

INTEGRATING BLOCKCHAIN TECHNOLOGY TO HARNESS BIG DATA: METHODS, OBSTACLES, AND FUTURE OUTLOOK

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ABSTRACT: *The distributed and secure nature of blockchain technology makes it an effective tool for combating corruption, increasing transparency, and streamlining processes across fields like healthcare, government, and finance. This research demonstrates that blockchain technology can revolutionize government transparency, financial management, and corporate structures. In nations with high corruption indices, combining blockchain with forensic accounting significantly enhances the openness and accountability of anti-corruption efforts. System integration challenges, legal constraints, a shortage of skilled professionals, and scalability issues hinder blockchain adoption from reaching its potential. Overcoming these obstacles requires further research, legal frameworks, and cross-sector collaboration. To enhance decision-making in a data-driven economy and maximize blockchain's potential, a governance model that integrates big data analytics with blockchain could enable secure, transparent, and scalable adoption.*

Keywords: Blockchain, Big Data, Data Security, Privacy, Decentralization, Scalability, Interoperability, Data Management, Smart Cities, Healthcare, Innovation, Data Analytics, Transparency, Future Research.

1. INTRODUCTION

1.1 Blockchain as a solution to corruption

Momot, T. V [1], and Chekh, N. O [2] highlighted how corruption exacerbates inefficient state-market mechanisms, keeping systems opaque and distorting business conditions. Businesses contribute to this issue when employees engage in illicit activities that benefit their companies at society's expense. Blockchain technology, with its dispersed and secure qualities, offers a viable answer by providing transparency, reducing costs, removing intermediaries, and enhancing efficiency in both public and private sectors. Forecasters expect blockchain to play an important role in the worldwide economy by 2030, possibly boosting business worth by over \$3.1 trillion and addition more than \$3 billion to yearly firm value. The World Economic opportunity further forecasts that by 2027, blockchain will be related with 10% of global GDP, emphasizing its transformative impact.

F. Mario [3] examines how to remove corruption in Indonesia by mixing forensic accounting with blockchain technology. The study highlights how blockchain enhances forensic accounting by provided that reliable indication through transparent and safe transaction records. Furthermore, it proposes a structure for utilizing blockchain technology in the fight against corruption, while also tackling challenges like technical and regulatory hurdles. The results emphasize that integrating blockchain with forensic accounting can greatly enhance transparency and accountability in governmental operations.

Ilima, Fitri, Azmi, Alih, Aji, and Nugroho [4] emphasize the growing interest in using blockchain technology to improve government transparency and accountability, particularly in combating corruption. The study explores how blockchain, especially smart contracts, can enhance transparency and reduce corruption. It examines the feasibility of blockchain in Indonesia, considering its high corruption index, and identifies challenges like inadequate regulatory frameworks, organizational readiness, and lack of upper management support. The literature also urges further experimental research to assess blockchain's effectiveness in fighting corruption.

1.2 Transparency, Security, and Efficiency in Blockchain

Muhammad, Yamin, and Noch [5] examine the emergence of blockchain technology within decentralised financial systems, eliminating the necessity for conventional intermediaries. The literature emphasises blockchain's ability to improve efficiency and security in international financial management, while also addressing challenges such as regulatory uncertainty. Important factors to consider are the quality of financial information, management, and security concerns. The research highlights the significance of cooperation between fintech companies and banks, the revolutionary capabilities of blockchain, and the necessity for increased supervision and investigation to tackle concealed risks.

According to Totok and Dewayanto [6], smart contracts are becoming increasingly significant in accounting due to their ability to provide transparency and security; however, they encounter challenges related to efficiency and security. The research indicates the application of natural language processing (NLP) technology, like BERT, to enhance the efficiency of smart contracts and identify financial fraud. Bibliometric analysis uncovers trends and author partnerships, highlighting the essential impact of blockchain in research. The literature highlights the importance of global collaboration, continuous advancement, and the capabilities of BERT to improve smart contract systems.

1.3 Blockchain's Impact on Opaque Systems and Business Conditions

Fu-Hsiang [7] points out four main challenges to the adoption of blockchain in the industrial sector: system integration, issues related to functionality and reliability, a shortage of blockchain development skills, and regulatory limitations. Significant challenges involve merging blockchain technology with existing systems and the lack of qualified experts. Furthermore, the regulatory environment presents a significant hurdle. The research employs a combined FRST-PSO systematic review to prioritise these challenges and suggest strategies for enhancing blockchain implementation in the manufacturing sector.

According to Luciano [8], blockchain is a significant innovation that emerged in 2008, holding the potential to transform various industries. Blockchain transforms business models, fostering technology adoption and innovation.

Despite challenges like scalability and high energy consumption, blockchain holds significant applications in finance and information security. Emerging concepts such as distributed value, governance, and encrypted token applications illustrate its impact on businesses. This assessment highlights gaps in understanding blockchain's influence on business transformation and suggests further research to bridge these gaps.

The review of recent literature sources

Bitcoin, a cryptocurrency guaranteeing safe and transparent transactions, marked the first practical use of blockchain technology, which originated as a core concept in 2008. Respected scholars, including T. Momot, D. Tumietto, R. Teslenko [29], have researched blockchain's technical and practical aspects. Both public and private sectors now use blockchain to improve transparency, security, and efficiency. Its influence on society, government, and global economics has sparked sociological research, highlighting its significance beyond technology. This journey exemplifies blockchain's growing importance in both theoretical and practical fields.

2. Research Objectives and Scope

2.1 Description of the key objectives

1. Explain blockchain and Distributed Ledger Technologies (DLT) and describe their roles in today's digital economy.
2. Examine the possible advantages and disadvantages of implementing distributed ledger technology (DLT) and blockchain within both public and commercial sectors, with an emphasis on improving efficiency, scalability, and transparency.

2.2 Scope of the Study

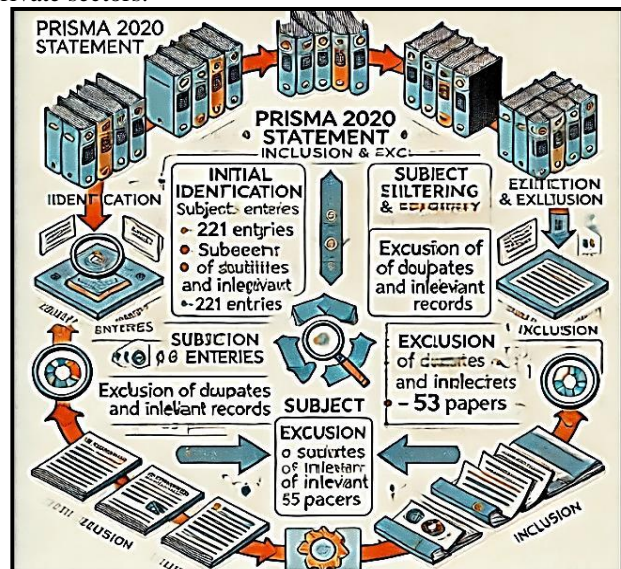
This study explores the potential of blockchain and Distributed Ledger Technologies (DLT) in combating corruption, enhancing transparency, and boosting efficiency across both public and commercial sectors. The research examines sectors such as manufacturing, financial management, and government systems to assess the transformative impacts of blockchain technology. The goal is to offer a comprehensive insight into the advantages and disadvantages of blockchain by examining its influence on governance, accounting, and business strategies. The study highlights obstacles, including regulatory limitations, difficulties in system integration, and a shortage of skilled personnel, while proposing strategies to promote wider acceptance and effective execution in different sectors. This review examines the application of blockchain in various contexts, emphasising its ability to improve the digital economy, increase transparency, and foster innovation across multiple sectors.

Theoretical and Methodological Framework of the Study

The research examines the incorporation of Distributed Ledger Technologies (DLT) and blockchain within both public and private sectors, highlighting their importance in the digital economy, while referencing both national and global literature. The study employs various methods to achieve a thorough understanding. Abstract-logical analysis aids in understanding the topic and deriving the outcomes. Theoretical generalisation highlights and categorises essential features of DLT and blockchain, particularly in relation to their scope, which encompasses smart contracts. System and

statistical analysis evaluate local and global instances of blockchain implementation, illuminating its practical applications and results. This research integrates various approaches to uphold the scientific and methodological foundations essential for the effective implementation of blockchain technology, harmonising theoretical ideas with real-world applications. This research investigates Distributed Ledger Technologies (DLT) and blockchain, emphasising their essential characteristics and ideas by analysing both local and global literature through abstract-logical analysis. Theoretical generalizations help clarify and organize the essential features of DLT and blockchain, especially regarding their applications, such as smart contracts. Researchers evaluate blockchain projects on both local and global scales using statistical and systemic analysis to assess the practical applications of blockchain technologies.

These analyses provide insights into the efficiency, outcomes, and practical applications of blockchain technology across different industries. To ensure a comprehensive and methodical selection of records, we follow the PRISMA 2020 guidelines throughout the literature review process. Using the Scopus database, researcher sourced papers from diverse fields, including computer science, engineering, ecology, sociology, mathematics, accounting, and health care. After subject-specific filtering, researcher retained 221 items from an original pool of 332 entries. Following the elimination of irrelevant, duplicate, or incomplete records, 57 articles remained for further research, ultimately including 54 papers in the final synthesis. This mixed-methods approach combines abstract-logical, theoretical, systemic, and statistical techniques, supported by a thorough and organized literature review, creating a well-rounded methodology that integrates theoretical insights with practical applications. This methodology supports the scientific and practical principles necessary for implementing blockchain technology and harnessing big data to enhance efficiency in both public and private sectors.



4. Analysis of blockchain technology in public and private sectors

4.1 Applications of blockchain for enhancing transparency, security, and efficiency.

Mahdi's (2018)[12] literature review extensively covers the broader application of Blockchain technology beyond its initial use in bitcoin [12]. The study compiles the advantages and disadvantages of using Blockchain in non-financial areas, such as healthcare, distributed voting, and storage systems. It tackles concerns such as energy use and scalability, while emphasising the evolution, security, decentralisation, and transparency of Blockchain. The review highlights Blockchain's ability to revolutionise industries such as IoT and cloud computing, reaching well beyond the scope of cryptocurrency.

Lisa Morhaim's [9] evaluation explored various fields including computing, cryptography, economics, law, and geography, highlighting the broad influence of Blockchain technology. The body of work on Blockchain and cryptocurrency examines its technical characteristics, real-world uses, and consequences. It connects progress in technology with emerging challenges that come about. This paper aims to provide a thorough analysis of the advancements in Blockchain, linking different areas of research.

4.2 Case studies of blockchain implementation in across different sectors.

Shiroq Al-Megren [10] explored the use of blockchain technology in different digital sectors, emphasising its impact on IoT, healthcare, supply chain management, and public services. Blockchain improves data integrity in IoT, yet it encounters obstacles related to scalability and energy use. It tackles regulatory obstacles while ensuring the protection of patient data sharing in the healthcare sector. Even with challenges such as regulatory frameworks and interoperability, blockchain provides clarity in supply chains and governmental processes like voting. The article highlights that blockchain, although promising, remains in the early stages of adoption within these sectors and requires additional research and evaluation.

Usman and Chohan [11] further explored the incorporation of blockchain technology within the cobalt mining industry, emphasising improvements in supply chain transparency, oversight, and operational efficiency. They demonstrate how blockchain can tackle intricate challenges in the industry, such as data quality, governance, and ethical issues like child labour. A pilot initiative in the DRC, backed by firms such as Samsung and Apple, seeks to monitor cobalt from artisanal mining through to its final applications. While blockchain offers transparency advantages, there are ongoing concerns about ethical dilution. One proposed solution is to integrate blockchain with current monitoring tools.

Blockchain technology has the potential to revolutionise various sectors, including energy, finance, land title administration, and the music industry, as demonstrated by the work of Mary B urer, Vincenzo Pallotta, Massimiliano Capezzali, Mauro Carpita, and Matthieu De Lapparent [13]. These examples demonstrate how blockchain can transform these sectors by improving efficiency, security, and transparency. Even with obstacles like regulatory intricacies and the transition from current systems, additional research is crucial to fully harness the capabilities of blockchain. During his presentation regarding digital transformation and blockchain technology in 2021, Daniel Sch nle discusses the

ways in which blockchain improves relationships between companies and facilitates the development of tailored business models. Blockchain technology, especially smart contracts, streamlines the creation of trust, automates processes, and ensures data control in scenarios involving multiple parties. This case study explores the integration of smart contracts into equipment maintenance using Hyperledger Fabric, aiming for enhanced machine availability while reducing costs. This implementation showcases how blockchain can revolutionise corporate operations by enhancing reliability, efficiency, and safety.

5. Possible Advantages of Merging Blockchain with Big Data

5.1 Effectiveness in handling and processing data.

Muhammad, Yamin, and Noch [5] explored the impact of blockchain technology on financial systems, highlighting its role in eliminating traditional intermediaries within decentralised finance (DeFi). The literature highlights challenges such as unclear regulations and compatibility problems in conventional banking, while also pointing out prospects for enhanced security and efficiency. Working together, banks and fintech companies play a vital role in unlocking the full capabilities of blockchain technology. Even with concealed dangers, blockchain technology possesses the potential to change the landscape of global financial management by altering transactions and commerce. Sergey Khvan [16] emphasised the advantages of combining blockchain technology with IoT devices, including enhanced efficiency, transparency, and security. The literature outlines how smart contracts facilitate secure direct transactions between IoT devices, reducing risks such as denial-of-service attacks without the involvement of intermediaries. The decentralised nature of blockchain enhances IoT networks by removing vulnerabilities. This integration brings forth innovative business models and strengthens security and privacy, illustrated by hands-on tutorials that highlight real-world applications.

5.2 Improvements in decision-making and clarity of data.

Dewi and Anggraeni examined the present condition of accounting, highlighting the difficulties encountered by conventional decision-making approaches in managing extensive amounts of financial data. The report emphasises the significant influence of big data technology, showcasing how sophisticated analytics can improve decision-making effectiveness and offer more profound insights. The article explores real-life case studies that highlight the advantages and problems of implementing big data analytics, while underscoring the necessity for accountants to enhance their skills in order to effectively use these skills.

6. Challenges and Barriers

6.1 Technical hurdles including scalability, interoperability, and security concerns.

Kitty So [18] examined how blockchain technology can enhance supply chain finance (SCF) and trade finance (TF) by eliminating paper-based processes and minimising risks such as double-financing. Research indicates that blockchain has the potential to improve transparency and efficiency; however, it also encounters challenges like legal uncertainties and scalability concerns. The paper emphasises the need for empirical data to grasp the factors affecting blockchain

adoption in supply chain finance and trade finance, pointing out the current research gaps.

Marco Alexandre (2024)[19] examines the increasing use of big data analytics in various sectors and observes that numerous organisations face challenges in successfully incorporating these technologies into their decision-making processes. The review points out that the adoption of big data in Brazil's insurance sector is still in its early stages, with research on the topic being quite scarce. It highlights effective implementation strategies and underscores challenges, including integration with multicloud platforms. The research highlights the varied approaches taken by organisations and calls for additional investigation to tackle these issues and enhance big data analytics.

6.2 Issues related to regulations, preparedness of the organisation, and absence of established standards.

James Almeida (2023)[20] explores the challenges associated with the implementation of blockchain technology in the realm of digital health by conducting an extensive literature review. The study emphasises the ability of blockchain to improve data security, empower patients, and facilitate interoperability within the healthcare sector. Nonetheless, obstacles like energy usage, network impacts, data standards, and adherence to regulations have been recognised. The study recommends engaging stakeholders, maintaining ongoing research, and encouraging open dialogue to facilitate the successful integration of blockchain in digital health. John, Robert, and Bautista [21] investigated the application of blockchain technology in the healthcare sector, emphasising the promise of decentralised applications such as "MediLinker" for the management of health records. The CORES framework, which encompasses Clinical, Organisational, Regulatory, Ethical, and Social aspects, is utilised to pinpoint and address challenges encountered in real-world implementation. Insights from professionals in government, academia, and business guide suggestions for enhancing public awareness, ensuring policy adherence, and fostering better patient interactions. The study, while not a conventional literature review, utilises previous research and insights from various disciplines to bolster its conclusions.

6.3 Challenges to implementation, including expenses, opposition from stakeholders, and compatibility of systems.

Ernest Barcelo [22] highlighted the importance of establishing a regulatory framework for the integration of blockchain technology within decentralised renewable energy systems. The study emphasises the ability of blockchain to facilitate secure and affordable energy trading, providing advantages for both the economy and the environment. Issues such as elevated energy usage and incorporation into extensive supply networks are also addressed. The paper explores consensus mechanisms such as Proof of Stake (PoS) and emphasises the importance of additional research, especially in minimising the energy requirements of blockchain technology in the context of renewable energy.

Anuj Jain [23] explored the growing significance of blockchain technology, emphasising its potential to improve reliability, transparency, and efficiency in multiple industries, beyond its links to cryptocurrencies. Research indicates that governments stand to gain considerably from blockchain

technology, as it enhances transparency and promotes engagement among multiple stakeholders. Nevertheless, obstacles like regulatory hurdles and a widespread lack of comprehension regarding blockchain hinder its acceptance. This paper features case studies on how governments have implemented blockchain, examining its benefits and obstacles.

7. Opportunities and Future Prospects

7.1 The ability of blockchain to fundamentally change data-driven operations.

Ahmad (2023)[24] classifies blockchain methods for IoT integration by architecture and modes, highlighting various blockchain-based IoT applications. The study indicates that blockchain can enhance privacy, security, and resource management in IoT networks, and support decentralized identity management systems. Platforms like Hyperledger and Ethereum are examined for their contributions to scalability and security. However, issues such as integration and interoperability persist, requiring further research to develop solutions and effective business models for broader adoption.

Farhan Aslam (2023)[25] to determine the advantages of cloud computing over traditional systems and explores how it enhances big data capabilities. The study finds that cloud platforms are crucial for integrating new technologies, increasing computational efficiency, and aiding decision-making. Future studies ought to focus on data privacy, cost efficiency, and streamlined deployment. These insights enable businesses to utilise cloud infrastructure effectively, enhancing their ability to make informed, data-driven decisions while tackling persistent challenges.

7.2 New applications in sectors like finance, healthcare, supply chain, and governance.

Cristobal and Aguilar-Gallardo [26] further suggested that the potential of blockchain technology to tackle issues in the decentralised, patient-specific manufacturing of Advanced Therapy Medicinal Products (ATMPs). The features of blockchain, such as its unchangeable nature and decentralised structure, enhance transparency, security, and automation within supply chains. The article emphasises the potential for product tracking, data sharing, and process automation, while also addressing challenges such as scalability, privacy, and regulatory issues. It also indicates the incorporation of blockchain with IoT to improve the effectiveness and clarity of ATMP networks.

Vichayanan's (2023)[27] research emphasises enhancing data security, privacy, and decentralisation by integrating blockchain and IoT in the healthcare sector. The research employs the PRISMA methodology to examine 100 publications related to cloud computing and healthcare services. Although research on blockchain and IoT is widespread, the application of smart contracts in healthcare remains limited, highlighting areas ripe for further investigation. The review emphasises the considerable promise of these technologies in improving health data security, patient outcomes, and the management of pharmaceutical supply chains.

In 2023, Yara and Dolla [28] ascertained that the blockchain applications across different sectors through a thematic lens. The benefits and drawbacks of blockchain technology were

meticulously analysed through an extensive literature review, encompassing scholarly articles, white papers, and case studies. They conducted interviews with industry experts and employed both quantitative and qualitative assessments to reach their conclusions. Furthermore, they developed a model referred to as the "Ecosystem of Blockchain Applications across Sectors" to demonstrate how various sectors might utilise blockchain technology and engage with one another.

8. Literature Gaps and Future Research Directions

8.1 Recognised deficiencies in existing studies regarding the integration of blockchain and big data.

Blockchain technology has the potential to enhance efficiency, increase transparency, and fight corruption in multiple sectors such as healthcare, government, and finance, as noted in recent studies. Nonetheless, the real-world application continues to encounter obstacles like integration problems, organisational and legal challenges, and pushback from stakeholders. Additional research should investigate the operation of blockchain across various socio-political environments, improve the security and efficiency of smart contracts, and boost adoption rates. Furthermore, studies need to explore the genuine influence of blockchain on reshaping business models and systems, while also tackling the challenges of scalability and interoperability in new applications.

8.2 Suggestions for upcoming exploratory or experimental research to fill these gaps.

To address these gaps in our current understanding, we should initiate pilot projects to evaluate the feasibility of blockchain integration across different sociopolitical environments, especially in developing countries. To assess the effectiveness of blockchain technology in combating corruption, it is essential to explore various combinations of blockchain and forensic accounting within different governance frameworks. It is essential to create and evaluate innovative smart contracts enhanced with natural language processing to boost efficiency and security in practical business operations. To gain a comprehensive understanding of how blockchain adoption impacts business models, research needs to concentrate on the particular ways in which organisational structures and practices have evolved. Creating standards and frameworks while promoting cooperation among government agencies will enhance the adoption of blockchain technology. To tackle resistance and boost adoption in various sectors, it is essential to investigate collaborative solutions among stakeholders. Ultimately, addressing scaling and interoperability challenges, particularly in practical applications within healthcare, IoT, and supply chain management, is essential for broadening the adoption of blockchain technology.

9. CONCLUSION

9.1 Summary of findings

Blockchain technology has the capability to tackle corruption, boost transparency, and increase efficiency across multiple sectors such as healthcare, banking, and government. The research highlights that it can address illegal activities by establishing a transparent framework, eliminating intermediaries, and enhancing financial security. However, obstacles like system integration, regulatory constraints, and

the need for skilled professionals still hinder widespread adoption. To tackle these challenges, further research, collaboration across sectors, and regulatory reforms are essential. When effectively utilised, blockchain technology can truly unlock its potential, significantly improving efficiency and transparency in both public and private sectors.

Research shows that blockchain technology could revolutionise industries like healthcare, government, and finance by improving efficiency, security, and transparency. Studies on the integration of blockchain technology with forensic accounting highlight its potential to fight corruption through the use of secure and decentralised transaction records. However, obstacles remain, including insufficient organisational preparedness, legal limitations, and technological hurdles. The lack of skilled professionals, along with challenges in system integration, scalability, and compliance with regulations, continues to pose a major obstacle to the widespread adoption of blockchain technology in various sectors. To maximise the potential of blockchain and understand its impact on business transformation, further research is crucial, especially in enhancing smart contracts with technologies like natural language processing. Technological advancements such as blockchain can significantly improve decision-making, reduce fraud, and optimise supply chain and financial management. Nonetheless, tackling the existing challenges is crucial for broader acceptance.

9.2 Concluding reflections on the practical consequences and future perspectives of merging blockchain with big data

The final thoughts on the current state and future prospects of integrating blockchain with big data indicate that the combination of these technologies could significantly enhance efficiency, security, and transparency in multiple industries. Blockchain has the potential to improve big data applications, particularly in sectors like healthcare, banking, and supply chain management, by ensuring secure and transparent data processing. To tackle present challenges such as scalability and regulatory compliance, it is essential for regulatory agencies, industry stakeholders, and technology developers to work closely together. Combining blockchain technology with big data has the potential to revolutionise businesses, enhancing decision-making processes and promoting innovation within a data-centric economy through thoughtful implementation and continuous progress.

10. Recommendations for Implementation

10.1 Recommendations for policymakers, industry professionals, and stakeholders.

It is essential for legislators, business owners, and other stakeholders to focus on creating regulatory frameworks that support the implementation of blockchain technology, all while maintaining security and compliance standards. Policymakers need to establish clear guidelines to tackle issues related to data privacy, scalability, and interoperability, facilitating the integration of blockchain across various sectors. Professionals in the field ought to concentrate on developing blockchain solutions that cater to specific requirements, enhancing system integration, and encouraging collaborations between fintech and conventional

organisations to drive adoption. Entities such as businesses, educational organisations, and government bodies must invest in training initiatives to cultivate a skilled workforce adept at handling and implementing blockchain technologies. Working together within these groups is crucial to foster innovation, address challenges, and fully leverage blockchain's ability to improve transparency, efficiency, and economic development.

10.2 Suggested frameworks for integrating blockchain with big data analytics.

Blockchain and big data analytics frameworks should be designed with multiple layers to ensure data security, scalability, and compatibility across different platforms. Establishing a governance model that clearly defines the responsibilities of all parties involved is essential for maintaining privacy and ethical data use. This model should address aspects such as data ownership, access control, and compliance requirements. Application programming interfaces (APIs) and smart contracts ought to promote clear and immediate data analytics, allowing for smooth data transfer between blockchain and big data platforms. Implementing a hybrid architecture that integrates both on-chain and off-chain data processing will enhance the management of extensive data sets in a secure and efficient manner. Ongoing monitoring and auditing systems are crucial for ensuring that stakeholders base their decisions on precise and up-to-date information, thus evaluating the stability of the blockchain network and the quality of big data insights.

REFERENCES

- Momot, T. V., Vashchenko, O. M., Teslenko, R. Yu. (2018), "The shadow economy as a threat to the economic security of Ukraine" ["Tinova ekonomika yak zahroza ekonomichnii bezpetsi Ukrainy"], *Ekonomika ta suspilstvo*, No. 15, P. 169–176, available at : http://www.economyandsociety.in.ua/journal/15_ukr/27.pdf (last accessed 20.08.2018).
- Chekh, N. O., Vashchenko, O. M. (2018), "Corruption in business: corrupt behaviour inside business environment" ["Koruptsiia v biznesi: koruptsiina povedinka u vnutrishno biznesovomu seredovyshchi"], *Innovative Technologies and Scientific Solutions for Industries*, No. 2 (2), P. 57–62. DOI: <https://doi.org/10.30837/2522-9818.2018.4.057>.
- F, Mario, Andaru., Bernadetta, Paradintya, Utami. (2024). The Convergence of 5.0 and Forensic Accounting: Leveraging Blockchains for Effective Corruption Prevention in Indonesia. *Asia Pacific Fraud Journal*, 9(1):17-26. doi: 10.21532/apfjournal.v9i1.338
- Ilima, Fitri, Azmi., Alih, Aji, Nugroho. (2023). Anti-corruption system 4.0: The adoption of blockchain technology in the public sector. *Integritas*, 9(1):93-108. doi: 10.32697/integritas.v9i1.985
- Muhammad, Yamin, Noch. (2024). The Application of Blockchain Technology in International Financial Management: Opportunities and Challenges. *Golden Ratio Of Mapping Idea And Literature Format*, 4(2):154-166. doi: 10.52970/grmilf.v4i2.396
- Totok, Dewayanto. (2024). Nlp-bert and optimization of efficiency-security in blockchain-accounting smart contracts. *Fokus Ekonomi: Jurnal Ilmiah Ekonomi*, 19(1):145-151. doi: 10.34152/fe.19.1.145-151
- Fu-Hsiang, Chen., Kuang-Hua, Hu., Sin-Jin, Lin., Ming-Fu, Hsu. (2023). A Decision Framework for Assessing and Improving the Barriers of Blockchain Technology Adoption. *Journal of Global Information Management*, doi: 10.4018/jgim.330134
- Luciano, Antonio, Prates, Junqueira., Luis, Hernan, Contreras, Pinochet., Kallita, Ester, Magalhães. (2021). Blockchain technology and the impact on business models. *12(2):131-138*. doi: 10.23925/2179-3565.2021V12I2P131-138
- Lisa, Morhaim. (2019). Blockchain and cryptocurrencies technologies and network structures: applications, implications and beyond.
- Shiroq, Al-Megren., Shada, Alsalamah., Lina, Altoaimy., Hessah, A., Alsalamah., Leili, Soltanisehat., Emad, Almutairi., Alex, Pentland. (2018). Blockchain Use Cases in Digital Sectors: A Review of the Literature. 1417-1424. doi: 10.1109/CYBERMATICS_2018.2018.00242
- Usman, W., Chohan. (2021). Blockchain and the Extractive Industries: Cobalt Case Study. *Social Science Research Network*, doi: 10.2139/SSRN.3138271
- Mahdi, H., Miraz., Maaruf, Ali. (2018). Applications of Blockchain Technology beyond Cryptocurrency. *arXiv: Cryptography and Security*, doi: 10.33166/AETIC.2018.01.001
- Mary, Jean, Bürer., Massimiliano, Capezzali., Matthieu, de, Lapparent., Vincenzo, Pallotta., Mauro, Carpita. (2019). Blockchain in Industry: Review of key use cases and lessons learned. 1-7. doi: 10.1109/ICE.2019.8792674
- Daniel, Schönle., Kevin, Wallis., Jan, Stodt., Christoph, Reich., Dominik, Welte., Axel, Sikora. (2021). Industry Use Cases on Blockchain Technology. 248-276. doi: 10.4018/978-1-7998-6650-3.CH011
- Muhammad, Yamin, Noch. (2024). The Application of Blockchain Technology in International Financial Management: Opportunities and Challenges. *Golden Ratio Of Mapping Idea And Literature Format*, 4(2):154-166. doi: 10.52970/grmilf.v4i2.396
- Sergey, Khvan., Refik, Çağlar, Kızıllırmak., Masoud, Shafiee. (2023). Exploring the Use of Blockchain Technology in IoT Applications. doi: 10.5772/intechopen.1003635
- Dewi, Anggraeni., Agus, Susanto., Putu, Anggreyani, Widya, Astuty., Loso, Judijanto., Margaretha, Turot. (2023). Implementation of Big Data Analysis Technology to Improve Decision Making in the Accounting Field. doi: 10.59613/global.v1i3.33
- Kitty, So. (2024). Drivers and Barriers of Leveraging Blockchain Technology in Supply Chain Finance and Trade Finance: A Mixed Methods Approach to Examine the State of Adoption. doi: 10.32920/26060779.v1
- Marco, Alexandre, Terlizzi., Fábio, Oliveira., Eduardo, de, Rezende, Francisco. (2024). Practices and barriers for big data projects. *Revista de Gestão e Projetos*, 15(1):1-35. doi: 10.5585/gep.v15i1.24673

20. James, Almeida. (2023). Challenges of Blockchain Applications in Digital Health: A Systematic Review. doi: 10.48550/arxiv.2304.04101
21. John, Robert, Bautista., Muhammad, Usman., Daniel, Toshio, Harrell., Eric, T., Meyer., Anjum, Khurshid. (2022). Clinical, Organizational and Regulatory, and Ethical and Social (CORES) Issues and Recommendations on Blockchain Deployment for Healthcare: Evidence from Experts. *Blockchain in healthcare today*, 5 doi: 10.30953/bhty.v5.199
22. Anuj, Jain. (2021). A Study on the Usage and Regulatory Issues of Blockchain Technology in the Government and the Public Sector. *Journal of emerging technologies and innovative research*, 8(9)
23. Ernest, Barcelo., Katarina, Dimic-Misic., Monireh, Imani., Vesna, Spasojevic, Brkic., Michael, Hummel., Patrick, A.C., Gane. (2023). Regulatory Paradigm and Challenge for Blockchain Integration of Decentralized Systems: Example—Renewable Energy Grids. *Sustainability*, 15(3):2571-2571. doi: 10.3390/su15032571
24. Ahmad, Anwar, Zainuddin., Hariz, Syahmi, Hairo, Rose, Sidi., Muhammad, Dini, Aulia, Shamsudin., Khaleel, Ahmad., Nur, Athirah, Mohd, Abu, Bakar., Nurain, Sufi, Sabreena, Mohd, Sukri., Nurul, Salshabila, Mustapa., Muhammad, Nurzikry, Mohd, Sazali. (2023). Recent Trends of Integration of Blockchain Technology With the IoT by Analysing the Networking Systems: Future Research Prospects. *Journal of Knowledge Management Practice*, 23(1) doi: 10.62477/jkmp.v23i1.4
25. Farhan, Aslam. (2023). Unleashing the Power of Cloud Computing for Big Data Management: Advantages, Challenges, and Future Prospects. *Asian Journal of Research in Computer Science*, 16(3):290-295. doi: 10.9734/ajrcos/2023/v16i3363
26. Cristobal, Aguilar-Gallardo., Ana, Bonora-Centelles. (2024). Blockchain technology for advanced therapy medicinal products: Applications in tracking, data sharing, and supply chain automation. *Journal of pharmaceutical and biopharmaceutical research*, 5(2):430-443. doi: 10.25082/jpbr.2023.02.004
27. Vichayanan, Rattanawiboomsom., Muhammad, Saleem, Korejo., Javed, Ali., Uthen, Thatsaringkharnsakun. (2023). Blockchain-Enabled Internet of Things (IoT) Applications in Healthcare: A Systematic Review of Current Trends and Future Opportunities. *International Journal of Online Engineering (ijoe)*, 19(10):99-117. doi: 10.3991/ijoe.v19i10.41399
28. Yara, Maha, Dolla, Ali. (2023). Blockchain beyond cryptocurrencies: An exploration of potential applications. *Advances in engineering innovation*, 5(1):None-None. doi: 10.54254/2977-3903/5/2023025
29. T. Momot, D. Tumietto, R. Teslenko. 2018, *Blockchain Technology as an Innovative Instrument of Digital Economy: Technology Essence, World experience and Implementation Problems*, 137-143, DOI: <https://doi.org/10.30837/2522-9818.2018.6.137>