



**MASTER'S DEGREE PROGRAMME IN
SUPPLY CHAIN MANAGEMENT**

Postgraduate Dissertation:

**Blockchain technologies as a
4th Industrial Revolution
facilitator in Logistics**

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Abstract

As Blockchain is all the more approached as a prominent facilitator for adopting 4th Industrial Revolution ideas across various industries, it is evident that Logistics is one of the sectors of the economy that is presented as the best candidates for such implementations. In this study, we explore both how academia and the business world approach this potential, the implementation of Blockchain technologies in Logistics as part of the whole 4th Industrial Revolution platform. After the necessary introductory chapter, where scope, purpose, methodologies etc. are discussed, in the second chapter we lay down the basic theory behind the three key concepts explored in this study. In chapters three and four, then, we conduct the actual research, first in the available scientific literature, through an SLR and a classical literature review, and then in terms of case studies from the real world. In the fifth and final chapter we discuss the extend at which the potential of Blockchain technologies implemented in Logistics has been tried out and how future research can further the subject.

Keywords: Blockchain, Logistics, 4th Industrial Revolution, Smart Contracts, Transparency

References

Bibliography

1. Abeyratne, S., & Monfared, P. (2016). Blockchain Ready Manufacturing Supply Chain Using Distributed Ledger. *International Journal of Research in Engineering and Technology*, 5(9), 110
2. Ahmad, R., Hasan, H., Jayaraman, R., Salah, K., & Omar, M. (2021). Blockchain applications and architectures for port operations and logistics management. *Research in Transportation Business & Management*, 41
3. Bayer, D., Haber, S., & Stornetta, W. S. (1992). Improving the Efficiency and Reliability of Digital Timestamping. *Sequences II*, 2, 329–334
4. Behzad, B. (2023). Port 4.0: a conceptual model for smart port digitalization. *Transportation Research Procedia*, 74, 346–353
5. Brito, J., & Castillo, A. (2016). *Bitcoin: A Primer for Policymakers*. Mercatus Center, George Mason University
6. Chaum, D. (1982). Computer Systems Established, Maintained, and Trusted by Mutually Suspicious Groups
7. Chbaika, N., Khiata, A., Bahnasseb, A., Ouajji, H. (2022). The Application of Smart Supply Chain Technologies in The Moroccan Logistics. *Procedia Computer Science*, 198, 578–583
8. Christidis, K., & Devetsikiotis, M. (2016). Blockchain and Smart Contracts for Insurance: Is the Technology Mature Enough? *Future Internet*, 8(2)
9. Christopher, M., & Peck, H. (2004). Building the Resilient Supply Chain. *The International Journal of Logistics Management*, 15(2), 1-14.
10. Crosby, M., Pattanayak, P., Verma, S., & Kalyanaraman, V. (2015). *Blockchain Technology: Beyond Bitcoin*. University of California, Berkeley

11. Delke, V., Schiele, H., Buchholz, W., & Kelly, S. (2023). Implementing Industry 4.0 technologies: Future roles in purchasing and supply management. *Technological Forecasting & Social Change*, 196
12. Dewey, A. & Drahota, A. (2016) Introduction to systematic reviews: online learning module
13. Dimitrov, M., Scheller, J., & Neumann, D. (2020). The Blockchain and Supply Chain Management: An Exploration of Current Status and Future Applications. *Logistics*, 4(3)
14. Dwork, C., & Naor, M. (1993). Pricing via Processing or Combatting Junk Mail. *Advances in Cryptology — CRYPTO' 92, Lecture Notes in Computer Science*, 740, 139–147
15. Eyal, I. (2017). Blockchain Technology: Transforming Libertarian Cryptocurrency Dreams to Finance and Banking Realities. *Computer*, 50(9)
16. Fan, S., Wang, S., & Zhang, X. (2020). The Fourth Industrial Revolution and Smart Logistics: A Review. *Sustainability*, 12(19), 8125.
17. Governatori, G., Idelberger, F., Milosevic, Z., Riveret, R., Sartor, G., Xu, X. (2018). On legal contracts, imperative and declarative smart contracts, and Blockchain systems. *Artificial Intelligence and Law*, 26(4)
18. Grant, M. J., & Booth, A. (2009). A typology of reviews: An analysis of 14 review types and associated methodologies. *Health Information & Libraries Journal*, v. 26, n. 2, pp. 91-108
19. Guo, L., Chen, J., Li, S., Li, Y., & Lu, J. (2022). A blockchain and IoT-based lightweight framework for enabling information transparency in supply chain finance. *Digital Communications and Networks*, 8, 576–587
20. Haber, S. & Stornetta, W.S. (1991). How to timestamp a digital document. *Journal of Cryptology*, 3(2), 99–111
21. Hassoun, A., Kamiloglu, S., Garcia, G., Parra-Lopez, C., Trollman, H., Jagtap, S., Aadil, M., Esatbeyoglu, T. (2023). Implementation of relevant fourth industrial revolution innovations across the supply

- chain of fruits and vegetables: A short update on Traceability 4.0. Food Chemistry, 409
22. Hofmann, E., Strewe, U., & Bosia, N. (2018). How Does the Full Potential of Blockchain Technology in Supply Chain Finance Look Like. Supply Chain Finance and Blockchain Technology
 23. Huang, K., Wang, K., Lee, P., & Andy C.L. Yeung, A. (2023). The impact of industry 4.0 on supply chain capability and supply chain resilience: A dynamic resource-based view. International Journal of Production Economics, 262
 24. Huckle, S., Bhattacharya, R., & White, M. (2016). Internet of Things, Blockchain and Shared Economy Applications. Procedia Computer Science, 98, 461-466
 25. Hugos, M. H. (2018). Essentials of Supply Chain Management (4th ed.). Wiley
 26. Iansiti, M., & Lakhani, K. R. (2017). The Truth about Blockchain. Harvard Business Review, 95(1), 118-127
 27. Ichimura, Y., Dalaklis, D., Kitada, M. & Christodoulou, A. (2022). Shipping in the era of digitalization: Mapping the future strategic plans of major maritime commercial actors. Digital Business, 2
 28. Iranmanesh, M., Maroufkhani, P., Asadi, S., Ghobakhloo, M., Dwivedi, Y., & Tseng, M. (2023). Effects of supply chain transparency, alignment, adaptability, and agility on blockchain adoption in supply chain among SMEs. Computers & Industrial Engineering
 29. Jaikaran, C. (2018). Blockchain: Background and Policy Issues. Washington, DC: Congressional Research Service
 30. Jensen, T., Hedman, J., & Henningson, S. (2019). How TradeLens Delivers Business Value With Blockchain Technology. MIS Quarterly Executive, v. 18, n. 4, pp. 221-243
 31. Johnsen, M. (2020). Blockchain in Digital Marketing: A New Paradigm of Trust
 32. Kannan Govindan, K., Kannan, D., Ballegård, T., & Nielsen, T. (2022). Supply Chain 4.0 performance measurement: A systematic literature review, framework development, and empirical evidence. Transportation Research Part E, 164

33. Kosba, A., Miller, A., Shi, E., Wen, Z., & Papamanthou, C. (2016). Hawk: The Blockchain Model of Cryptography and Privacy-Preserving Smart Contracts. In Proceedings of the 2016 ACM SIGSAC Conference on Computer and Communications Security, 839-851
34. Kshetri, N. (2018). Blockchains Roles in Meeting Key Supply Chain Management Objectives. International Journal of Information Management
35. Lace, S. (2017). Pilot project connects blockchain and mairpallets. CSCMP's Supply Chain Quarterly
36. Lim, A., & Pan, E. (2021). Toward a Global Social Contract for Trade - a Rawlsian approach to Blockchain Systems Design and Responsible Trade Facilitation in the New Bretton Woods era. Journal of Responsible Technology
37. Lorenz-Meyer, F., & Santos, V. (2023). Blockchain in the shipping industry: A proposal for the use of blockchain for SMEs in the maritime industry. Procedia Computer Science, 219, 807-814
38. Manyika, J., Chui, M., & Miremadi, M. (2016). Where machines could replace humans—and where they can't (yet). McKinsey Quarterly.
39. Mariano, D., Leite, C., Santos, L., Rocha, R., & Minardi, R. (2017). A guide to performing systematic literature reviews in bioinformatics. Universidade Federal de Minas Gerais
40. Melissanidis, E. (2022). Blockchain implementation in logistics – The maritime logistics case
41. Mueen, U., Khaled, S., Raja, J., & Sasa, P. (2021). Blockchain for drug traceability: Architectures and open challenges. Health Informatics Journal, 27 (2)
42. Nadir Munir, H., Syed Abdul Rehman, K., Muhammad Umair, K., & Adnan Ahmed, S. (2023). Interconnection between the role of blockchain technologies, supply chain integration, and circular economy: A case of small and medium-sized enterprises in Pakistan. Science Progress
43. Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016). Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton, New Jersey: Princeton University Press

44. Nian, L., Chuen, D., & Lee, K. (2015). *A Light Touch of Regulation for Virtual Currencies*. Academic Press
45. Nikou, S., Azarian, R., Hryciuk, M., & Knoll, A. (2021). *Blockchain in Logistics and Supply Chain Management: A Literature Review*. 54th Hawaii International Conference on System Sciences.
46. Noorul Shaiful Fitri Abdul Rahman, N., Hamid, A., Lirn, T., Al Kalbani, K., & Sahin, B. (2022). The adoption of industry 4.0 practices by the logistics industry: A systematic review of the gulf region. *Cleaner Logistics and Supply Chain*, 5
47. Núñez-Merino, M. Maqueira-Marín, J., Moyano-Fuentes, J., & Castano-Moraga, C. (2022). Industry 4.0 and supply chain. A Systematic Science Mapping analysis. *Technological Forecasting & Social Change*, 181
48. Ortiz, A., Camacho, E., Rojas, J., Camacho, T., Zoe, S., Tatiana, N., Vásquez Perdomo, A., Del Castillo Herazo, V., & Giraldo, R. (2022). A Practical Guide to Perform a Systematic Literature Review and Meta-analysis. *Principles and Practice of Clinical Research*, 7(4), 47–57
49. Philbeck, T., & Davis, N. (2018). The Fourth Industrial Revolution. *Journal of International Affairs*, 72(1), 17–22
50. Pittway, L. (2008). Systematic literature reviews. In Thorpe, R. & Holt, R. *The SAGE dictionary of qualitative management research*
51. Puthal, D., Malik, N., Mohanty, S., Kougianos, E., & Das, G. (2018). Everything you Wanted to Know about the Blockchain. *IEEE Consumer Electronics Magazine*, 7(4), 6–14
52. Rad, F., Oghazi, P., Palmi, M., Chirumalla, K., Pashkevich, N., Patel, P., & Sattari, S. (2022). Industry 4.0 and supply chain performance: A systematic literature review of the benefits, challenges, and critical success factors of 11 core technologies. *Industrial Marketing Management*, 105
53. Rafik, M., Bahnasse, A., & Khiat, A. (2019). Towards a Smart Energy Sharing in Micro Smart Grid Adopting SDN Approach. *Procedia Computer Science*, 151, 717-724
54. Raval, S. (2016). *Decentralized Applications: Harnessing Bitcoin's Blockchain Technology*. O'Reilly Media

55. Saberi, S., Kouhizadeh, M., & Sarkis, J. (2018). Blockchain technology and its relationships to sustainable supply chain management. Taylor & Francis
56. Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019). Blockchain Technology and Its Relationships to Sustainable Supply Chain Management. *International Journal of Production Research*, 57(7)
57. Saleh, F. (2021). Blockchain without Waste: Proof-of-Stake. *The Review of Financial Studies*, 34 (3), 1156–1190
58. Sangeerth, P., & Lakshmy, K., (2021). Blockchain based smart contracts in automation of shipping ports. 6th International Conference on Inventive Computation Technologies (ICICT), 1248-1253.
59. Schniederjansa, D., Curadob, C., & Khalajhedayati, M. (2020). Supply chain digitisation trends: An integration of knowledge management. *International Journal of Production Economics*, 220
60. Schwab, K. (2017). *The Fourth Industrial Revolution*. Crown Business.
61. Shaffril, M., Samsuddin, S.F., & Abu Samah, A. (2021). The ABC of systematic literature review: the basic methodological guidance for beginners. *Qual Quant*, 55, 1319–1346
62. Sherman, A., Javani, F., Zhang, H., & Golaszewski, E. (2019). On the Origins and Variations of Blockchain Technologies. *IEEE Security Privacy*, 17(1), 72–77
63. Sontakke, N., Shivansh, R. Utekar, S. & Sonawane, S. (2023). A Novel Approach for Invoice Management using Blockchain. *International Journal of Innovative Science and Research Technology*
64. Swan, M. (2015). *Blockchain: Blueprint for a New Economy*. O'Reilly Media.
65. Tapscott, D., & Tapscott, A. (2016). *Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World*. Penguin.
66. Tian, F. (2017). A Supply Chain Traceability System for Food Safety Based on HACCP, Blockchain & Internet of Things. 2017 International Conference on Service Systems and Service Management (ICSSSM)

67. Tijan, E., Aksentijevi, S., Ivani, K., & Jardas, M. (2019). Blockchain Technology Implementation in Logistics. Sustainability
68. Yassine Issaouia, Y., Khiata, A., Bahnasseb, A., Ouajji, H. (2019). Smart logistics: Study of the application of blockchain technology. Procedia Computer Science, 160, 266–271

Online resources

1. BiTA, 2024, "Blockchain in Transport Alliance". Available at: <https://bita.studio/> [Retrieved 2/1/2024]
2. Browne, R., 2017, "IBM partners with Nestle, Unilever and other food giants to trace food contamination with blockchain", CNBC. Available at: <https://www.cnbc.com/2017/08/22/ibm-nestle-unilever-walmart-blockchain-food-contamination.html> [Retrieved 10/12/2023]
3. Chandler, S., 2022, "Proof of stake vs. proof of work: key differences between these methods of verifying cryptocurrency transactions", Business Insider. Available at: <https://www.businessinsider.com/personal-finance/proof-of-stake-vs-proof-of-work> [Retrieved 10/11/2023]
4. Charles Sturt University, "Literature Review: Systematic literature reviews". Available at: <https://libguides.csu.edu.au/review/Systematic> [Retrieved 5/10/2023]
5. China's Ministry of Industry and Information Technology, 2017, "Made in China 2025". Available at: http://english.www.gov.cn/policies/policywatch/201705/19/content_281475670249336.html [Retrieved 2/6/2023]
6. del Castillo, M., 2017, "Microsoft Unveils Project Manifest, A Plan For Blockchain Product Tracking", CoinDesk. Available at: <https://www.coindesk.com/markets/2017/01/25/microsoft-unveils-project-manifest-a-plan-for-blockchain-product-tracking/> [Retrieved 1/12/2023]
7. Deloitte, 2020, "Blockchain in the Logistics Industry". Available at: https://www2.deloitte.com/content/dam/insights/us/articles/5019_Blockchain-in-logistics/DI_Blockchain-in-logistics.pdf [Retrieved 2/6/2023]

8. Deloitte, 2020, "The Fourth Industrial Revolution: At the Intersection of Readiness and Responsibility". Available at:
<https://www2.deloitte.com/content/dam/Deloitte/us/Documents/about-deloitte/us-innovation-deloitte-the-fourth-industrial-revolution.pdf>
[Retrieved 2/6/2023]
9. DHL Trend Research, 2018, "Blockchain in Logistics". Available at:
<https://www.dhl.com/content/dam/dhl/global/core/documents/pdf/glo-core-Blockchain-trend-report.pdf> [Retrieved 2/6/2023]
10. DHL, 2019, "Trend Research Blockchain in Logistics; Perspectives on the Upcoming Impact of Blockchain Technology and use Cases for the Logistics Industry". Available at:
<https://www.logistics.dhl/content/dam/dhl/global/core/documents/pdf/glo-core-blockchain-trend-report.pdf> [Retrieved 2/12/2023]
11. Eurostat, 2021, "Statistics on the Transport Sector". Available at:
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Transport_statistics_at_regional_level
[Retrieved 2/6/2023]
12. Everledger, 2024, "Our industry solutions". Available at:
<https://everledger.io/industry-solutions/> [Retrieved 2/1/2024]
13. Ewing, J., 2021, "How a Tiny Chip Shortage Snarled Car Factories and Why It Won't End Soon", The New York Times, April 8th. Available at: <https://www.nytimes.com/2021/04/08/business/auto-chip-shortage.html> [Retrieved 2/6/2023]
14. Hackett, R., 2017, "Wal-Mart Explores Blockchain for Delivery Drones", Fortune. Available at:
<https://fortune.com/2017/05/30/walmart-blockchain-drones-patent/>
[Retrieved 2/12/2023]
15. Honrubia, M., 2023, "7 Blockchain Applications in Logistics", Ennomotive. Available at: <https://www.ennomotive.com/Blockchain-applications-in-logistics/> [Retrieved 9/11/2023]
16. IBM, 2023, "IBM Food Trust". Available at:
<https://www.ibm.com/products/supply-chain-intelligence-suite/food-trust> [Retrieved 10/12/2023]

17. Maersk, 2022, "A.P. Moller - Maersk and IBM to discontinue TradeLens, a blockchain-enabled global trade platform". Available at: <https://www.maersk.com/news/articles/2022/11/29/maersk-and-ibm-to-discontinue-tradelens> [Retrieved 10/12/2023]
18. McGregor, R., 2020, "Digital Transformation Is Accelerating in the Time of COVID", Harvard Business Review, September 21st. Available at: <https://hbr.org/2020/09/digital-transformation-is-accelerating-in-the-time-of-covid> [Retrieved 2/6/2023]
19. Mouawad, J., 2020, Cargo Prices Surge as Freighters Wait Months for Space, The New York Times, June 1st. Available at: <https://www.nytimes.com/2020/06/01/business/cargo-prices-coronavirus.html> [Retrieved 2/6/2023]
20. Nakamoto, S, 2008, "Bitcoin: A Peer-to-Peer Electronic Cash System". Available at: <https://bitcoin.org/bitcoin.pdf> [Retrieved 2/6/2023]
21. Provenance, 2024, "About Provenance Blockchain". Available at: <https://provenance.io/foundation/> [Retrieved 2/1/2024]
22. Request Network, 2024, Official Website. Available at: <https://request.network/> [Retrieved 05/01/2024]
23. Rizzo, P., 2016, "World's Largest Mining Company to Use Blockchain for Supply Chain", Coindesk. Available at: <https://www.coindesk.com/markets/2016/09/23/worlds-largest-mining-company-to-use-blockchain-for-supply-chain/> [Retrieved 1/12/2023]
24. Saenz, T., 2020, "Collaboration Will Be Key to COVID-19 Recovery", Supply Chain Dive, July 16th. Available at: <https://www.supplychaindive.com/news/collaboration-key-to-covid19-recovery/581642/> [Retrieved 2/6/2023]
25. Samburaj, D., 2021, "FedEx Turns to Blockchain to 'Transform the Logistics Industry". Available at: <https://www.ccn.com/fedex-turns-blockchain-transform-logistics-industry/> [Retrieved 2/1/2024]
26. Sristy, A., 2021, "Blockchain in the food supply chain - What does the future look like?", Walmart. Available at: <https://tech.walmart.com/content/walmart-global->

tech/en_us/news/articles/blockchain-in-the-food-supply-chain.html

[Retrieved 10/12/2023]

27. The Economist, 2015, "The great chain of being sure about things", October 31st. Available at:
<https://www.economist.com/briefing/2015/10/31/the-great-chain-of-being-sure-about-things> [Retrieved 15/11/2023]
28. The Federal Ministry for Economic Affairs and Energy, 2021, "Industrie 4.0". Available at:
<https://www.bmwi.de/Redaktion/EN/Artikel/Industrial-policy/industrie-4-0.html> [Retrieved 2/6/2023]
29. UNCTAD, 2018, "Review of Maritime Transport". Available at:
https://unctad.org/system/files/official-document/rmt2018_en.pdf [Retrieved 2/6/2023]
30. Wallis, C., 2020, "How the Pandemic Broke Supply Chains", BBC, September 15th. Available at:
<https://www.bbc.com/future/article/20200914-covid-19-how-the-pandemic-has-broken-global-supply-chains> [Retrieved 2/6/2023]
31. Ward, M., 2020, "Five Supply Chain Lessons from the COVID-19 Pandemic", Forbes. Available at:
<https://www.forbes.com/sites/marciaturner/2020/06/03/five-supply-chain-lessons-from-the-covid-19-pandemic/?sh=2078b2e54980> [Retrieved 2/6/2023]
32. World Bank, 2019, "Logistics Performance Index". Available at:
<https://lpi.worldbank.org/> [Retrieved 2/6/2023]
33. World Economic Forum, 2018, "The Future of Jobs Report 2018". Available at: <https://www.weforum.org/reports/the-future-of-jobs-report-2018> [Retrieved 2/6/2023]
34. World Economic Forum, 2020, "The Future of the Last-Mile Ecosystem". Available at:
http://www3.weforum.org/docs/WEF_The_Future_of_the_Last_Mile_Ecosystem_report.pdf [Retrieved 2/6/2023]
35. World Economic Forums Report (WEFR), 2018, "Enabling Trade. Valuing Growth Opportunities". Available at:

[http://www3.weforum.org/docs/WEF SCT EnablingTrade Report 2013.pdf](http://www3.weforum.org/docs/WEF_SCT_EnablingTrade_Report_2013.pdf) [Retrieved 2/12/2023]

36. Zhao, W., 2017, "Australia's Biggest Grain Exporter Trials Blockchain Tracking System", Coindesk. Available at:
<https://www.coindesk.com/markets/2017/08/03/australias-biggest-grain-exporter-trials-blockchain-tracking-system/> [Retrieved 1/12/2023]
37. Zumbun, J., Leherer, A., & Lin, L., 2020, "Coronavirus Epidemic Threatens China's Economy and Global Shipping", The Wall Street Journal, February 12th. Available at:
<https://www.wsj.com/articles/coronavirus-epidemic-threatens-chinas-economy-and-global-shipping-11581529810> [Retrieved 2/6/2023]

Appendix

A. List of articles selected in the SLR process

1. Abdalmajeed, A., Najed, A., Anwar, A., Loai Naser, A., & Amer Moh'd, A. (2023). Adoption of Blockchain Technology in Supply Chain. SAGE Publications
2. Alves, L., Ferreira, E., Lopes, S., Faria, P., & Rosado da Cruz, A. (2022). Towards circular economy in the textiles and clothing value chain through blockchain technology and IoT: A review. Waste Management & Research
3. Azza, S., Zouina, S., Muzna, S., Aminah, A., Shehar, B., Sarabjot, S., Sindhu, T., Trissa, P., Muhammad, K., & Nishwa, A. (2022). Industry 4.0 Technologies for the Manufacturing and Distribution of COVID-19 Vaccines. Journal of Primary Care & Community Health, 13
4. Behzad, B. (2023). Port 4.0: a conceptual model for smart port digitalization. Transportation Research Procedia, 74, 346–353
5. Bernards, N., Campbell-Verduyn, M., & Rodima-Taylor, D. (2022). The veil of transparency: Blockchain and sustainability governance in global supply chains. Environment and Planning C: Politics and Space
6. Biswas, S., Turan, H., Elsayah, S., Richmond, M., & Cao, T. (2023). The future of military medical evacuation: literature analysis focused on the potential adoption of emerging technologies and advanced decision-analysis techniques. The Journal of Defense Modeling and Simulation
7. Chbaika, N., Khiata, A., Bahnasseb, A., Ouajji, H. (2022). The Application of Smart Supply Chain Technologies in The Moroccan Logistics. Procedia Computer Science, 198, 578–583
8. Delke, V., Schiele, H., Buchholz, W., & Kelly, S. (2023). Implementing Industry 4.0 technologies: Future roles in purchasing and supply management. Technological Forecasting & Social Change, 196
9. Du, J., Nielsen, B., & Welch, C. (2023). From Buzzword to Biz World: Realizing Blockchain's Potential in the International Business Context. California Management Review

10. Guo, L., Chen, J., Li, S., Li, Y., & Lu, J. (2022). A blockchain and IoT-based lightweight framework for enabling information transparency in supply chain finance. *Digital Communications and Networks*, 8, 576–587
11. Hacker, J., Miscione, G., Felder, T., & Schwabe, G. (2023). Commit or Not? How Blockchain Consortia Form and Develop. *California Management Review*
12. Hassoun, A., Kamiloglu, S., Garcia, G., Parra-Lopez, C., Trollman, H., Jagtap, S., Aadil, M., Esatbeyoglu, T. (2023). Implementation of relevant fourth industrial revolution innovations across the supply chain of fruits and vegetables: A short update on Traceability 4.0. *Food Chemistry*, 409
13. Hirvonen-Ere, S., & Bask, A. (2022). Toward environmentally sustainable supply chains: How contract management can help companies along their transformation journey. *Journal of Strategic Contracting and Negotiation*, 6 (3), 199-220
14. Huang, K., Wang, K., Lee, P., & Andy C.L. Yeung, A. (2023). The impact of industry 4.0 on supply chain capability and supply chain resilience: A dynamic resource-based view. *International Journal of Production Economics*, 262
15. Ichimura, Y., Dalaklis, D., Kitada, M. & Christodoulou, A. (2022). Shipping in the era of digitalization: Mapping the future strategic plans of major maritime commercial actors. *Digital Business*, 2
16. Iranmanesh, M., Maroufkhani, P., Asadi, S., Ghobakhloo, M., Dwivedi, Y., & Tseng, M. (2023). Effects of supply chain transparency, alignment, adaptability, and agility on blockchain adoption in supply chain among SMEs. *Computers & Industrial Engineering*
17. Jiang, F., Isa, F., Ng, S., & Bhatti, M. (2023). The Impact of Supply Chain Integration to Supply Chain Responsiveness in Chinese Electronics Manufacturing Companies. *SAGE Open*, 13 (4)
18. Kannan Govindan, K., Kannan, D., Ballegård, T., & Nielsen, T. (2022). Supply Chain 4.0 performance measurement: A systematic literature review, framework development, and empirical evidence. *Transportation Research Part E*, 164

19. Lim, A., & Pan, E. (2021). Toward a Global Social Contract for Trade - a Rawlsian approach to Blockchain Systems Design and Responsible Trade Facilitation in the New Bretton Woods era. *Journal of Responsible Technology*
20. Mohan, S., Zahra, S., Hossein, T., & Danny, S. (2022). Why emerging supply chain technologies initially disappoint: Blockchain, IoT, and AI. *Production and Operations Management*, 31 (6), 2517-2537
21. Mueen, U., Khaled, S., Raja, J., & Sasa, P. (2021). Blockchain for drug traceability: Architectures and open challenges. *Health Informatics Journal*, 27 (2)
22. Nadir Munir, H., Syed Abdul Rehman, K., Muhammad Umair, K., & Adnan Ahmed, S. (2023). Interconnection between the role of blockchain technologies, supply chain integration, and circular economy: A case of small and medium-sized enterprises in Pakistan. *Science Progress*
23. Noorul Shaiful Fitri Abdul Rahman, N., Hamid, A., Lirn, T., Al Kalbani, K., & Sahin, B. (2022). The adoption of industry 4.0 practices by the logistics industry: A systematic review of the gulf region. *Cleaner Logistics and Supply Chain*, 5
24. Núñez-Merino, M. Maqueira-Marín, J., Moyano-Fuentes, J., & Castano-Moraga, C. (2022). Industry 4.0 and supply chain. A Systematic Science Mapping analysis. *Technological Forecasting & Social Change*, 181
25. Qingyu, Z., Salman, K., Safeer Ullah, K., & Ikram Ullah, K. (2023). Understanding Blockchain Technology Adoption in Operation and Supply Chain Management of Pakistan: Extending UTAUT Model With Technology Readiness, Technology Affinity and Trust. *SAGE Open*, 13 (4)
26. Rad, F., Oghazi, P., Palmi, M., Chirumalla, K., Pashkevich, N., Patel, P., & Sattari, S. (2022). Industry 4.0 and supply chain performance: A systematic literature review of the benefits, challenges, and critical success factors of 11 core technologies. *Industrial Marketing Management*, 105

27. Schniederjansa, D., Curadob, C., & Khalajhedayati, M. (2020). Supply chain digitisation trends: An integration of knowledge management. *International Journal of Production Economics*, 220
28. Syed Abdul, R., Zeeshan, A., Adnan Ahmed, S., & Zhang, Y. (2022). Digital transformation, smart technologies, and eco-innovation are paving the way toward sustainable supply chain performance. *Science Progress*, 105 (4)
29. Yassine Issaouia, Y., Khiata, A., Bahnasseb, A., Ouajji, H. (2019). Smart logistics: Study of the application of blockchain technology. *Procedia Computer Science*, 160, 266–271