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Blockchain Technology in Supply Chain Management: A Comprehensive Overview

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ABSTRACT

Blockchain technology has emerged as a groundbreaking solution for addressing various challenges in supply chain management (SCM). This paper provides a comprehensive overview of the integration of blockchain technology into SCM, focusing on its definition, importance, key features, challenges, applications, and future trends. The paper begins by elucidating the concept of blockchain technology and its significance in fostering transparency, trust, and real-time data management in supply chains. It explores the potential of blockchain in enhancing accountability, traceability, collaboration, and decentralization across diverse industries and applications. Furthermore, the paper discusses the challenges inherent in traditional SCM and how blockchain technology can mitigate these challenges, particularly in areas such as transparency, traceability, and counterfeit prevention. Several real-world blockchain applications in SCM are examined, including food safety, product authenticity, and supply chain transparency. Finally, the paper explores future trends and implications of blockchain technology in SCM, highlighting the need for deeper integration, development, and self-decentralization to create more flexible and adaptive supply chain systems.

Keywords: Blockchain technology, Supply chain management, Transparency, Traceability, Counterfeit prevention, Decentralization, Collaboration, Future trends

INTRODUCTION

In the contemporary landscape of global commerce, the efficient management of supply chains stands as a paramount concern for businesses across various industries [1, 2]. Supply chain management (SCM) encompasses a complex network of interrelated activities, spanning from procurement and production to distribution and delivery, all aimed at delivering value to customers. However, traditional SCM systems often grapple with challenges related to transparency, traceability, and security, which can impede operational efficiency and erode consumer trust. The emergence of blockchain technology has heralded a new era of innovation in supply chain management, offering unprecedented opportunities to address these challenges and transform conventional practices [3-6]. Blockchain, originally conceptualized as the underlying technology powering cryptocurrencies, has evolved into a robust solution for creating transparent, tamper-proof, and decentralized systems of record-keeping. This paper provides an in-depth exploration of the integration of blockchain technology into supply chain management, elucidating its definition, importance, key features, challenges, applications, and future implications. By leveraging blockchain's core attributes, including immutability, decentralization, and consensus mechanisms, businesses can revolutionize their supply chain operations, fostering trust, efficiency, and accountability throughout the value chain [7, 8]. Through a comprehensive examination of real-world use cases and emerging trends, this paper aims to offer insights into the transformative potential of blockchain technology in reshaping the dynamics of modern supply chains. As organizations increasingly recognize the value proposition of blockchain in SCM, the stage is set for a paradigm shift towards more transparent, resilient, and agile supply chain ecosystems [9, 10].

Supply Chain Management

The world has been unable to create an interconnection platform that is incorruptible and where the data inserted is true from the source and carries permanent operation. Blockchain technology is a peer-to-peer platform where every node forwarded is called a block [11, 12]. More recently, the plethora of uses and value in blockchain technology in supply chain and logistics has gained many contributions from various parts of the world as the world is fully moving towards a demand-driven supply chain mechanism [13,

14]. A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, the transformation of these materials into intermediate goods and final products, and the distribution of these final products to customers. A supply chain is a set of organizations that are involved in the manufacturing, processing, storage, distribution, and sale of a product. The collective name for these organizations is the supply chain [15, 16]. The location of these organizations can be in the same or different countries and can be an internal/external or internal/external collaboration function. Supply chain management (SCM) is the design and management of seamless, end-to-end value delivery systems to optimize organizational performance and customer satisfaction in the face of dynamic supply and demand complex contextual and systemic uncertainty challenges [17, 18]. Blockchain represents a technical innovation that is committed to the creation of an indestructible technology for the transparent and real-time management of data and information. The core structure of blockchain, distributed ledger technology (DLT), was originally invented by Fujitsu over 30 years ago and has been widely used in mass operations, financial and insurance sectors [19, 20]. As the DLT or blockchain technology has continued to grow, its features have made it a winning solution across a range of industries: finance (for transactions), energy (for distributed energy trading), agriculture (for fair trade operations), notary (for e-government operations), healthcare (patient data management), and textiles (supply chain and IP hidden code) [22]. Indeed, blockchain is the reference for this application, but more so for the e-gate of customs and tax-free operations overseen by the United Nations. Furthermore, The EU Parliament has also signed a regulation that e-invoicing between EU members of electronic invoicing was made simple and easily checkable [23, 24].

Definition and Importance

The idea of Supply Chain Management (SCM) was developed to integrate and coordinate all relevant activities of independent legal entities through a connected network to increase the efficiency, sustainability, and safety of connections. Blockchain has proven to be fundamental in fostering transparency and trust among all actors in different sectors and applications, including in the agri-food sector, participatory sustainability, urban development, and smart manufacturing [25, 26]. Discussions of blockchain have primarily focused on the transaction and on the execution phases. It has been shown that blockchain-based systems can be efficiently employed to optimize processes such as product traceability, supply chain integrity, and contract management. A blockchain-based software tool for SCM can not only improve the functionalities of traditional SCM systems, including real-time traceability in the food sector, but can also sustain the development of circular, dematerialized, and innovative business models. SCM will become more transparent, robust, and reliable once blockchain technology and the Internet of Things are fully integrated into SCM [27, 28] The Internet of Things (IoT) involves inserting a range of sophisticated devices into everyday objects that can observe, track, and provide all kinds of information, allowing a system to be more intelligent and capable for automatically adjusting the status of third devices/objects involved in the processes. Here, we propose an IoT application in a specific sector such as the supply chain management (SCM) of international routes and, as an enabling technology, we suggest using a specific type of non-centralized and near-time data sharing, e.g., blockchain. It is already known that within IoT systems, sensor nodes and different types of devices will consume lots of resources for performing different operational tasks [29, 30]. Moreover, devices will need to interact with each other a lot. To avoid any malicious third party to intercept data and subsequently change the quality and volume of information, it can be useful leveraging the capability offered by specific technologies — such as blockchains, for SCM. We share an approach that effectively outlines the more critical elements a blockchain-based system integrated within an IoT system dedicated to SCM should enumerate to be considered as a good reference architecture, and functional and security securing solutions available [31, 32].

Overview of Blockchain Technology

Blockchain technology is increasingly used across different disciplines [33]. The penetration of Blockchain technology in supply chain management is a hot topic and has attracted particular attention in different segments [34]. How to better utilize supply chain data captured from the physical world to improve overall value for the companies in the supply chain, such as food companies, is difficult. It is a big issue to improve customer confidence. In this paper, we propose an original and comprehensive Blockchain-enabled method to manage the supply chain in the food industry. We demonstrate the way to improve efficiency and security across the supply chain and reduce costs, frauds, and efforts needed to manage the supply chain [35, 36]. Practically speaking, to solve the problem in the food industry, we apply the different lifecycles of food products as the activities from the supply chain design view. How they interact with each other and how connections between them contribute to improving supply chain management is the main focus in this work [37].

What is Blockchain?

Blockchain acceptance rates have the promise to increase goods management procedures. The overview goes into detail about ways of blockchain systems and intelligent contracts from a logistics point of view. Initially, blockchain systems use particular technology that players in a decentralized logistics and supply chain manage their liquidity well, specifically to trade economic properties [38, 39]. Owners may be economic organizations, open suppliers in a decentralized maintenance system, as well as barter marked in a decentralized stock or a cryptocurrency pass box. Blockchain logistics can use it to succeed out dealings in URLs and images or other valuable properties rejoins by individuals in the intellectual property cog or in other choices avatars. Blockchain has been recognized as an essential technology driving future networks and logistics due to forward points in ensuring traceability, trustworthiness, just conduct as well as user safety [40, 41]. The blockchain user network, more specifically the general public ledger, drives a fresh chance for troublesome design in essential logistics and sourcing without the demand for intermediaries, hence providing light ways for a straight linking of essential parties in the goods movement mode. Blockchain systems operate with a decentralized setup and trustless information sanitation, specifications which have been at the center of goods management transactions for a long time [42]. Intelligent contracts provide AI activities represented in the centralized algorithms of a certain private operation and may finalize logistical exchanges to get less property without essential organizations' claims [43].

Key Features and Benefits

Besides guaranteeing the uniqueness of the item, blockchain can be designed to retain data from all previous states of the item a direct function of tamper-proof nature. This thus allows the complete traceability of products/data including all, even minor, alterations (no erasures, no contradictions), perfect synergy with corporate and international Standard Management Systems, and rich digital support in compliance checks. All this can simplify activities such as audits, inspections, and investigations [44, 45]. All these features, naturally, are also crucial in guaranteeing safety and fighting counterfeit products. Blockchain's security enhances supply chain management, by guaranteeing the uniqueness of each item. Blockchain's tamper-proof nature ensures that a 'sticky' digital version of the item follows it throughout the chain and becomes a certifiable "digital twin". Every participant who shares this digital supply chain will certify the properties of the items passing through according to its business, and according to the user's data-sharing preferences. Statutory certifications can also be added by certified authorities, whether brought into the consultation exchange by the blockchain itself or requested by the user. In this way, every item will have a complete, continually updated profile, ensuring the uniqueness of the physical item and the digital twin [46, 47].

Challenges in Traditional Supply Chain Management

Paper companies are exposed to unsophisticated and inefficient technical data storage from current business strategies. In which databases are strongly centralized, irrespective of their "confidentiality" or "integrity". Without physical verification of stock levels in the warehouse inventory data can be forged on centralized servers without discussion of regional managers about the new globally concentration policy. In addition, fraud can be committed via transportation by illegally removing inventory from trucks before unloading to find stock documents [48, 49]. Provided that a company characterises its data in traditional formats, it also meets the obstacle of manipulating numerous data sources. These sources or directories are shown online, and makes data easier to be shared or manipulated. And during times of bargaining, product transaction data is still new on the global ledger. Supply chain management traditionally causes high costs and problems with insufficient efficiency. Although transport and logistics are fast, the process and procedures underpinning supply chains normally take a long time. During a transaction, each division has its own record, company and, therefore, may have its own logbook. Therefore, it is easy to falsify, manipulate, sabotage, or erase data, such as the change of product name, quantity, owner, and price [50, 51]. Supply chain management undergoes specific issues and challenges such as lack of traceability of items or delays which can be mitigated by the implementation of new technology innovations like blockchain [52, 53]. Manufacturing of products often has no traceability control system and can easily produce substandard or counterfeit products [54]. The supply chain is highly centralized, so it can only rely on the trust built on the reputation of the main supply agencies, leading to potential rumors or manipulation. Therefore, the blockchain can be beneficial for supply chain transaction records in quickly verifying the traceability of items and for miscount prevention as soon as undue days and payments are detected. In a blockchain-enabled supply chain, the services are an intermediate process, which is almost transparent and it is easier to integrate business processes and establish trust [55, 56]. In conclusion, with the increasing development of supply chain tracking system technology, enterprises are important to

enhance their supply chain security. Uninterrupted blockchain-based supply chain management could be able to handle real-time transactions and ensure data history is safe and secure [57, 58].

Transparency and Traceability Issues

Customers can be informed of product information when required. Blockchain can also detect malicious actors who modify the products' historical data by updating newer reports. In traditional supply chains, customers cannot track and trace the historical information of the whole product. In the event of problems, the provenance of the problem cannot be traced [59, 60]. The storing of all transaction data without interference on the blockchain is expected to overcome such problems. In blockchain technology, real-time point-to-point verification distinguishes it from traditional supply chains. With the main feature of immutable and tamper-evident ledgers, the technology can address the transparency issue encountered [61]. Supply chain members can quickly detect and handle potential trust violations, iqestions about product quality, product measurement and specification discrepancies, certification problems, and other issues with real-time analytics and distributed machine learning-based decision support systems. Logistical information such as bar codes, QR codes, RFID information, and other Internet of Things (IoT) sensor data can also be shared with all supply chain members in real-time. Tracking notes, current conditions, and other product status data are kept updated [62, 63]. Therefore, the transparency and traceability problem outlined in the literature can also be addressed by integrating IoT, big data artificial intelligence solutions, and blockchain technology in the supply chain. This essentially refers to using cloud-based decision support systems to provide an information basis for supply chain processes in the form of real-time big data. Supply chain integration provides more efficient management of the entire supply chain network, taking the disclosure of product travel time to a point to the extent of enabling real-time tracking of product development phases [64, 65]. Blockchain technology can improve transparency. In supply chains, customers and producers do not trust the authenticity of intermediaries. The technology mitigates such problems by offering high transparency and traceability in the supply chain network. This allows all organizational members to access the products' history. It enables tracking and tracing of product locations and suggests a fast spot mechanism for product verification. Blockchain technology can connect all supply chain members in a decentralized manner and prevent the use of intermediaries by providing more transparency and traceability. A sender can track the progress of a product in real-time. This information is recorded and cannot be tampered with, leading to greater transparency [66, 67].

Applications of Blockchain in Supply Chain Management

Blockchain is also known to be the perfect solution for hamburger data management to avoid food contamination, which increases food safety, reduces waste, and enhances the economy since blockchain technology can be used to fully integrate value chain actors. The blockchain system can help in efficient recall, providing a network manager with a multi-actor, multi-object recall process that can be sufficiently accurate, track, and recall it quickly enough [68, 69]. The system can store information on the quantity of each product, from batch to retail, and the channels used for shipment. What is also is also being tracked is the health status of cattle and the blenders. For all beef and stakeholders, the data points are available and accurate it would be possible to conduct a quick and efficient product recall sanction procedure [70]. Blockchain technology provides new applications and designs that can facilitate and enhance different supply chain management processes. Blockchain applications have been successfully introduced by major firms across various sectors, including food and beverages (e.g. Walmart's Food Safety solution), healthcare (e.g. Chronicled's MediLedger), logistics (e.g. IBM's TradeLens), automotive (e.g. Renault's Impact Ledger) or luxury, textile, and diamonds (e.g. Arianee's luxury-certified ledger) [71, 72]. IBM has developed Food Trust, an industry consortium serving as a warehouse for key product information such as its provenance (i.e. where it was manufactured and purchased), handling, transportation, storage, expiration, and other in-pipe of countries such as the US, UK, and several EU members [73-77].

Product Authenticity and Counterfeit Prevention

Counterfeit and pirated products have rapidly spread, especially in the age of globalization. This particularly endangers the individual in the form of various ailments, but it also hinders, in particular, the developed economic development of the member state. Therefore, different traceability technologies (e.g., global standards such as GS1, RFID, NFC, UHF, and blockchain) have been introduced into the production and supply chain of countries. This article aims to examine potential applications of these technologies in a new e-commerce ecosystem to verify the authenticity of products in the value chain, thereby increasing consumer awareness and demand. This chapter observes e-commerce consumers' attitudes and behavior in emerging blockchain technology and their potential orientation. Baseline compared to RFID technology [78-81]. The global incidence of counterfeit pharmaceuticals has risen

dramatically in the past two decades, resulting in a growing threat to public health. According to estimates, approximately 10–15% of pharmaceuticals are counterfeit, and this percentage reportedly rises to approximately 25% in less developed countries. Many countries are dependent on global supply chains for industrial masks (N95) and non-medical face masks, causing international supply disturbances during the pandemic. Therefore, cryptography and blockchain could potentially increase the control of production, distribution, and consumption [82-84]. Moreover, counterfeit masks are more likely to lead to tragic consequences, and hence, anti-counterfeiting technologies need to be implemented. Ison and Hemp provide a system of RFID combined with blockchain to prevent counterfeiting in PPE. When a user requires PPE, the system provides complete information about the product by reading RFID tags using an individual software app in a communication device. Users can inspect the unique QR code on the wristband to verify the authenticity of products. [85] identify a mechanism where the producer and the customer interact to validate (using black-chain technology) the originality and authenticity of a product. Between 2013 and 2016, globally, there was a 48% rise in trade-related counterfeit and pirated goods. As supply chain transactions expand to a global network, their complexity and opacity invite subversion that results in fraudulent activities [85-87]. Blockchain technology, which maintains a shared and incorruptible ledger among the organizations in a framework, was proposed to be ideal for tracking and tracing supply chain transactions. Blockchain technology can facilitate faster recall ledgers, stronger data security, automated compliance audits, more transparent risk management, user-responsive smart contracts, multiple-parties involvement, and end-to-end visibility. This development is particularly powerful in the automotive industry. The International Migratory Logistics Priority Area and the global production of components and assembly lines from different geographical locations bring many challenges to the automotive supply chain. Counterfeit and pirated parts are one of the biggest challenges in the automobile industry [88, 89].

Future Trends and Implications

The future of the supply chain requires a disruptive interdisciplinary-based method and blockchain could catalyze the same. The structure of blockchain balances and collaborates resources, and aligns the practices with the related operational aspects. In addition, the union of different information, social, economic, and IT-based applications will require adaptive and reconfigurable computing paradigms; which can detect, identify, integrate, create, and analyze the resources. The future supply chain management may not lean on a certain trust-based system [90, 91]. Current blockchain technologies have been widely applied for the management of supply chain systems, which focuses on ensuring consensus-based and trustless transactional capabilities. At the same time, there should be a deeper integration and development of blockchain in the future. Only by this can a more flexible design and a more adaptive system be developed. Some concrete suggestions are; network decoding and layering of the data structure, computing paradigm development and reconfiguration, and so forth [92]. Thus, the main focus of self-decentralization will lead to less trust and trustlessness-based management of the supply chain [93-95].

CONCLUSION

Blockchain technology holds immense promise for revolutionizing supply chain management by addressing critical issues such as transparency, traceability, and counterfeit prevention. Through its decentralized and tamper-proof ledger system, blockchain enables seamless collaboration, enhances trust among stakeholders, and facilitates real-time tracking of products across the supply chain. Real-world applications of blockchain in SCM, such as food safety solutions and product authenticity verification, have demonstrated their potential to improve efficiency, security, and customer confidence. Looking ahead, deeper integration and development of blockchain technology are essential for creating more flexible and adaptive supply chain systems that can effectively navigate the complexities of modern global trade. As blockchain continues to evolve, it will play an increasingly integral role in shaping the future of supply chain management, driving innovation, and fostering a more transparent and resilient global economy.

REFERENCES

1. Xu, Pei & Lee, Joonghee & Barth, James & Richey, Robert. (2021). Blockchain as supply chain technology: considering transparency and security. International Journal of Physical Distribution & Logistics Management. ahead-of-print. 10.1108/IJPDLM-08-2019-0234.
2. Tukundane Benson, Emuron Lydia (2023).The Role Played by Research and Development in Uganda's MSME toward Promoting SDGs. Springer Nature Singapore. 155-173
3. A. K. Al-Alawi, A., R., L., Al-Busaidi, undefined, R., undefined, & Shaikh, undefined (2022). Towards Security Enhancement of Blockchain-based Supply Chain Management. [PDF]

4. Rachel Okwaja Puche and Eric Mabonga Ugwu Jovita Nnenna, Mbabazi Asiat, Tom Mulegi, Eze Chidinma Esther, Aleke Jude Uchechukwu (2023). The Benefits of Emotional Intelligence to Healthcare in Nigeria. NEWPORT INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN HUMANITIES AND SOCIAL SCIENCES. 3(2). 1-5
5. S. Al-Rakhami, M. & Al-Mashari, M. (2021). A Blockchain-Based Trust Model for the Internet of Things Supply Chain Management. ncbi.nlm.nih.gov
6. Anupama Kumar, S. & Anusha, M. (2023). Blockchain Enabled Supply Chain Management. ncbi.nlm.nih.gov
7. Tom Mulegi.(2022). An Overview of Performance of Health Workers in Uganda. IDOSR JOURNAL OF HUMANITIES AND SOCIAL SCIENCES 7(1): 113-124.
8. Benson Tukundane, Muhammad Kibuuka, Arthur Sunday (2020). New Product Development Practices and the Growth of Small and Medium Enterprises in Kampala Metropolitan, Uganda. International Journal of Research and Innovation in Social Science. 4(4), 266-271.
9. Khanna, A., Sah, A., Bolshev, V., Burgio, A., Panchenko, V., & Jasiński, M. (2022). Blockchain–Cloud Integration: A Survey. ncbi.nlm.nih.gov
10. Abura Samuel Pirir, Ongodia Ekomolot, Kiweewa Emmanuel, Tukundane Benson (2022). Assessment of Recruitment Methods and Employees Performance in local Governments, Karamoja Sub Region, Uganda. International Journal of Research and Innovation in Social Science. 6(7), 410-427.
11. Tukundane Benson, Kibuuka Muhammad, Sunday Arthur (2020). Information Technology Adoption and Growth of Small and Medium Enterprises in Greater Kampala Metropolitan Area, Uganda. International Journal of Advanced Research and Publications. 4(4), 69-74.
12. Mbyemeire Patrick, Deusdedit Byabashaija, Tumwesigye Mathias, Muhindo Tadeo, Beyongyera Julius, Nyabuhuzi M Donatien. (2016). Human Resource Planning and Employee Performance in Rwanda: A Perspective of Peoples Bank of Rwanda. Scholars Journal of Economics, Business and Management. 3(6), 316-320.
13. FRED SIAMBE OMWERI, WILSON MUNA, JANE NJOROGE. (2023). An analysis of how politics stream affects the implementation of road safety policy measures in Nyanza Region, Kenya. Reviewed Journal International of Business Management. 4(1), 13-21.
14. CALVINE CHEPLETING SEREM, TOM ONGESA. (2023). Opportunity for advancement strategy on performance of non-academic staff in the university of Eldoret, Kenya. Reviewed Journal International of Business Management. 4(1), 516-529.
15. J. Omweri, F. S., Muna, W., & Njoroge. (2023). EFFECTS OF PROBLEM STREAM ON IMPLEMENTATION OF ROAD SAFETY POLICY MEASURES IN NYANZA REGION, KENYA. The Strategic Journal of Business & Change Management. 10(1), 269-285.
16. Fred Omweri Siambe Dr. Thomas Otieno Juma. (2022). Bureaucratic Corruption on Devolved Units on Hard - Core Infrastructural Service Delivery: Case of Lake Region Economic Block, Kenya. American Based Research Journal. 11(5), 01-26.
17. Thomas Gisemba Onsarigo, Gladys Nyaiburi Ogaro. (2015). Gender based violence: An examination of ITS effect on women's social economic status a survey of Langas estate, Uasin Gishu County. International Journal of Advanced Research in Management and Social Sciences. 4(4), 281-290.
18. Kobusinge Aida. (2023). The Effect of Risk Management on Financial Performance in Centenary Bank Masindi Branch. EURASIAN EXPERIMENT JOURNAL OF HUMANITIES AND SOCIAL SCIENCES (EEJHSS). 4(1), 17-25.
19. Mulegi Tom and Eleanor Kirahora Barongo Usman Bappi.(2023). Examination of the level of community development in Gombe local government, Nigeria. IDOSR JOURNAL OF ARTS AND MANAGEMENT. 8(2): 48-62.
20. Joseph Ekpang, Godwin Omelagah. (2018). Advertising and the Culture of Consumerism in Nigeria: An Analysis of the "Black Friday" Sales of SPAR Nigeria. Journal of Humanities, Management and Social Sciences, 1(1), 36-52.
21. Eljazzar, M. M., A. Amr, M., S. Kassem, S., & Ezzat, M. (2018). Merging supply chain and blockchain technologies. [PDF]
22. Nyambane, D. O., & Ouma, B. O. (2017). Cash Management and Profitability of cement Industries in Kenya.
23. Byabashaija, D., Aluonzi, B., Karoro, E. A., Manyage, M. N., Nyambane, D. O., & Besigye, O. (2015). Group Formation Criteria of Money lending Associations in Rubirizi District, Western. Uganda.

24. DUSHIMIMANA GERARD (2016). Agricultural support projects and coffee production in rwanda: a case study of price project in huye district.
25. Hannington, T., Asuman, B., & Mary, B. (2022). Loans and women involvement in business in Kasese District: A Case of Women Entrepreneurs in Hima Town Council. *INOSR Humanities and Social Sciences*, *8*(1), 11-18.
26. Fred Ssemugenyi, Augustine Amboka Asumwa, Sophia Kazibwe. Balancing the delicate space between organizational culture and customer service quality: An empirical review for systemic excellence in the electrical energy sector in Kenya. Asian Research Journal of Arts & Social Sciences. 2020, 10(4), 20-32.
27. Emurugat Immaculate Azabo, Sofia Sol Gaite, Blessing Ijeoma Anumaka, Yakubu Ibrahim Wunti. Remuneration and discipline of employees in private universities in Uganda. Advances in Social Sciences Research Journal. 2020, 7(1), 438-451.
28. Shoaib, M., Zhang, S., & Ali, H. (2022). A bibliometric study on blockchain-based supply chain: a theme analysis, adopted methodologies, and future research agenda. ncbi.nlm.nih.gov
29. Enoch Oluwatomiwo Oladunmoye. A regression analysis of perceived organizational support, interpersonal relationship and employee turnover intention in southwest Nigeria. International Journal of Information, Business and Management. 2017, 9(3), 147.
30. LO Yekinni, Toyin A Rasaq. THE MEDIATING ROLE OF GENDER AND SELF-ESTEEM BETWEEN PARENT-CHILD RELATIONSHIP AND SEXUAL ABUSE AMONG SCHOOL ADOLESCENTS IN NIGERIA: A PATH ANALYTICAL MODEL. International Journal of Information, Business and Management. 2023, 15(2), 61-72.
31. Oladunmoye E. O, A Rasaq Toyin, Adegunle SO, Chibuzor E ONYEMA. Mediation analysis of Pre-Marital Sexual behaviour in Nigeria: The direct and indirect effects of peer pressure, socioeconomic status, and parent-child relationship. International Journal of Humanities Social Science and Management. 2022, 2(4), 140-148.
32. Samanya Bulhan, Nagaruka Deborah. Non-monetary incentives and employee relations in homes of hope non-government organisation (Mbarara district) IDOSR JOURNAL OF ARTS AND MANAGEMENT. 2023, 8(2), 22-30.
33. Kibuuka Muhammad, Novembrieta Sumil, Byamukama Eliab Mpora, Sophia Kazibwe, Manuel Sumil, Fred Ssemugenyi, Tindyebwa Wilberforce. Managerial skills and success of small-scale entrepreneurs in Kampala Uganda. Canadian International Journal of Social Science and Education. 2015, 3, 546-552.
34. Kukundakwe Rosen, Samanya Bulhan. Decentralization and service delivery in government aided primary schools of Buremba Sub-County. IAA Journal of Management. 2023, 10(1), 78-88.
35. Kusingiza Christine, Samanya Bulhan. Women's Participation and Management of Primary Schools in Ibare Sub-County: Bushenyi District, Uganda. IAA JOURNAL OF SOCIAL SCIENCES. 2023, 9(1), 55-61.
36. Samanya Bulhan, Beyogyera Naboth. Record keeping and operational accountability in Mutara sub-county Mitooma district, Western Uganda. IDOSR JOURNAL OF ARTS AND HUMANITIES. 2023, 9(1), 55-61.
37. Bulhan Samanya, Tom Mulegi, Ramadhan Badru Malinga, Hussein Muhaise, Wallen Atwijukire. Examining the Influence of Regulatory Governance on Service Quality in Bwera District Hospital, Kasese District, Western Uganda. IAA Journal of Management. 2023, 10(2), 17-31.
38. Bulhan Samanya, Umurungi Musiime Florence. Quality management system in Corporate business: A case study of a Customer focus approach in Kimironko Sector-Gasabo District. NEWPORT INTERNATIONAL JOURNAL OF RESEARCH IN EDUCATION. 2023, 3(2), 23-37.
39. Bulhan Samanya, Elias Amanya. Evaluation of Youth Empowerment and Community Development: A Case Study of Kamunganguzi Sub County, Kabale District, Uganda. IDOSR JOURNAL OF ARTS AND MANAGEMENT. 2023, 8(2), 11-21.
40. Roozkhosh, P., Pooya, A., & Agarwal, R. (2022). Blockchain acceptance rate prediction in the resilient supply chain with hybrid system dynamics and machine learning approach. ncbi.nlm.nih.gov
41. Cammarano, A., Varriale, V., Michelino, F., & Caputo, M. (2022). Blockchain as enabling factor for implementing RFID and IoT technologies in VMI: a simulation on the Parmigiano Reggiano supply chain. ncbi.nlm.nih.gov

42. Bulhan Samanya, Seezi Kusemererwa. English language and Academic Performance among Learners in Inclusive Schools of Mabaale Sub County, Kagadi District. NEWPORT INTERNATIONAL JOURNAL OF RESEARCH IN EDUCATION (NIJRE) 2023, 3(2), 81-90.
43. Paul, S., Adhikari, A., & Bose, I. (2022). White knight in dark days? Supply chain finance firms, blockchain, and the COVID-19 pandemic. ncbi.nlm.nih.gov
44. Longo, F., Nicoletti, L., Padovano, A., d'Atri, G., & Forte, M. (2022). Blockchain-enabled supply chain: An experimental study. [PDF]
45. Sankar Ramachandran, G., Malik, S., Pal, S., Dorri, A., Dedeoglu, V., Kanhere, S., & Jurdak, R. (2021). Blockchain in Supply Chain: Opportunities and Design Considerations. [PDF]
46. Bulhan Samanya, Tom Mulegi, Ramadhan Badru Malinga, Hussein Muhaise, Wallen Atwijukire(2023). Examining the Influence of Regulatory Governance on Service Quality in Bwera District Hospital, Kasese District, Western Uganda. IAA Journal of Management. 10(2) : 17-31.
47. Bulhan Samanya, Tom Mulegi, Ramadhan Badru Malinga, Hussein Muhaise, Wallen Atwijukire(2023). Exploring the Impact of Decentralization on Service Quality at Bwera District Local Government Hospital in Kasese District. IAA Journal of Management. 10(2): 1-16.
48. Asanairi Bwambale, Tom Mulegi, Samanya Bulhan.(2024). The Effect of Laissez-Faire Leadership Style on Academic Performance of Primary School Pupils in Selected Primary Schools in Kasese District. IAA Journal of Education 10(1):23-28.
49. Mulegi Tom and Eleanor Kirahora Barongo Usman Bappi (2023). Examination of the level of governance in Gombe local government, Nigeria. IDOSR JOURNAL OF BANKING, ECONOMICS AND SOCIAL SCIENCES 8(1): 60-74.
50. Asanairi Bwambale, Tom Mulegi, Samanya Bulhan.(2024 The Effect of Transactional Leadership on Academic Performance of Primary School Pupils in Social Studies in Munkunyu Sub County Kasese District . IAA Journal of Education 10(1):17-22.
51. Stangl, P. & P. Neumann, C. (2023). FoodFresh: Multi-Chain Design for an Inter-Institutional Food Supply Chain Network. [PDF]
52. Asanairi Bwambale, Tom Mulegi, Samanya Bulhan.(2024 The Effect of Transformational Leadership on Academic Performance of Primary School Pupils in Social Studies in Munkunyu Sub County Kasese District. NEWPORT INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN HUMANITIES AND SOCIAL SCIENCES 4(2): 25-31.
53. Habimana Theogene, Tom Mulegi and Niyompano Hosee (2017). The contribution of financial ratios analysis on effective decision making in commercial banks International Journal of Management and Applied Science.3(6): 33-40
54. Tom Mulegi(2022). Evaluation of the Skill Mix of Health Professionals in Government Regional Referral Hospitals in Uganda. International Digital Organization for Scientific Research.7(1): 43-68
55. Jovita Nnenna Ugwu, Tom Mulegi, Mbabazi Asiati, Chidinma Esther Eze . (2023). Prospects and Challenges of Sustainsble Development in Africa. IDOSR JOURNAL OF COMMUNICATION AND ENGLISH. 8(1) . 6-12.
56. Rachel Okwaja Puche and Eric Mabonga Ugwu Jovita Nnenna, Mbabazi Asiat, Tom Mulegi, Eze Chidinma Esther, Aleke Jude Uchechukwu.(2023). Mentorship and Increased Participation of Women in Politics: A Review. NEWPORT INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN HUMANITIES AND SOCIAL SCIENCES.3(2). 10-13.
57. Mbyemeire Patrick, Deusdedit Byabashaija, Tumwesigye Mathias, Muhindo Tadeo, Beyongyera Julius, Nyabuhuzi M Donatien. Human Resource Planning and Employee Performance in Rwanda: A Perspective of Peoples Bank of Rwanda. Scholars Journal of Economics, Business and Management. 2016, 3(6), 316-320.
58. Rachel Okwaja Puche and Eric Mabonga Ugwu Jovita Nnenna, Mbabazi Asiat, Tom Mulegi, Eze Chidinma Esther, Aleke Jude Uchechukwu. (2023). The Impacts of Teaching Strategies and Skills for Effective Learning of English Language in Cameroon. NEWPORT INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN HUMANITIES AND SOCIAL SCIENCES. 3(2). 6-9.
59. Jovita Nnenna Ugwu, Tom Mulegi, Mbabazi Asiati, Chidinma Esther Eze(2023). Challenges Confronting Community Newspapers in Meeting Aesthetics Standards. IDOSR JOURNAL OF COMMUNICATION AND ENGLISH 8(1): 1-5

60. Rachel Okwaja Puche and Eric Mabonga Ugwu Jovita Nnenna, Mbabazi Asiat, Tom Mulegi, Eze Chidinma Esther, Aleke Jude Uchechukwu(2023). Evaluation of Factors that Affect Teachers' Job Satisfaction and the Impact on Student Academic Performances. NEWPORT INTERNATIONAL JOURNAL OF RESEARCH IN EDUCATION 3(3) . 6-9
61. Tom Mulegi, Usman Bappi and Bulus Jonah Saidu (2023). An Assessment of the Effect of Motivation and Affirmative Action on Employee's Performance in Gombe Local Government, Nigeria. IDOSR JOURNAL OF BANKING, ECONOMICS AND SOCIAL SCIENCES.8(1) . 50-59.
62. Tom Mulegi and Lubaale G. Barongo E. K., Busingye J. D.(2023). Gendered Economic Gap in Uganda: Education Attainment and Women's Access to and Land Ownership in Bunyoro Sub-region. IDOSR JOURNAL OF ARTS AND MANAGEMENT. 8(2): 1-10.
63. Mwaniki Roseanne and Eleanor Kirahora Barongo Tom Mulegi, Ndagire Laila. (2023). A situational analysis of Access to and utilization of sexual and reproductive health services under decentralization in Kampala, Uganda. INOSR HUMANITIES AND SOCIAL SCIENCES. 9(1):31-50.
64. Mulegi Tom and Barongo Kirahora Eleanor Rukundika Francois, Mwaniki Roseann(2023). Evaluation of the effect of Education service interventions on re-integration of ex-combatant children in Haute-Kotto Prefecture of the Central African Republic. NEWPORT INTERNATIONAL JOURNAL OF RESEARCH IN EDUCATION (NIJRE) 3(2): 120-131.
65. Tom Mulegi and Lubaale G. Barongo E. K., Busingye J. D.(2023). Gendered Economic Gap in Uganda: Education Attainment and Women's Access to and Land Ownership in Bunyoro Sub-region. IDOSR JOURNAL OF ARTS AND MANAGEMENT. 8(2):1-10.
66. Mulegi Tom and Barongo Kirahora Eleanor Rukundika Francois, Mwaniki Roseann,(2023). The effect of Health service interventions on reintegration of ex-combatant children in Haute-Kotto Prefecture of the Central African Republic. NEWPORT INTERNATIONAL JOURNAL OF RESEARCH IN EDUCATION (NIJRE). 3(2):108-119.
67. Mulegi Tom and Barongo Kirahora Eleanor Rukundika Francois, Mwaniki Roseann(2023). The influence of the family support interventions on re-integration of ex-combatant children in HauteKotto Prefecture of the Central African Republic (CAR). NEWPORT INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN HUMANITIES AND SOCIAL SCIENCES (NIJCRHSS).3(1):24-34.
68. Mwaniki Roseanne and Eleanor Kirahora Barongo Tom Mulegi, Ndagire Laila (2023). Social, economic and cultural factors that influence access and utilization of sexual and reproductive health services under decentralization In Kampala, Uganda. INOSR HUMANITIES AND SOCIAL SCIENCES. 9(1): 15-30.
69. Rachel Okwaja Puche and Eric Mabonga Ugwu Jovita Nnenna, Mbabazi Asiat, Tom Mulegi, Eze Chidinma Esther, Aleke Jude Uchechukwu , (2023). Effect of Cultural Values on Character Formation: Implication for Education. NEWPORT INTERNATIONAL JOURNAL OF RESEARCH IN EDUCATION 3(3): 1-5.
70. Barongo Eleanor Kirahora and Tom Mulegi (2023). Empowerment and Participation of Women in Community Development in Lower Local Governments: A Case of Makindye Division, Kampala, Uganda. INOSR ARTS AND HUMANITIES 9(1): 48-61.
71. Mwaniki Roseanne and Eleanor Kirahora Barongo Tom Mulegi, Ndagire Laila (2023). Assessment of the level of knowledge and awareness of women on sexual and reproductive health services (SRH) under decentralization in Kampala Uganda. INOSR ARTS AND HUMANITIES 9(2): 35-47
72. Jovita Nnenna Ugwu, Tom Mulegi, Mbabazi Asiati, Chidinma Esther Eze.(2023). Barriers to Women Leadership. IDOSR JOURNAL OF ARTS AND HUMANITIES 9(1): 6-10
73. Tom Mulegi (2015). Skills and motivation of work performance of health professionals in government regional referral hospitals in Uganda :presented at the Canadian International Conference on Advances in Computer Science, Humanities and Education, April 1-2, 2015, Dubai, UAE.conference paper. http://hdl.handle.net/20.500.12306/1304.
74. Bulhan Samanya, Tom Mulegi, Ramadhan Badru Malinga, Hussein Muhaise, Wallen Atwijukire. Exploring the Impact of Decentralization on Service Quality at Bwera District Local Government Hospital in Kasese District. IAA Journal of Management. 2023, 10(2), 1-16.
75. George, William & Al-Ansari, Tareq. (2023). Review of Blockchain Applications in Food Supply Chains. Blockchains. 1. 34-57. 10.3390/blockchains1010004.

76. Xia, Jianting, Haohua Li, and Zhou He. 2023. "The Effect of Blockchain Technology on Supply Chain Collaboration: A Case Study of Lenovo" *Systems* 11, no. 6: 299. https://doi.org/10.3390/systems11060299
77. Gong, D.; Liu, S.; Liu, J.; Ren, L. Who benefits from online financing? A sharing economy E-tailing platform perspective. *Int. J. Prod. Econ.* **2020**, *222*, 107490. [Google Scholar] [CrossRef]
78. Flankegård, F.; Granlund, A.; Johansson, G. Supplier involvement in product development: Challenges and mitigating mechanisms from a supplier perspective. *J. Eng. Technol. Manag.* **2021**, *60*, 101628. [Google Scholar] [CrossRef]
79. Leng, K.; Bi, Y.; Jing, L. Research on agricultural supply chain system with double chain architecture based on blockchain technology. *Fu. Gen. Comput. Sys.* **2018**, *86*, 641–649. [Google Scholar] [CrossRef]
80. Malik, S.; Kanhere, S.S.; Jurdak, R. Product Chain: Scalable Blockchain Framework to Support Provenance in Supply Chains. In Proceedings of the IEEE 17th International Symposium on Network Computing and Applications, Cambridge, MA, USA, 1–3 November 2018. [Google Scholar]
81. Abeyratne, S.; Monfared, R. Blockchain Ready Manufacturing Supply Chain Using Distributed Ledger. *Int. J. Res. Engi. Tech.* **2016**, *5*, 1–10. [Google Scholar]
82. Li, J.; Zhu, S.; Zhang, W.; Yu, L. Blockchain-driven supply chain finance solution for small and medium enterprises. *Front. Eng. Manag.* **2020**, *7*, 500–511. [Google Scholar] [CrossRef]
83. Kopanaki, E. Conceptualizing Supply Chain Resilience: The Role of Complex IT Infrastructures. *Systems* **2022**, *10*, 35. [Google Scholar] [CrossRef]
84. Till, B.M.; Peters, A.W.; Afshar, S.; Meara, J.G. From blockchain technology to global health equity: Can cryptocurrencies finance universal health coverage? *BMJ Glob. Health* **2017**, *2*, e000570. [Google Scholar] [CrossRef] [Green Version]
85. Kromes R, Li T, Bouillion M, Güler TE, van der Hulst V, Erkin Z. Fear of Missing Out: Constrained Trial of Blockchain in Supply Chain. Sensors (Basel). 2024 Feb 2;24(3):986. doi: 10.3390/s24030986. PMID: 38339703; PMCID: PMC10856840.
86. Da Silva, E.R.; Lohmer, J.; Rohla, M.; Angelis, J. Unleashing the circular economy in the electric vehicle battery supply chain: A case study on data sharing and blockchain potential. *Resour. Conserv. Recycl.* **2023**, *193*, 106969. [Google Scholar] [CrossRef]
87. Khan, M.; Hussain, M.; Hussein, M.S. Information sharing in a sustainable supply chain. *Int. J. Prod. Econ.* **2016**, *181*, 208–214. [Google Scholar] [CrossRef]
88. Bray, R.L.; Mendelson, H. Information Transmission and the Bullwhip Effect: An Empirical Investigation. *Manag. Sci.* **2012**, *58*, 860–875. [Google Scholar] [CrossRef] [Green Version]
89. Zhou, M.; Dan, B.; Ma, S.X. Supply chain coordination with information sharing: The informational advantage of GPOs. *Eur. J. Oper. Res.* **2017**, *256*, 785–802. [Google Scholar] [CrossRef]
90. Danese, P.; Mocellin, R.; Romano, P. Designing blockchain systems to prevent counterfeiting in wine supply chains: A multiple-case study. *Int. J. Oper. Prod. Manag.* **2021**, *41*, 1–33. [Google Scholar] [CrossRef]
91. Brookbanks, M.; Parry, G. The impact of a blockchain platform on trust in established relationships: A case study of wine supply chains. *Supply Chain Manag. Int. J.* **2022**, *27*, 128–146. [Google Scholar] [CrossRef]
92. Naef, S.; Wagner, S.M.; Saur, C. Blockchain and network governance: Learning from applications in the supply chain sector. *Prod. Plann. Contr.* **2022**, *20*, 1–16. [Google Scholar] [CrossRef]
93. Teodorescu, M.; Korchagina, E. Applying Blockchain in the modern supply chain management: Its implication on open in-novation. *J. Open Innov. Technol. Mark. Complex.* **2021**, *7*, 80. [Google Scholar] [CrossRef]
94. Kramer, M.P.; Bitsch, L.; Hanf, J. Blockchain and Its Impacts on Agri-Food Supply Chain Network Management. *Sustainability* **2021**, *13*, 2168. [Google Scholar] [CrossRef]
95. Ahmed, W.A.H.; MacCarthy, B.L. Blockchain-enabled supply chain traceability in the textile and apparel supply chain: A case study of the fiber producer, Lenzing. *Sustainability* **2021**, *13*, 10496. [Google Scholar] [CrossRef]

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