International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Blockchain Technology In Supply Chain Management: A Systematic Review And Meta-Analysis

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Abstract:
Blockchain is a promising technology with its features such as immutability and decentralized database. It has applications in various fields such as pharmaceutical, finance, & food industry. At the core of its heart lies its feature, traceability which is the most desired key in supply chains. However, supply chains have always been hit rock bottom by scandals and controversies. In this review paper, we have explored the advancement and research gaps, of blockchain technology (BT) in supply chain management (SCM). We have used the Prisma framework for systematic literature review (SLR) and included a minuscule amount of grey literature to reduce publication bias. We found that supply chain traceability and transparency is the most researched objective in SCM. There was hardly any research in supply chain resilience. Further, we found that 40 % of the papers were application based. Most articles have focused on the advantages of BT, rather than analyzing it critically. This study will help identify gaps and, suitable actions to be followed for an efficient implementation of BT in SCM.

Keywords: Blockchain technology, Supply chain management, Supply chain transparency, Supply chain traceability

1. Introduction:

In these unusual times where coronavirus pandemic, has enforced havoc on small and big business communities, there is growing resentment among supply chain community against the traditional way of exchanging services. With imposed lockdowns, all over the globe, it is an excellent opportunity for goods and service exchange communities to adopt BT. It will also help in abiding by the law of the state where physical distancing is a must. BT is a peer to peer network [1] [2]. It is a combination of various technologies where its key objectives are, trust and consensus. It is seen as a revolutionizing technology [3].

There had been numerous scandals in food, textile and pharmaceutical industries. Such as horsemeat scandal [4] [5], Salmonella outbreak due to Maradol papayas [4] [6] and Welspun scandal in textile industry [7]. These scandals are primarily due to inadequate information flow in supply chains, human error and no mechanism of tracking the source of production.

These scandals also involve human exploitation. Child labour by Nike in Asia [8] [9], Foxconn suicide scandal in 2010 [8] [10] are some of the examples.

Many people know BT by Bitcoins and mostly associate it to financial markets [11]. Cryptocurrencies, (most famous of all is Bitcoin) are based on blockchain technology. It is a decentralized currency [12] [13] [14] by which anyone could buy, transact, sell goods and provide services with anonymity & trust. The value of bitcoin is currently standing at 9,277.62 USD $ [15].

Big MNC's have started to implement blockchain technology in their supply chains. An Australian automobile company, Tomcar, use Bitcoin for end to end transactions [16].

With volatile markets, the flow of services and goods is many times constrained [17] [18]. In such situations, BT can enhance and ease the flow of information between players in supply chains [19]

BT is not a solution for all difficulties [20]. It requires integration with multiple technologies to assist favourable outcomes. BT can ease down the process of security protocols and its underlying friction between various groups. Although supply chains are examined routinely at multiple levels [21], there is always scope for human error. Due to the diverse nature of components in the supply chain globally, it is hard to bring them on a single stage [22]. Smart contracts can play a considerable role to solve this dilemma. They are the future/ They can ease up the work in supply chains.[23].

To integrate the supply chain network using BT, we have defined two research questions.

1)What is the current situation of BT in SCM?

2)What are the underlying causes behind the unsuccessful implementation of BT in SCM?

To the author's best knowledge, there had been no previous literature review that had taken such a vast amount of manuscripts to know the research gaps. We also included grey literature to know, the extent of research done in this area.

2. Research Methodology:

The research methodology for the SLR is based on Prisma framework guidelines [24].

2.1 Eligibility Criteria –

Both qualitative and quantitative studies have been included in the study. Peer-reviewed journals of the previous four years have been included. At the same time, grey literature, i.e. thesis, magazines, reports have also been taken mostly from, reputed companies, i.e. IBM [25] Deloitte [26].

Inclusion Criteria	Exclusion Criteria
Included studies must have the full text in English. Included studies must be from the previous four years. Must have the searching keywords. Included studies must be from credible databases	Studies in a language other than English. Studies exceeding limit of 4 years. Papers without full-text accessibility Not relevant in abstract and full-text reading. Notes, Duplicates

2.2. Information sources:

Scientific databases, i.e. ScienceDirect, IEEE, Springer, were searched. The search started on 01/05/20, and the last date searched was 30/05/20.

2.3. Search:

However, to identify relevant studies keywording is used. Google Scholar was used for searching articles, with searching keywords, i.e. Blockchain, supply chain, logistics. The title should either Blockchain , BT

or decentralized ledger. The web pages were searched until there were no studies remained with keywords. Maximum rotation of 10 webpages was done. This could be a limit and lead to searching bias.

2.4. Study Selection:

Study selection was made on the Prisma 2009 flowchart [24]. Records were screened based on title, abstract, and full-text reading. Sequentially after database searching, those records which cannot be accessed full or were duplicates were removed.

2.5. Study selected:

A total of 90 papers were selected for further screening. These are as follows,

IEEE – 20
ScienceDirect – 17
Springer – 16
Emerald Insight – 9
ACM – 10
Research Gate – 7
PLOS – 1
JEFC – 1
Semantic Scholar – 1
LUP Students paper (2016) – 1
MATEC Web of conferences – 1
MDPI – 2
Tandfonline – 2
JMIR – 1
University of Nottingham – 1

PRISMA FLOWCHART

Identification	Records identified through database searching. (N= 90)	Additional records identified through other sources. (N = 16)

⬇

Records after duplicates removed, N = 70		
Screening	Records screened (N=70) Title and abstract screening (N =8)	Records excluded (N = 8)

Eligibility	Full text articles accessed for eligibility: (N = 62)
Included	Studies included for systematic review and met-analysis (N = 50)

3. Results:

Total no. of peer-reviewed papers = 46

Total no. of papers in grey literature = 4

The final papers were as follows,

[1],[3],[4],[7],[8],[11],[12],[17,[19],[20],[21],[22],[23],[24],[25],[26],[27],[28],[29],[30],[31],[32],[33],[34],[35],,[36],[37],[38],[39],[40],[41],[42],[43],[44],[45],[46],[47],[48],[49],[50],[51],[52],[53],[54],[55],[56],[57],[58],[59],[60],[61]

We distributed the studies based on their key themes.

Key themes	Sources
Supply chain traceability	[1],[4],[7],[8],[27],[29],[33],[34],[38],[39],[41],[44],[51],[52],[53],[55],[56],[57],[58],[61]
Supply chain transparency	[1],[3],[7],[8],[11],[12],[19],[20],[21],[25],[26],[29],[31],[35],[37],[39],[40],[60]
Supply chain Sustainability	[11],[22],[30],[32],[50],
Supply chain privacy	[1],[20],[21],[23],[36],[43],[49]
Supply chain cost	[1],[3],[22],[26],[42],[47],[59]
Supply chain resilience	[28],[45]
Supply chain quality	[7],[25],[22],[54],

Firstly, we classified the papers, based on their publication type. (Book sections =BS , Grey literature = GL)

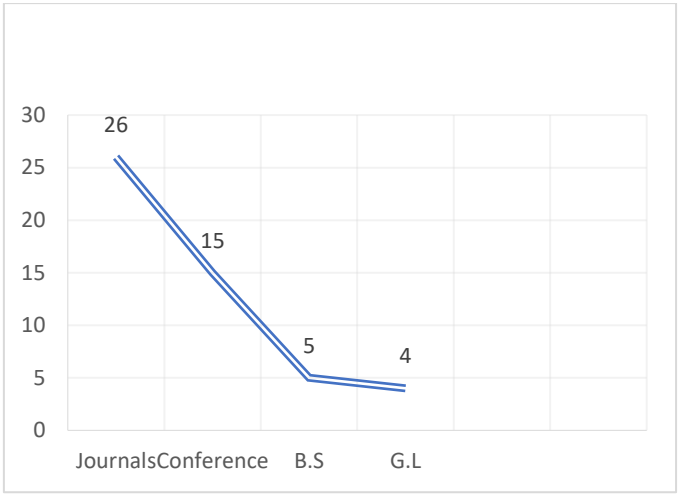


Fig [1] **Publication Types**

Then, we distributed them year-wise.

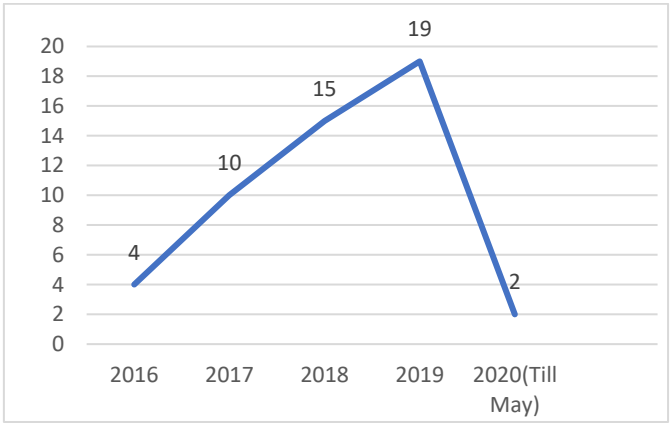


Fig [2] **Year-wise distribution**

We sorted them on the basis of their countries.

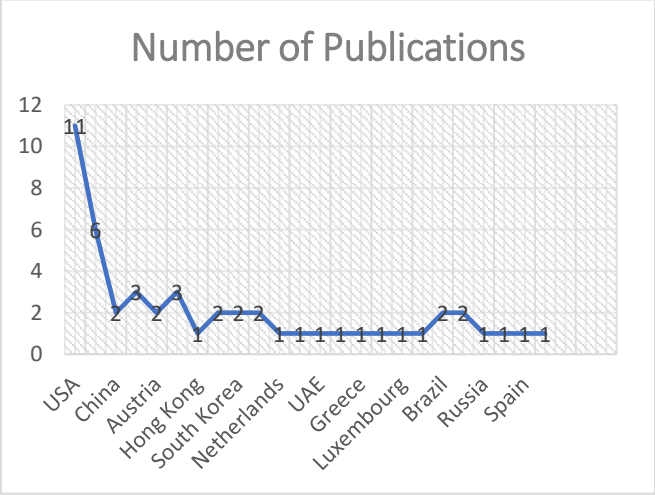
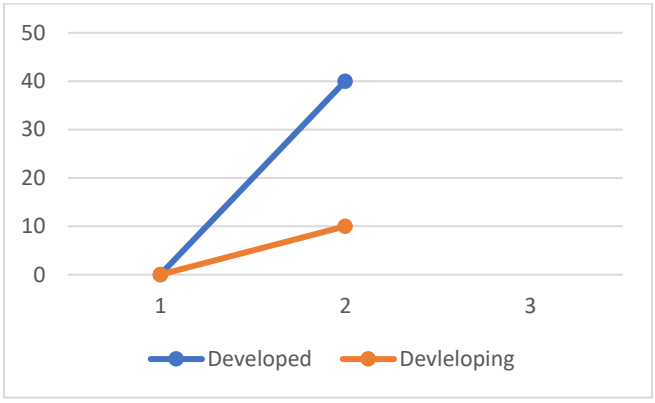


Fig [3] **Country wise classification**

We further divided them into two groups,



Fig[4]**Classification based on developed and developing countries**

We further classified them based on their applications,

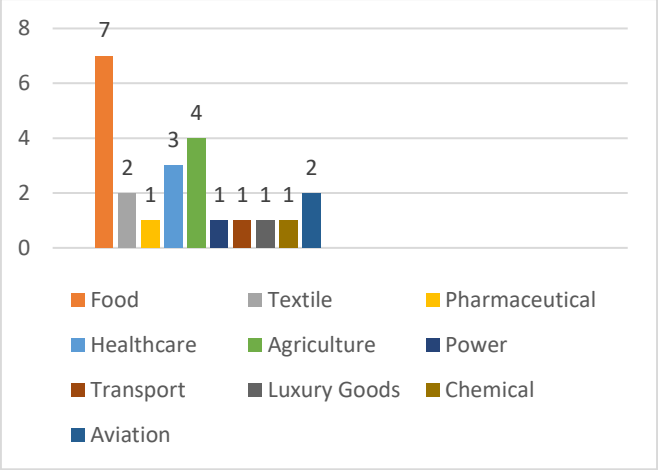


Fig [5] **Application based classification**

Lastly, we classified them on their key themes,

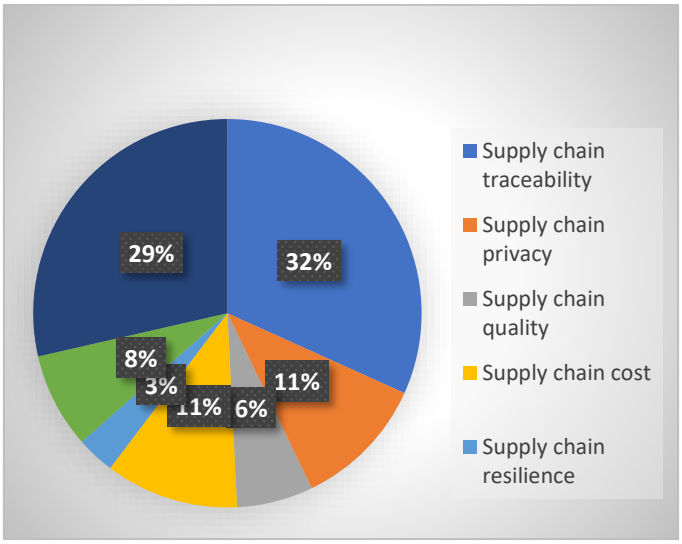


Fig [6] **Key themes distribution**

4. Discussions:

There had been a serene increase in studies focusing blockchain in supply chains. We showed the statistics of published studies till May 2020. We also took into consideration the grey literature as it reduces publication bias. Our work consists of studies from 25 countries, of whom the USA is leading the research in the respective field. We found a stark difference in research between developed and developing countries. About 80% of the studies were researched in developed countries. Our research covers more geographical boundaries than previous studies [46].

Further, we analyzed the papers based on their applications. 46 % of the papers were application-based papers, while the rest were either discussion or solution-based papers. Food supply chain constitutes 7% of the total research in this area, followed by agriculture with 4 %. The application-specific papers were scattered between pharmaceuticals, aviation, power, transport, luxury goods and chemical supply chains. Healthcare supply chains also have a significant amount of research (3%).

Supply chain key objectives like traceability, transparency, quality, privacy, resilience and sustainability was taken into consideration. Most papers focused on the supply chain, traceability (32%) and transparency (29%). Supply chain, privacy and costs are covered in equal proportion (11%) that is less than average. The least focus was on supply chain resilience (2%).

In the previous literature reviews, [17] [34], [46], limited papers were analyzed. We covered a diverse range of studies to know the extent of work dedicated. The friction in blockchain implementation lies due to unawareness and government regulations. Most papers provided a mechanism for blockchain implementation in supply chains concerning SCM objective. However, there was no emphasis on the resiliency if blockchain also fails in the supply chains. There is no guarantee that blockchain won't fail in some situations. Secondly, government crackdowns on Bitcoin have troubled the advancement of BT in financial sectors. Yet, BT can play a crucial role in non-financial areas like food, pharmaceutical and healthcare supply chains.

5. Limitations:

Although we include grey literature to reduce publication bias, we may have missed some critical studies.

6. Conclusions:

Most papers have focused on the advantages of BT and the development of frameworks in SCM, for its successful realism. The technology has to be critically studied before it can be implemented on a universal scale. For a successful technology, its flaws have to be located first. Very few studies focus on supply chain costs after BT implementation. The sharp contrast between BT adoption in developed and developing countries show us the lack of research in the later area. Blockchain adoption in poor countries can be achieved by focusing on its costs. Also, governments need to cooperate with keyholders for its successful implementation. The successful realization of BT in SCM, is possible only if there will be a clever mechanism to resilience for supply chains even after Blockchain failure.

7. Declaration of Interests:

None

8. Funding:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-

for-profit sectors.

9. References

1. Wang, Y., Singgih, M., Wang, J. and Rit, M. (2019). Making sense of blockchain technology: How will it transform supply chains? *International Journal of Production Economics*, [online] 211, pp.221–236. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0925527319300507
2. Brown, R.G., 2016. 'Technology'. Chapter 2 in Distributed Ledger Technology: Beyond Blockchain. Government Office for Science, London, pp. 32–38. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf
3. Brody, P. (2017). *How Blockchain is Revolutionizing the Supply Chain Industry | Hacker Noon*. [online] hackernoon.com. Available at: https://hackernoon.com/how-blockchain-is-revolutionizing-the-supply-chain-industry-ghw83v0m
4. Tan, B., Yan, J., Chen, S. and Liu, X. (2018). *Smart Blockchain*. [online] *Lecture Notes in Computer Science*. Cham: Springer International Publishing. Available at: https://link.springer.com/chapter/10.1007/978-3-030-05764-0_18.
5. Levitt, T.: Three years on from the horsemeat scandal: 3 lessons we have learned. The Guardian (2016). https://www.theguardian.com/sustainable-business/2016/jan/07/horsemeat-scandal- food-safety-uk-criminal-networks-supermarkets
6. Menon, S.: Supply Chain: Applications of Blockchain Platform in Agri-Food Supply Chains. Bio Voice, 23 May 2018. https://www.biovoicenews.com/applications-blockchain-platform-agri- food-supply-chain/
7. ElMessiry, M. and ElMessiry, A. (2018). Blockchain Framework for Textile Supply Chain Management. *Lecture Notes in Computer Science*, [online] pp.213–227. Available at: https://link.springer.com/chapter/10.1007/978-3-319-94478-4_15
8. Abeyratne, S. and Monfared, R. (2016). BLOCKCHAIN READY MANUFACTURING SUPPLY CHAIN USING DISTRIBUTED LEDGER. *International Journal of Research in Engineering and Technology*, [online] 05(09), pp.1–10. Available at: https://www.researchgate.net/profile/Radmehr_Monfared/publication/308163874_Blockchain_Ready_Manufacturing_Supply_Chain_Using_Distributed_Ledger/links/57fe2dde08ae7275640133b0/Blockchain-Ready-Manufacturing-Supply-Chain-Using-Distributed-Ledger.pdf.
9. C. Tim, Still Waiting For Nike To Do It. San Francisco: Gobal Exchange, 2001.
10. M. Moore, "'Mass suicide' protest at Apple manufacturer Foxconn factory," The Telegraph, UK, 2012. [Online]. Available: http://www.telegraph.co.uk/news/worldnews/asia/china/9006988/Mass-suicide-protest-at-Apple-manufacturer-Foxconn-factory.html
11. Badzar, A. (2016). *Blockchain for securing sustainable transport contracts and supply chain transparency - An explorative study of blockchain technology in logistics*. [online] Lub.lu.se. Available at: https://lup.lub.lu.se/student-papers/search/publication/8880383
12. Wang, Y., Han, J.H. and Beynon-Davies, P. (2019). Understanding blockchain technology for future supply chains: a systematic literature review and research agenda. *Supply Chain Management: An International Journal*, [online] 24(1), pp.62–84. Available at: https://www.emerald.com/insight/content/doi/10.1108/SCM-03-2018-0148/full/html

13. Kosba, A., Miller, A., Shi, E., Wen, Z. and Papamanthou, C. (2016), "'Hawk: the blockchain model of cryptography and Privacy-Preserving smart contracts", IEEE Symposium on Security andPrivacy, pp. 839-858
14. Wright, A. and De Filippi, P. (2015), "Decentralized blockchain technology and the rise of lex cryptographia", SSRN Electronic Journal, available at: https://doi.org/ 10.2139/ssrn.2580664. (accessed 21 March 2018).
15. coindesk (2020). *Bitcoin Price Index — Real-time Bitcoin Price Charts*. [online] CoinDesk. Available at: https://www.coindesk.com/price/bitcoin.
16. Marr, B. (2018). *How Blockchain Will Transform The Supply Chain And Logistics Industry*. [online] Forbes. Available at: https://www.forbes.com/sites/bernardmarr/2018/03/23/how-blockchain-will-transform-the-supply-chain-and-logistics-industry/#37db829c5fec.
17. Kamble, S., Gunasekaran, A. and Arha, H. (2018). Understanding the Blockchain technology adoption in supply chains-Indian context. *International Journal of Production Research*, [online] 57(7), pp.2009–2033. Available at: https://www.tandfonline.com/doi/full/10.1080/00207543.2018.1518610
18. Pereira, J. V. 2009. "The new Supply Chain's Frontier: Information Management." International Journal ofInformation Management 29 (5)
19. Queiroz, M.M. and Fosso Wamba, S. (2019). Blockchain adoption challenges in supply chain: An empirical investigation of the main drivers in India and the USA. *International Journal of Information Management*, [online] 46, pp.70–82. Available at: https://scinapse.io/papers/2903429044.
20. Mylrea, M. and Gourisetti, S.N.G. (2018). Blockchain for Supply Chain Cybersecurity, Optimization and Compliance. *2018 Resilience Week (RWS)*. [online] Available at: https://ieeexplore.ieee.org/abstract/document/8473517
21. Madhwal, Y. and Panfilov, P. (2017). Blockchain And Supply Chain Management: Aircrafts' Parts' Business Case. *DAAAM Proceedings*, [online] (17269679), pp.1051–1056. Available at: https://www.researchgate.net/publication/321663407 Blockchain.
22. Kshetri, N. (2018). 1 Blockchain's roles in meeting key supply chain management objectives. *International Journal of Information Management*, [online] 39, pp.80–89. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0268401217305248.
23. Terzi, S., Zacharaki, A., Nizamis, A., Votis, K., Ioannidis, D., Tzovaras, D. and Stamelos, I. (2019). Transforming the supply-chain management and industry logistics with blockchain smart contracts. *Proceedings of the 23rd Pan-Hellenic Conference on Informatics - PCI '19*. [online] Available at: https://dl.acm.org/doi/abs/10.1145/3368640.3368655
24. Moher, D., Liberati, A., Tetzlaff, J. and Altman, D.G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine*, [online] 6(7), p.e1000097. Available at: https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1000097.
25. IBM, B. (2019). *A Taste for Collaboration*. [online] Available at: https://www.ibm.com/downloads/cas/D2L1BJVA
26. Laurent, P., Chollet, T., Pfeiffer, T., Castiaux, J., Sommerfeld, B., Bruneton, M., Willems, A. and Sainlez, L. (2017). *Continuous interconnected supply chain Using Blockchain & Internet-of-Things in supply chain traceability*. [online] Available at: https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/technology/lu-blockchain-internet-things-supply-chain-traceability.pdf.

27. De Aguiar, E.J., Faiçal, B.S., Krishnamachari, B. and Ueyama, J. (2020). A Survey of Blockchain-Based Strategies for Healthcare. *ACM Computing Surveys*, [online] 53(2), pp.1–27. Available at: https://dl.acm.org/doi/abs/10.1145/3376915.
28. Min, H. (2019). Blockchain technology for enhancing supply chain resilience. *Business Horizons*, [online] 62(1), pp.35–45. Available at: https://www.sciencedirect.com/science/article/pii/S0007681318301472
29. Jayaraman, R., Salah, K. and King, N. (2019). Improving Opportunities in Healthcare Supply Chain Processes via the Internet of Things and Blockchain Technology. *International Journal of Healthcare Information Systems and Informatics*, [online] 14(2), pp.49–65. Available at: https://www.igi-global.com/article/improving-opportunities-in-healthcare-supply-chain-processes-via-the-internet-of-things-and-blockchain-technology/222730.
30. Di Vaio, A. and Varriale, L. (2019). Blockchain technology in supply chain management for sustainable performance: Evidence from the airport industry. *International Journal of Information Management*, [online] 52, pp.0–1. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0268401219304803.
31. Kamilaris, A., Fonts, A. and Prenafeta-Boldύ, F.X. (2019). The rise of blockchain technology in agriculture and food supply chains. *Trends in Food Science & Technology*, [online] 91, pp.640–652. Available at: https://www.sciencedirect.com/science/article/pii/S0924224418303686.
32. Lund, E.H., Jaccheri, L., Li, J., Cico, O. and Bai, X. (2019). Blockchain and Sustainability: A Systematic Mapping Study. *2019 IEEE/ACM 2nd International Workshop on Emerging Trends in Software Engineering for Blockchain (WETSEB)*. [online] Available at: https://dl.acm.org/doi/abs/10.1109/WETSEB.2019.00009.
33. Montecchi, M., Plangger, K. and Etter, M. (2019). It's real, trust me! Establishing supply chain provenance using blockchain. *Business Horizons*, [online] 62(3), pp.283–293. Available at: https://www.sciencedirect.com/science/article/pii/S0007681319300084.
34. Blossey, G., Eisenhardt, J. and Hahn, G. (2019). *Blockchain Technology in Supply Chain Management: An Application Perspective*. [online] scholarspace.manoa.hawaii.edu. Available at: https://scholarspace.manoa.hawaii.edu/handle/10125/60124.
35. Kim, J.-S. and Shin, N. (2019). The Impact of Blockchain Technology Application on Supply Chain Partnership and Performance. *Sustainability*, [online] 11(21), p.6181. Available at: https://www.mdpi.com/2071-1050/11/21/6181/pdf.
36. Xu, Z., Jiao, T., Wang, Q., Van, C.B., Wen, S. and Xiang, Y. (2019). An Efficient Supply Chain Architecture Based on Blockchain for High-value Commodities. *Proceedings of the 2019 ACM International Symposium on Blockchain and Secure Critical Infrastructure - BSCI '19*. [online] Available at: https://dl.acm.org/doi/abs/10.1145/3327960.3332384
37. Zhu, Q. and Kouhizadeh, M. (2019). Blockchain Technology, Supply Chain Information, and Strategic Product Deletion Management. *IEEE Engineering Management Review*, [online] 47(1), pp.36–44. Available at: https://ieeexplore.ieee.org/abstract/document/8637776.
38. Behnke, K. and Janssen, M.F.W.H.A. (2019). Boundary conditions for traceability in food supply chains using blockchain technology. *International Journal of Information Management*. [online] Available at: https://www.sciencedirect.com/science/article/pii/S0268401219303536
39. Shireesh Apte and Nikolai Petrovsky (2019). Will blockchain technology revolutionize excipient supply chain management? *Journal of Excipients and Food Chemicals*, [online] 7(3), p.910. Available

at: https://jefc.scholasticahq.com/article/910-will-blockchain-technology-revolutionize-excipient-supply-chain-management.

40. Cole, R., Stevenson, M. and Aitken, J. (2019). Blockchain technology: Implications for operations and supply chain management. *Supply Chain Management: An International Journal*, [online] 24, pp.469–483. Available at: https://eprints.lancs.ac.uk/id/eprint/131605/
41. Clauson, K.A., Breeden, E.A., Davidson, C. and Mackey, T.K. (2018). Leveraging Blockchain Technology to Enhance Supply Chain Management in Healthcare: *Blockchain in Healthcare Today*. [online] Available at: https://www.blockchainhealthcaretoday.com/index.php/journal/article/view/20/7.
42. Hofmann, E., Strewe, U.M. and Bosia, N. (2018). *Supply Chain Finance and Blockchain Technology*. [online] *SpringerBriefs in Finance*. Cham: Springer International Publishing. Available at: https://link.springer.com/chapter/10.1007/978-3-319-62371-9_1.
43. Leng, K., Bi, Y., Jing, L., Fu, H.-C. and Van Nieuwenhuyse, I. (2018). Research on agricultural supply chain system with double chain architecture based on blockchain technology. *Future Generation Computer Systems*, [online] 86, pp.641–649. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0167739X18304527 [Accessed 26 Jun. 2020].
44. Rahmadika, S., Kweka, B.J., Latt, C.N.Z. and Rhee, K.-H. (2018). A Preliminary Approach of Blockchain Technology in Supply Chain System. *2018 IEEE International Conference on Data Mining Workshops (ICDMW)*. [online] Available at: https://ieeexplore.ieee.org/abstract/document/8637475.
45. Cui, Y. and Idota, H. (2018). Improving Supply Chain Resilience with Establishing A Decentralized Information Sharing Mechanism. *Proceedings of the 5th Multidisciplinary International Social Networks Conference on - MISNC '18*. [online] Available at: https://dl.acm.org/doi/abs/10.1145/3227696.3227723
46. Tribis, Y., El Bouchti, A. and Bouayad, H. (2018). Supply Chain Management based on Blockchain: A Systematic Mapping Study. *MATEC Web of Conferences*, [online] 200, p.00020. Available at: https://www.matec-conferences.org/articles/matecconf/abs/2018/59/matecconf_iwtsce2018_00020/matecconf_iwtsce2018_00020.html.
47. Perboli, G., Musso, S. and Rosano, M. (2018). Blockchain in Logistics and Supply Chain: A Lean Approach for Designing Real-World Use Cases. *IEEE Access*, [online] 6, pp.62018–62028. Available at: https://ieeexplore.ieee.org/abstract/document/8493157.
48. Treiblmaier, H. (2018). The impact of the blockchain on the supply chain: a theory-based research framework and a call for action. *Supply Chain Management: An International Journal*, [online] 23(6), pp.545–559. Available at: https://www.emerald.com/insight/content/doi/10.1108/SCM-01-2018-0029/full/html
49. Gao, Z., Xu, L., Chen, L., Zhao, X., Lu, Y. and Shi, W. (2018). CoC: A Unified Distributed Ledger Based Supply Chain Management System. *Journal of Computer Science and Technology*, [online] 33(2), pp.237–248. Available at: https://link.springer.com/article/10.1007/s11390-018-1816-5.
50. Saberi, S., Kouhizadeh, M., Sarkis, J. and Shen, L. (2018). Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research*, [online] 57(7), pp.2117–2135. Available at: https://www.tandfonline.com/doi/full/10.1080/00207543.2018.1533261.

51. Sylim, P., Liu, F., Marcelo, A. and Fontelo, P. (2018). Blockchain Technology for Detecting Falsified and Substandard Drugs in Distribution: Pharmaceutical Supply Chain Intervention. *JMIR Research Protocols*, [online] 7(9), p.e10163. Available at: https://www.researchprotocols.org/2018/9/e10163/?utm_source=TrendMD&utm_medium=cpc&utm_campaign=JMIR_TrendMD_0.
52. Banerjee, A. (2018). Blockchain Technology: Supply Chain Insights from ERP. *Advances in Computers*, [online] pp.69–98. Available at: https://www.sciencedirect.com/science/article/pii/S0065245818300202.
53. Agrawal, T.K., Sharma, A. and Kumar, V. (2018). Blockchain-Based Secured Traceability System for Textile and Clothing Supply Chain. *Artificial Intelligence for Fashion Industry in the Big Data Era*, [online] pp.197–208. Available at: https://link.springer.com/chapter/10.1007/978-981-13-0080-6_10.
54. Chen, S., Shi, R., Ren, Z., Yan, J., Shi, Y. and Zhang, J. (2017). A Blockchain-Based Supply Chain Quality Management Framework. *2017 IEEE 14th International Conference on e-Business Engineering (ICEBE)*. [online] Available at: https://ieeexplore.ieee.org/abstract/document/8119146.
55. Kumar, M.V. and Iyengar, N.C.S.N. (2017). A Framework for Blockchain Technology in Rice Supply Chain Management Plantation. *Advanced Science and Technology Letters*, [online] Vol.146 (FGCN 2017), pp.125–130. Available at: https://www.researchgate.net/publication/323259797.
56. Toyoda, K., Mathiopoulos, P.T., Sasase, I. and Ohtsuki, T. (2017). A Novel Blockchain-Based Product Ownership Management System (POMS) for Anti-Counterfeits in the Post Supply Chain. *IEEE Access*, [online] 5, pp.17465–17477. Available at: https://ieeexplore.ieee.org/abstract/document/7961146.
57. Tse, D., Zhang, B., Yang, Y., Cheng, C. and Mu, H. (2017). Blockchain application in food supply information security. *2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*. [online] Available at: https://ieeexplore.ieee.org/abstract/document/8290114
58. Kennedy, Z.C., Stephenson, D.E., Christ, J.F., Pope, T.R., Arey, B.W., Barrett, C.A. and Warner, M.G. (2017). Enhanced anti-counterfeiting measures for additive manufacturing: coupling lanthanide nanomaterial chemical signatures with blockchain technology. *Journal of Materials Chemistry C*, [online] 5(37), pp.9570–9578. Available at: https://www.researchgate.net/publication/319193078_Enhanced_anti-counterfeiting_measures_for_additive_manufacturing_Coupling_lanthanide_nanomaterial_chemical_signatures_with_blockchain_technology
59. Korpela, K., Hallikas, J. and Dahlberg, T. (2017). Digital Supply Chain Transformation toward Blockchain Integration. *Proceedings of the 50th Hawaii International Conference on System Sciences (2017)*. [online] Available at: https://www.researchgate.net/publication/312218996_Digital_Supply_Chain_Transformation_toward_Blockchain_Integration.
60. Nakasumi, M. (2017). Information Sharing for Supply Chain Management Based on Block Chain Technology. *2017 IEEE 19th Conference on Business Informatics (CBI)*. [online] Available at: https://ieeexplore.ieee.org/document/8010716/figures#figures
61. Tian, F. (2016). An agri-food supply chain traceability system for China based on RFID & blockchain technology. *2016 13th International Conference on Service Systems and Service Management (ICSSSM)*. [online] Available at: https://ieeexplore.ieee.org/abstract/document/7538424.