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Blockchain-Assisted Financial Cryptocurrency Strategies for Green Business Practices: A Comparative Study

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Abstract: This paper explores the intricate relationship between sustainable business practices and blockchain-assisted financial cryptocurrency strategies in the contemporary global landscape. Recognizing the dynamic nature of the business environment, the study addresses the imperative to unravel the impact of technology on sustainability metrics. Employing a robust methodology involving the Error-Trend-Seasonality (ETS), Exponentially Weighted Moving Average (EWMA), and Holt-Winters methods, the research analyzes temporal patterns within financial cryptocurrency data. The results provide valuable insights into emerging trends and comparative performance among cryptocurrencies. Through a synthesis of our analytical approach, this study contributes to the ongoing dialogue on the integration of blockchain in finance, offering stakeholders a nuanced understanding of the potential implications for green business practices.

Keywords: Blockchain; Cryptocurrency; Error-Trend-Seasonality; Exponentially Weighted Moving Average; Holt-Winters; Green Business.

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1. Introduction

Blockchain technology has the potential to enable the creation of novel operating and business models as well as goods and services for customers. Creativity is widely acknowledged as a key source of economic benefit in a world that is changing quickly. Creativity is a method as well as a product [1]. Similar to earlier fundamental advancements, systemic change is necessary for business innovation utilizing blockchain technology to hasten its broader adoption. The use of blockchain technology can be crucial in advancing environmental sustainability. In particular, sustainable blockchains are an effective tool for companies that are dedicated to environmentally friendly operations since they provide accountability, transparency, and efficiency. For instance, blockchain makes it possible for companies to track the origins and movements of items, enabling product traceability. This openness lowers the possibility of environmental impact and guarantees ethical sourcing. Blockchain supports fair commerce, prevents fraud, and encourages sustainable practices by tracking each stage of a supply chain on an immutable ledger. Also, accurate carbon footprint tracking on blockchain networks can be facilitated by tokenization [2]. Transparency in the measurement and offsetting of emissions by businesses promotes environmental responsibility. By

automating carbon credit transactions, smart contracts might encourage companies to lessen their environmental effect. Platforms built on blockchain technology can tokenize rewards for environmentally responsible actions. These tokens are used by green finance to support environmentally friendly initiatives including infrastructure for renewable energy sources and reforestation. By endorsing initiatives that share their environmental ideals, investors may take part in ethical investing [3]. Blockchain technology fights greenwashing, a practice in which businesses overstate their environmental efforts without demonstrating a tangible impact. Businesses are held responsible for their sustainability promises via immutable records. When customers can use a blockchain to confirm a business's green policies, they become more trustworthy.

Indeed, certain blockchain-assisted financial cryptocurrency strategies —like Bitcoin, which uses proof-of-work—have substantial energy footprints, while other blockchains—like Ethereum, which switched to proof-of-stake—are significantly more energy-efficient. With the recent proof-of-stake update of the Ethereum network, energy consumption dropped by an astounding 99.9%1. Initiatives like the Ethereum Climate Platform (ECP), which includes major players in the sector including the Ethereum Enterprise Alliance, ConsenSys, Microsoft, Aave, and Polygon, are also aimed at tackling Ethereum's previous carbon footprint [4,5]. In spite of widespread interest in blockchain applications, industry sectors continue to have low levels of maturity and significant instances of failure. The majority of blockchain initiatives fail due to insufficient specifications and standardization processes [6]. A dearth of strategies for successfully overseeing the widespread implementation of blockchain-based business sustainability contributed to the failure of 92% of blockchain projects before 2019 [7]. nevertheless, by the middle of 2021, 2047 both blockchain and cryptocurrency initiatives had failed [8]. The increased rate of failure indicates the wider intricacy of change driven by technology [9]. The concomitant adverse consequences of these failure rates frequently impede the sustainability of economic and social outcomes, including but not limited to business administration, risk mitigation, financial administration, human resource and culture leadership, and competition. Even while there are presently 70 million active blockchain pockets, the majority of which are used for cryptocurrency trading activities in the decentralized finance and gaming sectors, it seems that broad-based usage of blockchain continues to be in its early stages [10, 11]. As a consequence, the intersection of blockchain, cryptocurrency, and green business practices has emerged as a focal point of innovation and transformation [12-14].

This paper delves into the dynamic landscape where financial technologies, particularly blockchain, converge with sustainable business practices to forge a novel path towards economic resilience and ecological responsibility. As businesses navigate the complexities of a globalized economy, the integration of blockchain and financial cryptocurrency approaches offers a promising avenue for fostering transparency, efficiency, and accountability. Our exploration seeks to unravel the synergies between these transformative technologies and sustainable business strategies, shedding light on the potential for positive environmental and economic impacts in the pursuit of a resilient and sustainable future.

The remainder of this paper is organized as follows. Section 2 elaborates on the pertinent literature of blockchain technology and environmental concerns. Section 3 explains the proposed

methodology. Section 4 presents the derived comparative results. Section 5 offers conclusions and suggestions for the future.

2. Related Works

This section critically reviews and synthesizes pertinent literature, capturing the evolution of research and applications at the nexus of blockchain technology, financial cryptocurrency, and sustainable business management. In the examination of pertinent literature studies, various facets of blockchain applications in diverse domains were explored, laying the groundwork for understanding the landscape of technological integration with sustainability.

Yang et al. [10] presented a dynamic distributed iterative computational model, emphasizing the synergy of blockchain and the Internet of Things (IoT) for payment information management in shared logistics. Alshehri [11] extended this discourse to smart livestock farming, proposing a blockchain-assisted IoT framework. Kandpal et al. [12] contributed insights into secure data management within supply chain systems using blockchain technology. The intersection of blockchain, crypto assets, and digital entrepreneurship was examined by Ulrich et al. [13], providing fresh perspectives on the evolving understanding of this dynamic field. Delardas and Giannos [14] contributed to the discussion of energy transition by exploring the use of blockchain in renewable certificates, thereby supporting sustainability commitments. Bhushan et al. [15] conducted a thorough review of blockchain architectures for smart cities, shedding light on integration trends and future research directions. Ullah et al. [16] delved into the applications of blockchain in sustainable smart cities, offering insights into the potential transformative impact of this technology. Huang et al. [17] presented a comprehensive survey of state-of-the-art blockchain theories, modelings, and tools, providing a foundational understanding of the technological landscape. Bürer et al. [18] explored blockchain use cases in the energy industry, emphasizing emerging business models and associated risks. Yoon and Pishdad-Bozorgi [19] conducted a state-of-the-art review focusing on blockchain-enabled construction supply chains, contributing to the growing body of knowledge in this domain.

This paper explores the dynamic interplay of sustainable business practices and financial technology, specifically blockchain, to create a new route towards ecological responsibility and economic resilience. The merger of blockchain technology with financial cryptocurrency techniques presents a potential option for businesses to create accountability, efficiency, and transparency as they traverse the challenges of a globalized market. Our investigation aims to reveal the connections between these revolutionary technology and environmentally friendly business practices, highlighting the possibility of beneficial effects on the environment and the economy in the quest for a resilient and sustainable future.

3. Methodology

In this section, we delineate the structured framework guiding our study, emphasizing the rigor and precision necessary for meaningful insights. Methodological transparency is paramount as we navigate the complex interplay between technology and sustainable business practices.

In our methodology, we employ a comprehensive analytical framework known as the Error-Trend-Seasonality (ETS) method to rigorously analyze financial cryptocurrency data. The ETS method is a powerful time series analysis tool that enables us to disentangle and understand the inherent patterns within the financial cryptocurrency dataset. This approach involves decomposing the data into three fundamental components: Error, representing the random fluctuations in the data; Trend, capturing the long-term trajectory or directionality; and Seasonality, accounting for recurring patterns or fluctuations that occur at regular intervals. By meticulously applying the ETS method, we can systematically examine the temporal dynamics of financial cryptocurrency metrics, discerning underlying trends, and identifying patterns influenced by seasonality. This methodological choice is particularly apt for our study as it facilitates a nuanced understanding of the temporal variations in financial cryptocurrency data, offering valuable insights into the underlying factors that contribute to the sustainability and resilience of business models in this dynamic and evolving landscape [20-22].

In addition to the Error-Trend-Seasonality (ETS) method, our methodology incorporates the application of Exponentially Weighted Moving Average (EWMA) to analyze financial cryptocurrency data. The EWMA technique is a robust statistical tool that allows us to emphasize recent observations in the dataset while still considering historical data, striking a balance between responsiveness and smoothing. By applying EWMA, we gain a dynamic perspective on the evolving trends and patterns within the financial cryptocurrency metrics. This method is particularly valuable in capturing short-term variations and detecting rapid changes in the data, which is crucial in the context of the dynamic and volatile nature of cryptocurrency markets. The use of EWMA enhances the precision of our analysis by providing a nuanced view of the evolving dynamics in the financial cryptocurrency data, contributing to a more comprehensive understanding of the factors influencing sustainable business management in this technologically driven financial landscape [23-24].

In our methodological approach, we further enrich our analysis of financial cryptocurrency data by implementing the Holt-Winters method. The Holt-Winters method is a powerful time series forecasting technique that extends the Error-Trend-Seasonality (ETS) method, incorporating the ability to capture and project trends and seasonality over time. This method proves instrumental in forecasting future values based on historical patterns, making it particularly suitable for the dynamic and evolving nature of financial cryptocurrency data. By applying the Holt-Winters method, we aim to enhance the accuracy of our predictions and gain deeper insights into the potential trajectories of key financial cryptocurrency metrics. This methodological choice empowers us to not only comprehend the current state of the cryptocurrency market but also to anticipate future trends, providing valuable insights for sustainable business management strategies in the context of blockchain-assisted financial approaches.

4. Experimental Results and Discussion

In this section, we present the results derived from our rigorous investigation, offering a comprehensive portrayal of the empirical outcomes and insights garnered. The symbiosis between technology and sustainable business practices unfolds as we dissect the data, revealing patterns,

Figure 1: Correlation Map depicting the Interrelationships between Blockchain-Assisted Financial Cryptocurrency Strategies and Sustainable Business Metrics.

correlations, and noteworthy trends. Our discussion goes beyond mere presentation, delving into the nuanced implications of the findings within the broader context of contemporary business ecosystems. In Figure 1, we present a visually illuminating correlation map derived from our empirical analysis, serving as a graphical representation of the intricate relationships discerned among key variables. This visual depiction allows for a comprehensive understanding of the interconnectedness and dependencies within the dataset, shedding light on the nuanced dynamics between blockchain-assisted financial cryptocurrency strategies and sustainable business metrics. The correlation map serves not only as a visually intuitive tool for discerning patterns but also as a pivotal reference point for interpreting the strength and directionality of relationships among the variables under scrutiny. This graphical representation adds a layer of clarity to our results, offering stakeholders and researchers alike an accessible means of grasping the complex interplay between technology and sustainability within the context of our study.

In Figure 2, we meticulously visualize the top six most trending and least trending cryptocurrencies in conjunction with Bitcoin, providing a succinct overview of the dynamic cryptocurrency landscape. This graphical representation not only identifies the leading contenders in the market but also illuminates the comparative performance of select cryptocurrencies concerning

Bitcoin. By focusing on both the most trending and least trending cryptocurrencies, our analysis aims to offer a nuanced perspective on the varying degrees of market influence and investor interest. This visual exploration serves as a valuable resource for stakeholders, enabling them to discern notable trends and patterns in the evolving cryptocurrency ecosystem, while also informing strategic decision-making in the context of financial cryptocurrency approaches and their implications for sustainable business management. In Figure 3, we present a comprehensive visualization of the cryptocurrency landscape by focusing on the top six most trending and least trending cryptocurrencies in correlation with Ethereum. This graphical representation provides an insightful overview of the diverse performance trajectories within the cryptocurrency market, emphasizing the comparative standing of selected cryptocurrencies alongside Ethereum. This visual exploration serves as a valuable tool for stakeholders, facilitating a nuanced understanding of trends and patterns in the cryptocurrency ecosystem. Such insights are crucial for shaping informed decisions, especially in the context of financial cryptocurrency approaches and their implications for sustainable business management. In Figure 4, we present a visual representation of the results obtained through the application of the Exponentially Weighted Moving Average (EWMA) and the Error-Trend-Seasonality (ETS) analysis. This graphical depiction serves as a pivotal element in our methodology, offering stakeholders and researchers a clear and intuitive view of the temporal dynamics and trends within the financial cryptocurrency dataset. By visualizing the outcomes of the EWMA and ETS analysis, we provide a tangible illustration of the nuanced insights derived from our analytical approach. This figure encapsulates the evolving patterns, trends, and fluctuations in the financial cryptocurrency data, enhancing the interpretability of our findings and facilitating a deeper understanding of the interplay between blockchain-assisted financial strategies and sustainable business metrics.

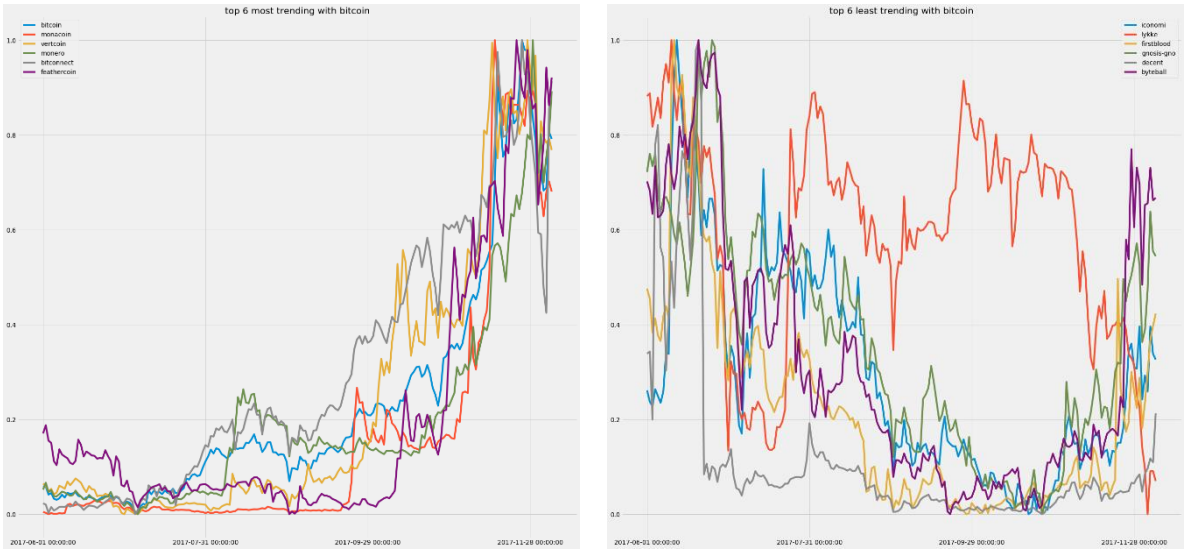

Figure 2: Comparative Analysis of Top 6 Most Trending and Least Trending Cryptocurrencies in Relation to Bitcoin, Unveiling Market Dynamics, and Investor Interest in the Cryptocurrency Landscape.

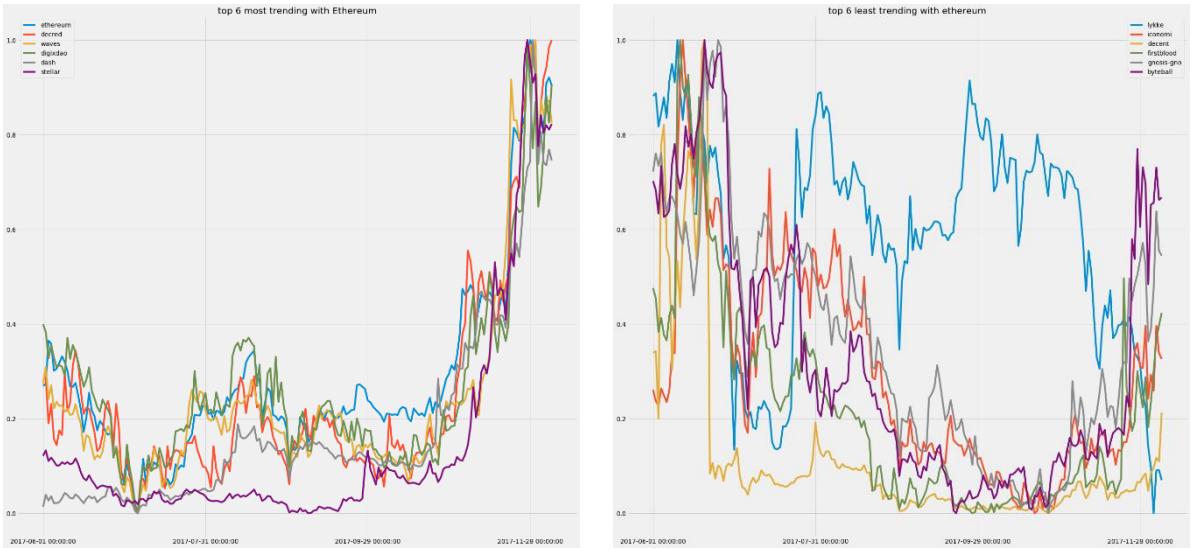

Figure 3: Comparative Analysis of Top 6 Most Trending and Least Trending Cryptocurrencies in Relation to Ethereum, Unveiling Market Dynamics and Investor Interest in the Cryptocurrency Landscape.

5. Conclusion

This study delves into the symbiotic relationship between blockchain-assisted financial cryptocurrency strategies and sustainable business management, employing a robust analytical framework encompassing the Error-Trend-Seasonality (ETS), Exponentially Weighted Moving Average (EWMA), and Holt-Winters methods. Through a meticulous analysis of the financial cryptocurrency data, our findings unveil nuanced temporal dynamics and trends, providing valuable

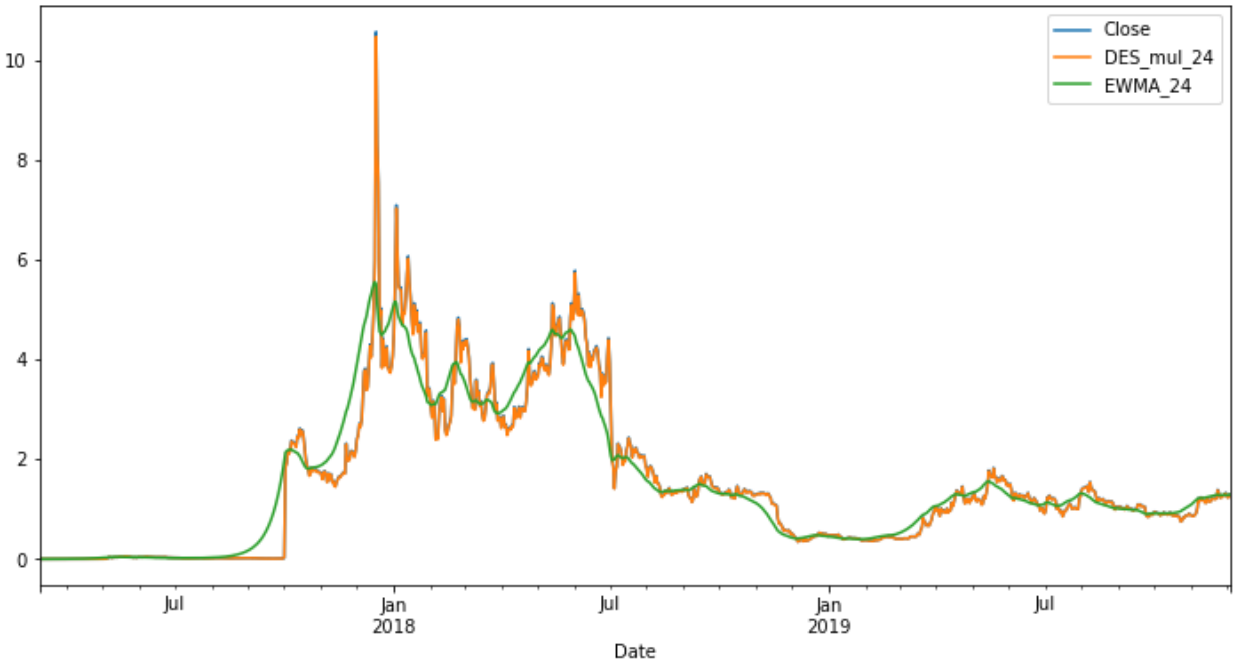

Figure 4: Visualization of Financial Cryptocurrency Data Analysis using Exponentially Weighted Moving Average (EWMA)

insights for stakeholders navigating the intricate intersection of technology and sustainability. The visual representations offer a clear and intuitive depiction of the cryptocurrency landscape, shedding light on market trends, investor interests, and the impact of various financial cryptocurrencies on sustainable business metrics. This research contributes to the evolving discourse on blockchain applications in finance and sustainability, offering a foundation for informed decision-making and strategic planning. As the global business landscape continues to evolve, the integration of blockchain and financial cryptocurrency approaches emerges as a transformative force with the potential to reshape and advance sustainable business practices.

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This article does not contain any studies with human participants or animals performed by any of the authors.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

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References

[1] Otoum, Safa, and Hussein T Mouftah. 2021. "Enabling Trustworthiness in Sustainable Energy Infrastructure through Blockchain and AI-Assisted Solutions." IEEE Wireless Communications 28 (6): 19–25.

[2] Ashton, Weslynne, Suzana Russell, and Elizabeth Futch. 2017."The adoption of green business practices among small US Midwestern manufacturing enterprises." Journal of environmental planning and management 60(12), 2133-2149.

[3] Golgeci, Ismail, Dilshod Makhmadshoev, and Mehmet Demirbag. 2021."Global value chains and the environmental sustainability of emerging market firms: A systematic review of literature and research agenda." *International Business Review* 30(5),101857.

[4] Wendl, Moritz, My Hanh Doan, and Remmer Sassen. 2023."The environmental impact of cryptocurrencies using proof of work and proof of stake consensus algorithms: A systematic review." *Journal of Environmental Management* 326,116530.

[5] Truby, Jon, et al. 2022. "Blockchain, climate damage, and death: Policy interventions to reduce the carbon emissions, mortality, and net-zero implications of non-fungible tokens and Bitcoin." *Energy Research & Social Science* 88,102499.

[6] Dosso, Mamadou, and Ahmet Faruk Aysan. 2022. "The Technological Impact in Finance: A Bibliometric Study of Fintech Research." In Eurasian Business and Economics Perspectives: Proceedings of the 35th Eurasia Business and Economics Society Conference, 193–209.

[7] Eligüzel, Nazmiye. 2023. "An Analysis of the Integration of Sustainability Concepts into Blockchain Technology." International Journal of Applied Methods in Electronics and Computers 11 (3): 158–64.

[8] Albakri, Ashwag, Bayan Alabdullah, and Fatimah Alhayan. 2023. "Blockchain-Assisted Machine Learning with Hybrid Metaheuristics-Empowered Cyber Attack Detection and Classification Model." Sustainability 15 (18): 13887.

[9] Cao, Yifan, Bin Shen, and Hau-Ling Chan. 2023. "Buyer Direct Financing with Blockchain-Assisted Due Diligence in Supply Chain." International Transactions in Operational Research.

[10] Yang, Juanjuan, C B Sivaparthipan, and BalaAnand Muthu. 2021. "Dynamic Distributed Iterative Computational Model for Payment Information Management in Shared Logistics Using Blockchain-Assisted Internet of Things Approach." Soft Computing 25: 12439–51.

[11] Alshehri, Mohammed. 2023. "Blockchain-Assisted Internet of Things Framework in Smart Livestock Farming." Internet of Things 22: 100739.

[12] Kandpal, Meenakshi, Chandramouli Das, Chinmaya Misra, Abhaya Kumar Sahoo, Jagannath Singh, and Rabindra Kumar Barik. 2022. "Blockchain Assisted Supply Chain Management System for Secure Data Management." In 2022 International Conference on Advancements in Smart, Secure and Intelligent Computing (ASSIC), 1–6.

[13] Ulrich, Klaus, José Manuel Guaita Mart\'\inez, Patricia Carracedo, and Domingo Ribeiro Soriano. 2023. "Blockchain Technology-Based Crypto Assets: New Insights into the Evolution of the Understanding of Digital Entrepreneurship." Management Decision.

[14] Delardas, Orestis, and Panagiotis Giannos. 2022. "Towards Energy Transition: Use of Blockchain in Renewable Certificates to Support Sustainability Commitments." Sustainability 15 (1): 258.

[15] Bhushan, Bharat, Aditya Khamparia, K Martin Sagayam, Sudhir Kumar Sharma, Mohd Abdul Ahad, and Narayan C Debnath. 2020. "Blockchain for Smart Cities: A Review of Architectures, Integration Trends and Future Research Directions." Sustainable Cities and Society 61: 102360.

[16] Ullah, Zaib, Muddasar Naeem, Antonio Coronato, Patrizia Ribino, and Giuseppe De Pietro. 2023. "Blockchain Applications in Sustainable Smart Cities." Sustainable Cities and Society, 104697.

[17] Huang, Huawei, Wei Kong, Sicong Zhou, Zibin Zheng, and Song Guo. 2021. "A Survey of State-of-the-Art on Blockchains: Theories, Modelings, and Tools." ACM Computing Surveys (CSUR) 54 (2): 1–42.

[18] Bürer, Mary Jean, Matthieu de Lapparent, Vincenzo Pallotta, Massimiliano Capezzali, and Mauro Carpita. 2019. "Use Cases for Blockchain in the Energy Industry Opportunities of Emerging Business Models and Related Risks." Computers \& Industrial Engineering 137: 106002.

[19] Yoon, Jong Han, and Pardis Pishdad-Bozorgi. 2022. "State-of-the-Art Review of Blockchain-Enabled Construction Supply Chain." Journal of Construction Engineering and Management 148 (2): 3121008.

[20] Muthuswamy, M. and M. Ali, A. (2023) "Sustainable Supply Chain Management in the Age of Machine Intelligence: Addressing Challenges, Capitalizing on Opportunities, and Shaping the Future Landscape", Sustainable Machine Intelligence Journal, 3. doi: 10.61185/SMIJ.2023.33103.

[21] Baniata, Hamza, Ahmad Anaqreh, and Attila Kertesz. 2021. "PF-BTS: A Privacy-Aware Fog-Enhanced Blockchain-Assisted Task Scheduling." Information Processing \& Management 58 (1): 102393.

[22] Mansour, Romany F. 2022. "Blockchain Assisted Clustering with Intrusion Detection System for Industrial Internet of Things Environment." Expert Systems with Applications 207: 117995.

[23] Abdelmaboud, Abdelzahir, Abdelmuttlib Ibrahim Abdalla Ahmed, Mohammed Abaker, Taiseer Abdalla Elfadil Eisa, Hashim Albasheer, Sara Abdelwahab Ghorashi, and Faten Khalid Karim. 2022. "Blockchain for IoT Applications: Taxonomy, Platforms, Recent Advances, Challenges and Future Research Directions." Electronics 11 (4): 630.

[24] Makani, Shanmukha, Rachitha Pittala, Eitaa Alsayed, Moayad Aloqaily, and Yaser Jararweh. 2022. "A Survey of Blockchain Applications in Sustainable and Smart Cities." Cluster Computing 25 (6): 3915–36.

[25] Luna, Manuel, Simon Fernandez-Vazquez, Emilio Tereñes Castelao, and Álvaro Arias Fernández. 2024. "A Blockchain-Based Approach to the Challenges of EU's Environmental Policy Compliance in Aquaculture: From Traceability to Fraud Prevention." Marine Policy 159: 105892.

[26] Mohamed, M. (2023) "Agricultural Sustainability in the Age of Deep Learning: Current Trends, Challenges, and Future Trajectories", Sustainable Machine Intelligence Journal, 4, p. (2):1–20. doi: 10.61185/SMIJ.2023.44102.

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