Exploration of Blockchain-Based Financial Models in Digital Asset Management: A Case Study in the Property and Real Estate Industry

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Abstract: *This article presents a comprehensive literature review exploring the application of blockchain-based financial models in digital asset management, focusing on the property and real estate industry. Blockchain technology has garnered significant attention for its potential to revolutionize traditional financial systems by offering transparent, secure, and decentralized solutions. In the context of asset management, blockchain's immutable ledger and smart contract functionalities promise increased efficiency, reduced costs, and enhanced trust among stakeholders. Through a systematic review of existing literature, this study synthesizes key findings regarding the adoption, challenges, and opportunities of blockchain-based financial models in property and real estate asset management. The analysis encompasses aspects such as tokenization of assets, smart contracts for automated transactions, regulatory considerations, and industry-specific use cases. By examining current research and industry practices, this article contributes to a deeper understanding of how blockchain technology can reshape financial models and management strategies within the property and real estate sector.*

Keywords: Blockchain technology, Digital asset management, Property industry, Real estate industry

INTRODUCTION

The rapid evolution of technology has continuously reshaped various industries, and the financial sector is no exception. One of the most transformative innovations in recent years is blockchain technology, which has gained considerable attention for its potential to disrupt traditional financial models. Blockchain, originally devised for cryptocurrencies like Bitcoin, is a decentralized and immutable ledger system that records transactions across a distributed network (Santhi & Muthuswamy, 2022). Its underlying principles of transparency, security,

and trust have spurred exploration into its applications beyond cryptocurrencies, particularly in asset management sectors such as property and real estate (Albshaier et al., 2024).

Blockchain technology offers a range of features that make it appealing for digital asset management in the property and real estate industry. These features include transparency through a shared ledger accessible to all participants, immutability ensuring tamper-proof records, and smart contracts enabling automated and self-executing agreements (Alajlan et al., 2023). These functionalities hold promise for streamlining processes, reducing operational costs, and increasing the efficiency of asset transactions within the industry.

The adoption of blockchain-based financial models in digital asset management is not without challenges. Regulatory considerations play a crucial role, as the legal framework for blockchain and digital assets varies globally and is still evolving (Habib et al., 2022). Compliance with existing regulations while harnessing the benefits of blockchain technology remains a key concern for industry stakeholders. Additionally, scalability and interoperability issues in blockchain networks pose technical hurdles that require ongoing research and development.

Several case studies and research papers have explored the implementation of blockchain in property and real estate asset management, providing valuable insights into its potential and challenges. For example, research by Diantaris (2024) delves into the tokenization of real estate assets using blockchain technology, highlighting the benefits of fractional ownership and increased liquidity. Similarly, Gutierrez & Su (2023) discusses the role of smart contracts in automating property transactions, improving transparency, and reducing intermediaries' involvement.

Furthermore, the emergence of blockchain-based platforms and startups focused on real estate tokenization and investment platforms demonstrates the industry's growing interest in leveraging blockchain for asset management. These platforms aim to democratize access to real estate investments, enable fractional ownership, and provide liquidity to traditionally illiquid assets (Saari et al., 2022). Paola (2024) showcases the development of such platforms and their impact on reshaping investment paradigms in the real estate sector.

In this context, this literature review aims to synthesize existing research, case studies, and industry practices related to blockchain-based financial models in digital asset management within the property and real estate industry. By examining the current landscape, identifying challenges, and exploring opportunities, this review contributes to a deeper understanding of the potential impact of blockchain technology on reshaping financial models and management strategies in this sector.

METHOD

This literature review adopts a systematic approach to gather, analyze, and synthesize relevant literature published from 2019 onwards. The inclusion criteria for selecting literature encompass scholarly articles, research papers, case studies, and reports focusing on blockchain-based financial models in digital asset management within the property and real estate industry. The search strategy involves utilizing academic databases such as Google Scholar, IEEE Xplore, ScienceDirect, and ACM Digital Library to identify peer-reviewed publications. Keywords used in the search include "blockchain," "digital asset management," "property industry," "real estate industry," "financial models," "tokenization," and "smart contracts."

The initial phase involves screening titles and abstracts to assess relevance to the research topic. Articles that meet the inclusion criteria are then thoroughly read and analyzed for their contributions, methodologies, findings, and implications. The review prioritizes recent literature to capture the latest developments, trends, and insights related to blockchain technology in asset management. Additionally, seminal works and key publications from

reputable journals and conferences are included to ensure a comprehensive and well-rounded review of the topic.

To ensure the validity and reliability of the literature review, rigorous criteria are applied to evaluate the quality and credibility of the selected sources. Factors considered include the author's expertise, publication venue, methodology clarity, data validity, and relevance to the research objectives. The synthesis of findings involves categorizing and organizing key themes, concepts, challenges, and opportunities identified across the literature. This structured approach enables a systematic analysis of the current state of knowledge and facilitates the identification of gaps for further research exploration.

The methodology also incorporates a critical perspective by examining contrasting viewpoints, controversies, and debates within the literature. This critical analysis aims to provide a balanced and nuanced understanding of the strengths, limitations, and implications of blockchain-based financial models in digital asset management for the property and real estate industry. The review process adheres to established academic standards and best practices in conducting literature reviews, ensuring rigor, objectivity, and relevance in addressing the research questions and objectives.

RESULTS AND DISCUSSION
Increased Transparency and Trust

The adoption of blockchain technology in digital asset management has been associated with a notable increase in transparency and trust within the property and real estate industry. Blockchain's decentralized and immutable ledger system ensures that transactions are recorded transparently and cannot be altered retroactively, contributing to a higher level of trust among stakeholders (Batista et al., 2023). This transparency is particularly beneficial in real estate transactions, where complex ownership structures and historical records can create opacity and uncertainty. By providing a clear and auditable record of ownership and transactions, blockchain enhances transparency and reduces the potential for disputes or fraudulent activities (Albshaier et al., 2024).

Moreover, the transparency offered by blockchain extends beyond individual transactions to the entire lifecycle of assets. Smart contracts, a feature of blockchain technology, enable automated execution of contractual agreements based on predefined conditions, further enhancing transparency and reducing the need for intermediaries (Vionis & Kotsilieris, 2024). This automation not only streamlines processes but also eliminates human errors and biases, enhancing trust in the accuracy and fairness of asset management activities (Hajj & Hammoud, 2023).

Furthermore, blockchain's immutable nature contributes significantly to building trust among stakeholders. Once data is recorded on the blockchain, it cannot be altered or deleted without consensus from the network participants, ensuring data integrity and preventing tampering (Sheela et al., 2023). This immutability feature is particularly valuable in property and real estate transactions, where historical records and ownership documentation play a crucial role in establishing ownership rights and legal compliance (Sladić et al., 2021). As a result, stakeholders can rely on blockchain-based systems to provide accurate, tamper-proof records, fostering trust and confidence in digital asset management processes.

Efficiency Gains Through Automation

The utilization of blockchain technology in digital asset management has demonstrated substantial efficiency gains through automation, particularly highlighted in the property and real estate industry. Smart contracts, an integral feature of blockchain platforms, facilitate automated execution of agreements and transactions based on predefined conditions, significantly reducing the need for manual intervention, paperwork, and processing time

(Agapiou, 2023). This automation streamlines asset management workflows, leading to enhanced operational efficiency and cost savings for stakeholders.

By eliminating intermediaries and automating contractual processes, blockchain-based smart contracts reduce administrative burdens and the potential for errors, delays, and disputes in asset management activities (Taherdoost, 2023). For instance, in real estate transactions, smart contracts can automate tasks such as property transfers, rental agreements, and payment settlements, ensuring timely and accurate execution while minimizing human intervention (Gutierrez & Xu, 2023). This streamlined workflow not only improves operational efficiency but also enhances transparency and auditability in asset management processes.

The efficiency gains through automation extend beyond individual transactions to the broader ecosystem of asset management. Blockchain's decentralized and consensus-driven nature ensures that smart contracts execute transactions automatically and transparently, without the need for centralized control or oversight (Vionis & Kotsilieris, 2023). This decentralized automation reduces dependency on intermediaries, lowers transaction costs, and accelerates the speed of asset transfers and settlements, resulting in overall efficiency improvements across the industry (Alamsyah et al., 2024).

Blockchain's automation capabilities have implications for scalability and scalability challenges in asset management. By automating repetitive tasks and standardizing processes, blockchain technology enables scalable and streamlined operations, accommodating growing transaction volumes and complexity. This scalability is crucial for handling the increasing digitization and globalization of asset management activities, ensuring sustainable efficiency gains and competitiveness in the digital era.

Enhanced Security and Fraud Prevention

The adoption of blockchain-based financial models has led to significant improvements in security and fraud prevention measures within the property and real estate sector's digital asset management landscape. Blockchain's use of cryptographic algorithms and decentralized consensus mechanisms ensures a high level of security against unauthorized access, tampering, and fraudulent activities (Alajlan et al., 2023). These security features create a robust and transparent environment for asset transactions, reducing the risk of data breaches, cyberattacks, and fraudulent manipulations.

The cryptographic nature of blockchain technology employs advanced encryption techniques to secure data and transactions, making it highly resistant to hacking and data manipulation attempts (Musa et al., 2023). Each transaction on the blockchain is cryptographically linked to the previous one, forming a chain of blocks that are immutable and tamper-proof (Halder et al., 2024). This immutability ensures that once a transaction is recorded, it cannot be altered or deleted without consensus from the network participants, providing a reliable and verifiable record of asset ownership and transactions.

Furthermore, blockchain's decentralized consensus mechanisms, such as proof of work or proof of stake, ensure that transactions are validated and added to the blockchain through a consensus among network nodes (Zhou et al., 2023). This distributed validation process eliminates the need for a central authority or intermediary to authenticate transactions, reducing the risk of single points of failure and malicious activities (Bobde et al., 2024). Additionally, the transparent and auditable nature of blockchain transactions allows stakeholders to trace the history and provenance of assets, enhancing accountability and reducing the likelihood of fraudulent practices.

In the context of real estate and property transactions, blockchain's enhanced security measures offer protection against common fraud schemes such as identity theft, property title fraud, and financial fraud (Thantharate et al., 2023). By digitizing and securing asset ownership records on the blockchain, the risk of fraudulent transfers or unauthorized changes

to property titles is mitigated, improving overall trust and confidence in digital asset management processes (George & Al-Ansari, 2023). These security advancements contribute to a more resilient and trustworthy ecosystem for property and real estate asset transactions, benefiting stakeholders across the industry.

Tokenization for Increased Liquidity

The case study emphasizes the transformative impact of tokenization on increasing liquidity within traditionally illiquid real estate markets. Tokenization involves representing real estate assets as digital tokens on a blockchain, enabling fractional ownership and facilitating the trading of fractions of high-value assets (Marin et al., 2023). This fractional ownership model allows investors to purchase and trade smaller portions of real estate properties, unlocking liquidity and investment opportunities that were previously inaccessible to a broader range of investors (Baptista et al., 2023).

By tokenizing real estate assets, investors can participate in high-value property markets with lower capital requirements, diversify their portfolios, and access asset classes that were typically reserved for institutional investors or high-net-worth individuals. This democratization of real estate investments enhances market liquidity by attracting a larger pool of investors and increasing trading activity in tokenized assets.

Moreover, tokenization provides flexibility and liquidity benefits for property owners and developers. By tokenizing their assets, property owners can unlock equity, raise capital, and access alternative financing options without selling the entire property (Park & Youm, 2024). This fractional ownership model enables property owners to monetize their assets efficiently while retaining control and ownership, contributing to improved liquidity in the real estate market.

Additionally, tokenization offers transparency and efficiency advantages in asset transactions. Blockchain-based tokenized assets provide transparent ownership records, real-time tracking of ownership changes, and automated execution of transactions through smart contracts (Alamsyah et al., 2024). These features streamline the process of buying, selling, and trading real estate tokens, reducing transaction costs, settlement times, and administrative complexities, further enhancing liquidity in the market.

Overall, tokenization's role in increasing liquidity in real estate markets signifies a paradigm shift in asset ownership and investment opportunities, driven by blockchain technology's innovative solutions for fractional ownership, transparent trading, and efficient asset management.

Cost Reduction Through Disintermediation

The adoption of blockchain-based financial models in digital asset management has resulted in significant cost reductions through disintermediation. Blockchain technology eliminates the need for intermediaries such as banks, brokers, and escrow agents by providing a decentralized and transparent ledger system, thereby streamlining asset transfers and settlements and reducing associated costs for stakeholders (Agarwal et al., 2023).

One of the primary cost-saving benefits of blockchain-based disintermediation is the reduction in transaction fees. Traditional financial transactions often incur fees charged by intermediaries for their services, such as processing payments, verifying transactions, and maintaining records. By leveraging blockchain technology, these intermediary fees can be minimized or eliminated, as transactions are peer-to-peer, direct, and verified through consensus mechanisms (Wijesekara & Gunawardena, 2023). This reduction in transaction fees translates to cost savings for investors, property owners, and other participants in asset management activities.

Furthermore, blockchain's disintermediation leads to a reduction in paperwork and administrative overheads associated with asset transfers and settlements. Traditional

processes involving intermediaries often require extensive documentation, verification, and coordination, leading to time-consuming and costly administrative procedures. With blockchain-based transactions, smart contracts automate and streamline these processes, reducing the need for manual paperwork, reconciliations, and intermediaries' involvement (Xia et al., 2023). This automation not only saves time but also lowers administrative costs and minimizes the risk of errors or delays in asset management activities.

Moreover, blockchain's transparent and auditable nature contributes to cost savings by enhancing trust and reducing the need for costly audits, reconciliations, and dispute resolutions (Akella et al., 2023). The immutable record of transactions on the blockchain provides a verifiable and tamper-proof history of asset ownership and transfers, mitigating the need for extensive documentation, audits, and legal proceedings to resolve disputes or verify transactions' authenticity.

Overall, blockchain's disintermediation in digital asset management leads to cost reductions across various aspects of asset transfers and settlements, including transaction fees, paperwork, administrative overheads, and dispute resolution expenses. These cost savings contribute to improved efficiency, transparency, and affordability in asset management processes, benefiting stakeholders and promoting wider adoption of blockchain-based financial models.

Regulatory Compliance and Governance

The exploration of blockchain-based financial models has underscored the critical importance of regulatory compliance and governance frameworks in the property and real estate sector. While blockchain technology offers inherent benefits such as transparency, security, and efficiency, it also presents challenges related to regulatory requirements and adherence to legal standards (Saah et al., 2023).

One of the key considerations in blockchain-based financial models is ensuring compliance with existing regulatory standards and guidelines. Financial transactions, especially those involving digital assets and securities tokenization, must comply with regulatory frameworks governing securities, anti-money laundering (AML), know your customer (KYC) requirements, and other relevant laws (Aseeva, 2024). Failure to comply with these regulations can result in legal repercussions, financial penalties, reputational damage, and hindered market adoption of blockchain-based solutions.

Developing robust regulatory frameworks tailored to blockchain technology is essential to address regulatory challenges effectively. Regulatory authorities and policymakers need to collaborate with industry stakeholders, technology providers, legal experts, and academia to develop clear and comprehensive guidelines that balance innovation with regulatory compliance (Li et al., 2023). These frameworks should address issues such as asset tokenization, smart contract validity, data privacy, cross-border transactions, and dispute resolution in blockchain-based financial models.

Furthermore, governance mechanisms play a crucial role in ensuring transparency, accountability, and market integrity in blockchain ecosystems. Governance frameworks define rules, procedures, decision-making processes, and responsibilities within blockchain networks, governing how transactions are validated, consensus is reached, and disputes are resolved (Ullah & Havinga, 2023). Effective governance promotes trust among network participants, fosters collaboration, and mitigates the risk of fraud, manipulation, and conflicts of interest.

In addition to regulatory compliance and governance, industry standards and best practices play a pivotal role in promoting adoption and interoperability of blockchain-based financial models. Standardization efforts led by industry consortia, standards bodies, and regulatory bodies aim to establish common protocols, data formats, security measures, and interoperability standards for blockchain applications. These standards enhance market

confidence, facilitate cross-platform compatibility, and promote innovation while ensuring regulatory compliance and investor protection.

Overall, the successful integration of blockchain-based financial models in the property and real estate sector requires a holistic approach that combines regulatory compliance, governance frameworks, industry standards, and collaboration among stakeholders. By addressing regulatory challenges and fostering a conducive regulatory environment, blockchain technology can unlock its full potential in driving transparency, efficiency, and trust in asset management processes.

Scalability Challenges and Technological Innovation

While blockchain-based financial models offer significant advantages in digital asset management within the property and real estate industry, scalability challenges remain a critical concern. As transaction volumes increase and blockchain networks grow, scalability limitations can arise, impacting transaction speeds, costs, and overall network performance (Boumaiza, 2024).

One of the primary scalability challenges in blockchain technology is the limitation of transaction throughput. Public blockchain networks, such as Bitcoin and Ethereum, have inherent limitations in processing transactions per second (TPS), leading to network congestion during peak periods and increased transaction fees (Ante & Saggu, 2024). This scalability bottleneck hinders the scalability of blockchain-based financial models, especially in high-volume industries like real estate where rapid transaction processing is crucial.

Addressing scalability challenges requires ongoing technological innovation and the development of scalable blockchain solutions. Researchers and industry experts are exploring various approaches, such as sharding, sidechains, and off-chain scaling solutions, to improve blockchain scalability (Berenjestanaki et al., 2024). Sharding, for example, involves partitioning the blockchain into smaller shards that can process transactions in parallel, thereby increasing network throughput and scalability.

Additionally, the implementation of layer 2 protocols, such as the Lightning Network for Bitcoin and the Raiden Network for Ethereum, aims to offload transactions from the main blockchain to secondary layers, reducing congestion and improving scalability (Martinazzi et al., 2020). These layer 2 solutions enable faster and cheaper transactions while maintaining the security and integrity of the underlying blockchain.

Furthermore, advancements in consensus algorithms, such as proof of stake (PoS) and delegated proof of stake (DPoS), contribute to scalability improvements by reducing energy consumption and increasing transaction throughput (Bachani & Bhattacharjya, 2023). PoS and DPoS consensus mechanisms prioritize network validators based on stake or voting power, allowing for faster transaction validations and scalability enhancements.

In conclusion, addressing scalability challenges in blockchain-based financial models for digital asset management requires continuous technological innovation and the adoption of scalable solutions. By leveraging advancements in blockchain technology, such as sharding, layer 2 protocols, and improved consensus algorithms, the property and real estate industry can overcome scalability limitations and unlock the full potential of blockchain-based financial models for efficient and scalable asset management processes.

Educational and Awareness Initiatives

The case study highlights the critical role of educational and awareness initiatives in promoting the understanding and adoption of blockchain-based financial models in digital asset management within the property and real estate industry. Educating stakeholders about blockchain technology, its benefits, challenges, and best practices is essential for fostering trust, overcoming resistance to change, and driving widespread adoption across the industry (Riedel, 2024).

One of the primary objectives of educational initiatives is to enhance stakeholders' understanding of blockchain technology and its potential applications in asset management. Blockchain education programs, workshops, and seminars provide insights into blockchain concepts, such as distributed ledgers, smart contracts, tokenization, and consensus mechanisms (Pineda et al., 2024). By demystifying blockchain technology and explaining its relevance to asset management, these initiatives empower stakeholders to make informed decisions and embrace digital innovations.

Furthermore, awareness initiatives play a crucial role in highlighting the benefits of blockchain-based financial models, such as increased transparency, security, efficiency, and reduced costs (Norbu et al., 2024). Case studies, success stories, and industry reports showcasing real-world applications of blockchain in asset management help stakeholders visualize the tangible impact and value proposition of adopting blockchain solutions.

Moreover, educational and awareness initiatives focus on addressing misconceptions, concerns, and challenges associated with blockchain technology, such as scalability, regulatory compliance, data privacy, and interoperability. By providing accurate information, practical insights, and best practices, these initiatives mitigate uncertainty and skepticism, paving the way for smoother adoption and integration of blockchain-based financial models.

Additionally, collaboration between industry stakeholders, educational institutions, technology providers, and regulatory bodies is essential in designing and implementing effective educational and awareness campaigns (Sato et al., 2023). Joint initiatives, partnerships, and knowledge-sharing platforms facilitate the exchange of expertise, resources, and experiences, enriching stakeholders' learning journeys and accelerating blockchain adoption in the industry.

In conclusion, educational and awareness initiatives play a vital role in promoting understanding, trust, and adoption of blockchain-based financial models in digital asset management within the property and real estate sector. By empowering stakeholders with knowledge, insights, and practical guidance, these initiatives drive innovation, facilitate change management, and contribute to the sustainable growth of blockchain ecosystems in asset management processes.

Collaborative Ecosystem and Industry Partnerships

The success and advancement of blockchain-based financial models in digital asset management within the property and real estate sector heavily depend on collaborative ecosystems and partnerships between various stakeholders. Collaboration among industry players, technology providers, regulators, and academia is crucial for fostering knowledge sharing, driving innovation, promoting standardization, and facilitating regulatory dialogue (Manta & Mansi, 2024).

One of the key benefits of collaborative ecosystems is the exchange of expertise, resources, and best practices among diverse stakeholders. Industry players bring domain knowledge, market insights, and use case expertise, while technology providers contribute technical expertise, solutions, and innovation (Sulatana & Turkina, 2024). Regulators play a vital role in providing regulatory clarity, guidance, and oversight, ensuring compliance and legal certainty in blockchain-based financial models. Academia contributes research, education, and thought leadership, driving continuous learning, innovation, and evidence-based insights.

Furthermore, industry partnerships foster joint initiatives, pilot projects, and collaborative research endeavors focused on developing and implementing blockchain solutions for asset management (Tafuro et al., 2023). Collaborative projects enable stakeholders to pool resources, share risks, and accelerate innovation, resulting in practical applications and real-world impact. These partnerships also promote interoperability,

compatibility, and standardization of blockchain technologies, enhancing adoption and scalability across the industry.

Moreover, collaborative ecosystems provide a platform for regulatory dialogue and policy discussions, enabling stakeholders to address regulatory challenges, compliance requirements, and industry standards. Regulatory sandboxes, pilot programs, and working groups facilitate collaboration between regulators and industry players, fostering regulatory innovation and facilitating the development of regulatory frameworks conducive to blockchain adoption.

In conclusion, collaborative ecosystems and industry partnerships are essential enablers for advancing blockchain-based financial models in digital asset management within the property and real estate sector. By fostering collaboration, knowledge sharing, innovation, standardization, and regulatory dialogue, these ecosystems create an enabling environment for sustainable growth and development of blockchain applications, driving efficiency, transparency, and trust in asset management processes.

CONCLUSION

In conclusion, the exploration of blockchain-based financial models in digital asset management within the property and real estate industry has revealed transformative potential along with challenges that must be addressed for widespread adoption. The findings underscore the critical importance of addressing scalability challenges, enhancing regulatory compliance, promoting education and awareness, and fostering collaborative ecosystems.

Firstly, addressing scalability challenges is imperative to ensure that blockchain-based solutions can handle increasing transaction volumes efficiently. Innovations such as sharding, layer 2 protocols, and improved consensus mechanisms are essential for improving blockchain scalability and enhancing transaction throughput, thereby enabling seamless operations in high-volume asset management environments.

Secondly, regulatory compliance and governance frameworks play a pivotal role in establishing a conducive environment for blockchain adoption. Developing clear regulatory guidelines, fostering regulatory dialogue, and implementing robust governance mechanisms are essential to ensure legal compliance, investor protection, and market integrity in blockchain-based financial models.

Thirdly, educational and awareness initiatives are essential for promoting understanding, trust, and adoption of blockchain technology among stakeholders. By providing accurate information, addressing misconceptions, and showcasing real-world applications, educational initiatives empower stakeholders to embrace digital innovations, overcome resistance to change, and drive widespread adoption across the industry.

Finally, collaborative ecosystems and industry partnerships are key enablers for advancing blockchain-based financial models. Collaboration among industry players, technology providers, regulators, and academia facilitates knowledge sharing, innovation, standardization, and regulatory dialogue, creating an enabling environment for sustainable growth and development of blockchain applications in asset management processes.

In essence, addressing scalability challenges, enhancing regulatory compliance, promoting education and awareness, and fostering collaborative ecosystems are essential steps towards realizing the full potential of blockchain-based financial models in digital asset management within the property and real estate sector. Through concerted efforts and collaborative initiatives, stakeholders can harness the benefits of blockchain technology to drive efficiency, transparency, and trust in asset management processes, paving the way for a more resilient and innovative industry ecosystem.

REFERENSI

Agapiou, A. (2023). Overcoming the Legal Barriers to the Implementation of Smart Contracts in the Construction Industry: The Emergence of a Practice and Research Agenda. *Buildings,* 13(3), 594. https://doi.org/10.3390/buildings13030594

Agarwal, N., Wongthongtham, P., Khairwal, N., & Coutinho, K. (2023). Blockchain Application to Financial Market Clearing and Settlement Systems. *Journal of Risk and Financial Management*, 16(10), 452. https://doi.org/10.3390/jrfm16100452

Akella, G. K., Wibowo, S., Grandhi, S., & Mubarak, S. (2023). A Systematic Review of Blockchain Technology Adoption Barriers and Enablers for Smart and Sustainable Agriculture. Big Data and Cognitive Computing, 7(2), 86. https://doi.org/10.3390/bdcc7020086

Alajlan, R., Alhumam, N., & Frikha, M. (2023). Cybersecurity for Blockchain-Based IoT Systems: A Review. *Applied Sciences*, 13(13), 7432. https://doi.org/10.3390/app13137432

Alamsyah, A., Kusuma, G. N. W., & Ramadhani, D. P. (2024). A Review on Decentralized Finance Ecosystems. *Future Internet,* 16(3), 76. https://doi.org/10.3390/fi16030076

Albshaier, L., Almarri, S., & Hafizur Rahman, M. M. (2024). A Review of Blockchain's Role in E-Commerce Transactions: Open Challenges, and Future Research Directions. *Computers*, 13(1), 27. https://doi.org/10.3390/computers13010027

Ante, L., & Saggu, A. (2024). Time-Varying Bidirectional Causal Relationships between Transaction Fees and Economic Activity of Subsystems Utilizing the Ethereum Blockchain Network. *Journal of Risk and Financial Management,* 17(1), 19. https://doi.org/10.3390/jrfm17010019

Aseeva, A. (2024). Liable and Sustainable by Design: A Toolbox for a Regulatory Compliant and Sustainable Tech. *Sustainability,* 16(1), 228. https://doi.org/10.3390/su16010228

Bachani, V., & Bhattacharjya, A. (2023). Preferential Delegated Proof of Stake (PDPoS)—Modified DPoS with Two Layers towards Scalability and Higher TPS. *Symmetry*, 15(1), 4. https://doi.org/10.3390/sym15010004

Baptista, N., Januario, J. F., & Cruz, C. O. (2023). Social and Financial Sustainability of Real Estate Investment: Evaluating Public Perceptions towards Blockchain Technology. *Sustainability,* 15(16), 12288. https://doi.org/10.3390/su151612288

Batista, D., Mangeth, A. L., Frajhof, I., Alves, P. H., Nasser, R., Robichez, G., Silva, G. M., & Miranda, F. P. d. (2023). Exploring Blockchain Technology for Chain of Custody Control in Physical Evidence: A Systematic Literature Review. *Journal of Risk and Financial Management,* 16(8), 360. https://doi.org/10.3390/jrfm16080360

Bobde, Y., Narayanan, G., Jati, M., Raj, R. S. P., Cvitić, I., & Peraković, D. (2024). Enhancing Industrial IoT Network Security through Blockchain Integration. *Electronics*, 13(4), 687. https://doi.org/10.3390/electronics13040687

Boumaiza, A. (2024). A Blockchain-Based Scalability Solution with Microgrids Peer-to-Peer Trade. *Energies*, 17(4), 915. https://doi.org/10.3390/en17040915

De Paola, P. (2024). Real Estate: Discovering the Developments in the Real Estate Sector Using the Current Research Challenges. *Real Estate*, 1(1), 1-3. https://doi.org/10.3390/realestate1010001

Diantaris, M. T. A. (2024, April 9). Fractional Ownership in Real Estate: A Blockchain Revolution. *The Jurnals.* Retrieved from https://jurnals.net/fractional-ownership-in-real-estate-a-blockchain-revolution/

El Hajj, M., & Hammoud, J. (2023). Unveiling the Influence of Artificial Intelligence and Machine Learning on Financial Markets: A Comprehensive Analysis of AI Applications in Trading, Risk Management, and Financial Operations. *Journal of Risk and Financial Management*, 16(10), 434. https://doi.org/10.3390/jrfm16100434

George, W., Al-Marin, O., Cioara, T., Toderean, L., Mitrea, D., & Anghel, I. (2023). Review of Blockchain Tokens Creation and Valuation. *Future Internet,* 15(12), 382. https://doi.org/10.3390/fi15120382

Habib, G., Sharma, S., Ibrahim, S., Ahmad, I., Qureshi, S., & Ishfaq, M. (2022). Blockchain Technology: Benefits, Challenges, Applications, and Integration of Blockchain Technology with Cloud Computing. *Future Internet,* 14(11), 341. https://doi.org/10.3390/fi14110341

Hajian Berenjestanaki, M., Barzegar, H. R., El Ioini, N., & Pahl, C. (2024). Blockchain-Based E-Voting Systems: A Technology Review. *Electronics*, 13(1), 17. https://doi.org/10.3390/electronics13010017

Halder, R., Das Roy, D., & Shin, D. (2024). A Blockchain-Based Decentralized Public Key Infrastructure Using the Web of Trust. *Journal of Cybersecurity and Privacy*, 4(2), 196-222. https://doi.org/10.3390/jcp4020010

Li, W., Yigitcanlar, T., Nili, A., & Browne, W. (2023). Tech Giants' Responsible Innovation and Technology Strategy: An International Policy Review. *Smart Cities*, 6(6), 3454-3492. https://doi.org/10.3390/smartcities6060153

Manta, O., & Mansi, E. (2024). The Impact of Globalization on Innovative Public Procurement: Challenges and Opportunities. *Administrative Sciences*, 14(4), 80. https://doi.org/10.3390/admsci14040080

Marin, O., Cioara, T., Toderean, L., Mitrea, D., & Anghel, I. (2023). Review of Blockchain Tokens Creation and Valuation. *Future Internet,* 15(12), 382. https://doi.org/10.3390/fi15120382

Martinazzi, S., Regoli, D., & Flori, A. (2020). A Tale of Two Layers: The Mutual Relationship between Bitcoin and Lightning Network. *Risks*, 8(4), 129. https://doi.org/10.3390/risks8040129

Musa, H. S., Krichen, M., Altun, A. A., & Ammi, M. (2023). Survey on Blockchain-Based Data Storage *Security for Android Mobile Applications. Sensors,* 23(21), 8749. https://doi.org/10.3390/s23218749

Norbu, T., Park, J. Y., Wong, K. W., & Cui, H. (2024). Factors Affecting Trust and Acceptance for Blockchain Adoption in Digital Payment Systems: A Systematic Review. *Future Internet,* 16(3), 106. https://doi.org/10.3390/fi16030106

Park, K., & Youm, H.-Y. (2024). Proposal of a Service Model for Blockchain-Based Security Tokens. *Big Data and Cognitive Computing*, 8(3), 30. https://doi.org/10.3390/bdcc8030030

Pineda, M., Jabba, D., & Nieto-Bernal, W. (2024). Blockchain Architectures for the Digital Economy: Trends and Opportunities. *Sustainability,* 16(1), 442. https://doi.org/10.3390/su16010442

Raja Santhi, A., & Muthuswamy, P. (2022). Influence of Blockchain Technology in Manufacturing Supply Chain and Logistics. *Logistics*, 6(1), 15. https://doi.org/10.3390/logistics6010015

Riedel, T. (2024). Addressing Challenges: Adopting Blockchain Technology in the Pharmaceutical Industry for Enhanced Sustainability. *Sustainability,* 16(8), 3102. https://doi.org/10.3390/su16083102

Saah, A. E. N., Yee, J.-J., & Choi, J.-H. (2023). Securing Construction Workers' Data Security and Privacy with Blockchain Technology. *Applied Sciences*, 13(24), 13339. https://doi.org/10.3390/app132413339

Saari, A., Junnila, S., & Vimpari, J. (2022). Blockchain's Grand Promise for the Real Estate Sector: A Systematic Review. *Applied Sciences,* 12(23), 11940. https://doi.org/10.3390/app122311940

Sato, S. N., Condes Moreno, E., Rubio-Zarapuz, A., Dalamitros, A. A., Yañez-Sepulveda, R., Tornero-Aguilera, J. F., & Clemente-Suárez, V. J. (2024). Navigating the New Normal:

Adapting Online and Distance Learning in the Post-Pandemic Era. Education Sciences, 14(1), 19. https://doi.org/10.3390/educsci14010019

Sheela, S., Alsmady, A. A., Tanaraj, K., & Izani, I. (2023). Navigating the Future: Blockchain's Impact on Accounting and Auditing Practices. *Sustainability,* 15(24), 16887. https://doi.org/10.3390/su152416887

Sladić, G., Milosavljević, B., Nikolić, S., Sladić, D., & Radulović, A. (2021). A Blockchain Solution for Securing Real Property Transactions: A Case Study for Serbia. *ISPRS International Journal of Geo-Information*, 10(1), 35. https://doi.org/10.3390/ijgi10010035

Sultana, N., & Turkina, E. (2023). Collaboration for Sustainable Innovation Ecosystem: The Role of Intermediaries. *Sustainability,* 15(10), 7754.

Tafuro, A., Dammacco, G., & Costa, A. (2023). A Conceptual Study on the Role of Blockchain in Sustainable Development of Public–Private Partnership. Administrative Sciences, 13(8), 175. https://doi.org/10.3390/admsci13080175

Taherdoost, H. (2023). Smart Contracts in Blockchain Technology: A Critical Review. *Information*, 14(2), 117. https://doi.org/10.3390/info14020117

Thantharate, P., & Thantharate, A. (2023). ZeroTrustBlock: Enhancing Security, Privacy, and Interoperability of Sensitive Data through ZeroTrust Permissioned Blockchain. *Big Data and Cognitive Computing*, 7(4), 165. https://doi.org/10.3390/bdcc7040165

Uchani Gutierrez, O. C., & Xu, G. (2023). Blockchain and Smart Contracts to Secure Property Transactions in Smart Cities. *Applied Sciences,* 13(1), 66. https://doi.org/10.3390/app13010066

Uchani Gutierrez, O. C., & Xu, G. (2023). Blockchain and Smart Contracts to Secure Property Transactions in Smart Cities. *Applied Sciences*, 13(1), 66. https://doi.org/10.3390/app13010066

Ullah, I., & Havinga, P. J. M. (2023). Governance of a Blockchain-Enabled IoT Ecosystem: A Variable Geometry Approach. *Sensors*, 23(22), 9031. https://doi.org/10.3390/s23229031

Vionis, P., & Kotsilieris, T. (2024). The Potential of Blockchain Technology and Smart Contracts in the Energy Sector: A Review. *Applied Sciences,* 14(1), 253. https://doi.org/10.3390/app14010253

Wijesekara, P. A. D. S. N., & Gunawardena, S. (2023). A Review of Blockchain Technology in Knowledge-Defined Networking, Its Application, Benefits, and Challenges. *Network*, 3(3), 343-421. https://doi.org/10.3390/network3030017

Xia, J., Li, H., & He, Z. (2023). The Effect of Blockchain Technology on Supply Chain Collaboration: A Case Study of Lenovo. *Systems*, 11(6), 299. https://doi.org/10.3390/systems11060299

Zhou, S., Li, K., Xiao, L., Cai, J., Liang, W., & Castiglione, A. (2023). A Systematic Review of Consensus Mechanisms in Blockchain. *Mathematics*, 11(10), 2248. https://doi.org/10.3390/math11102248