out this consultation again may increase the number of documents.

The references found in the RIS format were downloaded from both databases to begin debugging and eliminating repeated ones, as done in Endnote 8.0 software. Once cleaned, they were integrated into a spreadsheet in CSV format and read in Excel. However, accepted but not published articles were excluded, focusing only on those with a journal number and volume assigned to them. Similarly, the years 2022 and 2023 were excluded, as they affect the adjustment of trend lines, analyzing only up to 2021, which has already culminated.

### *1.2.2 Analysis of References*

Once the database has been cleaned, the data are analyzed using VOSviewer v 1.6.18, which focuses on the following:

1. Identify the main authors researching SCS, institutions, and the countries where they are based.
2. Recognize the main keywords used by authors and editors in SCS documents.
3. Define the most cited documents, journals, authors, institutions, and countries.

4. Co-citations for references, sources, and authors.

A combination of graphs generated by VOSviewer software and others is illustrated in Excel for clarity. It is important to mention that all databases are available in a repository that readers can consult at the following link: http://dx.doi.org/10.17632/cs9zv3tx48.1.

## 1.3 Results

### *1.3.1 Identification of Documents*

A total of 1987 papers were identified in the SCOPUS and DIMENSIONS databases. However, when the databases were downloaded and cleaned, 477 were identified as repeats and were removed, leaving only 1510. In addition, 79 documents from 2022 to 2023 were removed to obtain a more accurate trend analysis, yielding a total of 1430 documents to be analyzed. Figure 1.2 illustrates the purging process of the database analyzed according to the PRISMA methodology.

### *1.3.2 The Main Authors*

A total of 3196 authors were identified who have published on SCS, and Table 1.1 indicates those with at least three publications. It is noted that Christopher M. leads this area of research, Saputra J. and Wang S. have nine papers each, and Caniato F., Kumar S., Liu S. and Moyano-Fuentes J. have six.

By analyzing the first 1000 authors, 15 clusters were identified in different colors, as illustrated in Fig. 1.3. It can be seen that Wang S. is one of the pioneers, although his network of collaborators is small. Similarly, authors such as Zhang, X; Zhang, J; Wang, X. Goh, M. and Liu, S. lead other very active clusters. For a list of authors, see the supplementary material in Excel in the sheet entitled Authors.

However, not all authors have started research on this topic simultaneously, so to know the academic productivity of these authors over time, Fig. 1.4 illustrates the years on the horizontal axis and the names of some of the most important authors on the vertical axis. The name or surname was not identified for many of them; therefore, they were reported as NA in the first line. In the same way, it is observed which of them were active in the year 2021, indicating the number of articles they generated. In this case, Liu S, Lestari F, Chen Z and Maqueira-Marin JM were the ones who, in that year, reported some academic products.

Figure 1.5 illustrates the authors' impact according to the H-index because not all the documents they generated are equally cited. In this case, Saputra J and Christopher M, one of the initiators of this topic, has had the greatest impact on his academic

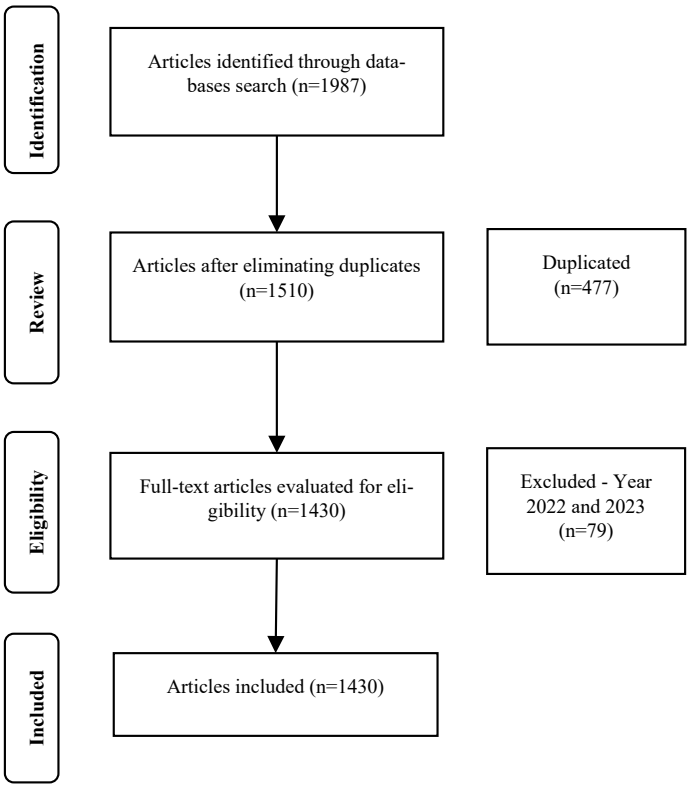



**Fig. 1.2** PRISMA methodology for paper identification in SCS

output, indicating that his work has been widely cited. Similarly, Wang S, with an H-index of six, ranks second, while Helmi, Kumar, and Min occupy third place.

### *1.3.3 The Main Areas of Application of the SCS*

The application of SCS is very varied; although it starts in industrial production systems, nowadays, it is possible to observe that SCS is being applied to food production systems, vaccine and drug distribution systems, and the production and distribution of medicines (Tan et al. 2022; Pérez-Mesa et al. 2021), distribution of vaccines and medicines (Prosser et al. 2022; Sarley et al. 2017) distribution of food in periods of health crises, among many others (Raassens et al. 2022) among many others. However, strategies have always aided the decision-making process, and there are many areas of knowledge in this field (Sreekumar and Rajmohan 2019), and there are many areas of knowledge in which they have been applied.

**Table 1.1** Main authors in SCS

| Authors | Documents |
|---|---|
| Christopher M., Saputra J., Wang S | |
| Caniato F., Kumar S., Liu S., Moyano-Fuentes J | |
| Chen Z., Ferreira L. M. D. F., Godsell J., Goh M., Helmi S. A., Lestari F., Maqueira-Marín J. M., Min H., Naim M., Naim M. M., Qi Y., Sahay B. S., Sundarakani B., Wang W., Wang X., Xie G | 5 |
| Bandinelli R., Berrado A., Caridi M., Castelli C., Chandak A., Chen W., Chinnam R. B., Fantazy K. A., Fearne A., Galankashi M. R., Harris G. A., Ismail K., Lau K. H., Lee H. L., Li C., Liu L., Mollenkopf D., Moreira A. C., Potter A., Roth A. V., Russo I., Shankar R., Sharma R. R. K., Snowdon A. W., Soni G., Vanteddu G., Wang J., Wang Y., Zailani S., Zhang J., Zhang X., Zhao X., Zimmermann R | |
| Bindi B., Birtwistle G., Brun A., Cagliano R., Chen X., Cheung W., Componation P. J., Dalpati A., Darkow I.-L., Elshin L. A., Fani V., Fiorito S. S., Gosling J., Hafeez K., Han C., Hong P., Huang X., Jermsittiparsert K., Jiang H., Kim S. W., Kumar A., Kumar R., Leung J., Liu J., Liu X., Mangla S. K., Mohan R., Morita H., Kim S. W., Kumar A., Kumar R., Leung J., Liu J., Liu X., Mangla S. K., Mohan R., Morita M., Mostafa S., Mustafin A. N., Oliveira-Dias D., Osman A., Pustovarov A. A., Rajagopal P., Randall W. S., Raut R. D., Richey R. G., Roath A. S., Ronchi S Safiullin M. R., Sharma M., Solaiman M., Stank T. P., Stevenson M., Su Y., Tarafdar M., Tate W. L., Towill D., Towill D. R., Tsay A. A., Tsay A. A., Ukolov V. F., Ukolov V. F., Ukolov V. F., Ukolov V. F., Ukolov V. F., Ukolov V. F., Ukolov V. F., Wang C., Wong C. Y., Wright A., Xu J., Yao D.-Q., Yue W., Zhao Y | |

Figure 1.6 illustrates the main areas in which the applications of the term SCS have been classified in the documents analyzed. It can be seen that Business, Management and Accounting is the category with the highest level of applications with 30%, followed by Decision Sciences with 18%, and Computer Sciences and Engineering with 15%. To report an easy-to-interpret graph, categories representing less than 1% were integrated into a category called other. Refer to the supplementary material for readers who wish to see the full list of applications.

### *1.3.4 Types of Documents Published on SCS*

One way to understand the consolidation of research topics is to check the type of document in which it is published, and for SCS. Table 1.2 illustrates the distribution and shows that most of the documents identified fall into the category of Articles or Conference papers, indicating that this research area is consolidated as it has gone through a peer review process.

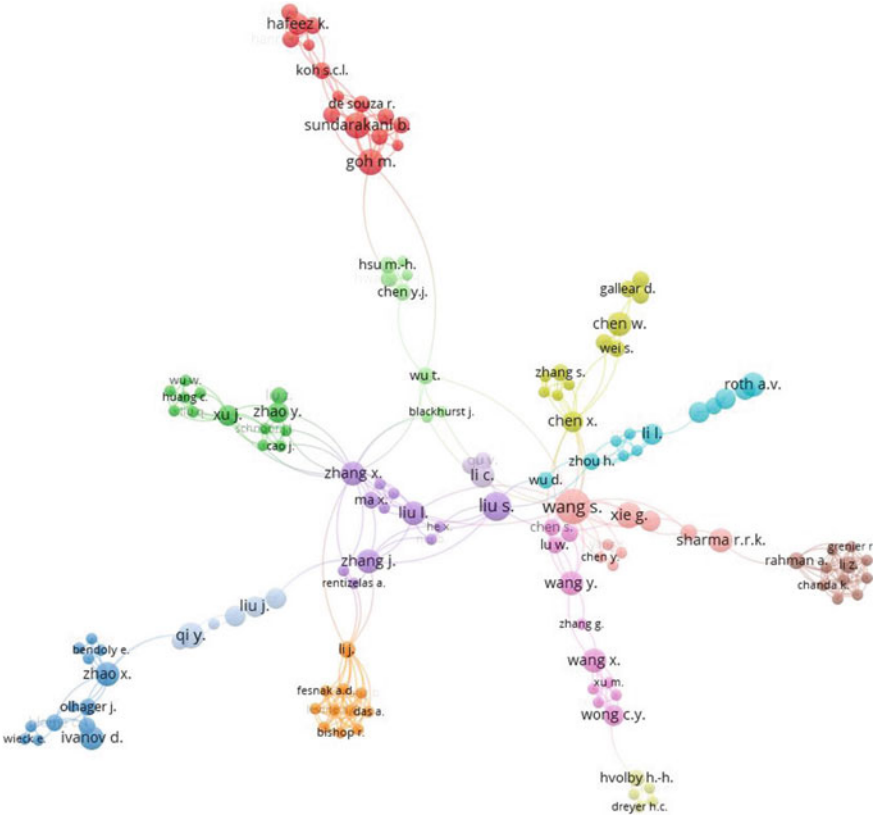



**Fig. 1.3** Main authors in SCS

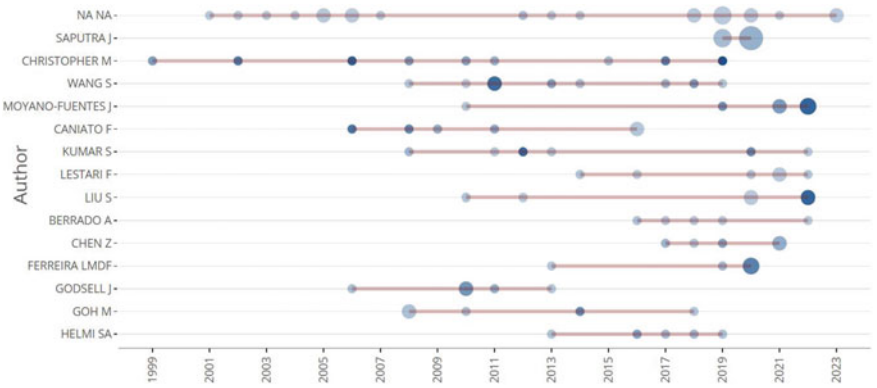



**Fig. 1.4** Productivity of authors over time

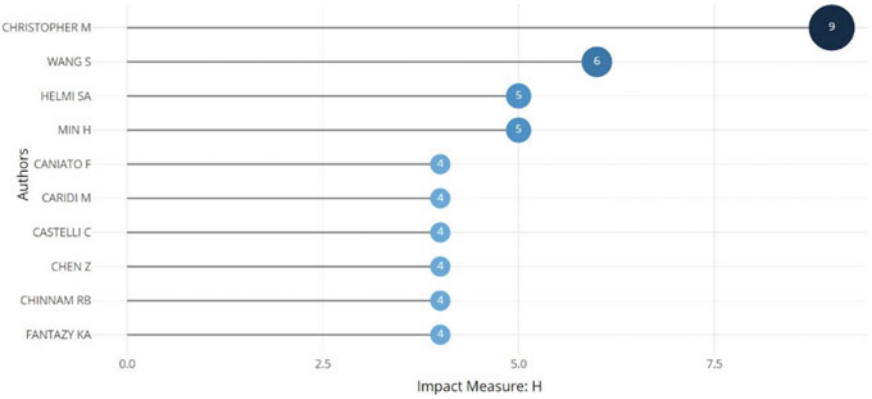



**Fig. 1.5** Authors' H-index in SCS

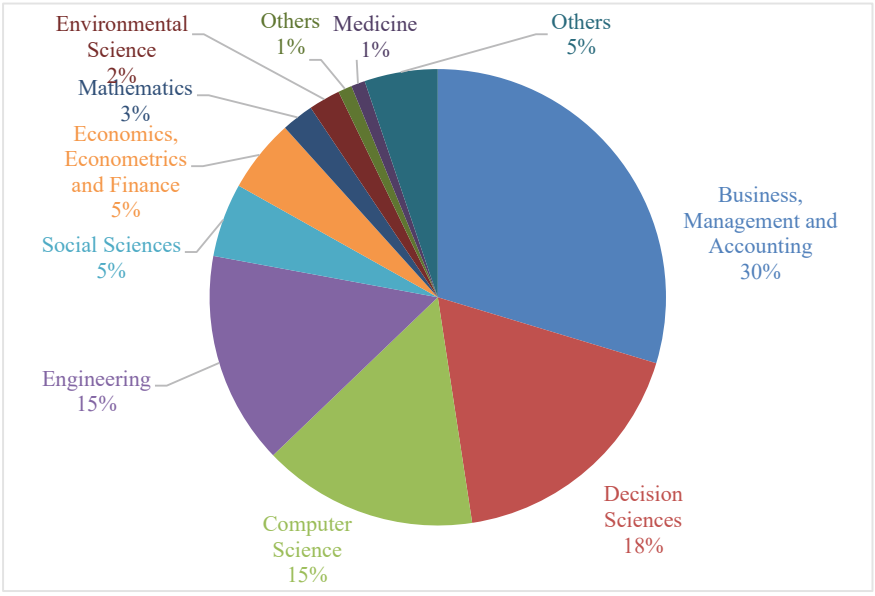



**Fig. 1.6** Research areas in SCS

### *1.3.5 Funding and Sponsors in SCS Research*

The design and application of SCS have been of interest to many organizations that have funded many research projects and, as a result, are recognized through publications. Figure 1.7 illustrates the main institutions that have funded this research topic, with the National Natural Science Foundation of China and the Kazan Federal University leading the way. It is noteworthy that, in this case, the Kazan Federal

**Table 1.2** Type of SCS documents

| Document | Number |
|---|---|
| Article | 893 |
| Conference paper | 265 |
| *Book chapter* | |
| Review | 55 |
| Book | |
| Short survey | 10 |
| Conference review | 8 |
| *Editorial* | |
| Note | 3 |
| Abstract report | 1 |
| Erratum | 1 |

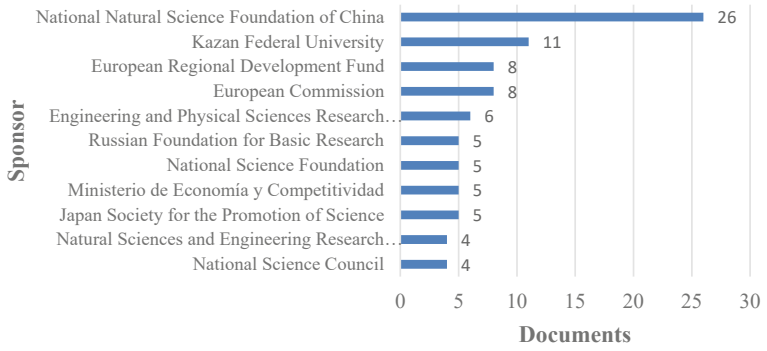



**Fig. 1.7** Funding and sponsor institutions for SCS research

University is a university and not a national or international body, such as the European Commission and the European Regional Development Fund, which demonstrates the focus of that institution, as well as the fact that it ranks first in terms of the number of papers published.

### *1.3.6 The Main Institutions Where SCS Research is Carried Out*

A total of 2524 institutions have been identified as the affiliation of the authors researching SCS, as shown in Table 1.3, with the Kazan Federal University of the Russian Federation having published the most papers out of all the others, with 12 papers (three times more than the second-ranked institutions). The next institutions are the Faculty of Business, Economics and Social Development, Universiti

**Table 1.3** Main institutions doing SCS research

| Organizations | Documents |
|---|---|
| Kazan Federal University, Russian Federation | |
| Faculty of Business, Economics and Social Development, Universiti Malaysia; Terengganu, Kuala Nerus, Terengganu, Malaysia; Management Development Institute, Gurgaon, India | |
| Andersen Consulting, New Zealand; Auburn University, United States; Business School, Nanjing Normal University, Qixia District, Nanjing, 210,023, China; Cardiff Business School, Cardiff University, Cardiff, United Kingdom; Cranfield School of Management, Cranfield University, Cranfield, United Kingdom; Department Of Mathematics, Faculty Of Mathematics And Natural Sciences, Universitas Padjadjaran, Indonesia; Eada Business School, Barcelona, Spain; Faculty of Business, Economics And Social Development, Universiti Malaysia; Terengganu, Kuala Nerus, Terengganu, Malaysia; Kazan National University Of Science And Technology, Russian Federation; Kent Business School, University Of Kent, Canterbury, United Kingdom; Kulliyah Muamalat, Insaniah University College, Kuala Ketil, Kedah, 09,300, Malaysia; Manchester Business School, University of Manchester, Manchester, United Kingdom; Michigan State University, United States; Plekhanov Russian University of Economics, Russian Federation; School of Economics and Management, Tongji University, Shanghai, China; Supply Chain and Logistics Management Research Lab, Department of Business; Administration, School of Business, Soochow University, Taipei, Taiwan; University of Tennessee, United States | |

Malaysia; Terengganu, Kuala Nerus, Terengganu in Malaysia; and the Management Development Institute, Gurgaon in India, with four papers. These results are interesting because these two institutions belong to Indonesia.

This analysis shows that many institutions are involved in SCS research and there are no leading institutions beyond those mentioned above, because more than 2,000 institutions have only one document.

However, not all institutions have evolved in a similar manner. Figure 1.8 illustrates on the x-axis the years (timeline) and on the y-axis the number of documents published. It can be seen that many universities have been growing relatively slowly but steadily. However, the number of papers published by the Kazan Federal University from 2018 onwards is striking, and since 2018, it has maintained high academic productivity.

It is also noted that there were several papers where it was impossible to identify an institution of affiliation and that appear as not reported, which unfortunately are on the increase.

### *1.3.7 Countries Where SCS Research is Being Conducted*

A total of 122 countries were identified in which an author or institution has generated research in the SCS, and Fig. 1.9 illustrates the top 15. It is clear that, as countries,

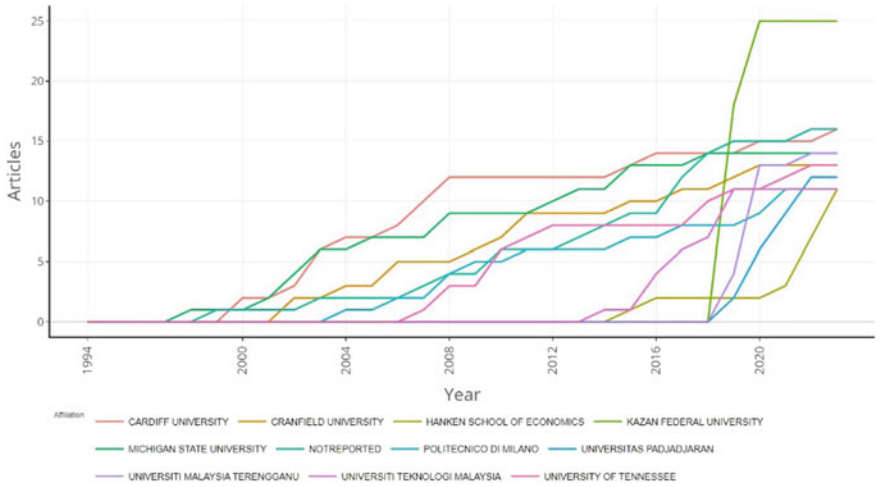
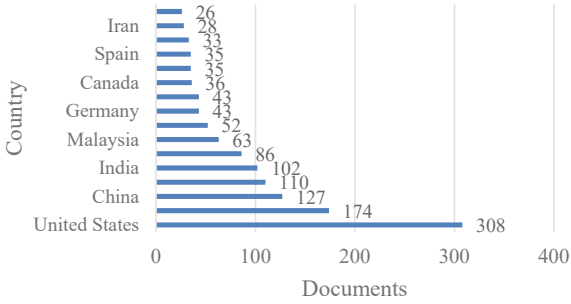



**Fig. 1.8** Academic output by the institution on SCS

the United States of America and the United Kingdom have led this line of research; however, countries such as China, Indonesia, and India have a significant scientific output, which is to be expected, as they have many educational institutions and research centers. Countries such as the Russian Federation, which has the institution with the highest academic productivity with SCS, appear in sixth place.

Figure 1.10 shows the relationships between the countries, which have been integrated into 13 clusters, dominated by the United States of America, the United Kingdom, China, India, and Indonesia, and the Russian Federation, which has been excluded from the graph for reasons of symmetry and because it is only related to the United States of America, the United Kingdom, and India. Figure 1.10 illustrates the countries in different colors; in this case, the purple color represents countries with a long history, such as the United States, the Netherlands, Hong Kong, Australia, Taiwan, and Finland, while the countries starting in this line of research are those represented in yellow, such as Oman, Indonesia, Malaysia, and Peru.

**Fig. 1.9** Countries publishing on SCS



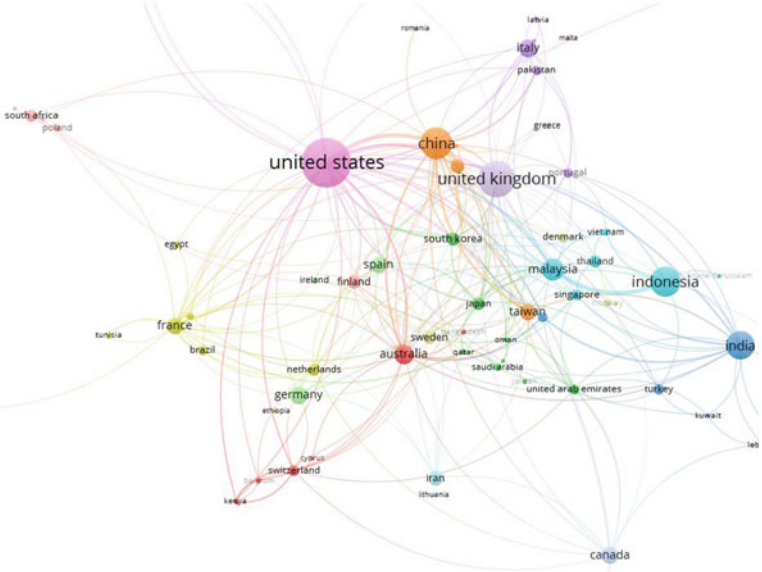



**Fig. 1.10** Countries researching SCS and their level of maturity

Figure 1.11 graphically illustrates the distribution of cooperation between countries regarding SCS. It can be seen that in the Americas, the United States collaborates most with other countries, while in Europe, it is the United Kingdom, and in Asia, it is China and India. However, to a lesser extent, countries such as Japan, South Korea, Australia, New Zealand, Spain, and Germany have begun to research this topic and collaborate with other countries.

Figure 1.12 illustrates the timeline of academic productivity in the different countries. It can be seen that the United States, United Kingdom, China, and India have

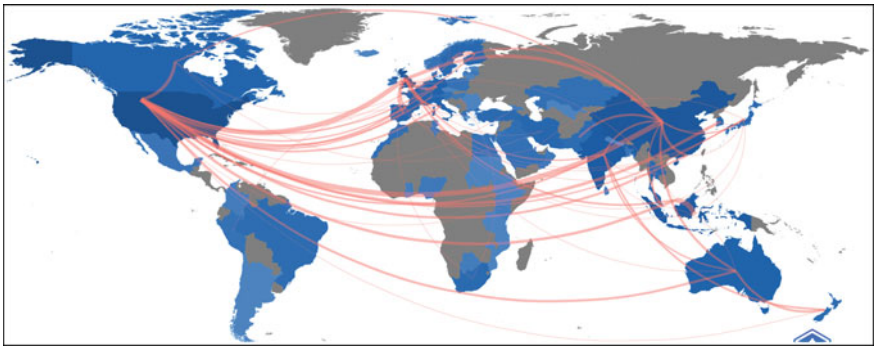


**Fig. 1.11** Relationships between countries in SCS publications

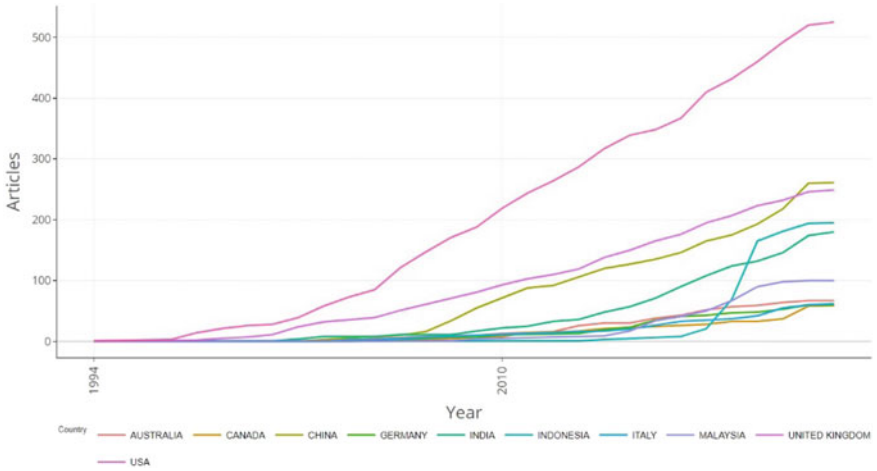



**Fig. 1.12** Timeline of SCS publications in pioneer countries

a steady incremental trend. Other countries, such as Iran, Italy, and Malaysia, have recently published papers on SCS and are also on the rise.

### *1.3.8 Main Keywords*

A total of 3338 keywords used by the authors were identified in all the documents analyzed, and Fig. 1.13 illustrates the top 15. Supply chain management (SCM), supply chain strategy (SCS), and supply chain (SC), which rank first, second, and third, stand out.

This analysis is important because it allows us to see that SCS has been related to CS performance, agility, sustainability of its activities, SC integration, lean operations, simulation, and even, in recent times, to Covid-19, where SCs have undergone disruption, so the associated word of risk management is also observed. See the supplementary material in the keyword sheet for a complete list of words.

Figure 1.14 illustrates the distribution of keywords presented at least five times and was integrated into 12 clusters. The keywords represented by purple circles are those initially used in this study, and are represented by supply chain management, retailing, logistics, modeling, integration, and simulation, among others. In contrast, other intermediate words in seniority are represented by green circles, such as agility, leanness, agility, performance, supply chain integration, knowledge management, and operational strategy. Finally, the most recent words are in yellow and refer to blockchain, sustainability, resilience, the Internet of Things, Industry 4.0, covid-19, and big data, among others.

However, not all the words used by authors are used by publishers to index documents in different databases. A total of 3680 different words were identified, and

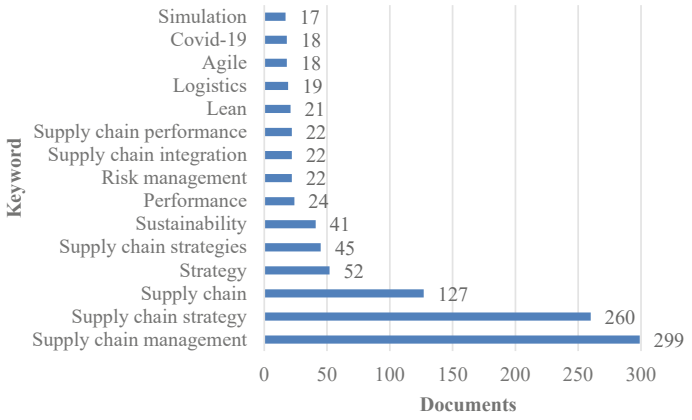



**Fig. 1.13** Main keywords

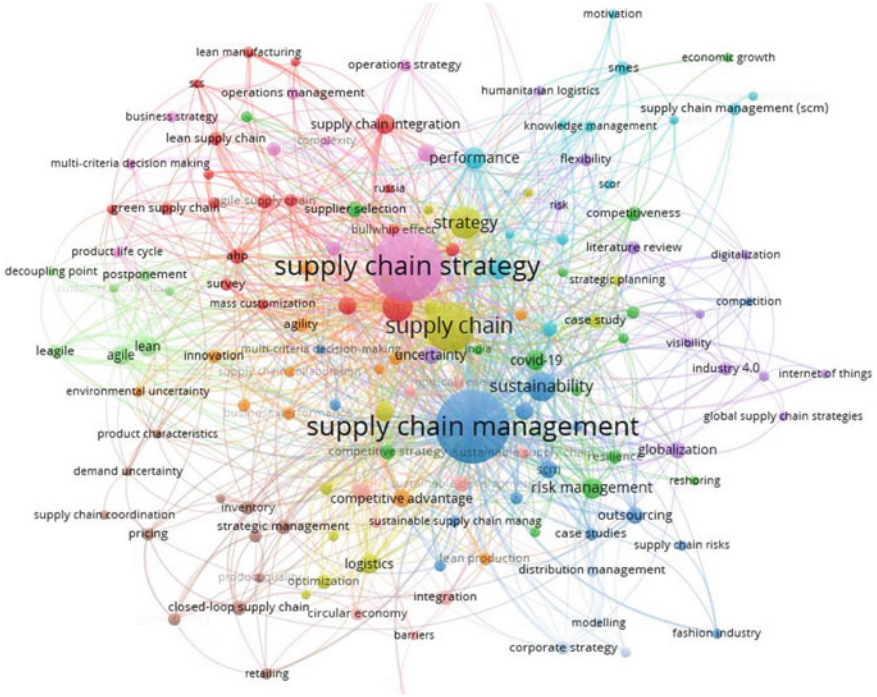



**Fig. 1.14** Main keywords used by authors

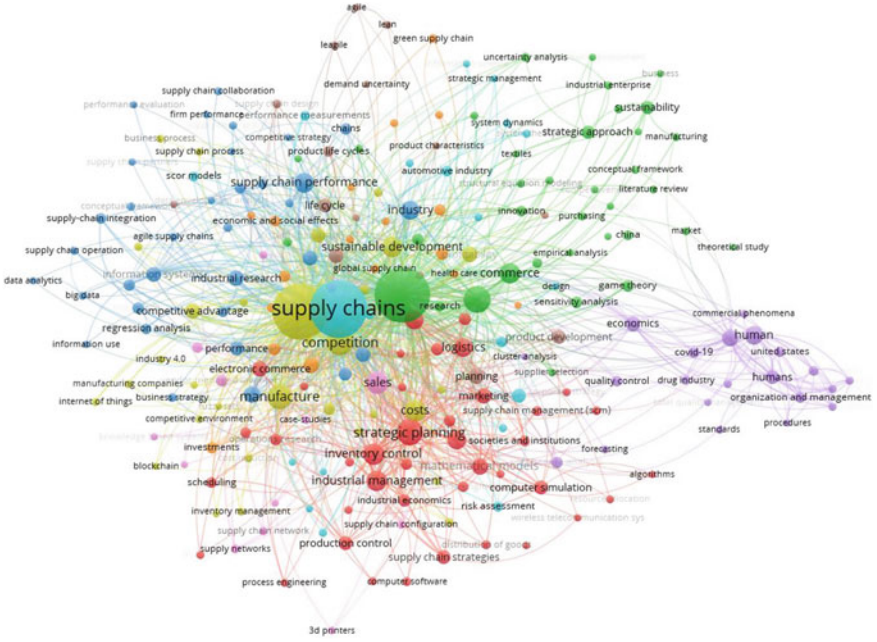



**Fig. 1.15** Index keywords for SCS

Fig. 1.15 illustrates the keywords used and appearing at least five times. The most frequently appearing words were supply chains (289), supply chain management (279), supply chain strategy (267), competition (68), decision making (65), strategic planning (61), manufacturing (57), sales (49), inventory control (49), and costs (44). From these words, it can be seen that SCS has been used for better management of SC, improving the competitiveness of SC, facilitating decision-making processes, and, above all, two words are associated with economic aspects, such as sales and costs.

Figure 1.16 illustrates how the word Supply Chain Strategy and Supply Chain Management are among the most important words and how others have evolved or been generated based on those considered to be the origin, indicating the number of occurrences and the percentage they represent. Currently, the keywords related to "supply chain strategies" are China, "supply chains", "agile supply chains", integration, and "corporate strategy". However, other recent intermediate words refer to simulation, supplier selection, sustainable development, the global supply chain, optimization, and strategy management.

When analyzing the evolution of the main keywords used by the authors to index their documents, it can be seen that at least three of them have grown in the number of times they were used per year, which refers to "supply chain management", "supply chain strategy" and "supply chain". Figure 1.17 illustrates the evolution of the first 10 words used by the authors cumulatively.

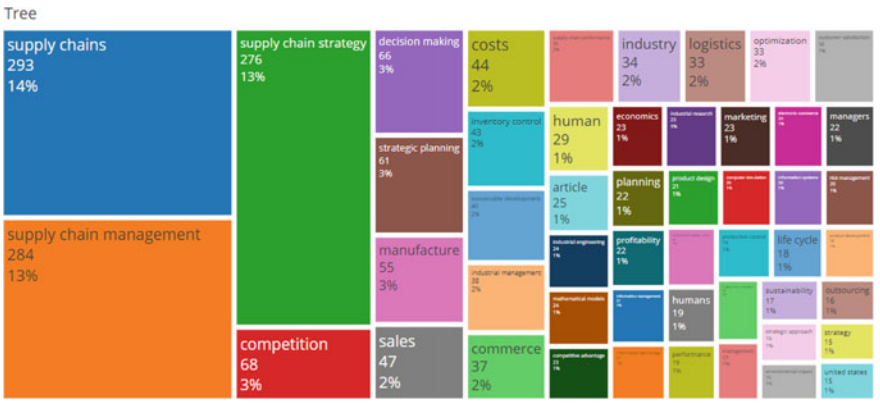



**Fig. 1.16** Keyword generation

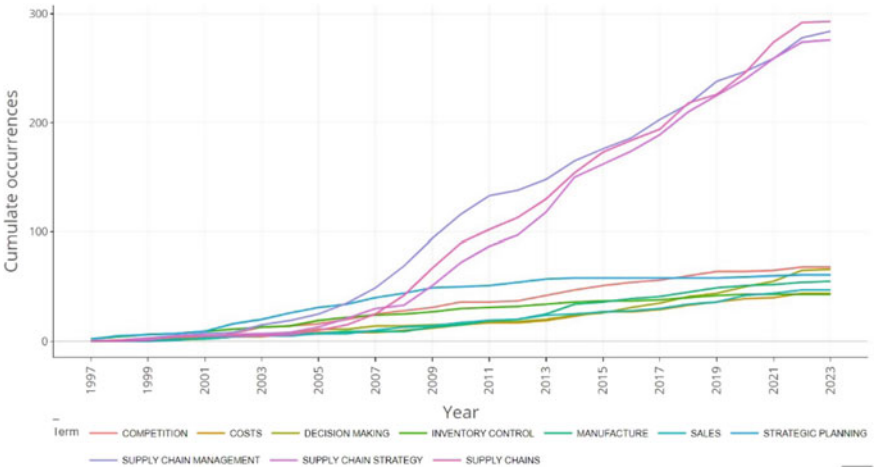



**Fig. 1.17** Evaluation of the use of the main keywords

Figure 1.18 illustrates the evolution of the keywords, showing the date when they were first and last used. The circles indicate that they were applied more than once on these dates. For example, it can be seen that recently associated words such as "COVID-19", "food supply chain", "Industry 4.0", "supply chain resilience", "circular economy", "uncertainty," and "sustainable supply chain" are currently being used the most. However, the words that first appeared to be used in this topic are "supply chain management", "simulation", "information systems", "corporate strategy," and integration.

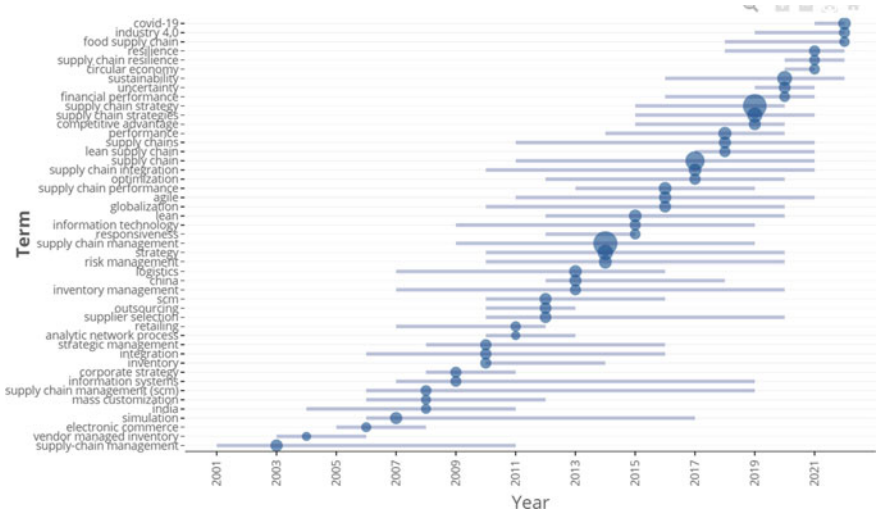



**Fig. 1.18** Keyword trends

### *1.3.9 Most Cited Documents*

Of the 1430 papers identified in this analysis, only 1000 have at least one citation, and 430 have not yet been cited, which may be because they have only recently been published. Table 1.4 illustrates the top 10 most cited papers and for the full list in descending order (see the supplementary material). The analysis of the names of these most-cited documents concludes that SCS relates to other aspects of CS, such as integration, agility, rapid response to customers, alignment with uncertainty, social responsibility, flexibility, and environmental aspects, which can be considered as strategies to be applied.

Figure 1.19 illustrates the distribution network of the most cited papers on SCS with at least one citation, which was integrated into 39 clusters. In this case, authors with purple or purple documents are pioneering or older documents, while those represented in green are more recent, and the yellow ones are the most current. Figure 1.19 is interesting, as it shows that many papers with different focuses (agility, flexibility, and customers) have always been the basis for other studies.

### *1.3.10 Most Cited Sources*

A total of 652 different sources, journals, or journals have been identified, and Fig. 1.20 illustrates the 15 most important ones, where it is observed that the Journal of Operations Management and the International Journal of Production Economics are the most important. In the same way, Fig. 1.21 illustrates the distribution network

**Table 1.4** Most cited documents

| Authors | Document | Quotations |
|---|---|---|
| Frohlich and Westbrook (2001) | Arcs of integration: an international study of supply chain strategies | 1657 |
| Ben Naylor et al. (1999) | Leagility: integrating the lean and agile manufacturing paradigms in the total supply chain | 1087 |
| Vickery et al. (2003) | The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships | 864 |
| Lee (2002) | Aligning supply chain strategies with product uncertainties | 843 |
| Rosenzweig et al. (2003) | The influence of an integration strategy on competitive capabilities and business performance: an exploratory study of consumer products manufacturers | 619 |
| Narasimhan and Kim (2002) | Effect of supply chain integration on the relationship between diversification and performance: evidence from Japanese and Korean firms | 503 |
| Tate et al. (2010) | Corporate social responsibility reports: a thematic analysis related to supply chain management | 450 |
| Stevenson and Spring (2007) | Flexibility from a supply chain perspective: definition and review | 425 |
| Mollenkopf et al. (2010) | Green, lean, and global supply chains | 423 |
| Wang et al. (2004) | Product-driven supply chain selection using integrated multi-criteria decision-making methodology | 422 |

of the main journals integrated into 21 clusters, where those represented by purple mean that they have at least two decades of publishing works related to SCS, those represented by green are journals that have approximately one decade, and those represented in yellow are the most recent ones.

In this case, it is observed that the International Journal of Supply Chain Management, which is one of the most representative journals, is very recent in comparison to others, such as Manufacturing and Services Operations Management and Sustainability, which have been published on this topic for a long time and do so very little.

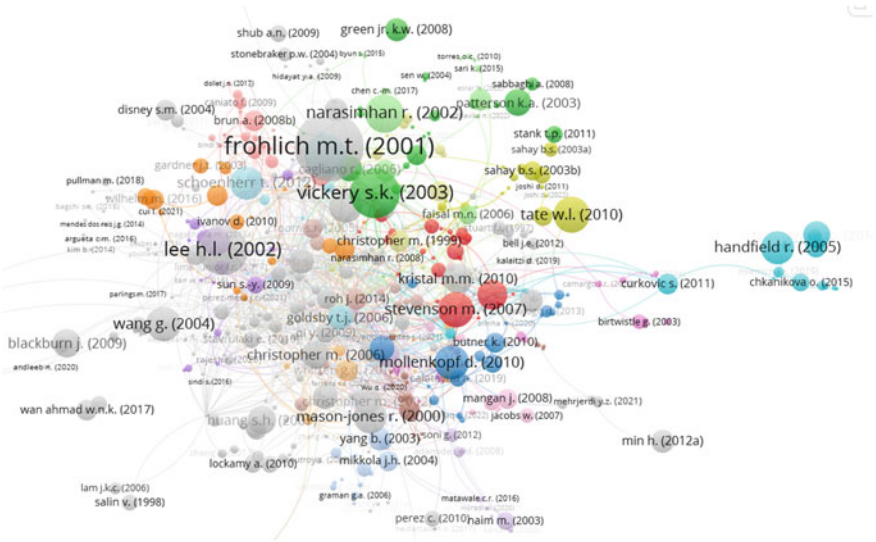



**Fig. 1.19** Most cited documents and their authors

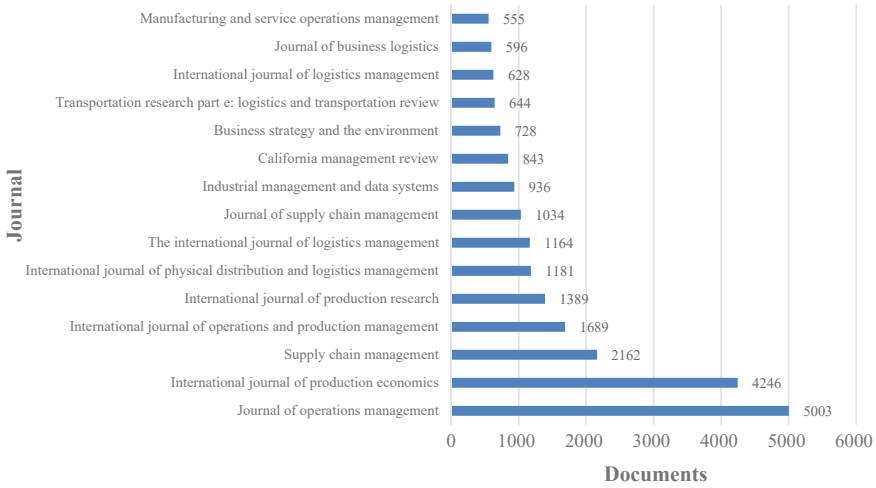



**Fig. 1.20** Top 15 most cited sources

## *1.3.11 Most Cited Authors*

Of the total number of authors identified, only 2318 had at least one citation and 1954 had at least two citations. Table 1.5 illustrates the top 15 most-cited authors, the number of papers they have generated, and the total number of citations accumulated in all their papers. In this case, it can be seen that Frohlich M. T. and Westbrook R.

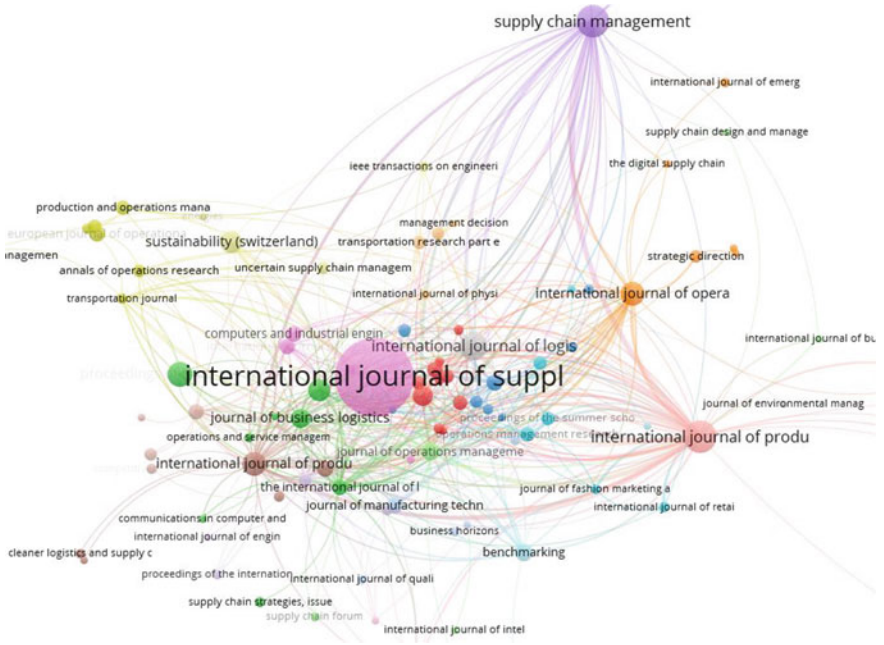



**Fig. 1.21** Distribution network of most cited sources

together have generated only two papers on SCS but have accumulated 2036 citations, while Naim M. M. in five papers has accumulated 1319 citations and Christopher M. with 9 papers has accumulated 1118 citations. In addition, Ben Naylor J. and Berry D., together generated 1087 citations in one paper.

The 1954 authors with at least two citations are integrated into 34 clusters, and Fig. 1.22 illustrates their distribution network. When the links they have with other authors are analyzed to determine their academic collaboration network, Christopher M. (386), Qi Y. (352), Towill D. (290), Lee H. L. (283), Zhao X. (266), Qrunfleh S. (265), Tarafdar M. (198), Frohlich M. T. (177) and Westbrook R. (177) are the most collaborative.

### *1.3.12 Most Cited Institutions*

Not all institutions that publish papers are cited. In this case, a total of 1867 institutions have been identified as having at least one paper and receiving at least one citation, while 1612 have at least two and 1444 have at least three. Table 1.5 illustrates the most cited institutions, the country of origin, the document number, and the number of citations they have received. It is important to mention that if the same university has campuses in different cities, they are considered differently as they represent

**Table 1.5** Most cited authors

| Authors | Documents | Citation |
|---|---|---|
| Frohlich M. T | | 2036 |
| Westbrook R | | 2036 |
| Naim M. M | 5 | 1319 |
| Christopher M | 9 | 1118 |
| Ben Naylor J | 1 | 1087 |
| Berry D | 1 | 1087 |
| Roth A. V | | 1031 |
| Lee H. L | | 919 |
| Tate W. L | | 873 |
| Calantone R | 1 | 864 |
| Droge C | 1 | 864 |
| Jayaram J | 1 | 864 |
| Vickery S. K | 1 | 864 |
| Huang S. H | | 713 |
| Rosenzweig E. D | | 703 |

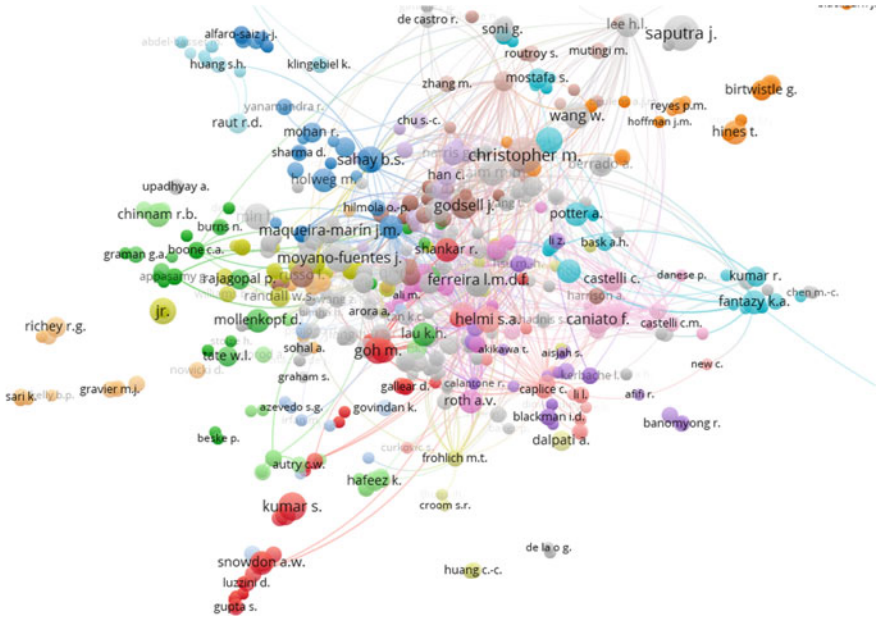



**Fig. 1.22** Relationships between the most cited authors

**Table 1.6** Most cited institutions in SCS

| Organizations | Documents | Citations |
|---|---|---|
| London Business School, London, United Kingdom | 1 | 1657 |
| The University of Oxford, Oxford, United Kingdom | 1 | 1657 |
| Formerly Logistics Syst. Dynam. Grp., Bristol, United Kingdom | 1 | 1087 |
| Logistics Systems Dynamics Group, Cardiff, United Kingdom | 1 | 1087 |
| Michigan State University, United States | 1 | 864 |
| University Of South Carolina, United States | 1 | 864 |
| Emory University, United States | | 703 |
| Univ. North Carolina, Chapel Hill, United States | 1 | 619 |
| University Of Tennessee, Knoxville, United States | | 551 |
| Michigan State University, East Lansing, United States | 1 | 503 |
| Miami University, United States | 1 | 450 |
| Lancaster University Management School, Lancaster, United Kingdom | 1 | 425 |
| University Of Toledo, Toledo, United States | 1 | 422 |
| University Of Cincinnati, Cincinnati, United States | 1 | 422 |

different research groups. The list shown in Table 1.6 indicates that universities in the United States of America and the United Kingdom have been cited most frequently; however, when analyzing the number of documents they have generated, it can be seen that many of them have produced only one, and only Emory University and the University of Tennessee at Knoxville have generated two, so it can be concluded that there are no consolidated research groups that continue with this line of research.

### *1.3.13 Most Cited Countries*

A total of 122 countries were identified as having at least one document related to SCS; 90 had at least one citation, while 32 had none. However, only 85 had at least two citations and 83 had at least three citations. Table 1.7 illustrates the top 15 of the 122 countries. The United States of America and the United Kingdom lead the list, with 14,924 and 10,316 citations, respectively, indicating that each of these papers has an average of 48.45 and 59.28 citations, respectively. However, it is important to note that, on the Asian continent, China, India, and Hong Kong stand out in publications related to this topic.

However, these countries have been pioneers in SCS research (Fig. 1.23). They are depicted in purple, indicating that they have been conducting research in this area for more than two decades. Similarly, Indonesia, Malaysia, China, India, and Iran are at least a decade old. More recently, countries such as Bahrain, Mexico, and Oman have begun to study the topic shown in yellow.

**Table 1.7** Most cited countries

| Country | Documents | Citation |
|---|---|---|
| United States of America | 308 | 14,924 |
| United Kingdom | 174 | 10,316 |
| China | 128 | 1790 |
| India | 102 | 1446 |
| Italy | 43 | 1191 |
| Hong Kong | 26 | 1121 |
| Canada | 39 | 922 |
| Germany | 43 | 877 |
| Netherlands | 23 | 845 |
| Taiwan | 34 | 788 |
| Malaysia | 63 | 785 |
| Spain | 35 | 766 |
| Australia | 52 | 734 |
| Sweden | 23 | 603 |
| South Korea | 22 | 592 |

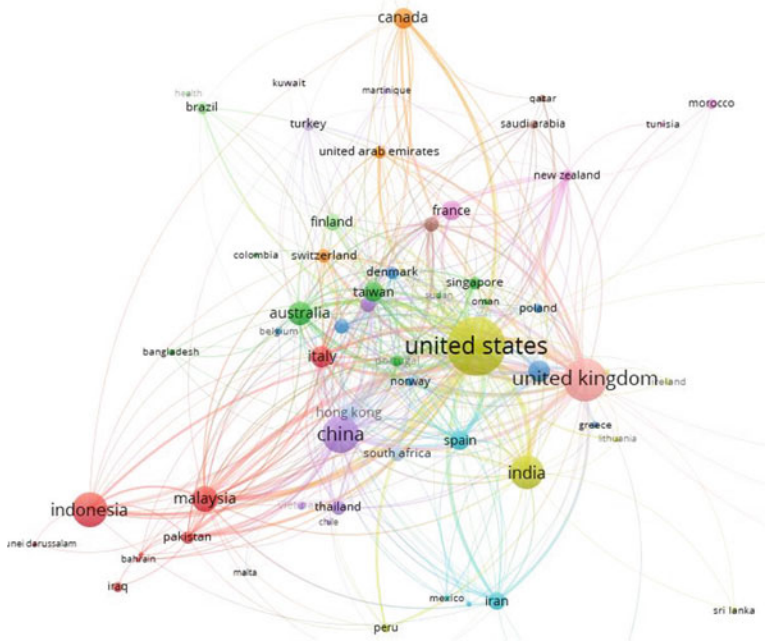



**Fig. 1.23** Most cited countries

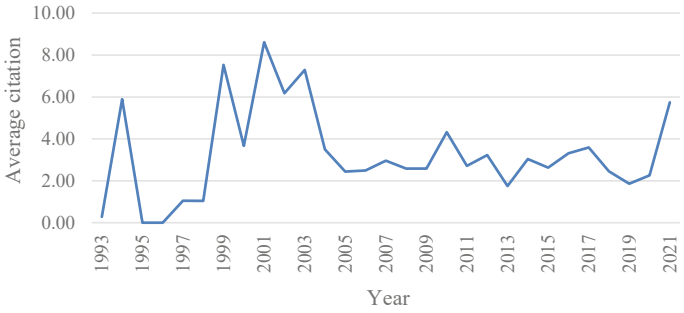



**Fig. 1.24** Average citations per year

### *1.3.14 Average Number of Citations*

The evolution of the average number of citations received per year is vital to understanding the evolution and importance of a research topic, and Fig. 1.24 illustrates this trend. It can be seen that immediately after the concept appeared in 1993, in 1994, there was an average of 5.89 citations per article, which were few and far between and a novelty. After that period, it was in 1999 that there was again an increase, being the second highest value with 7.53 citations on average, only after the year 2001 with 8.61.

However, after that period, in 2003, the trend stabilized, by which time there were more documents and authors could resort to new bibliographic consultations. Therefore, in the year 2021, an increase is again observed, which may be because many of the paradigms that were held for SCS have failed since the COVID-19 pandemic; therefore, scholars in this area of research are once again showing greater interest in this topic.

## 1.4 Conclusions

The bibliometric analysis of the 1430 papers published in the Scopus and Dimensions database on SCS led to the following conclusions.

1. The number of documents published on this topic is increasing, with the first document appearing in 1993; however, in 2020 and 2021, the number of documents decreased, which may be due to the period of health pandemic due to COVID-19.
2. The authors who have published the most academic papers on SCS are Christopher M., Saputra J. and Wang S. (9 papers each).
3. Wang S, Liu S and Zhang X are the authors with the most collaborations and lead established research groups.

4. Christopher M, Cianato F and Gossel are the authors who initiated the generation of academic papers on SCS. However, Christopher M and Wans S are the authors who have had the greatest impact H on others.
5. The main research areas in which SCS has been published are Business Management and Accounting, Decision Sciences, Computer Sciences and Engineering.
6. Most documents published on SCS are articles, conference papers, or book chapters.
7. The largest funders of SCS research are the National Natural Science Foundation of China and Kazan Federal University.
8. The most researched institutions in the SCS are the Kazan Federal University (Russian Federation), Terengganu University (Malaysia), and the Management Development Institute (India).
9. The countries that publish the most on SCS are the United States of America, the United Kingdom, China, Indonesia, and India, which in turn cooperate the most with other countries worldwide. In addition, they are also the ones that have shown an incremental evolution in terms of the number of publications over time.
10. The most used keywords were supply chain management (SCM), supply chain strategy (SCS), and supply chain (SC). However, recently, words associated with COVID-19, outsourcing, integration, agility, and corporate strategy have also been used.
11. The two most-cited papers in this area are Frohlich and Westbrook (2001) and Ben Naylor et al. (1999).
12. The most cited journals are the International Journal of Supply Chain Management, International Journal of Production Economics, and Supply Chain Management.
13. Authors with more than 1000 citations on this topic are Frohlich M. T., Westbrook R., Naim M. M., Christopher M., Ben Naylor J., Berry D. and Roth A. V.
14. Institutions with more than 1000 citations are London Business School (London, United Kingdom), University of Oxford (Oxford, United Kingdom), and Formerly Logistics Syst. Dynam. Grp. (Bristol, United Kingdom), and Logistics Systems Dynamics Group (Cardiff, United Kingdom).
15. The institutions with the most citations in SCS are the United States of America, the United Kingdom, China, and India; however, the former has more than 10,000 citations.
16. Finally, the average number of citations of SCS documents must be approximately three per document.

Finally, due to the current trade war between North American countries and NATO members with China, there is a likelihood that the trends in publications and collaborations between countries on SCS issues will change due to the new geopolitical game between these nations. For example, China and Europe may collaborate more with Latin American countries to improve their supply chains of raw materials and

energy resources. In addition, because of the high exchange of consumer goods that will originate from the Tehuantepec isthmus inter-oceanic corridor project in Mexico, it is expected that there will be a large mobilization of goods to different countries, both North America and South America, and among many other countries around the world. Thus, these new trade routes and the geopolitical movement will present challenges in countries such as Mexico for designing low-cost, flexible, and automated supply chains. Therefore, this paper contributes significantly to locating the research groups in this field of study, locating the institutions that have conducted the most research on SC to quickly learn about their contributions and to find applications in upcoming challenges.

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