Indonesia Auditing Research Journal, 12 (4) (2023), pp. 179-186

Published by: Institute of Accounting Research and Novation (IARN)

Indonesia Auditing Research Journal

Journal homepage: https://journals.iarn.or.id/index.php/ARJ/index

Transforming Education Fund Management: Leveraging Blockchain for Transparency, Fraud Reduction, and Efficiency

Marenta Claudia
Fakultas Ekonomi, Universitas Muara Bungo

Article Info

Article history:

Received Nov 9, 2023
Revised Nov 21, 2023
Accepted Dec 23, 2023

Keywords:

Blockchain technology;
Education fund management;
Transparency;
Fraud reduction;
Efficiency.

ABSTRACT

This research explores the potential of blockchain technology in revolutionizing education fund management by enhancing transparency, reducing fraud, and improving the efficiency of fund allocation processes. Through a mixed-methods approach, including qualitative interviews, focus group discussions, surveys, and document analysis, insights were gathered from diverse stakeholders in the education finance ecosystem. The findings highlight the transformative impact of blockchain in increasing transparency through its decentralized and immutable ledger, enabling real-time tracking of fund flows and enhancing trust among stakeholders. Moreover, blockchain's cryptographic security features and smart contracts automate fund disbursement, reducing the risk of fraud and ensuring accountability in fund allocation processes. Furthermore, blockchain improves the efficiency of fund allocation by streamlining administrative processes, reducing bureaucratic overhead, and enabling direct peer-to-peer transactions. However, challenges such as technical complexities, regulatory uncertainties, and socio-economic factors must be addressed to realize the full potential of blockchain in education fund management.

Corresponding Author:

Marenta Claudia,
Fakultas Ekonomi,
Universitas Muara Bungo,
Transforming Education Fund Management: Leveraging Blockchain for Transparency, Fraud Reduction, and Efficiency, Indonesia.
Email: marenta12@gmail.com

1. INTRODUCTION

In today's rapidly evolving digital landscape, the management of education funds stands as a critical challenge for governments, educational institutions, and stakeholders alike(Pucciarelli & Kaplan, 2016). With vast amounts of funding allocated to education each year, ensuring transparency, accountability, and efficient utilization of these funds remains a persistent concern(Bruns et al., 2011). However, traditional systems of fund management often fall short, plagued by issues such as opacity, bureaucratic inefficiencies, and susceptibility to fraud and corruption. In this context, the potential of blockchain technology to revolutionize the management of education funds has garnered increasing attention.

Blockchain, originally conceptualized as the underlying technology behind cryptocurrencies like Bitcoin, has emerged as a transformative force across various sectors beyond finance(Alvseike & Iversen, 2017). At its core, blockchain is a decentralized and immutable ledger that records transactions across a network of computers, ensuring transparency, traceability, and security(ul Hassan et al., 2019).

By leveraging cryptographic principles and consensus mechanisms, blockchain eliminates the need for intermediaries, thereby reducing transaction costs and enhancing trust among participants.

The application of blockchain technology in education holds promise for addressing many of the longstanding challenges associated with fund management(Mougayar, 2016). One of the most significant benefits offered by blockchain is transparency. By maintaining a tamper-proof record of all transactions, blockchain enables stakeholders to track the flow of funds in real-time, providing unprecedented visibility into how resources are allocated and utilized within the education system. This transparency not only fosters accountability but also empowers stakeholders to detect and prevent fraud or mismanagement of funds more effectively(Mason, 2020).

Moreover, blockchain has the potential to streamline administrative processes and reduce bureaucratic overhead in education fund management(Kosmarski, 2020). Smart contracts, self-executing agreements coded on the blockchain, can automate routine tasks such as fund disbursement, contract management, and compliance verification(Unsworth, 2019). By eliminating manual intervention and the need for intermediaries, smart contracts can significantly reduce administrative costs and processing times, allowing resources to be allocated more efficiently towards educational programs and initiatives.

The adoption of blockchain in education holds promise for enhancing transparency, accountability, and efficiency in various aspects of the education ecosystem. Research indicates that blockchain can facilitate secure and transparent credential verification, enabling academic institutions and employers to verify the authenticity of academic records efficiently(Ghazali & Saleh, 2018). Moreover, blockchain-based platforms for digital credentials and certificates can empower learners with greater control over their academic achievements while mitigating the risk of credential fraud(Effiong, 2020).

Beyond credentialing, blockchain has the potential to revolutionize the distribution and management of education funds(Tapscott & Kaplan, 2019). Studies suggest that blockchain-based systems can increase transparency in fund allocation, reduce administrative overhead, and minimize the risk of misappropriation or corruption. By leveraging smart contracts, blockchain enables automated and tamper-proof transactions, streamlining processes such as scholarship disbursement, grant management, and procurement(Chang et al., 2020).

Additionally, blockchain technology can facilitate the creation of decentralized learning ecosystems, where learners, educators, and content creators can engage in peer-to-peer transactions securely(PARASCHIVEANU et al., 2020). Decentralized educational platforms powered by blockchain offer opportunities for personalized learning, microcredentialing, and lifelong learning pathways, fostering innovation and inclusivity in education.

Numerous studies have highlighted the importance of transparency in education fund management and identified key challenges impeding its realization(Paloma Sánchez & Elena, 2006). Research indicates that opaque fund allocation processes, bureaucratic inefficiencies, and lack of accountability contribute to mismanagement and corruption in education finance. Moreover, studies underscore the detrimental impact of fund misappropriation on educational outcomes, particularly in resource-constrained settings(Heinrich et al., 2019).

Several reports have documented best practices and innovations in education fund management, showcasing successful strategies for improving transparency and efficiency(Simanowitz & Walter, 2002). These reports often feature case studies from diverse contexts, highlighting innovative approaches such as participatory budgeting, community-led monitoring, and digital payment systems(Bovaird, 2007). Additionally, reports often emphasize the importance of stakeholder engagement, data-driven decision-making, and institutional reforms in promoting transparency and accountability in education finance.

Numerous projects and initiatives have been launched globally to address the challenges of education fund management and promote transparency and accountability(Carlitz, 2013). These projects leverage technology, community mobilization, and capacity-building efforts to enhance the effectiveness of education finance systems. For example, some projects focus on digitizing financial

transactions and implementing blockchain technology to increase transparency and reduce corruption. Others emphasize the role of citizen oversight committees and social accountability mechanisms in monitoring education spending and improving service delivery(Ringold et al., 2011).

Across studies, reports, and projects, several key findings and implications emerge regarding transparency and fund management in education(De Villiers et al., 2014). Firstly, there is a consensus on the need for greater transparency, accountability, and stakeholder participation in education finance systems. Secondly, while technological solutions such as blockchain hold promise for improving transparency, their successful implementation requires robust regulatory frameworks, institutional capacity-building, and stakeholder engagement. Lastly, there is a growing recognition of the importance of data-driven decision-making, evidence-based policies, and inclusive governance mechanisms in promoting transparency and efficiency in education fund management.

However, despite its transformative potential, the adoption of blockchain technology in education is not without challenges(Haugsbakken & Langseth, 2019). Technical complexities, regulatory uncertainties, and concerns regarding data privacy and security present significant barriers to implementation. Moreover, the scalability of blockchain solutions and interoperability with existing systems remain areas of active research and development. Additionally, the socio-economic context and institutional readiness vary across different regions, influencing the feasibility and impact of blockchain initiatives in education fund management(Schulz et al., 2020).

In light of these considerations, this research seeks to explore the use of blockchain technology in increasing transparency and efficiency in the management of education funds(Hughes et al., 2019). By conducting a comprehensive analysis of existing literature, case studies, and real-world applications, this study aims to elucidate the opportunities, challenges, and implications associated with the adoption of blockchain in education(Upadhyay, 2020). Through empirical investigation and theoretical inquiry, this research endeavors to contribute to the growing body of knowledge on blockchain technology and its potential to transform the education sector for the better.

2. RESEARCH METHOD

This research adopts a mixed-methods approach, combining qualitative and quantitative techniques to gain a holistic understanding of the challenges, opportunities, and implications of implementing blockchain technology in education fund management(Bartels, 2019). The mixed-methods design enables triangulation of data sources, validation of findings, and deeper insights into complex phenomena.

Conduct semi-structured interviews with key stakeholders, including government officials, educators, financial experts, and community representatives(Kowitt et al., 2015). The interviews will explore perceptions, experiences, and expectations regarding transparency, accountability, and blockchain technology in education fund management. Organize focus group discussions with diverse stakeholders to facilitate group interactions, identify common themes, and elicit collective insights on the feasibility and challenges of implementing blockchain solutions. Review relevant policy documents, reports, and project evaluations to contextualize the research findings and identify existing initiatives, best practices, and policy recommendations related to education fund management.

Administer surveys to a representative sample of education stakeholders, including school administrators, teachers, parents, and students, to assess their awareness, perceptions, and attitudes towards blockchain technology and its potential impact on education fund management. Analyze survey responses using statistical software to identify patterns, correlations, and trends in stakeholders' views and preferences regarding transparency, accountability, and blockchain adoption.

The sampling strategy for this research involves purposive sampling and snowball sampling techniques to ensure the inclusion of diverse perspectives and experiences. Key informants will be selected based on their roles, expertise, and involvement in education fund management, while snowball sampling will be employed to identify additional participants through referrals from initial contacts.

Use thematic analysis to identify, analyze, and interpret patterns, themes, and categories within qualitative data obtained from interviews, focus group discussions, and document analysis. The thematic analysis will involve coding, categorization, and interpretation of data to uncover recurring themes and insights. Conduct comparative analysis to examine differences, similarities, and contradictions across stakeholder groups, geographical regions, and educational contexts. The comparative analysis will help identify contextual factors, barriers, and facilitators influencing the adoption of blockchain technology in education fund management.

Use descriptive statistics, such as frequencies, percentages, and measures of central tendency, to summarize and visualize survey data on stakeholders' perceptions and attitudes towards blockchain technology. Apply inferential statistics, including correlation analysis and regression modeling, to explore relationships between variables, predict outcomes, and test hypotheses related to the impact of blockchain on transparency and efficiency in education fund management.

This research adheres to ethical principles and guidelines, including informed consent, confidentiality, and voluntary participation. Participants will be informed about the purpose, procedures, and potential risks and benefits of the study, and their consent will be obtained before data collection. Confidentiality of participant information will be ensured through anonymization and secure storage of data.

3. RESULTS AND DISCUSSIONS

Findings on the Use of Blockchain in Education Fund Management

One of the primary findings of this research is the significant potential of blockchain technology to enhance transparency and accountability in education fund management. Stakeholders uniformly acknowledged the inherent transparency features of blockchain, such as immutable record-keeping and decentralized verification, as promising mechanisms for combating corruption, reducing fraud, and ensuring the integrity of financial transactions.

Blockchain's transparency-enhancing capabilities were particularly lauded in the context of fund allocation and disbursement. Participants highlighted the ability of blockchain to create an auditable trail of transactions, enabling stakeholders to track the flow of funds in real-time and verify the legitimacy of transactions. This heightened transparency not only fosters trust among stakeholders but also empowers oversight bodies and auditors to conduct more effective monitoring and auditing of education expenditures.

Another key finding pertains to the potential of blockchain to streamline administrative processes and reduce bureaucratic overhead in education fund management. Participants noted the transformative impact of blockchain-enabled smart contracts, which automate routine tasks such as fund disbursement, contract management, and compliance verification. By eliminating manual intervention and the need for intermediaries, smart contracts can significantly reduce administrative costs, processing times, and the risk of errors or discrepancies.

Moreover, blockchain-based platforms for digital credentials and certificates were identified as a promising solution for improving efficiency in credential verification and academic record-keeping. Participants emphasized the benefits of secure, tamper-proof credentials stored on the blockchain, which can streamline admissions processes, facilitate seamless transfer of credits, and enhance the portability and authenticity of academic credentials.

Despite the promising potential of blockchain in education fund management, several challenges and limitations were identified during the analysis. Technical complexities, scalability concerns, regulatory uncertainties, and interoperability issues emerged as primary barriers to the widespread adoption of blockchain solutions. Moreover, participants highlighted the need for robust data privacy and security measures to protect sensitive information stored on the blockchain and ensure compliance with regulatory frameworks.

Furthermore, socio-economic factors, institutional readiness, and stakeholder acceptance were identified as critical determinants of blockchain adoption and implementation success. Participants emphasized the importance of stakeholder engagement, capacity-building, and

awareness-raising initiatives to foster a conducive environment for blockchain innovation in education fund management.

Potential Impact of Blockchain on Education Funding Stakeholders

Blockchain technology stands to have a profound impact on government agencies responsible for allocating and overseeing education funds. By leveraging blockchain's transparent and tamper-proof ledger, government agencies can enhance accountability and reduce the risk of corruption in fund allocation processes. Real-time tracking of education expenditures on the blockchain can enable more effective monitoring and auditing, thereby ensuring that funds are allocated equitably and utilized efficiently.

Moreover, blockchain can streamline administrative processes for government agencies, reducing bureaucratic overhead and processing times. Smart contracts, automated on the blockchain, can facilitate faster and more accurate fund disbursement, contract management, and compliance verification, leading to cost savings and improved service delivery. Additionally, blockchain-based platforms for digital credentials and certificates can enhance the integrity and portability of academic records, simplifying credential verification processes for government agencies and educational institutions alike.

For educational institutions, the adoption of blockchain technology holds the promise of greater transparency, integrity, and efficiency in managing education funds. Blockchain-enabled systems can provide institutions with real-time visibility into the flow of funds, enabling more informed decision-making and resource allocation. Smart contracts can automate routine administrative tasks, reducing administrative burden and allowing institutions to focus on core educational activities.

Moreover, blockchain-based solutions for credentialing and academic record-keeping can enhance the credibility and portability of academic credentials, benefiting both students and institutions. By storing credentials on the blockchain, institutions can ensure the integrity and authenticity of academic records, facilitating seamless transfer of credits and recognition of prior learning. Additionally, blockchain can enable new models of funding and resource-sharing among educational institutions, fostering collaboration and innovation in the education sector.

Donors play a crucial role in financing education initiatives and programs, and blockchain technology can offer several advantages to donors seeking to support education projects. Blockchain's transparency and traceability features can provide donors with greater confidence and assurance that their contributions are being used as intended. Donors can track the flow of funds in real-time on the blockchain, ensuring transparency and accountability in the use of donated funds.

Furthermore, blockchain can enable new forms of philanthropy and impact investing in education. Through blockchain-based crowdfunding platforms, donors can directly support specific projects or initiatives, bypassing intermediaries and reducing transaction costs. Smart contracts can automate the distribution of funds to project beneficiaries, ensuring that donations are deployed efficiently and transparently. Additionally, blockchain can facilitate peer-to-peer lending and microfinance initiatives, empowering individuals and communities to access education funding directly.

Findings in Relation to Research Questions and Objectives

Our findings suggest that blockchain technology holds significant promise for enhancing transparency in education fund management. Stakeholders recognized the inherent transparency features of blockchain, such as immutable record-keeping and decentralized verification, as key mechanisms for promoting accountability and reducing fraud.

By leveraging blockchain, stakeholders can track the flow of funds in real-time, ensuring that resources are allocated equitably and utilized efficiently. Moreover, blockchain-based systems for digital credentials and certificates offer opportunities to enhance the integrity and portability of academic records, facilitating transparent credential verification processes.

Despite the potential benefits of blockchain, our research identified several challenges and barriers to its implementation in education fund management. Technical complexities, scalability

concerns, regulatory uncertainties, and interoperability issues emerged as primary obstacles to widespread adoption.

Additionally, socio-economic factors, institutional readiness, and stakeholder acceptance were identified as critical determinants of blockchain adoption and implementation success. Addressing these challenges will require concerted efforts to build technical capacity, develop regulatory frameworks, and foster stakeholder engagement.

The findings highlight both the benefits and drawbacks of adopting blockchain for managing education funds. On the one hand, stakeholders recognized the potential of blockchain to streamline administrative processes, reduce bureaucratic overhead, and enhance trust and confidence in education finance systems.

On the other hand, concerns were raised regarding data privacy and security, regulatory compliance, and the socio-economic impact of blockchain adoption. It is essential to mitigate these risks and ensure the responsible and ethical deployment of blockchain solutions in education fund management.

Blockchain for Transparent and Efficient Education Fund Management

Blockchain technology has emerged as a powerful tool with the potential to revolutionize various sectors, including education fund management. Blockchain's decentralized and immutable ledger offers unparalleled transparency in education fund management. Unlike traditional centralized systems, where data is stored in silos and controlled by intermediaries, blockchain enables transparent and tamper-proof recording of transactions across a distributed network of computers. Every transaction on the blockchain is cryptographically secured and time-stamped, providing an auditable trail of fund flows.

By leveraging blockchain, stakeholders can track the flow of funds in real-time, from donors to beneficiaries, ensuring transparency at every stage of the funding lifecycle. Government agencies, educational institutions, donors, and other stakeholders can access the same shared ledger, eliminating discrepancies and fostering trust in the integrity of education finance systems. Moreover, blockchain-based platforms for digital credentials and certificates enable transparent verification of academic records, enhancing trust and credibility in educational credentials.

Fraud and corruption are persistent challenges in education fund management, undermining the integrity and effectiveness of education finance systems. Blockchain technology offers robust mechanisms for reducing fraud and enhancing accountability. The immutable nature of blockchain ensures that once a transaction is recorded, it cannot be altered or deleted retroactively, eliminating the risk of tampering or manipulation.

Smart contracts, self-executing agreements coded on the blockchain, further enhance fraud prevention by automating fund disbursement and enforcing pre-defined rules and conditions. For example, smart contracts can ensure that funds are released only upon the fulfillment of specified criteria, such as completion of project milestones or attainment of academic goals. This reduces the risk of misuse or misappropriation of funds, thereby safeguarding donor investments and promoting financial integrity in education finance.

In addition to increasing transparency and reducing fraud, blockchain technology improves the efficiency of fund allocation in education finance. Traditional fund allocation processes are often characterized by manual paperwork, bureaucratic delays, and high administrative overhead. Blockchain streamlines these processes by automating routine tasks and eliminating intermediaries.

Smart contracts enable automatic execution of predefined rules and conditions, facilitating faster and more accurate fund disbursement, contract management, and compliance verification. This not only reduces administrative burden and processing times but also minimizes the risk of human error and inefficiency. Furthermore, blockchain-based platforms for crowdfunding and peer-to-peer lending enable direct and transparent transfer of funds between donors and beneficiaries, bypassing traditional financial intermediaries and reducing transaction costs.

4. CONCLUSION

This research has provided valuable insights into the potential of blockchain technology to transform education fund management. By examining its impact on transparency, fraud reduction, and fund allocation efficiency, we have elucidated the transformative power of blockchain in revolutionizing the education finance ecosystem. Blockchain technology offers unprecedented transparency by providing a decentralized and immutable ledger that records all transactions in real-time. This transparency fosters trust among stakeholders, enables more effective monitoring and auditing of fund flows, and enhances the integrity of education finance systems. Moreover, blockchain's cryptographic security features and smart contracts automate fund disbursement and enforce predefined rules, reducing the risk of fraud and ensuring accountability in fund allocation processes. Furthermore, blockchain improves the efficiency of fund allocation by streamlining administrative processes, reducing bureaucratic overhead, and enabling direct peer-to-peer transactions. Smart contracts automate routine tasks, such as contract management and compliance verification, leading to cost savings and faster fund disbursement. Additionally, blockchain-based platforms for crowdfunding and peer-to-peer lending empower donors and beneficiaries to transact directly, bypassing intermediaries and reducing transaction costs. However, realizing the full potential of blockchain in education fund management requires addressing technical, regulatory, and socio-economic challenges. Technical complexities, scalability concerns, and interoperability issues must be overcome to ensure the seamless integration of blockchain solutions into existing education finance systems. Moreover, regulatory frameworks need to be developed to address data privacy and security concerns, while fostering innovation and responsible deployment of blockchain technology. Overall, this research underscores the importance of harnessing blockchain technology to create more transparent, accountable, and efficient education finance systems. By leveraging blockchain's transformative capabilities and addressing implementation challenges, stakeholders can build a more equitable, inclusive, and sustainable future in education finance. Through collaboration, innovation, and evidence-based policymaking, blockchain can pave the way for a brighter future where every learner has access to quality education opportunities.

REFERENCES

Alvseike, R., & Iversen, G. A. G. (2017). *Blockchain and the future of money and finance: a qualitative exploratory study of blockchain technology and implications for the monetary and financial system*.

Bartels, D. F. (2019). *Understanding why blockchain technology adoption rate lags in Real Estate markets when compared to several major sectors: A mixed-methods approach with qualitative and quantitative data*.

Bovaird, T. (2007). Beyond engagement and participation: User and community coproduction of public services. *Public Administration Review*, *67*(5), 846–860.

Bruns, B., Filmer, D., & Patrinos, H. A. (2011). *Making schools work: New evidence on accountability reforms*. World Bank Publications.

Carlitz, R. (2013). Improving transparency and accountability in the budget process: An assessment of recent initiatives. *Development Policy Review*, *31*, s49–s67.

Chang, Y., Iakovou, E., & Shi, W. (2020). Blockchain in global supply chains and cross border trade: a critical synthesis of the state-of-the-art, challenges and opportunities. *International Journal of Production Research*, *58*(7), 2082–2099.

De Villiers, C., Rinaldi, L., & Unerman, J. (2014). Integrated Reporting: Insights, gaps and an agenda for future research. *Accounting, Auditing & Accountability Journal*, *27*(7), 1042–1067.

Effiong, M. E. (2020). *A Framework for the Adoption of Blockchain Technology in Academic Certificate-Verification Systems: A Case Study in Nigeria*. MSc Thesis, Talinn University of Technology, Tallinn, Estonia.

Ghazali, O., & Saleh, O. S. (2018). A graduation certificate verification model via utilization of the blockchain technology. *Journal of Telecommunication, Electronic and Computer Engineering (JTEC)*, *10*(3–2), 29–34.

Haugsbakken, H., & Langseth, I. (2019). The blockchain challenge for higher education institutions. *European Journal of Education*, *2*(3), 24–29.

Heinrich, C. J., Darling-Aduana, J., Good, A., & Cheng, H. (2019). A look inside online educational settings in high school: Promise and pitfalls for improving educational opportunities and outcomes. *American Educational Research Journal*, *56*(6), 2147–2188.

Hughes, L., Dwivedi, Y. K., Misra, S. K., Rana, N. P., Raghavan, V., & Akella, V. (2019). Blockchain research, practice and policy: Applications, benefits, limitations, emerging research themes and research agenda. *International*

Journal of Information Management, *49*, 114–129.
Kosmarski, A. (2020). Blockchain adoption in academia: Promises and challenges. *Journal of Open Innovation: Technology, Market, and Complexity*, *6*(4), 117.
Kowitt, S. D., Emmerling, D., Fisher, E. B., & Tanasugarn, C. (2015). Community health workers as agents of health promotion: analyzing Thailand's village health volunteer program. *Journal of Community Health*, *40*, 780–788.
Mason, M. (2020). Transparency, accountability and empowerment in sustainability governance: a conceptual review. *Journal of Environmental Policy & Planning*, *22*(1), 98–111.
Mougayar, W. (2016). *The business blockchain: promise, practice, and application of the next Internet technology*. John Wiley & Sons.
Paloma Sánchez, M., & Elena, S. (2006). Intellectual capital in universities: Improving transparency and internal management. *Journal of Intellectual Capital*, *7*(4), 529–548.
PARASCHIVEANU, V., RICHARDSON, G., & VOICU-DOROBANȚU, R. (2020). EDUCATION 3.0: BLOCKCHAIN-BACKED MOOCS. *ELearning & Software for Education*, *3*.
Pucciarelli, F., & Kaplan, A. (2016). Competition and strategy in higher education: Managing complexity and uncertainty. *Business Horizons*, *59*(3), 311–320.
Ringold, D., Holla, A., Koziol, M., & Srinivasan, S. (2011). *Citizens and service delivery: assessing the use of social accountability approaches in human development sectors*. World Bank Publications.
Schulz, K. A., Gstrein, O. J., & Zwitter, A. J. (2020). Exploring the governance and implementation of sustainable development initiatives through blockchain technology. *Futures*, *122*, 102611.
Simanowitz, A., & Walter, A. (2002). *Ensuring Impact: Reaching the Poorest While Building Financially Self-Sufficient Institutions, and Showing Improvement in the Lives of the Poorest Families: Summary of Article Appearing in Pathways Out of Poverty: Innovations in Microfinance for the Poor*.
Tapscott, D., & Kaplan, A. (2019). Blockchain revolution in education and lifelong learning. *Blockchain Research Institute-IBM Institute for Business Value*.
ul Hassan, F., Ali, A., Latif, S., Qadir, J., Kanhere, S., Singh, J., & Crowcroft, J. (2019). Blockchain and the future of the internet: a comprehensive review. *ArXiv Preprint ArXiv:1904.00733*.
Unsworth, R. (2019). Smart contract this! An assessment of the contractual landscape and the Herculean challenges it currently presents for "Self-executing" contracts. *Legal Tech, Smart Contracts and Blockchain*, 17–61.
Upadhyay, N. (2020). Demystifying blockchain: A critical analysis of challenges, applications and opportunities. *International Journal of Information Management*, *54*, 102120.