Journal of Advanced Research and Multidisciplinary Studies
ISSN: 2997-3155
Volume 5, Issue 1, 2025 (pp. 108-115)
www.abjournals.org

BRIDGING CLIMATE FINANCE GAPS: BLOCKCHAIN AS A TOOL FOR SUSTAINABILITY IN AFRICA AND BEYOND

Anya Adebayo Anya[1], Kelechi Adura Anya[2],

Eke Kehinde Anya[3], and Akinwale Victor Ishola[4]

[1]Department of Political Science, Obafemi Awolowo University Ile-Ife.
Email: adeanya@summalogix.com

[2]Computer Science, Landmark University Omu-Aran Nigeria.
Email: anyakelechiadura@gmail.com

[3]Scottish Power Headquarters, Glasgow.
Email: eanya@spenergynetworks.co.uk

[4]Department of Peace, Security and Humanitarian Studies, University of Ibadan.
Email: victorakinwale2@gmail.com

Cite this article:

Anya, A. A., Anya, K. A., Anya, E. K., Ishola, A. V. (2025), Bridging Climate Finance Gaps: Blockchain as a Tool for Sustainability in Africa and Beyond. Journal of Advanced Research and Multidisciplinary Studies 5(1), 108-115. DOI: 10.52589/JARMS-TUOQCY9M

Manuscript History

Received: 15 Feb 2025

Accepted: 17 Mar 2025

Published: 8 Apr 2025

ABSTRACT: *Climate finance is pivotal in addressing the adverse effects of climate change, particularly in supporting mitigation and adaptation initiatives in vulnerable regions. Despite its importance, significant gaps persist in Africa, where governance challenges, inadequate infrastructure, and capacity deficits constrain access to climate finance. These barriers impede the continent's ability to respond effectively to climate change and achieve sustainable development goals. This study explored the potential of blockchain technology as a transformative tool for bridging climate finance gaps in Africa and beyond. The study's objectives include examining the challenges associated with climate finance in Africa, evaluating blockchain's capabilities in enhancing transparency, efficiency, and trust in financial systems, and proposing strategies for integrating blockchain into existing frameworks. A qualitative research methodology was employed, relying on a desk review of existing literature. The findings unveil that blockchain technology offers significant potential to address climate finance gaps by reducing transaction costs, improving accountability, and fostering trust among stakeholders. The study recommends a multi-stakeholder approach to blockchain integration, emphasising collaboration among governments, private sectors, and non-governmental organisations.*

KEYWORDS: Climate Finance, Block-chain and Sustainability.

Article DOI: 10.52589/JARMS-TUOQCY9M
DOI URL: https://doi.org/10.52589/JARMS-TUOQCY9M

Journal of Advanced Research and Multidisciplinary Studies
ISSN: 2997-3155
Volume 5, Issue 1, 2025 (pp. 108-115)

www.abjournals.org

INTRODUCTION

Climate finance has emerged as a crucial mechanism for addressing climate change and promoting sustainability (Pathan et al., 2024; Lee et al., 2022). As nations grapple with the pressing need to transition to low-carbon economies and adapt to the impacts of climate variability, the mobilisation of financial resources has become a central focus of international policy frameworks, including the Paris Agreement. This agreement, which seeks to limit global temperature increases to below 1.5°C, reiterates the critical role of financing in driving climate action, particularly in vulnerable regions. However, while substantial funding commitments have been made, the realisation of these commitments and their effective utilisation remain significant challenges in achieving desired outcomes. The climate finance landscape is marked by persistent structural and operational challenges. Mismanagement and the lack of transparency in fund allocation have consistently undermined trust in the system, while inefficiencies in administrative processes create barriers to timely project execution. Moreover, the inequitable distribution of resources disproportionately affects developing regions, such as Africa, which bears a disproportionate burden of climate-related vulnerabilities despite contributing minimally to global emissions. These systemic issues hinder the effective deployment of resources, exacerbate regional inequalities, and impede progress toward global climate goals.

A critical barrier in the climate finance system lies in the inability to ensure transparency, accountability, and efficiency in the management and allocation of funds. In particular, the lack of real-time tracking mechanisms for climate funds has resulted in widespread concerns about the misuse of resources and delayed project implementations. In regions such as Africa, where institutional capacity may be limited and governance structures are often fragile, these challenges are even more pronounced. In the midst of these challenges, blockchain technology has emerged as a transformative tool with the potential to reshape climate financing systems. By leveraging its decentralised, transparent, and immutable architecture, blockchain can enhance accountability in fund management, streamline transactions, and ensure equitable distribution of resources. Through mechanisms such as smart contracts, blockchain enables automated and verifiable disbursements, minimising opportunities for corruption and inefficiency. Particularly in regions like Africa, where gaps in institutional capacity often hinder effective climate finance deployment, blockchain offers a viable pathway to addressing these deficiencies. It is against this backdrop that this paper seeks to critically examine the integration of blockchain technology into climate finance frameworks, with a specific focus on addressing the structural inefficiencies that limit the impact of such financing in Africa and beyond. It aims to explore how blockchain can resolve the inherent challenges of transparency, accountability, and inefficiency in climate financing, thereby optimising financial flows and contributing to the achievement of global sustainability objectives.

Article DOI: 10.52589/JARMS-TUOQCY9M
DOI URL: https://doi.org/10.52589/JARMS-TUOQCY9M

Journal of Advanced Research and Multidisciplinary Studies
ISSN: 2997-3155
Volume 5, Issue 1, 2025 (pp. 108-115)
www.abjournals.org

Understanding Blockchain Technology in Climate Financing

Blockchain technology has garnered significant attention as a decentralised digital ledger system characterised by its transparency, immutability, and decentralisation (Alhat, 2024; Monrat et al., 2019; Ghazi et al., 2022). These features make blockchain an innovative tool for addressing challenges across various domains. By operating as a distributed database, blockchain ensures data integrity and security by recording transactions in linked blocks maintained across a network of computers (Alhat, 2024). The system's key attributes include cryptographic security, peer-to-peer transactions, and consensus mechanisms, which collectively underpin its reliability and resilience (Liu & Wu, 2024; Monrat et al., 2019). Beyond its technical foundation, blockchain has found applications in sectors ranging from finance and supply chain management to healthcare and voting systems, showcasing its versatility (Alhat, 2024; Liu & Wu, 2024).

In the context of climate finance, blockchain technology is emerging as a transformative solution to critical challenges such as mismanagement, lack of transparency, and inefficiencies in fund allocation. One of its primary contributions lies in enhancing transparency and accountability by enabling real-time tracking of public fund allocations, ensuring that resources are directed toward intended climate initiatives (Bhole et al., 2021). This feature is particularly valuable in mitigating corruption and fostering trust among stakeholders.

Blockchain also facilitates the mobilisation of new funding sources, especially from private investors. By eliminating intermediaries, the technology reduces transactional costs, making it an attractive tool for green finance initiatives (Dorfleitner & Braun, 2019). For instance, blockchain can enable streamlined investments in renewable energy projects and other sustainability initiatives, thereby bridging funding gaps that have historically hindered climate action. Additionally, blockchain's ability to support Monitoring, Reporting, and Verification (MRV) processes enhances the credibility of climate-related projects, reducing the risk of greenwashing, a critical concern in global sustainability efforts (Dorfleitner & Braun, 2019).

Moreover, blockchain holds significant potential in advancing renewable energy and carbon market mechanisms. It has been identified as a catalyst for developing renewable energy micro-grids, where it can facilitate peer-to-peer energy trading and ensure accurate accounting of energy credits (Chen, 2018). In carbon markets, blockchain can improve accountability by securely tracking emissions reductions, enabling robust verification processes that align with international standards. Despite its potential, the integration of blockchain into climate finance frameworks is not without challenges. Issues such as scalability, energy consumption, and the need for supportive regulatory environments may pose barriers to its widespread adoption. These challenges warrant further research and development to maximise blockchain's impact on climate financing efforts.

Climate Finance Gaps in Africa and Beyond

Climate finance and technology gaps in Africa pose significant barriers to mitigating and adapting to climate change impacts. Limited access to climate information and services restricts effective risk management, policy integration, and the development of resilient solutions tailored to local contexts (Dinku et al., 2014). Despite the existence of international climate finance mechanisms, such as multilateral funds and private sector initiatives, their implementation in Africa remains constrained by unique challenges, including extreme

Article DOI: 10.52589/JARMS-TUOQCY9M
DOI URL: https://doi.org/10.52589/JARMS-TUOQCY9M

Journal of Advanced Research and Multidisciplinary Studies
ISSN: 2997-3155
Volume 5, Issue 1, 2025 (pp. 108-115)
www.abjournals.org

weather events, agricultural disruptions, and infrastructural inadequacies (Adisa et al., 2024). These gaps underscore the urgent need for innovative approaches to enhance the effectiveness and reach of climate finance. Blockchain technology emerges as a transformative tool to address these challenges by enhancing transparency, accountability, and efficiency in climate finance mechanisms. This decentralised digital ledger system records transactions across a network of computers, ensuring data integrity and security while reducing reliance on intermediaries (Thomason et al., 2018). By enabling peer-to-peer networks, blockchain facilitates direct access to climate finance, thereby reducing transaction costs and increasing financial inclusion for underserved regions. One of the primary strengths of blockchain lies in its ability to foster trust through transparent and standardised transactions. This capability encourages greater investment in climate projects by providing stakeholders with real-time tracking of fund allocation and project outcomes, reducing the risks of mismanagement and greenwashing (Schulz & Feist, 2021). Additionally, distributed ledger technologies offer robust governance frameworks that improve accountability and decision-making processes, ensuring that resources are allocated efficiently to achieve measurable impacts (Duchenne, 2018).

In the context of Africa's unique climate challenges, blockchain's potential to optimise financial flows and enhance resource management represents a critical step toward bridging climate finance gaps. By leveraging these technologies, Africa and other regions can advance their climate action goals, fostering a more equitable and sustainable future.

Case studies of Blockchain Implementations:

Blockchain technology is increasingly being adopted in climate-related projects to address systemic inefficiencies in carbon markets and renewable energy credit systems. In Europe, these initiatives are revolutionising carbon trading by enhancing transparency, efficiency, and trust, thus tackling persistent issues such as double-spending and exorbitant transaction costs.

A notable example is the development of decentralised ecosystems for carbon credit trading. Blockchain-based platforms enable transparent and standardised transactions, leveraging smart contracts to minimise human errors and ensure the integrity of carbon credit exchanges (Venkatesh et al., 2024). These systems not only streamline processes but also reduce transaction costs, making carbon trading more accessible to diverse stakeholders. Tokenization has emerged as a key innovation in voluntary carbon markets, exemplified by KlimaDAO. This platform facilitates the secure trading of tokenised carbon credits, enhancing market participation and providing greater transparency in trading activities. Despite its promise, challenges such as market maturity and regulatory alignment remain significant hurdles (Ballesteros-Rodríguez et al., 2024). These practical applications reiterate the transformative potential of blockchain technology in climate finance.

Benefits and Limitations of Blockchain in Climate Financing

Blockchain technology offers substantial opportunities for transforming climate finance and fostering sustainable investments. Among its most notable advantages are increased transparency, enhanced trust among stakeholders, and cost efficiency achieved through the deployment of smart contracts (Marke, 2018; Dorfleitner & Braun, 2019). These attributes are particularly significant in the context of climate finance, where the need for effective fund utilisation and robust accountability mechanisms is paramount. Blockchain facilitates the

Article DOI: 10.52589/JARMS-TUOQCY9M
DOI URL: https://doi.org/10.52589/JARMS-TUOQCY9M

mobilisation of new funding sources, especially from private investors, while also supporting effective monitoring, reporting, and verification processes that mitigate the risks of greenwashing (Dorfleitner & Braun, 2019). Applications of blockchain in climate finance are diverse, encompassing emissions trading, sustainable energy initiatives, mobility projects, and green financing frameworks (Thalhammer et al., 2022). Specifically, in the carbon market mechanisms, as outlined in the Paris Agreement, blockchain technology enhances transparency, automates trading processes, and ensures the prevention of double counting in carbon credits (Franke et al., 2020). These capabilities make blockchain an invaluable tool for optimising the operational efficiency and integrity of global climate finance systems.

However, the integration of blockchain into climate finance is not without challenges. One significant concern is the high energy consumption associated with some blockchain systems, which could inadvertently undermine the sustainability objectives they aim to promote (Thalhammer et al., 2022). Additionally, the absence of uniform standards and regulatory frameworks creates uncertainties that hinder the widespread adoption of blockchain technology in climate finance (Dorfleitner & Braun, 2019). In the African context, these challenges are further exacerbated by region-specific constraints such as regulatory ambiguities, inadequate digital and financial infrastructure, and a lack of technical expertise to implement and manage blockchain systems effectively (Chime, 2023; Romanello, 2021). Mitigating these challenges is crucial to unlocking the full potential of blockchain in bridging climate finance gaps and advancing sustainability goals across the continent.

POLICY RECOMMENDATIONS

The integration of blockchain technology into climate finance frameworks necessitates a multi-stakeholder approach, involving governments, the private sector, and non-governmental organisations (NGOs). To maximise the potential of blockchain in advancing sustainability goals, the following policy recommendations are offered;

1. Foster Multi-Stakeholder Collaboration

Governments in Africa and beyond should establish public-private partnerships (PPPs) to align regulatory frameworks with the operational needs of blockchain applications in climate finance. Collaborative initiatives with private sector actors can provide the technical expertise and innovation required to implement blockchain solutions effectively.

2. Develop Robust Regulatory Frameworks

Policymakers should prioritise the creation of clear and supportive regulatory environments to govern the application of blockchain technology. These frameworks should address issues such as data privacy, interoperability, and standards for decentralised systems. Harmonised regulations across jurisdictions would facilitate cross-border climate finance initiatives and enhance the scalability of blockchain solutions.

Article DOI: 10.52589/JARMS-TUOQCY9M
DOI URL: https://doi.org/10.52589/JARMS-TUOQCY9M

Journal of Advanced Research and Multidisciplinary Studies
ISSN: 2997-3155
Volume 5, Issue 1, 2025 (pp. 108-115)

www.abjournals.org

3. Prioritize Capacity-Building Initiatives in Africa

Capacity-building efforts are critical to ensuring the effective adoption and utilisation of blockchain technology in Africa. Governments and international organisations should invest in training programs aimed at equipping stakeholders, such as policymakers, technical experts, and community leaders, with the knowledge and skills required to navigate blockchain systems. This includes fostering local expertise in blockchain development and implementation, reducing reliance on external technical assistance.

4. Promote Inclusive Financing Mechanisms

Blockchain-based platforms should also be designed to democratise access to climate finance, particularly for small-scale actors in vulnerable regions. Governments and NGOs should collaborate to create funding mechanisms that leverage blockchain's transparency to reduce barriers to entry for local stakeholders. For example, tokenised microfinance initiatives could support grassroots climate-adaptation projects.

5. Incentivize Research and Development (R&D)

Governments and private entities should invest in research and development to explore innovative applications of blockchain in climate finance, such as smart contracts for renewable energy projects or decentralised platforms for carbon credit trading. Dedicated funding for R&D would accelerate the development of scalable solutions tailored to the unique challenges of climate financing in Africa.

CONCLUSION

The subject of bridging climate finance gaps remains a critical challenge, particularly in regions like Africa, where the impacts of climate change are disproportionately felt. Blockchain technology emerges as a promising tool for addressing these gaps by revolutionising how climate finance is mobilised, monitored, and managed. Through its core features, transparency, immutability, and decentralisation, blockchain can foster trust among stakeholders, streamline transactions, and ensure accountability in the deployment of funds for climate-related initiatives. In Africa, where governance challenges and infrastructural limitations often impede access to climate finance, blockchain offers a transformative potential to enhance efficiency and attract private sector investments. Globally, its application can redefine mechanisms such as carbon trading, renewable energy financing, and resource allocation, ensuring that funds are utilised effectively to advance sustainability goals.

However, unlocking the full potential of blockchain in climate finance requires a multi-stakeholder approach that prioritises collaboration among governments, private sector actors, and non-governmental organisations. Additionally, capacity-building initiatives must be a priority to equip African countries with the technical expertise and infrastructure necessary for blockchain adoption. As climate change continues to threaten livelihoods and ecosystems, leveraging innovative technologies like blockchain is essential for creating resilient, equitable, and sustainable financing systems. By bridging the climate finance gaps through blockchain, Africa and the world can take a significant step toward achieving long-term sustainability and mitigating the adverse effects of climate change.

Article DOI: 10.52589/JARMS-TUOQCY9M
DOI URL: https://doi.org/10.52589/JARMS-TUOQCY9M

REFERENCES

Adisa, O., Ilugbusi, B.S., Obi, O.C., Awonuga, K.F., Adelekan, O.A., Asuzu, O.F., & Ndubuisi, N.L. (2024). International climate finance mechanisms: A review with focus on Africa. *International Journal of Science and Research Archive*.

Alhat, P. (2024). Blockchain Technology. *INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN ENGINEERING AND MANAGEMENT*.

Ballesteros-Rodríguez, A., De-Lucio, J., Miguel-Angel, Sicilia. (2024). Tokenised carbon credits in voluntary carbon markets: The case of KlimaDAO. Frontiers in blockchain, doi: 10.3389/fbloc.2024.1474540

Bhole, K., Galphat, Y., Bathija, K., Saini, T., & Bhosale, A. (2021). Allocation and Tracking of Public Funds using Blockchain. *2021 4th Biennial International Conference on Nascent Technologies in Engineering (ICNTE)*, 1–4.

Chen, D.B. (2018). Utility of the Blockchain for Climate Mitigation. *The Journal of the British Blockchain Association*.

Chime, C.E. (2023). Application of Blockchain Technology in the African Energy Industry: Use Cases, Limitations and Solutions. *Day 3, Wed, August 02, 2023*.

Dinku, T., Block, P.J., Sharoff, J., Hailemariam, K., Osgood, D.E., del Corral, J., Cousin, R., & Thomson, M.C. (2014). Bridging critical gaps in climate services and applications in Africa. *Earth Perspectives, 1*, 1–13.

Dorfleitner, G., & Braun, D. (2019). Fintech, Digitalization and Blockchain: Possible Applications for Green Finance. *Palgrave Studies in Impact Finance*.

Duchenne, J. (2018). Blockchain and Smart Contracts: Complementing Climate Finance, Legislative Frameworks, and Renewable Energy Projects. 303–317. doi: 10.1016/B978-0-12-814447-3.00022-7

Franke, L.A., Schletz, M., & Salomo, S. (2020). Designing a Blockchain Model for the Paris Agreement's Carbon Market Mechanism. *Sustainability*.

Ghazi, A., Alisawi, M., Wahab, Y.M., Al-Dawoodi, A., Abdullah, S.S., Hammood, L., & Nawaf, A.Y. (2022). A Systematic Literature Review of Blockchain Technology. *Int. J. Interact. Mob. Technol., 16*, 97–108.

Lee, C., Li, X., Yu, C., & Zhao, J. (2022). The contribution of climate finance toward environmental sustainability: New global evidence. *Energy Economics*.

Liu, J., & Wu, J. (2024). A Comprehensive Survey on Blockchain Technology and Its Applications. *Highlights in Science, Engineering and Technology*.

Marke, A. (2018). Transforming Climate Finance and Green Investment with Blockchains.

Monrat, A.A., Schelén, O., & Andersson, K. (2019). A Survey of Blockchain from the Perspectives of Applications, Challenges, and Opportunities. *IEEE Access, 7*, 117134-117151.

Pathan, M.I., Seth, D.S., Tomar, L., Yadav, P., & Mahato, M.K. (2024). Climate Finance: Pioneering Pathways to Sustainability. *Economic Sciences*.

Romanello, M. (2021). Blockchain technology in Africa: problems and perspectives / Tecnologia Blockchain na África: problemas e perspectivas. *Brazilian Journal of Development*.

Schulz, K & Feist, M. (2021). Leveraging Blockchain Technology for Innovative Climate Finance under the Green Climate Fund. 7(39):100084-. doi: 10.1016/J.ESG.2020.100084

Thalhammer, F., Schöttle, P., Janetschek, M., & Ploder, C. (2022). Blockchain Use Cases Against Climate Destruction. *Cloud Computing and Data Science*.

Article DOI: 10.52589/JARMS-TUOQCY9M
DOI URL: https://doi.org/10.52589/JARMS-TUOQCY9M

Thomason, J., Ahmad, M., Bronder, P., Hoyt, E., Pocock, S., Julien, B., Katrina, Donaghy., David, Huysman., Tony, Willenberg., Ben, Joakim., Loretta, Joseph., David, Martin., David, Shrier. (2018). Blockchain—Powering and Empowering the Poor in Developing Countries. 137–152. doi: 10.1016/B978-0-12-814447-3.00010-0

Venkatesh, P., Vasanth, Kumar., Raghul, Karthik., Ug, Scholar. (2024). Blockchain Powered Carbon Credit Marketplace. 582-585. doi: 10.1109/iccsp60870.2024.10543794.

Article DOI: 10.52589/JARMS-TUOQCY9M
DOI URL: https://doi.org/10.52589/JARMS-TUOQCY9M