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Blockchain in the operations and supply chain management: Benefits, challenges and future research opportunities

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ABSTRACT

Blockchain technologies have captured the imagination of scholars, managers, and practitioners around the world. It is widely accepted by these actors that blockchain is not a buzzword, but a highly disruptive technology that is already remodeling the organizations and their supply chain business models. Despite the meaningful advance in the last years, blockchain applications regarding the operations and supply chain management (OSCM) are still in their infancy. Little is known about the role of blockchain in terms of operations traceability, as well in areas such as e-commerce, agriculture, public services, etc. Therefore, this Special Issue seeks to extend our understanding of blockchain applications in OSCM and how firms create and capture business value with blockchain. To this effect, this Special Issue will provide a well-articulated and in-depth discussion of the role of blockchain in creating value in the domain of OSCM. Specifically, it is expected that more light is shed on how blockchain integrates with and impacts new business models, transforms relationships, and improves performance and competitive advantage in OSCM. Also, the evolution of blockchain was reviewed in order to provide a strong background to the readers. The literature review was performed taking into account a bibliometric perspective of blockchain-related publications. The review supports the importance of this Special Issue by highlighting the urgent needs of this topic in this reputable journal. Finally, we provide future research directions and a guide for the papers presented in this Special Issue.

1. Introduction to the special issue

In the digital age, virtually all business models have been undergoing unprecedented disruptions thanks to unending breakthroughs in cutting-edge information and communication technologies (ICTs) (Ismagilova, Hughes, Dwivedi, & Raman, 2019). A prominent and highly disruptive technology is the blockchain, which is already contributing to remodeling traditional business models and creating new opportunities across the entire supply chain. As a rule, blockchain refers "to a fully distributed system for cryptographically capturing and storing a consistent, immutable, linear event log of transactions between networked actors" (Risius & Spohrer, 2017). Blockchain emerged as a technology to perform transactions in the cryptocurrency market (Nakamoto, 2008; Oh & Shong, 2017; Prybila, Schulte, Hochreiner, & Weber, 2017). Also, blockchain applications have reached an authoritative level in the financial sector, but it is only recently that they have spanned other areas, such as the OSCM field. Blockchain is considered as both a critical challenge and opportunity paradigm. For instance, blockchain can trigger significant improvements in transparency, accountability, and trust, security, efficiency and costs minimization (Kshetri, 2018).

Additionally, blockchain is viewed as a solution for supply chain management (SCM) traceability problems (Lu & Xu, 2017) and for generating closer and trustworthy relationships (Aste, Tasca, & Di Matteo, 2017; Wang, Luo, & Lee, 2019) not only between organizations and their suppliers, but also through the entire SCM. On the one hand, a blockchain-enabled smart contract (a script that can trigger a transaction) has the potential of bringing high levels of efficiency with a decentralized operation to SCM. On the other hand, blockchain can be combined with other cutting-edge technologies (e.g., big data analytics, the internet of things, cyber-physical systems, among others) to bring about disruptive impacts in all specialized fields.

Despite the numerous potential benefits of blockchain, blockchain-related concepts (e.g., enablers, adoption, implementation, etc.) are still to be well mastered by a good number of managers. The challenges about how they can ensure that blockchain adds value to their organizations and the SCM, remain unanswered. From the OSCM perspective, blockchain is still in its infancy, and all its potential remains unclear. For example, a recent review on bitcoin, blockchain and fintech in the SCM (Fosso Wamba, Kamdjoug, Robert, Bawack, & Keogh, 2018) identified few empirical studies using the survey method approach for investigating these subjects. Moreover, this adds to the scarcity of studies reporting blockchain applications employing empirical approaches, including surveys (Ying, Jia, & Du, 2018).

Thus, the focus of this Special Issue provides a well-articulated and in-depth discussion for OSCM scholars and practitioners in the investigation of the role of blockchain in creating value for OSCM. Specifically, this Special Section seeks to shed more light on and gain an in-depth understanding of how blockchain integrates with and impacts new business models, transforms relationships, and improves performance and competitive advantage in OSCM. Subsequently, we look forward to unveiling substantial practical and theoretical implications concerning blockchain in the OSCM context.

The remainder of this editorial is structured as follows. First, we rely

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on a bibliometric approach to present the current status of research on blockchain. This option enable us to highlight the most relevant sources in blockchain research, and to delineate their growth. So, the top 20 affiliations are being established by the number of publications, followed by the top 20 countries based on the number of publications and cited references. The various levels and types of collaboration between countries are also indicated. Then, a document-level analysis is conducted, and includes the top 20 globally cited publications, the most locally cited references, and a tree map of keywords provided by the different authors. The next point is about a knowledge structure, which is determined by highlighting the main themes and trends in blockchain research. Through a network approach in terms of collaborations, we then established a related intellectual and social structure. Ultimately, future research directions on blockchain and its interplay with OSCM are formulated, together with the papers selected for this Special Issue.

2. What is the current status of research on blockchain?

2.1. Source-level analysis

To analyze academic research papers on blockchain, we downloaded all the bibliometric data on blockchain found in the Web of Science (WoS) Core Collection database on October 17, 2019. We used "blockchain" as the key phrase, knowing that all papers with this phrase in their title, keywords or abstracts would be detected, thereby ensuring completeness in our document collection. WoS is widely recognized as the most reliable academic database, as it contains the most recognized, high-profile and high-quality international academic publications (Batistič & van der Laken, 2019; Zhang, Huang, Porter, Zhang, & Lu, 2019). We retrieved 3507 documents and made a number of observations: (i) publications on blockchain began in 2013 and were on the rise until 2018; (ii) the number of publications decreased drastically in 2019, leading to an annual growth rate of -9.43 %; (iii) as the year 2019 is not over yet, the trends show that this annual growth rate may change. Table 1 presents the top 20 blockchain publication sources in the above-mentioned dataset, while Fig. 1 shows the evolution in the number of publications by year. Most of the leading publication outlets are conferences or open access journals. Once more, we can observe a decrease in the number of publications.

2.2. Author-level analysis

Table 2 shows the top 20 relevant affiliations by the number of publications. The first striking observation is that leading universities and research institutions worldwide like Stanford University, MIT and Oxford University are not among the leaders in this research domain. Also, we notice that IBM Research is among the leading publishers on blockchain in academic outlets.

Table 3 presents the top 20 countries based on the number of publications. Like in most cases, China and the USA are the world leaders in academic publications in most research fields. The next top country is the UK, which has published only about half as many documents as the USA. However, we can observe that the USA has more citations than China. This is an interesting result because it raises issues related to the quality, applicability, relevance and visibility of publications from China.

Nevertheless, we can observe an almost equal involvement of the North American, Asian and European continents in blockchain research publications. The distribution of blockchain publications worldwide shows that all world regions are publishing academic research on blockchain, although there are a few countries not publishing yet, especially on the African continent. In any case, the top 5 most cited countries remain the USA, China, the UK, Germany, and South Korea.

Another interesting fact is the collaboration between these countries. Fig. 2 shows the international collaboration intensity per country for the top 20 countries. We observed that most countries are collaborating with other countries to publish research on blockchain. Also, there are more single-country publications (SCPs) than multiple-country publications (MCPs), thus indicating that collaborations in blockchain research are mostly between institutions of the same country.

2.3. Document-level analysis

In Table 4, we present the 20 most globally cited publications and unveils the most influential publications in blockchain research. We can observe from the topics that blockchain researchers mostly cited works on smart contracts, privacy, security, and the blockchain architecture.

When we went further to analyze the most locally cited references in our dataset's reference list, as shown in Table 5, we identified the historical origins of blockchain research domains and topics in terms of contributions with a strong impact in the field. Evidently, the most impactful reference is that of Bitcoin as an electronic cash system (Nakamoto, 2008). This is the study that initiated contemporary research on blockchain. However, reflections on how to minimize risks of catastrophic failures or vulnerabilities in computer systems that led to the development of blockchains started with the "Byzantine Generals Problem" (Lamport, Shostak, & Pease, 1982).

To further understand the blockchain research field, we analyzed the keywords found in our dataset (Figs. 3 and 4). We considered the

Table 1
The most relevant sources in blockchain research.

Sources	Articles	Sources	Articles
IEEE Access	182	Data Privacy Management Cryptocurrencies and Blockchain Technology	17
IEEE 2018 International Congress on Cybermatics / 2018 IEEE Conferences on Internet of Things Green Computing and Communications Cyber Physical and Social Computing Smart Data Blockchain Computer and Information Technology	97	Future Internet	17
IEEE Internet Of Things Journal	34	Journal of Medical Systems	17
Sensors	34	Energies	16
Proceedings Of 2018 1 st IEEE International Conference on Hot Information-Centric Networking (Hoticn 2018)	26	International Journal of Advanced Computer Science and Applications	16
IEEE Transactions on Industrial Informatics	23	2018 9th IFIP International Conference on New Technologies Mobility and Security (NTMS)	14
Future Generation Computer Systems-The International Journal of E-science	22	2018 Crypto Valley Conference on Blockchain Technology (CVCBT)	14
Sustainability	22	2018 IEEE 24th International Conference on Parallel and Distributed Systems (ICPADS 2018)	14
IT Professional	20	ERCIM News	14
Applied Sciences-Basel	19	2018 18th IEEE International Conference on Data Mining Workshops (ICDMW)	13

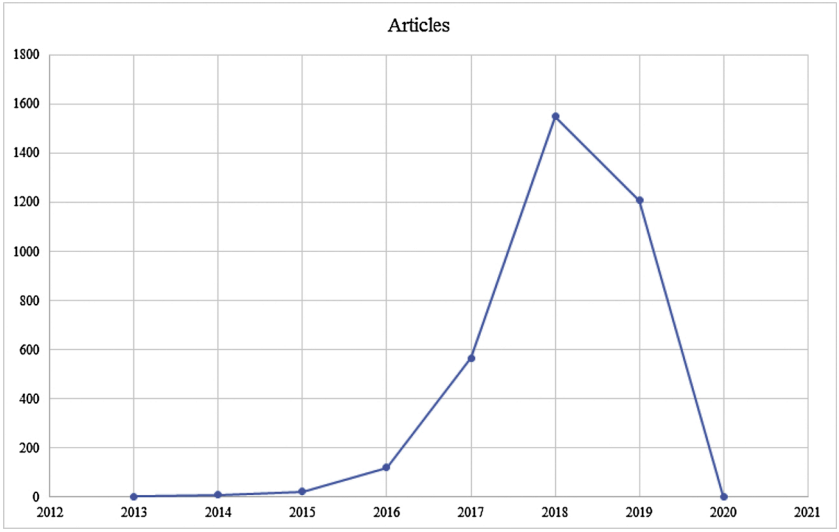

Fig. 1. Years of publication of the retrieved papers.

author's keywords and keywords plus (keywords obtained from the titles of references in our collection that were not necessarily provided by the authors). Both types of keywords provided us with a better understanding of the depth and breadth of the blockchain research field. We found that blockchain research had so far mostly focused on bitcoin, smart contracts, security, the internet of things (IoT), and blockchain technology. Keywords Plus revealed that these research studies are generally conducted in the context of management, security, technology, bitcoin, and IoT.

3. Conceptual structure

This section presents the main themes and trends in blockchain research.

3.1. Factorial analysis

Two main clusters characterize the conceptual structure of blockchain research, as shown in Fig. 5. The red cluster represents research on blockchain technologies, techniques and applications while the blue cluster represents emerging computing technologies applied to the blockchain.

3.2. Thematic evolution

Fig. 6 presents the thematic evolution of blockchain research. Based on the publication distribution, we analyzed the evolution of blockchain research themes in two intervals: 2013–2018, and 2019 onwards. Our first observation is that studies in information security are diverging into bitcoin. Secondly, research on bitcoin is diverging into blockchain technology, distributed ledger technology, and the internet of things (IoT). Thirdly, smart grid technology is diverging into blockchain technology. Fourthly, decentralization is diverging into the blockchain; and lastly, cloud computing is diverging into IoT topics.

Following co-citation analysis, the results revealed three main clusters that show the three categories of blockchain research that intellectually characterize this research field. Cluster 1 represents research that focuses on bitcoin. Cluster 2 reveals research that focuses on blockchain and smart contracts with their applications. Finally, Cluster 3 represents research on issues (challenges, vulnerabilities, limitations) related to the bitcoin and blockchain protocols. In addition, we used collaboration networks to show how institutions and countries relate and interact with each other in blockchain research. We identified three main clusters in blockchain research. All clusters had a very diverse set of institutions in terms of country. However, each of the two most prominent clusters of countries collaborating in blockchain research

Table 3
Top 20 countries in blockchain research based on the number of publications.

Region	Frequency	Region	Frequency
China	1586	France	196
USA	1146	Japan	167
UK	439	Spain	150
South Korea	270	Singapore	111
Australia	265	Switzerland	107
Germany	241	Netherlands	97
Russia	226	Taiwan	93
India	221	Austria	67
Italy	216	Brazil	64
Canada	198	Pakistan	61

Table 2
Top 20 affiliations by the number of publications.

Affiliations	Articles	Affiliations	Articles
Beijing University of Posts and Telecommunications	72	The University of Texas, San Antonio (USA)	29
University of Electronic Science and Technology of China (UESTC)	49	Guangdong University of Technology, China	28
Beihang University, China	45	The University of Sydney, Australia	28
Nanyang Technological University	42	Peking University, China	26
Tsinghua University	38	IBM Research	25
Not reported	37	Purdue University	25
Università degli Studi di Cagliari, Italy	36	National University of Singapore	24
Xidian University	36	University of Technology Sydney, Australia	24
Shanghai Jiao Tong University, China	31	National University of Defense Technology	23
Sun Yat-sen University	29	The University of British Columbia	22

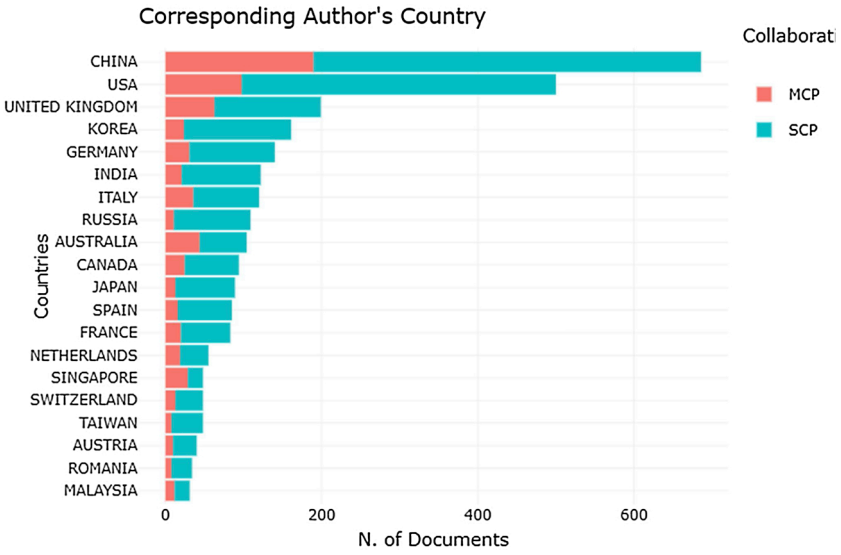

Fig. 2. International collaboration intensity in blockchain research.

had only two countries. Cluster 1 consisted mostly of North American and Asian countries while Cluster 2 consisted of European countries.

4. Future research directions

Blockchain technologies have been capturing the imagination and bringing challenges and opportunities for both academics and practitioners. Even though blockchain has advanced considerably in recent years, as identified in our literature review, there is a big gap regarding mainly empirical studies (Fosso Wamba et al., 2018; Frizzo-Barker et al., 2019). The review of blockchain showed an interesting increase in the number of published papers, mainly in 2018 and 2019. Besides, the most relevant sources identified in blockchain research were dominated by the IEEE (journals and conferences). Thus, it reinforces the paucity of blockchain studies from the perspective of information management. Moreover, the blockchain technologies have demonstrated strong adherence in the context of operations and supply chain management (Kshetri, 2018; Queiroz & Fosso Wamba, 2019; Ying et al.,

Table 4
Top 20 most globally cited publications in blockchain research.

Paper	Source	Topic / Short Title	Total Citations
CHRISTIDIS K, 2016	IEEE Access	Blockchains and smart contracts for the internet of things	397
ZYSKIND G, 2015	IEEE Security and Privacy Workshops (SPW)	Decentralizing privacy: Using blockchain to protect personal data	261
KOSBA A, 2016	IEEE Symposium on Security and Privacy (SP)	Hawk: The blockchain model of cryptography and privacy-preserving smart contracts	192
TSCHORSCH F, 2016	IEEE Communications Surveys & Tutorials	Bitcoin and beyond: A technical survey on decentralized digital currencies	175
AZARIA A, 2016	Proceedings 2016 2nd International Conference on Open and Big Data - OBD 2016	Medrec: Using blockchain for medical data access and permission management	142
ZHENG Z, 2017	IEEE 6th International Congress on Big Data (Bigdata Congress 2017)	An overview of blockchain technology: Architecture, consensus, and future trends	139
EYAL I, 2014	Financial Cryptography and Data Security, Fc 2014	Majority Is Not Enough: Bitcoin Mining Is Vulnerable	139
YLI-HUUMO J, 2016	Plos One	Where is current research on blockchain technology? — a systematic review	135
YUE X, 2016	Journal of Medical Systems	Healthcare data gateways: found healthcare intelligence on blockchain with novel privacy risk control	121
MENGELKAMP E, 2018	Applied Energy	Designing microgrid energy markets: A case study: The Brooklyn Microgrid	114
AITZHAN NZ, 2018	IEEE Transactions on Dependable and Secure Computing	2018 Index IEEE Transactions on Dependable and Secure Computing Vol. 15	106
UNDERWOOD S, 2016	Communications of the ACM	Blockchain beyond bitcoin	105
LUU L, 2016	Ccs'16: Proceedings of the 2016 ACM SIGSAC Conference on Computer and Communications Security-A	Smart contracts and blockchain	104
EYAL I, 2016	13th Usenix Symposium on Networked Systems Design and Implementation (Nsdi `16)	Bitcoin-NG: A scalable blockchain protocol	103
KHAN MA, 2018	Future Generation Computer Systems	IoT security: Review, blockchain solutions, and open challenges	102
KANG J, 2017	IEEE Transactions on Industrial Informatics	Enabling localized peer-to-peer electricity trading among plug-in hybrid electric vehicles using consortium blockchains	102
LANSITI M, 2017	Harvard Business Review	The truth about blockchain	102
XU LD, 2018	International Journal of Production Research	Industry 4.0: state of the art and future trends	88
SIKORSKI JJ, 2017	Applied Energy	Blockchain technology in the chemical industry: Machine-to-machine electricity market	87
HUH S, 2017, 2017	19th International Conference on Advanced Communications Technology (ICACT) - Opening New Era of Smart Society	Managing IoT devices using blockchain platform	84

Table 5
Most locally cited references.

Cited References	Source	Title / Short Title	Citations
NAKAMOTO S., 2008	N/A	Bitcoin: A peer-to-peer electronic cash system	1073
CHRISTIDIS K, 2016	IEEE Access	Blockchains and smart contracts for the internet of things	338
SWAN M, 2015.	Book	Blockchain: Blueprint for a new economy	325
ZYSKIND G, 2015	IEEE Security and Privacy Workshops (SPW)	Decentralizing privacy: Using blockchain to protect personal data	212
KOSBA A, 2016	IEEE Symposium on Security and Privacy (SP)	Hawk: The blockchain model of cryptography and privacy-preserving smart contracts	153
TSCHORSCH F, 2016	IEEE Communications Surveys & Tutorials	Bitcoin and beyond: A technical survey on decentralized digital currencies	140
LAMPORT L, 1982	ACM transactions on programming languages and systems	The Byzantine generals problem	135
AZARIA A, 2016	Proceedings 2016 2nd International Conference on Open and Big Data - OBD 2016	MEDREC: Using blockchain for medical data access and permission management	132
CASTRO M, 1999	USENIX Association Proceedings of The Third Symposium on Operating Systems Design and Implementation (OSDI `99), P173.	Practical Byzantine Fault Tolerance	132
WOOD G., 2014	N/A	Ethereum: A Secure Decentralised Generalised Transaction Ledger	129
TAPSCOTT DON, 2016	Book	Blockchain revolution: how the technology behind bitcoin is changing money, business, and the world.	128
ZHENG ZB, 2017	IEEE International Congress on Big Data	An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends	123
YLI-HUUMO J, 2016	PLOS One	Where Is Current Research on Blockchain Technology? — A Systematic Review	112
YUE X, 2016	Journal of Medical Systems	Healthcare data gateways: found healthcare intelligence on blockchain with novel privacy risk control	108
EYAL I, 2014	Lecture Notes in Computer Science, V8437, P436	Majority Is Not Enough: Bitcoin Mining Is Vulnerable	101
DORRI ALI, 2017	2017 IEEE International Conference on Pervasive Computing and Communications Workshops (PERCOM Workshops), P618	Blockchain for IoT security and privacy: The case study of a smart home	100
ANTONOPOULOS A. M., 2014	Book	Mastering Bitcoin: unlocking digital cryptocurrencies	97

2018). Nevertheless, studies contemplating the interplay of blockchain and supply chain remain at their embryonic stages (Queiroz, Telles, & Bonilla, 2019). Against this backdrop, the "*International Journal of Information Management*" has been endeavoring to publish more high-quality papers about blockchain. Such an effort, coupled with our current analysis of the blockchain literature, is expected to usher in greater motivation for those willing to publish in this Special Issue.

Though the literature on blockchain is still at its infancy (Janssen, Weerakkody, Ismagilova, Sivarajah, & Irani, 2020), it represents a robust foundation for studies in the area of information management (Hughes et al., 2019) while the interplay between blockchain and other cutting-edge technologies (2017a, Duan, Edwards, & Dwivedi, 2019; Dwivedi et al., 2019; Kshetri, 2017b) could offer a high potential for tackling OSCM problems. Our search found that the top five most-cited countries are led by the USA and China, which top the list, followed by two European nations, namely the UK and Germany, and completed by South Korea. In a context where these nations represent a high level of industrialization, it is therefore important that both the academia and industry sectors develop strategic projects involving cutting-edge technologies in developing countries. Hence, such an outlook should offer extensive opportunities for future research on blockchain in their OSCM.

Blockchain applications in OSCM tend to work together with other cutting-edge technologies. For instance, blockchain can be well combined with artificial intelligence (Dwivedi et al., 2019), IoT (Kshetri, 2018), and big data (Chae, 2019), among others. As reported previously, mainly in the treemap of keywords and in the Dendrogram, there is an evident lack of studies on blockchain in the OSCM field. This may also explain the importance of this Special Issue. In addition, considering the thematic map, the thematic evolution of blockchain research and the main blockchain research themes and trends, insightful suggestions about hot topics in blockchain research have emerged. For instance, there have been successful experiences regarding the integration of blockchain with artificial intelligence

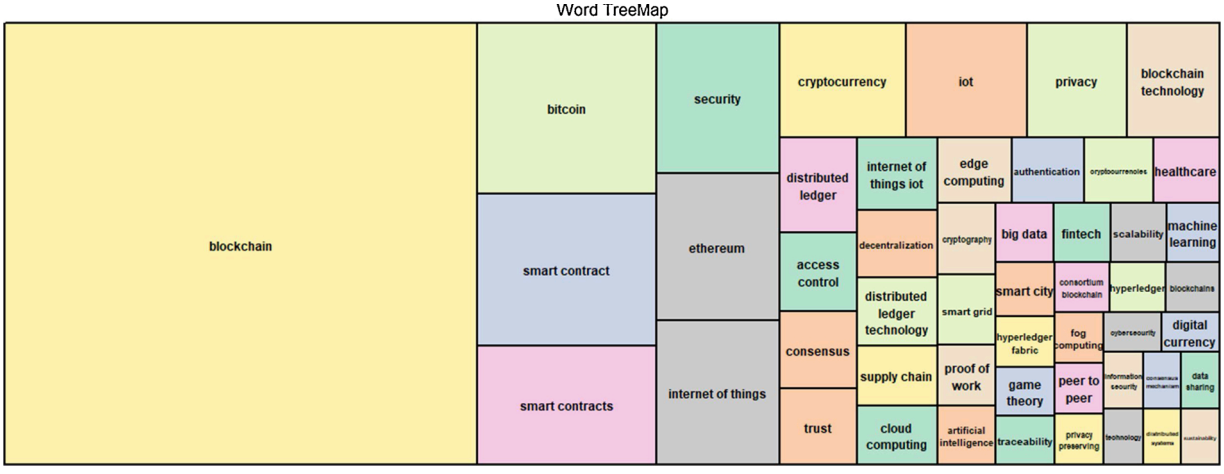

Fig. 3. Treemap of author-provided keywords.

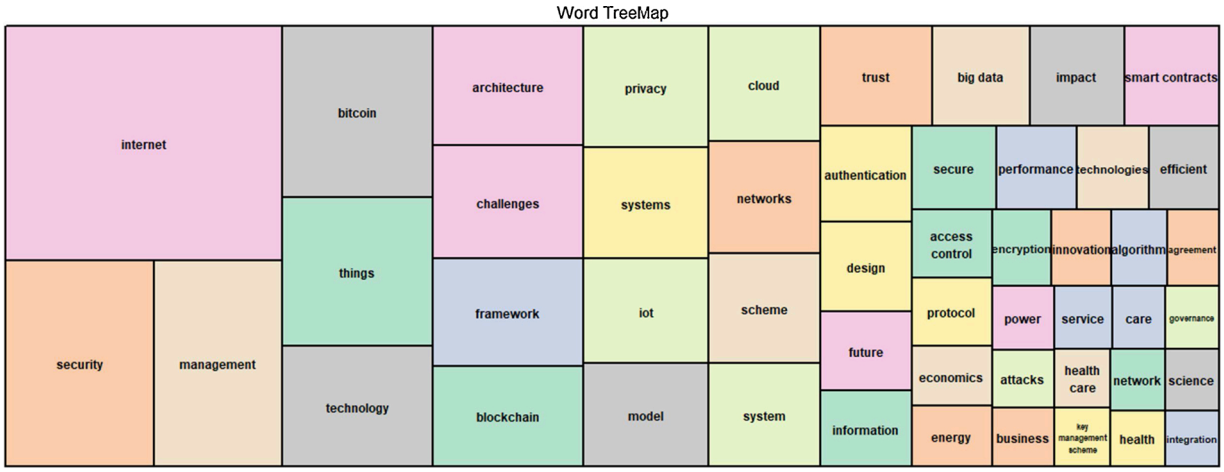

Fig. 4. Treemap of keywords plus.

techniques for product traceability improvement in supply chains (Chen, 2018), with IoT (Reyna, Martín, Chen, Soler, & Díaz, 2018) in order to increase trust among supply chain partners, and with bitcoin to support sharing economy business models, among others. Finally, we consider the results of our bibliometric analysis and the papers selected for this Special Issue to make the following suggestions in terms of research directions:

- The interplay between blockchain and artificial intelligence in OSCM and how this interaction could contribute to creating value.
- How can blockchain leverage the traceability of food supply chains in a global perspective?
- How can blockchain effectively contribute to enhancing the relationships between social variables (e.g., trust, power, knowledge sharing, cooperation) and supply chain members?
- Is blockchain a tamper-proof system to e-commerce, procurement, etc?
- What is the role of blockchain in health care systems?
- What is the impact of blockchain in the environment? How can it affect an organization's business operation models?
- Is blockchain a sustainable technology to help organizations create value? What is the role of the blockchain continuance intention?
- What are the real cost savings that blockchain technologies enable in supply chain transactions by minimizing the intervention of intermediaries?

On the other hand, there is a need to underscore the importance of developing more empirical studies on blockchain in OSCM as well as on its integration with other cutting-edge technologies. Moreover, although the blockchain technologies being applied in representative emerging economies (e.g., India, China, Malaysia), such countries, like their counterparts form the developing world, are expected to put in more effort to understand the various blockchain adoption stages.

5. Papers in this special issue

The focus of this Special Issue was to invite OSCM scholars and practitioners to ponder on how blockchain integrates with and impacts new business models, transforms relationships, and improves performance and competitive advantage in OSCM. By so doing, this Special Issue contributes to shedding more light on the dynamics of blockchain in OSCM while unlocking opportunities regarding blockchain integration in OSCM-related fields. All papers accepted for this Special Issue are in line with the objectives indicated earlier. A total of twelve

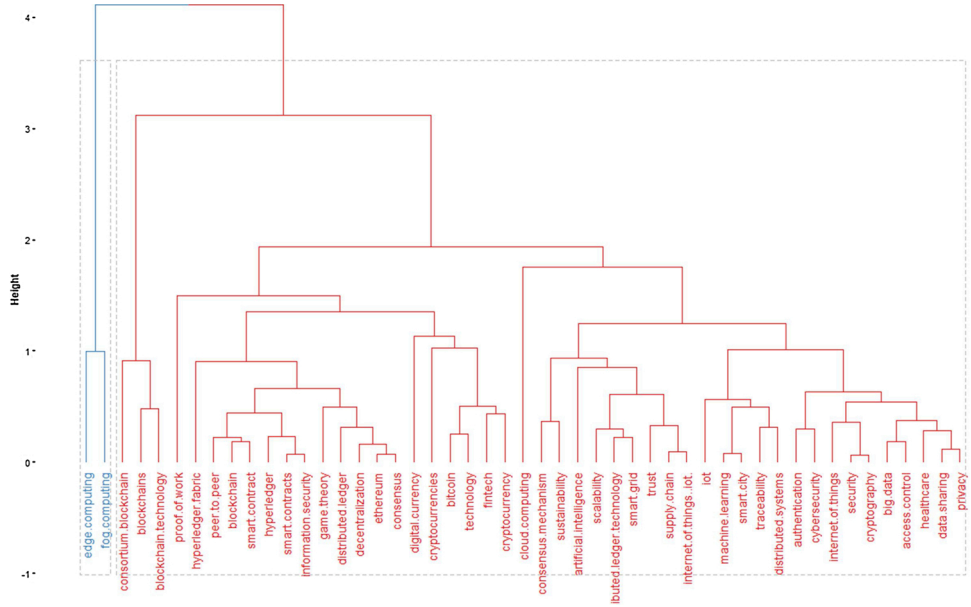

Fig. 5. The conceptual structure of blockchain research – Dendrogram.

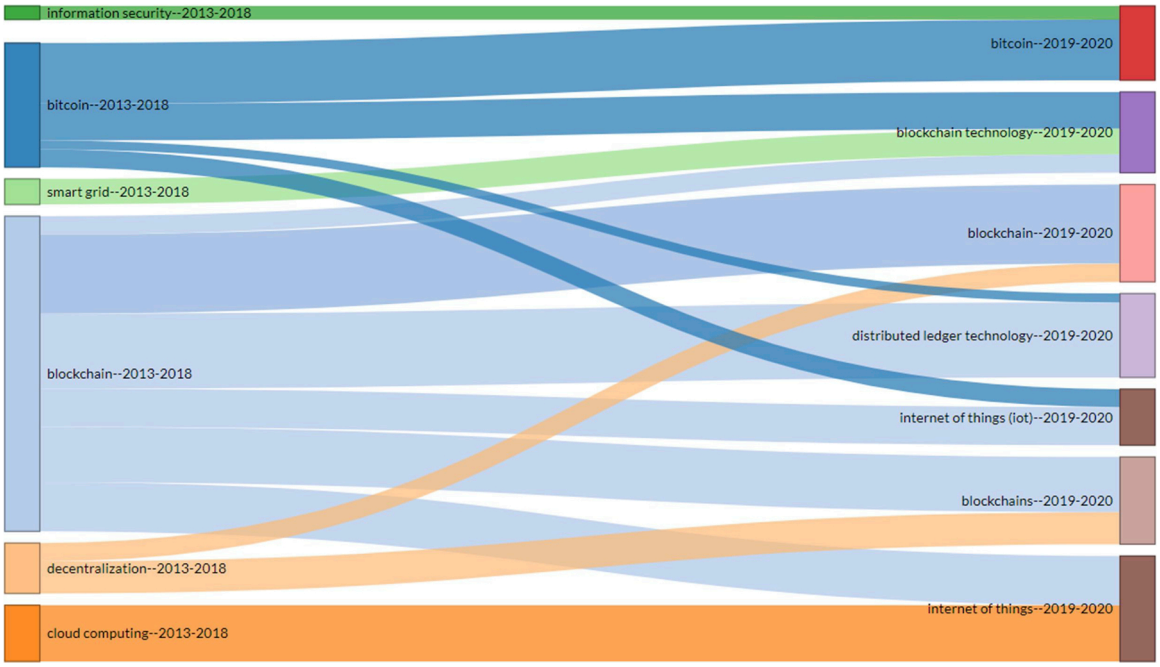

Fig. 6. Thematic evolution of blockchain research.

distinguished research articles have been selected.

The first paper, entitled "A blockchain-based framework of cross-border e-commerce supply chain", by Liu and Li, presents an exciting blockchain framework focused on product transactions and traceability in e-commerce. The paper proposes new approach methods and algorithms which can improve security, and traceability in e-commerce's supply chains, and therefore contribute to minimizing counterfeit attacks (Liu & Li, 2019).

The second paper titled "An intelligent blockchain-based system for safe vaccine supply and supervision", by Yong, Shen, Liu, Li, Chen and Zhou, demonstrates a blockchain application for a safe vaccine in Chinese supply chains. Their research develops a blockchain system integrated with machine learning and smart contracts for vaccine supervision. The proposed blockchain system can enhance the traceability of vaccines, prevent frauds, provide a more effective demand forecasting and, consequently, minimize the expiration of vaccines (Yong et al., 2019).

In the third paper, "Blockchain technology in supply chain management for sustainable performance: Evidence from the airport industry", by Di Vaio and Varriale, the authors explore the blockchain interplay with supply chain and sustainable performance. They describe the case of a collaborative blockchain platform in an Italian airport. Besides, the paper reports the main benefits produced by the blockchain platform and its convergence to sustainable performance (Di Vaio & Varriale, 2019).

In the fourth paper, "Perception-based model for analyzing the impact of enterprise blockchain adoption on SCM in the Indian service industry", by Karamchandani, S. Srivastava and R. Srivastava, the authors address the issue of enterprise blockchain adoption by relying on a research model derived from the well-known technology acceptance model (TAM) and the innovation diffusion theory (IDT). The paper identifies six supply chain management dimensions, namely "the customer relationship, information quality, service quality, supply uncertainty, mass customization, and delivery reliability" related to blockchain perceived benefits in supply chains (Karamchandani, Srivastava, & Srivastava, 2019).

In the fifth paper, "A blockchain use case in food distribution: Do you know where your food has been?", by Bumblauskas, Mann, Dugan and Rittmer, the authors provide insights into a use case for blockchain food traceability in the U.S. context. The paper demonstrates a proof-of-concept approach, the needs and benefits for building food supply chains that are more transparent, reliable, efficient and cost-effective. Thus, increased transparency and the use of traceability mechanisms can enhance the relationships between supply chain partners (Bumblauskas, Mann, Dugan, & Rittmer, 2019).

In the sixth paper is entitled "Time to seize the digital evolution: Adoption of blockchain in operations and supply chain management among Malaysian SMEs", by Wong, Leong, Hew, Tan, and Ooi. The paper evaluates the adoption of blockchain by small and medium enterprises (SMEs) in a Malaysian context, for their operations and the management of their supply chains. The study proposes a research model based on the technology, organization and environment Framework (TOE), and points out exciting findings regarding the significant influence that competitive pressure, complexity, cost and relative advantage exert on the intention to adopt blockchain (Wong, Leong, Hew, Tan, & Ooi, 2019).

The seventh paper, "Boundary conditions for traceability in food supply chains using blockchain technology", by Behnke and Janssen, clearly sets the boundary conditions for which blockchain technologies in food supply chains can lead to increased traceability. In the first place, the authors report four interview-based cases involving food supply chains, then provide an analysis that takes into account five elements, namely business, supply chain process, regulation, quality assurance, and traceability. Finally, they identify eighteen boundary conditions distributed in these five elements (Behnke & Janssen, 2019).

In the eighth paper, "Blockchain technology and enterprise operational capabilities: An empirical test", by Xiongfeng Pan, Xianyou Pan, Song, Ai and Ming, the authors present the interplay of blockchain technology with enterprise operational capabilities. The paper identifies fifty blockchain technology-listed enterprises in the Chinese context, then they argue that the enterprise's total asset is one of the most prominent variables concerning the implementation of blockchain (Pan, Pan, Song, Ai, & Ming, 2019).

The ninth paper, "Land records on Blockchain for implementation of Land Titling in India", by Thakur, Doja, Dwivedi, Ahmad and Khadanga, reports the land records management problems in India and how blockchain technologies can solve them. The authors provide a well-articulated description of blockchain in land records process, as

well as the main challenges (Thakur, Doja, Dwivedi, Ahmad, & Khadanga, 2019).

In the tenth paper, "Blockchain, adoption, and financial inclusion in India: Research opportunities", by Schuetz and Venkatesh, the authors present a resourceful work about the connection of blockchain technologies and their potential to facilitate financial inclusion in rural Indian areas. The authors suggest that global supply chain challenges like high costs, geographical access, financial literacy and inappropriate banking products could be met by blockchain adoption. To crown it all, the study highlights the antecedents of blockchain adoption (Schuetz & Venkatesh, 2019).

The eleventh paper, "Analysing the impact of blockchain-technology for operations and supply chain management: An explanatory model drawn from multiple case studies", by Tönnissen and Teuteberg, strove to develop an exploratory model supported by a multiple case analysis approach. The proposed model provides essential insights into the dynamics of the relationship between the various actors as a result of the impact of blockchain not only on the supply chain stakeholders, but also on operations and supply chain business models, not to mention the role of disintermediation (Tönnissen & Teuteberg, 2019).

In the last paper, "Modeling the blockchain enabled traceability in agriculture supply chain", by Kamble, Gunasekaran and Sharma, the authors identify the enablers of blockchain technologies for supply chains in agriculture in India. The authors identified thirteen enablers, the most influential of which are traceability, auditability, immutability, and provenance in the agricultural sector (Kamble, Gunasekaran, & Sharma, 2019).

Acknowledgments

This Special Issue is the outcome of an intensive interaction of various scholars and practitioners, including the guest editors and the journal's editorial board. We would like to thank Prof. Yogesh Dwivedi for his guidance and comments on the early version of the call for papers proposal, they helped greatly in improving the said proposal while guiding us throughout the whole review cycle of this Special Issue. Our gratitude also goes to the team of reviewers who devoted their time to help us improve on the quality of the different manuscripts that were accepted for this Special Issue. We are eventually indebted to all the authors of the papers that are being accepted on this occasion.

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