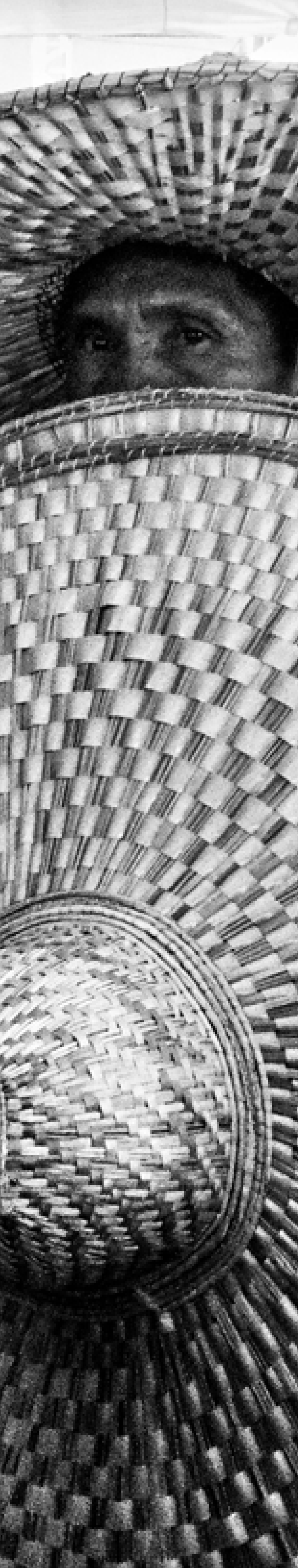

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BIBLIOMETRIC ANALYSIS OF CLOUD SUPPLY CHAIN MANAGEMENT: EMPIRICAL DATA AND SECURITY

Análisis bibliométrico de la gestión de la cadena de suministro en la nube: datos empíricos y seguridad

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ABSTRACT

This research analyzes the phenomenon of the increasing interest on cloud supply chain management (CSCM) through bibliometric analysis. We wanted to know about how the empirical data can show how to defend the supply systems from a third part attack. The methodology employed is descriptive, based on the analysis of bibliometric data obtained from the Web of Science database. (WoS). The sample includes 1,715 records of scientific publications between 2013 and 2024, analyzed using VoSviewer software to visualize bibliometric networks. They indicate a sustained growth in scientific production on CSCM, with peaks in 2019 and 2022. The most relevant journals include IFAC Papersonline and Sustainability. China leads in scientific production, followed by the USA and India. The institutions with the highest number of publications are South China University of Technology and Hong Kong Polytechnic University. This review showed that potential danger related of its use is not easy to solve, and although, there is a general optimistic context to receive this kind of technology, empirical data in analyzed literature does not support yet the cybersecurity issues.

Keywords: cloud supply chain management, scientific production, cybersecurity, empirical data.

RESUMEN

Esta investigación analiza el fenómeno del creciente interés en la gestión de la cadena de suministro en la nube (CSCM) mediante análisis bibliométrico. Buscamos comprender cómo los datos empíricos pueden mostrar cómo defender los sistemas de suministro de un ataque de terceros. La metodología empleada es descriptiva, basada en el análisis de datos bibliométricos obtenidos de la base de datos Web of Science (WoS). La muestra incluye 1715 registros de publicaciones científicas entre 2013 y 2024, analizados mediante el software VoSviewer para visualizar redes bibliométricas. Estos indican un crecimiento sostenido en la producción científica sobre CSCM, con picos en 2019 y 2022. Las revistas más relevantes incluyen IFAC Papersonline y Sustainability. China lidera la producción científica, seguida de EE. UU. e India. Las instituciones con mayor número de publicaciones son la Universidad Tecnológica del Sur de China y la Universidad Politécnica de Hong Kong. Esta revisión mostró que el peligro potencial relacionado con su uso en cyber espacio no es fácil de resolver y, si bien existe un contexto general optimista para recibir este tipo de tecnología, aún su seguridad no está bien respaldada por suficientes datos empíricos en la literatura analizada.

Palabras claves : Gestión de la cadena de suministro en la nube, producción científica, cyberseguridad, datos empíricos.

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INTRODUCTION: HOW CSCM WORKS AND HOW IT IS PRESENTED TO SECURITY ISSUES

Cloud supply chain management is presented, in most the consulted literature, as having the ability to encompass tools, infrastructures, and general processes to oversee the chain supply of any enterprise through the informatic cloud. This enables people to access data from anywhere, to preserve cloud backups, which should be a guarantee against loss, damage, or theft.

The supply chain (SC), *per se*, is a multifaceted discipline that integrates various entities and processes to optimize the flow of goods and services from their origin to the customer. (Verma, 2024). In this context, it is a complex network of organizations, people, activities, information, and resources that collaborate in the creation, production, delivery, and sale of a product or service, covering all stages from its origin to the final consumer. (Aji, 2024). This includes several links that are part of logistics, such as raw material extraction, design, product manufacturing, transportation, inventory management, distribution, and finally, the disposal or recycling of the product at the end of its life cycle (Cai & Huang, 2O14). The main offered advantage is that it should be able to synchronize all the intelligent process of the chain supply, improving efficiency, quality, and as derived consequence, customer satisfaction (Li et al., 2021). In this sense, the SCM seeks to us a big amount of information interconnected to meet customer needs efficiently and profitably, for which it would become a critical component for business success in a globalized market (Wang, Guo, & Zhan, 2016).

It is normally presented as innovative (Yang, 2019) because it integrates technological devices such as data mining, blockchain, and the Internet of Things (IoT), to optimize inventory management, warehouses, transportation, distribution, order preparation, packaging, and other operational production processes (Zhang et al., 2024).

The CSCM addresses automatic data-driven inventory management and machine learning, which allows to AI to improve security of the chain process and automation (Tan et al., 2024). Additionally, centralized data storage and analysis improve decision- making and operational responsiveness (Karumanchi et al., 2023), but also gives to the downstairs executives the possibility to act in a two-stage model, where initial forecasts are refined through empirical data, addressing the complex challenges related to inventory management at different links in the supply chain (Naveen et al., 2024).

Normally CSCM is presented as a guarantee against data privacy attacks, because the technological dependence prevents vulnerability from inner attackers. This idea is based on its comparison against traditional systems, based on local servers, which can be vulnerated from internal offenders (Cai & Huang, 2014). Therefore, CSCM is defined as a secure network of organizations that collaborate through alliances in various processes and activities, creating value in the form of products and services for end customers. (Kava & Chinmayie, 2023; Apolinario & Guevara, 2021).

The CSCM is designed on the presumed idea that complexity can intervened by automated process, which are based on stable patterns in a globalized and automated economy (Yang, 2019). In other words, while organizations require greater speed and security throughout their entire chain the idea of a centralized system involving the generation, acquisition, transfer, and combination of knowledge, should enables better development in the pursuit of "comprehensive well-being" (Zhang et al., 2024).

PURPOSE: DOES SCIENTIFIC PRODUCTION OFFERS ENOUGH EMPIRICAL DATA TO INDICATE CSCM CYBERSECURITY?

This research aims to quantify the scientific production of the GCSN through a bibliometric study that measures its impact, collaboration, and trends (Ferreira et al., 2024), through indexed journal bibliometrics. Through this enquire, we aspire to observe de cybersecurity issues which are normally addressed to this kind of digital and centralized big data technology. The guiding question is: Does scientific production offers enough empirical data to indicate CSCM cybersecurity?

METHODS AND MATERIALS

The relevance of bibliometric study lies in the need to investigate and gather information on bibliographic production in the field of cloud computing. (Castillo & Casterron, 2010). This quantitative approach focuses on the mathematical analysis of statistical data and graphs published in high-impact global journals, with the aim of grouping them by titles, years, and authors, to draw useful conclusions for future studies (Ovalle et al., 2018). To carry out this process, an exhaustive search was conducted in two highly relevant research databases, such as Web of Science (WoS), using criteria such as authors, citations, titles, subtitles, and publication years in relation to the trend of GCSN (López, 2022).

The adopted bibliometric methodology employs mathematical and statistical ways to analyze the scientific production related to CSCM, a key variable from a managerial perspective, whose results are essential for its review (Valencia et al., 2016). This descriptive analysis significantly contributes to the advancement of knowledge and understanding of CSCM, fundamental for the transformation of practices and improvement in terms of efficiency, visibility, and sustainability at a global level (López et al., 2023).

The WoS Bibliometric Network

WoS is a platform that analyzes results by providing a wide range of bibliometric data, such as document type, publication titles, publishers, funding agencies, authors, author groups, countries or regions of the authors, languages, and publication years (López et al., 2023). In this context, the citation report offers metrics such as citation count, citation density, and the Hirsch index (h-index). (Ovalle et al., 2018). This index is defined as the number of articles with a citation count equal to or greater than h, and it is used to measure the scientific impact of a researcher or a journal. (Valencia et al., 2016). Additionally, the VoSviewer software was used to visualize semantic bibliometric networks through an automated algorithm that identifies both relevant terms and authors. (Manzano et al., 2021). This software facilitated the analysis of authors with the highest scientific productivity on a specific topic, as well as of the workgroups and the relationships that connect them, which is reflected in co-authorship networks (Álvarez, 2021).

WoS Scientific production on CSCM showed a production from 2013 and 2024, of 1,715 records in the Core Collection.

RESULTS

General appreciation and specific semantics on security

The WoS databases show that CSCM is a poorly explored topic. This gives importance of this bibliometric study in order to gain a deeper understanding of the cloud computing landscape and the publications (López et al., 2023). Authors such as Zhong et al. (2017), Lee & Lee (2015), Frank et al. (2019), Li et al. (2021), Oztemel & Gursev (2020), and Dwivedi & Hughes (2021) highlight the significant advancement that cloud computing represents for the efficiency of supply chain operations and to the impact it would have of CSCM in productivity, security, and continuous improvement of cloud information management as a security measure for the chain (Kava & Chinmayie, 2023).

It is almost always insisted that the use of cloud technology in companies optimizes business processes and allows for the development of infrastructures, platforms, and software solutions for the entire supply chain through the Internet (Lacković et al., 2017), with little considerations on cybersecurity. The main advantage of cloud-based technological systems would lie in their simplicity in solving compatibility issues through a platform approach that facilitates connections in every part of the SC, as if the cloud could not be intervened by third parts. Most of the limitations addresses to the high costs in the beginning of the process, which implies differences from a commercial and technical perspectives (Zhong et al., 2017).

Zhang et al. (2024) suggest that cloud computing has become an essential tool for information exchange and collaboration in supply chain operations. However, surprisingly, some authors reveal that the system has not been deeply investigated in a central issue: how information is shared in a cloud-based supply chain (Lee & Lee, 2015). This assertation contradicts the assertation on its success, because it would not be logic to obtain empirical data of its functioning, if it is not yet clear the functioning of the security weak points.

Although, Yang (2019) and Frank et al. (2019) describe a joint contract to coordinate the third-order cloud computing service supply chain, highlighting that the information is completely symmetric and that the requirements follow a uniform distribution (Büyüközkan & Göçer, 2018). The results indicate that the revenue-sharing contract can increase profits in the supply chain (Frank et al., 2019). Wang et al. (2016) and Li et al. (2021) argue about the importance of certifying quality management systems supported by this technology. (Wolfert et al., 2017; Yang, 2019), but they do not address cybersecurity theoretical limitations.

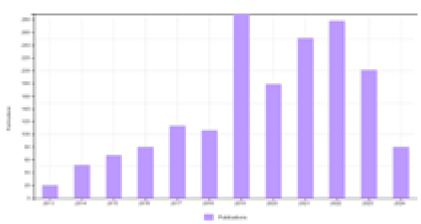
On the other hand, Zhan (2014) and Zhang et al. (2024) indicate that, in the era of networks, supply chain management focuses on customers, analyzing their current and future needs to offer suitable products. (Ivanov et al., 2022). This has led to the development of modern strategies such as electronic ordering systems and business networks. (Atzori et al., 2010). The proposed structure for the logistics service supply chain includes a cloud-based virtual platform that facilitates the integration of logistics functions. (Oztemel & Gursev, 2020).

Bibliometric Analysis of Cloud Supply Chain Management

Scientific production on CSCM shows sustained growth between 2013 and 2024, reaching a total of 1,715Z records in the Web of Science Core Collection. This increase reflects a progressive strengthening of research capabilities in this area, attributable to the growing importance of CSCM in the current context. Temporal analysis reveals pronounced peaks in scientific production, which may be associated with specific events such as the acquisition of additional funding, the completion of significant collaborative projects, or the implementation of policies that promote research. These peaks, especially observed in 2019 and 2022, suggest that scientific production in CSCM responds sensitively to both external and internal stimuli. Although some years show a decrease in the number of publications, the continuity of scientific productions evidences the resilience of research in CSCM in the face of various challenges. Thus, the CSCM consolidates itself in the period 2013-2024, adapting to changes and seizing growth opportunities, which strengthens its impact on knowledge development and the scientific community. Regarding annual production, the search in the Web of Science Core Collection was limited to the period 2013-2024, as data has been available since that year. After adjusting the inclusion criteria, 1,715 records were identified, with the maximum number of publications in 2019, as shown in Figure 1.

Figure 1.

Annual Scientific Production of Cloud Supply Chain Management



Note: Data obtained from Web of Science

The results of Table 1 indicate a growing interest in cloud computing applied to supply chain management. The journal IFAC Papersonline tops the list with 124 articles (7.23%), reflecting its relevance in research on automation and control, fundamental for Industry 4.0, where automation and data management are essential. Secondly, Sustainability, with 56 articles (3.27%), highlights the importance of sustainability in the industrial and technological fields, showing a clear trend towards research that integrates sustainability as a pillar of innovation and industrial development. The journal IEEE Access, with 43 articles (2.51%), and the International Journal of Production Research, with 26 publications (1.52%), reflect the interest in technological accessibility and the optimization of production processes, suggesting the search for accessible and efficient solutions in the supply chain. Also, specialized journals such as Sensors and Applied Sciences Basel, with 0.99% and 0.82% of the articles respectively, contribute specific research in sensor engineering and applied sciences. Although their frequency is lower, they contribute significantly to advanced areas such as IoT and precision engineering, complementing knowledge in key sectors. Finally, publications such as the Journal of Cleaner Production and Technological Forecasting and Social Change point to a trend towards responsible innovation and sustainable technological development, in line with the Sustainable Development Goals. (ODS). Overall, this distribution reflects a diversified scientific field that prioritizes both technological innovation and a commitment to sustainability and environmental responsibility in industrial and technological development, driving interest in cloud supply chain management. (GCSN). These data suggest that cloud technology is gaining popularity in companies due to its benefits in visibility, efficiency, and collaboration in supply chain processes. The table provides a comprehensive overview of research trends in this field,

highlighting the value that cloud computing brings to the strengthening and innovation in supply chain management.

Table 1.

Journals with the Most Publications

Sources	Articles	%
IFAC Papersonline	124	7.230 %
Sustainability	56	3.265 %
IEEE Access	43	2.507 %
International Journal of Production Research	26	1.516 %
Computers Industrial Engineering	20	1.166 %
International Journal of Production Economics	19	1.108 %
Lecture Notes in Computer Science	18	1.050 %
Annals of Operations Research	17	0.991 %
Sensors	17	0.991 %
Applied Sciences Basel	14	0.816 %
Technological Forecasting and Social Change	13	0.758 %
IFIP Advances in Information and Communication Technology	12	0.700 %
Journal of Cleaner Production	11	0.641 %
Computers in Industry	10	0.583 %
IEEE Transactions on Industrial Informatics	10	0.583 %
International Journal of Advanced Manufacturing Technology	10	0.583 %
International Journal of Computer Integrated Manufacturing	10	0.583 %
Journal of Cloud Computing Advances Systems and Applications	9	0.525 %
Journal of Enterprise Information Management	9	0.525 %
Procedia Manufacturing	9	0.525 %
IEEE International Conference on Industrial Informatics Indin	8	0.466 %
Industrial Management Data Systems	8	0.466 %
International Journal of Information Management	8	0.466 %
Mathematical Problems in Engineering	8	0.466 %
Production Planning Control	8	0.466 %

Note: Data obtained from Web of Science

Table 2 presents an analysis of the most cited articles in the context of advanced manufacturing technologies, Industry 4.0, IoT, Big Data, artificial intelligence, and digital supply chains, providing a perspective on the influence of these topics in academic literature. The leading articles in citations include the work of Zhong et al. (2017) on smart manufacturing in Industry 4.0, which ranks first with 1318 citations. This underscores the importance of smart manufacturing as the foundation of digital transformation in the industry, showing significant interest in technologies that optimize production processes. Secondly, the article by Lee and Lee (2015) on the Internet of Things (IoT), with 1289 citations, reflects the interest in IoT applications in businesses, especially in improving connectivity and asset management in productive environments. Similarly, Frank et al. (2019), with 1200 citations, explores the patterns of implementation of Industry 4.0 technologies, highlighting the relevance of adopting these technologies in manufacturing companies to remain competitive.

Moreover, the article by Wolfert et al. (2017) on Big Data in smart agriculture, with 1179 citations, indicates a growing interest in the integration of massive data for the optimization of agricultural production, which is crucial in the context of sustainability and food security. This interest is also observed in the article by Atzori et al. (2010) on IoT, which, with 937 citations, remains a key reference in discussions about the interconnection of devices across different sectors. On the other hand, recent studies such as that of Oztemel and Gursev (2020), which reviews the literature on Industry 4.0 and associated technologies, with 909 citations, and that of Dwivedi et al. (2021), which analyzes the challenges and opportunities of artificial intelligence from multidisciplinary perspectives (859 citations), highlight the interest in exploring new technological frontiers and their impact on efficiency and decision- making. Therefore, the articles highlighted in Table 2 demonstrate a convergence in research on the integration of advanced technologies in industry and agriculture, driving efficiency, sustainability, and digitalization in multiple sectors with the CSCM. This citation trend reflects the relevance of the CSCM variable as a utilization of technological advancement, as well as its transformative potential in practical applications, establishing itself as a central theme for sustainable and competitive industrial development.

Table 2.

Reference of Most Cited Articles

No.	Autors/Journals	Artícles	Total of Quotes
1	Zhong, R.Y., Xu, X., Klotz, E., Newman, S.T (2017) Engineerin	Intelligent Manufacturing in the Context of Industry 4.0: A Review	1318
2	Lee, I., Lee, K. (2015) Business Horizons	The Internet of Things (IoT): Applications, investments, and challenges for enterprises	1289
3	Frank, A.G., Dalenogare, L.S., Ayala, N.F. (2019) International Journal of Production Economic	Industry 4.0 technologies: Implementation patterns in manufacturing companies	1200
4	Wolfert, S., Ge, L., Verdouw, C., Bogaardt, M.J. (2016) Agricultural System	Big Data in Smart Farming - A review	1179

5	Atzori, L., Iera, A., Morabito, G. (2010) Computer Networks	The internet of things: a survey	937
6	Oztemel, E., Gursev, S. (2020) Journal of Intelligent Manufacturing	Literature review of Industry 4.0 and related technologies	909
7	Dwivedi, Y.K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T. (2021) International Journal of Information Management	Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy	859
8	Kusiak, A. (2018) International Journal of Production Research	Smart manufacturing	676
9	Hu, H., Wen, Y.G., Chua, T.S., Li, X.L. (2014) IEEE Access	Toward Scalable Systems for Big Data Analytics: A Technology Tutorial	594
10	Reddy, P., Pham, Q.V., Deepa, N., Dev, K., Reddy, T., Ruby, R., Liyanage, M. (2022) Journal of Industrial Information Integration	Industry 5.0: A survey on enabling technologies and potential applications	488
11	Büyüközkan, G., Göçer, F. (2018) Computers in Industry	Digital Supply Chain: Literature review and a proposed framework for future research	472
12	Wu, D.Z., Rosen, D.W., Wang, L.H., Schaefer, D (2015) Computer Aided Design	Cloud-based design and manufacturing: A new paradigm in digital manufacturing and design innovation	430
13	Tzounis, A., Katsoulas, N., Bartzanas, T., Kittas, C (2017) Biosystems Engineering	Internet of Things in agriculture, recent advances and future challenges	400
14	Sengupta, J., Ruj, S., Das Bit, S (2020) Journal of Network and Computer Applications	A Comprehensive Survey on Attacks, Security Issues and Blockchain Solutions for IoT and IIoT	393
15	Korpela, K., Hallikas, J., Dahlberg, T (2017) Proceedings of the 50th Annual Hawaii International Conference on System Sciences	Digital Supply Chain Transformation toward Blockchain Integration	382
16	Xu, BY., Xu, LD., Cai, HM., Xie, C., Hu, JY., Bu, FL. (2014) IEEE Transactions on Industrial Informatic	Ubiquitous Data Accessing Method in IoT-Based Information System for Emergency Medical Services	361

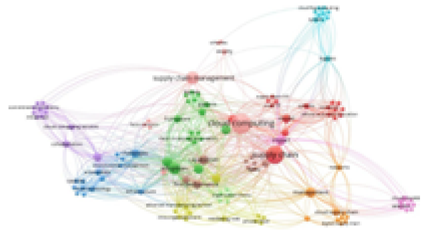
17	Cai, YP., Guan, KY., Peng, J., Wang, SW., Seifert, C., Wardlow, B., Li, Z. (2018) Remote Sensing of Enviroment	A high-performance and in-season classification system of field-level crop types using time-series Landsat data and a machine learning approach	312
18	Kshetri, N. (2017) Telecommunications Policy	Blockchain's roles in strengthening cybersecurity and protecting privacy	292
19	Sharma, R., Kamble, S., Gunasekaran, A., Kumar, V., Kumar, A (2020) Computers & Operations Research	A systematic literature review on machine learning applications for sustainable agriculture supply chain performance	283
20	Ardito, L., Petruzzelli, AM., Panniello, U., Garavelli, AC. (2019) Business Process Management Journal	Towards Industry 4.0 Mapping digital technologies for supply chain management-marketing integration	265
21	Bibby, L., Dehe, B. (2018) Production Planning & Control	Defining and assessing industry 4.0 maturity levels - case of the defence sector	197
22	Kong, Y., Zhang, M., Ye, D. (2017) Knowledge-Bases Systems	A belief propagation-based method for task allocation in open and dynamic cloud environments	187
23	Ooi, KB., Lee, VH., Tan, GWH., Hew, TS., Hew, JJ. (2018) Expert Systems With Application	Cloud computing in manufacturing: The next industrial revolution in Malaysia?	176
24	Wang, CG., Bi, ZM., Xu, LD. (2014) IEEE Transactions on Industrial Informatics	IoT and Cloud Computing in Automation of Assembly Modeling Systems	171
25	Ivanov, D., Dolgui, A., Sokolov, B. (2022) Transportation Research Part E-Logistics and Transportation Review	Cloud supply chain: Integrating Industry 4.0 and digital platforms in the "Supply Chain-as-a-Service"	97

Note: Data obtained from Web of Science

Figure 2 of the keyword network visualizes the interconnection of key concepts used by the authors in their research. VOSviewer is presented as a valuable tool for identifying main themes, trends, and relationships between different concepts in the context of a literature review. Among the main components, Cloud Computing and SCM stand out, with Cloud Computing being the central axis, which suggests that the research focuses on applications of cloud computing, especially in supply chain management. The close link between Supply Chain Management and Cloud Computing indicates that studies focus on how cloud technology transforms supply chain processes and operations. Moreover, the interest in Supply Chain Management reflects a focus on optimizing processes, reducing costs, and improving efficiency through the adoption of cloud technologies. The presence of Big Data suggests that researchers are exploring how the analysis of large volumes of data improves decision-making in the supply chain. Concepts such as “environmental management” and “sustainability” highlight the growing interest in the use of cloud technologies to promote sustainable practices within the supply chain. Similarly, terms like “adoption” and “challenges” reflect an interest in understanding the factors that influence the adoption of cloud technologies, and the challenges associated with their implementation. The connections between these terms indicate conceptual and thematic relationships, such as the strong connection between “cloud computing” and “supply chain management,” which suggests an exploration of how cloud technology can improve efficiency and visibility in supply chain management. In contrast, weaker connections may indicate emerging areas of research or less explored relationships. In summary, this Figure 2 of the keyword network provides an overview of research trends in the application of cloud computing to supply chain management. Researchers explore a wide range of topics, from technology adoption and change management to sustainability and supply chain resilience. The findings of this research have significant implications for companies seeking to improve their competitiveness in an increasingly digitalized business environment.

Figure 2.

Network of Keywords Used by *Authors*



Note: Data obtained from Web of Science

Table 3 focuses on production by country, identifying trends among countries, their distribution, and the possible geopolitical, economic, and technological implications of this data. China tops the list with a significantly higher production (507), followed by the U.S.

(236) and India (224). This indicates that most of the production is concentrated in countries with large economies and industrial capacities. There are significant contributions from Europe such as Germany (126), England (125), Italy (96), France (93), and other European countries like Spain and Poland have a notable representation. There is also the presence of Emerging Economies such as Iran (36), Brazil (34), and Morocco (28), showing that there is a significant presence of production in regions outside the traditionally dominant economies. A production gap is shown; there is a significant difference between China and other countries, reflecting China’s dominant role in global production. Even though the U.S. and several European countries have a considerable production volume, together they do not reach China’s volume. This could be interpreted in terms of differences in production policies, labor, and technology. Thus, there are key factors that influence production such as technological capacity, state policies, natural resources, and labor, with China and India standing out. Table 3 provides a basis for understanding not only the current position of each

country in terms of production but also the factors that contribute to these figures and their possible future implications in the global economic and political context.

Table 3.

Production by Country

Region	Frequence
China	507
EE. UU.	236
India	224
Alemania	126
Inglaterra	125
Italia	96
Francia	93
Australia	78
Taiwán	58
España	50
Malasia	46
Canadá	45
Finlandia	38
Corea del Sur	37
Irán	36
Brasil	34
Arabia Saudita	34
Polonia	33
Grecia	29
Marruecos	28
Portugal	26
Noruega	24
Pavo	24
Países Bajos	23
Emiratos Árabes	23

Note: Data obtained from Web of Science

Table 4 details the distribution of the institutional affiliations of the authors whose articles were analyzed in the bibliometric study of the GCSN. This table presents information about the institutions and the corresponding percentage of articles published by each one. The results indicate that the South China University of Technology leads the production with 33 articles (1.916% of the total), followed by the Hong Kong Polytechnic University (29 articles, 1.684%) and the Indian Institute of Technology System (24 articles, 1.394%). The predominance of Chinese institutions, such as the Chinese Academy of Sciences and Beihang University, as well as other Asian and European ones, including the Centre National de la Recherche Scientifique (CNRS) and the IMT Institute Mines Telecom, stands out. The geographical diversity of the represented institutions suggests extensive international collaboration in the field. This collaboration, along with the availability of resources, the quality of research programs, and specialization in high-tech and applied sciences, could explain the high productivity of these institutions. In conclusion, Table 4 reveals a notable presence of Asian institutions in scientific production, with a particular focus on high-tech areas. International collaboration and the quality of research programs seem to be determining factors in this high productivity.

Table 4.

Affiliations of the Articles

Affiliations

South China University of Technology	33	1.916%
Hong Kong Polytechnic University	29	1.684%
Indian Institute of Technology System IIT System	24	1.394%
Chinese Academy of Sciences	23	1.336%
Centre National de la Recherche Scientifique CNRS	19	1.103%
National Institute Of Technology NIT System	19	1.103%
Beihang University	17	0.987%
Shanghai Maritime University	17	0.987%
IMT Institute Mines Telecom	16	0.929%
Shanghai Jiao Tong University	16	0.929%
University of Hong Kong	15	0.871%
Indian Institute of Management IIM System	14	0.813%
University of Texas System	14	0.813%
Beijing University of Posts Telecommunications	13	0.755%
National Institute of Industrial Engineering Nitie	13	0.755%
Vellore Institute of Technology VIT	13	0.755%
State University System of Florida	12	0.697%
Universidad Politecnica de Valencia	12	0.697%
University of Auckland	12	0.697%
University of Technology Sydney	12	0.697%
Old Dominion University	11	0.639%
Sharif University of Technology	11	0.639%
Beijing Institute of Technology	10	0.581%
Berlin School of Economics Law	10	0.581%
Chongquing University	10	0.581%

Note: Data obtained from Web of Science

In general, it is no clear how SC can address problems of cybersecurity from WoS scientific production. In the non-specialized media, nor indexed nor peer-viewed, however, there are more concerns on problems related to the fact that CSCM is centralized model and all its information hangs outside the enterprise.

An example is the document “Supply Chain Attacks in the Cloud: Understanding the Risks and Defenses” anonymously written by a certain “IPSpecialist” (2025), which sees the possibility of an attacker to Identify Dependencies (a high dependent actor on technology is more vulnerable to be seriously attacked), to Compromise the Supplier (even if the very supplier is not involved, it can also be infiltrated), to Inject Malicious Code or Tools (even if the supplier is not interested in destroy de client, it can be a bridge to attack the enterprise), and to Expand and Escalate (once the system is polluted, the activity of the attack can be silent and progressive). The publication also points to the fact that SC is a complex system, with an enormous quantity of interconnections to different sources from all over the world, which makes harder to detect an attack. However, the analyzed papers and, even, the no peer-viewed one, are optimistic on the actual and future possibilities of CSCM.

Further, in WoS, it was not possible to find enough empirical data on cybersecurity of CSCM. The issue is not semantically central.

Much more, as seen in Figure 2, a semantic recurrent aspect on bibliometrics points to the importance of "The Commitment-Trust Theory of Relationship Marketing", which presupposes the need of an optimistic approach to start a business, in order to have success.

CONCLUSIONS

The evolution of SC is marked by globalization and the adoption of cloud computing, which is presented as offering new opportunities and challenges for information management and coordination. (Dwivedi et al., 2021). The implementation of quality systems and customer orientation are fundamental for success in this environment, an SC is, in this sense, an opportunity.

Nevertheless, there is still a need to develop better models and contracts to ensure optimal coordination and efficiency (Kusiak, 2018). It implies to stablish steady empirical data on a) its internal functioning, because it can become a black box where critical information can be lost or corrupted, b) to better understand its technical proceedings, it is also necessary to have an extensive empirical data of its success, limitations and possibilities, and c) to give important guarantees to the client against cyberattacks, or its misuse by the same provider company.

In global times, strategic relationships emerge as a critical component, transforming traditional interaction into deep collaboration, sharing risks and benefits, and enhancing competitiveness (Hu et al., 2014; Oztemel & Gursev, 2020). The advantages in terms of efficiency offer significant opportunities to improve traditional supply chain management. The CSCM also presents opportunities to promote sustainable development practices in the supply chain, because the ability to monitor and optimize resource use can contribute to a reduction in the environmental footprint and the achievement of the Sustainable Development Goals (SDGs).

But, in the other hand, larger amounts of information make difficult to understand empirical data, and the transparency of the real-time information exchange. Cloud technology, is not an exception: they can be a key to anticipating changes in demand and improving supply chain agility, centralizing all the procedures (Apolinario & Guevara, 2021). But it also can be critical and facing to risks, because the more the enterprise depends on one source of technology, the more it depends on the postmodern complexity and unpredictable events (Castro Aniyar, 2014).

The scientific production on CSCM shows sustained growth, with a notable increase in the number of publications starting from 2013. This growth reflects the increasing interest in the application of cloud technologies to improve supply chain management. The topics of research in CSCM are diverse, ranging from operational efficiency and sustainability to risk management and technological adoption. This diversification indicates a field of study in constant evolution, with multiple areas of interest and application, suggesting that GCSN will continue to be an active area of research and development in the future. More this topic increases, more it is important to address the main challenges of the CSCM on ensuring data privacy and security. The integration of technologies like blockchain can help mitigate these risks by providing a secure and transparent record of transactions, but the implementation of the CSCM can be complex due to the need to integrate multiple systems and technologies**.**

Future researches

To advance the knowledge and application of CSCM, it is crucial to research and develop new coordination models and contracts. These models must ensure greater efficiency and collaboration among the different actors in the supply chain. But this implies to have more empirical data on its functioning, a more clear description of its technical proceedings, and to guarantee, if possible, the defense of the client in front of son complex, big, and powerful system where the chain supplies, a core aspect of any productive enterprise, should make all its bets.

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