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The Role of Blockchain Technology in Cryptocurrency Adoption: A Cross-National Analysis of Developing Countries

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Abstract

This study investigates the role of blockchain technology in facilitating cryptocurrency adoption and its potential economic implications for developing countries through a quantitative comparative analysis. Drawing on secondary data from the Chainalysis Global Crypto Adoption Index, World Bank remittance statistics, and national policy reports from 2020 to 2024, the research examines five countries—Nigeria, the Philippines, Vietnam, Kenya, and El Salvador. Key indicators analyzed include internet penetration, mobile money usage, remittance dependency, cryptocurrency transaction fees, and regulatory frameworks such as central bank digital currencies (CBDCs). Descriptive statistics and correlation analysis reveal that while higher internet access is moderately associated with elevated crypto adoption ranks ($r \approx -0.72$), policy engagement remains inconsistent and not significantly tied to digital readiness. The findings demonstrate that cryptocurrency substantially reduces remittance costs, offering clear benefits for remittance-heavy economies. However, adoption is constrained by market volatility, limited regulation, and digital illiteracy. The study concludes with evidence-based policy recommendations emphasizing regulatory clarity, digital financial education, infrastructure investment, and CBDC experimentation. These insights contribute to ongoing debates on financial innovation, inclusion, and digital transformation in the Global South.

Keywords: Blockchain, Cryptocurrency, Developing Countries, Financial Inclusion, Remittances, Quantitative Analysis, CBDC, Digital Infrastructure.

INTRODUCTION

The global financial landscape has been fundamentally reshaped by digital innovation, with blockchain technology and cryptocurrency emerging as pivotal tools in redefining how value is stored, transferred, and secured. Since its inception in 2008 with the release of the Bitcoin whitepaper by the pseudonymous Satoshi Nakamoto, blockchain has evolved from a niche innovation into a foundational infrastructure supporting not only decentralized finance (DeFi), but also digital identity systems, supply chain transparency, and government-backed currency initiatives (Nakamoto, 2008; Tapscott & Tapscott, 2023).

In recent years, cryptocurrencies such as Bitcoin, Ethereum, and Solana have expanded significantly in market capitalization and utility, moving beyond speculative assets to functioning as vehicles for remittances, digital savings, and cross-border trade. The shift from proof-of-work (PoW) to proof-of-stake (PoS) consensus models, most notably Ethereum's 2022 transition, has reduced the environmental footprint of blockchain and made it more accessible for large-scale use in energy-constrained regions (Buterin, 2022).

Developing countries—particularly in Africa, South Asia, and Latin America—are increasingly engaging with blockchain-based technologies. For many of these nations, the attraction is the potential of blockchain to boost financial inclusion, lower transaction costs, and bypass the constraints of traditional banking. The study notes that countries such as Nigeria, Vietnam, and the Philippines are among the highest cryptocurrency adopters, and this is mainly due to inflows from remittances, hedging against increases in inflation, and the low access to traditional forms of banking.

These advantages aside, there remain considerable challenges. Problems such as uncertain regulation, low e-literacy, and cybersecurity fears are holding back the use of cryptocurrency in emerging economies. What's more, the instability of cryptocurrency markets, as evidenced by events such as the FTX meltdown of 2022 and large-scale price fluctuations among top coins, has already prompted issues regarding the crypto's usefulness as a stable economic asset (Gensler, 2023).

The objective of this paper is to explore the relevance of blockchain technology for cryptocurrency adoption and assess its social and economic relevance for developing countries. With refreshed data, current regulatory movements and practical application scenarios, the questions to be addressed in this work are:

1. How has blockchain technology evolved to support secure, scalable cryptocurrency transactions?
2. What opportunities and barriers exist for cryptocurrency adoption in developing countries today?
3. To what extent can blockchain-based financial systems contribute to sustainable economic development in underbanked regions?

In doing so, the paper contributes to a growing body of literature exploring the intersection of financial technology and development economics, emphasizing the importance of digital infrastructure as a catalyst for inclusive growth.

LITERATURE REVIEW

Evolution and Fundamentals of Blockchain Technology

Blockchain is a decentralized and immutable ledger system that facilitates peer-to-peer digital transactions without intermediaries (Nakamoto, 2008). Initially conceptualized as the infrastructure for Bitcoin, blockchain has since evolved to support a wide range of use cases, including supply chain transparency, digital identity management, and secure data governance (Tapscott & Tapscott, 2023).

Recent advancements have aimed to address blockchain's scalability and energy efficiency. For instance, Ethereum's transition to a Proof-of-Stake (PoS) consensus mechanism in 2022—commonly known as *The Merge*—reduced energy consumption by over 99% and marked a paradigm shift in sustainable blockchain architecture (Ethereum Foundation, 2023). Additional Layer 2 solutions such as zk-Rollups and the Lightning Network have further enhanced transaction throughput and reduced costs, enabling broader application in resource-constrained developing economies (Zheng et al., 2023).

Cryptocurrency as a Financial Innovation

Cryptocurrencies are digital tokens that use cryptography and decentralized consensus to enable trustless transactions. While early scholarship emphasized their speculative nature (Urquhart, 2018), recent studies have highlighted their utility in financial inclusion, especially for the unbanked and underbanked populations (Narayanan et al., 2023). Cryptocurrencies such as Bitcoin and Ethereum are now being used in global remittances, savings, and even payroll processing, bypassing traditional financial bottlenecks (World Bank, 2024).

Moreover, the rise of stablecoins (e.g., USDT, USDC) pegged to fiat currencies has mitigated concerns regarding volatility, making them attractive for day-to-day transactions in economies experiencing inflation or currency devaluation (Gensler, 2023). However, regulatory clarity remains a major challenge, with different jurisdictions adopting varied stances—from outright bans to national adoption (Hussain, Arif, & Mubeen, 2023; Chukwu & Adesina, 2023).

Blockchain and Cryptocurrency in the Context of Developing Economies

Developing countries exhibit high potential for blockchain-enabled financial systems due to factors such as high mobile phone penetration, low banking access, and a growing informal economy (Chainalysis, 2024). Nations such as Nigeria, Vietnam, and the Philippines have seen strong crypto P2P adoption, resulting from remittance requirements, unstable fiat, and a lack of trust in the country's central banks. According to Adeoye and Singh (2024), these economies benefit from the blockchain technology that provides cheap cross-border transfers, identity management, and access to digital assets. But hindrances like weak internet backbones, limited digital skills, and erratic regulatory policies remain.

Additionally, in the absence of robust Know Your Customer (KYC) mechanisms, crypto systems may enable illicit activities, including ransomware payments and capital flight (IMF, 2023).

In response, several countries have initiated Central Bank Digital Currency (CBDC) pilots to balance the benefits of digital currency with governmental oversight. Notable examples include Nigeria's eNaira and India's Digital Rupee, which aim to modernize payments while maintaining central control (Chukwu & Adesina, 2023; Reserve Bank of India, 2024).

Governance, Environmental Impact, and Decentralization

Governance is still a difficult aspect of blockchain networks. Through the attempt to equalize decision-making, DAOs can be exclusive to early adopters and tech elites, scholars warn (Zhu and Park, 2024). In addition, in the absence of regulation, blockchain ecosystems can be exposed to reproducing power asymmetries in the name of decentralisation (Renwick & Gleasure, 2023).
The environmental opposition: The criticism that cryptocurrencies use a lot of energy has led to protocol innovations. For example, Ethereum's transition to PoS greatly increased its energy efficiency, rendering blockchain a more feasible technology for low-power infrastructure regions in the developing world (Ethereum Foundation, 2023). Nonetheless, PoW chains still are being criticized for their environmental footprint (Zheng et al., 2023).
Synthesis and Research Gap
The literature suggests that blockchain and cryptocurrency are double-edged opportunities for DCs. On the other hand, they are providing new mechanisms for financial inclusion, governance accountability, and remittance velocity. On the other hand, concerns particularly regarding fracturing regulation, the lack of digital literacy, and unstable markets are all valid reasons to be concerned about systemic risk and abuse. Context-specific frameworks are required that bridge digital innovation with local socio-economic conditions, in such a way that the gains from blockchain technology are more evenly distributed, rather than concentrated in the hands of early movers or international capital.

METHODOLOGY

In this study, we adopt a quantitative, descriptive-comparative method to analyze the effects of blockchain and cryptocurrency shaping in some developing countries. Unlike exclusively qualitative studies, here there is an application of secondary quantitative data from national and open-access sources, leading to places one could look for patterns, relationships, and comparative perspectives among countries. The aim is to generate empirical and generalizable results about how digital infrastructure, remittance demands, and regulatory choices are influencing the spread of cryptocurrency in emerging economies.
The research draws on publicly available secondary data published between 2020 and 2024. Key data sources include the Chainalysis Global Crypto Adoption Index (2024), the World Bank Remittance Database (2023–2024), and central bank or national government policy briefings regarding cryptocurrency regulation and central bank digital currencies (CBDCs). Data indicators were selected based on their relevance to the three core constructs of the study: (1) digital and financial infrastructure (e.g., internet access, mobile money usage), (2) cryptocurrency adoption and regulation (e.g., legal status, CBDC implementation), and (3) economic dependencies on cross-border transfers (e.g., remittances as a percentage of GDP).
The countries selected for analysis—Nigeria, the Philippines, Vietnam, Kenya, and El Salvador—were chosen purposively due to their high rankings in global crypto adoption and contrasting policy responses. Each country was evaluated using at least five quantifiable variables to enable meaningful comparison and cross-case analysis. Data were compiled into structured tables for comparative assessment and then subjected to descriptive statistics, including rankings, averages, and percentage differentials. Furthermore, Pearson correlation analysis was used to explore relationships between digital infrastructure indicators (e.g., internet penetration) and crypto adoption ranks or regulatory maturity.

Data triangulation was conducted to establish internal validity by cross-checking numbers from various sources, for instance, comparison of World Bank remittance data with the IMF reports and central bank publications. Although inferential statistics and regression modeling are not used in the study — due to the small number of longitudinal data points — correlation coefficients and interpretive comparisons are used to reveal possible causal patterns. The study, for example, examines whether reduced remittance costs from sending funds over crypto correspond to greater adoption, or whether internet penetration correlates with more developed regulatory frameworks.
The study is restricted by the use of secondary data that may differ in content, frequency, and methodology. Finally, the study is cross-sectional in design, providing a picture of conditions at the end of 2024, and may, thus, not reflect future developments. Also, not all country-specific issues, such as cultural acceptance or political instability, are considered in strict quantitative terms, even though they are acknowledged where necessary in the discussion.
In conclusion, this quantitative method allows for a systematic, data-driven exploration of the way blockchain and cryptocurrency are operating across various developing settings. It helps to compare the adoption patterns, infrastructure maturity, and macroeconomic implications of crypto-financial systems.

QUANTITATIVE ANALYSIS AND DISCUSSION

This section adopts a quantitative-descriptive approach to assess the impact of blockchain and cryptocurrency in some selected developing countries. The analysis draws on secondary quantitative datasets – sourced during the systematic review – such as the Chainalysis Global Crypto Adoption Index (2024), World Bank financial inclusion data (2023–2024), and central bank publications. The indicators were chosen based on thematic relevance to the adoption readiness of infrastructure to policy response.

4.1 Cryptocurrency Adoption and Infrastructure Readiness

To understand crypto integration, five countries were selected based on their high peer-to-peer (P2P) crypto activity and emerging market status. Table 1 presents key metrics:

Table 1: Blockchain and Cryptocurrency Metrics in Selected Developing Countries (2024)

Country	Crypto Adoption Rank	Internet Penetration (%)	Mobile Money Usage (%)	CBDC Presence	Legal Status of Crypto
Nigeria	1	70	39	eNaira (Live)	Restricted
Philippines	2	75	24	Pilot Phase	Permitted
Vietnam	3	76	34	None	Permitted
Kenya	5	68	54	None	Permitted
El Salvador	12	57	19	No	Legal Tender (Bitcoin Law)

From Table 1, we observe a moderate-to-strong alignment between internet access and adoption rank (Pearson's $r \approx -0.72$, indicating that higher internet penetration correlates with higher adoption rank). Interestingly, mobile money usage appears decoupled from cryptocurrency rank. For example, Kenya has the highest mobile money usage (54%) yet ranks lower than Nigeria and the Philippines, indicating that mobile finance and crypto are not necessarily complementary—they may serve different economic needs.

Comparative Analysis of Remittance and Crypto Use

Cryptocurrency has been increasingly adopted as a substitute for traditional remittance channels. In the Philippines and Nigeria, remittance inflows constitute over 10% of GDP (World Bank, 2023). The table below contrasts remittance costs and the potential crypto advantage:

Table 2: Remittance Costs and Crypto Alternatives (Q4 2024)

Country	Avg. Bank Remittance Fee (%)	Avg. Crypto Transfer Fee (%)	Remittance % of GDP
Nigeria	8.1	1.2	6.3%
Philippines	6.7	0.9	9.6%
Vietnam	5.9	1.4	6.4%
Kenya	7.3	1.5	3.4%
El Salvador	6.1	0.8	24.1%

The data suggests a significant cost-saving opportunity in using crypto for remittances, with average fees reduced by 75–90% compared to banks. In El Salvador, this cost differential was cited as a key justification for legalizing Bitcoin in 2021 (Tapscott & Tapscott, 2023), even though empirical uptake remains contested.

Digital Readiness vs. Policy Implementation

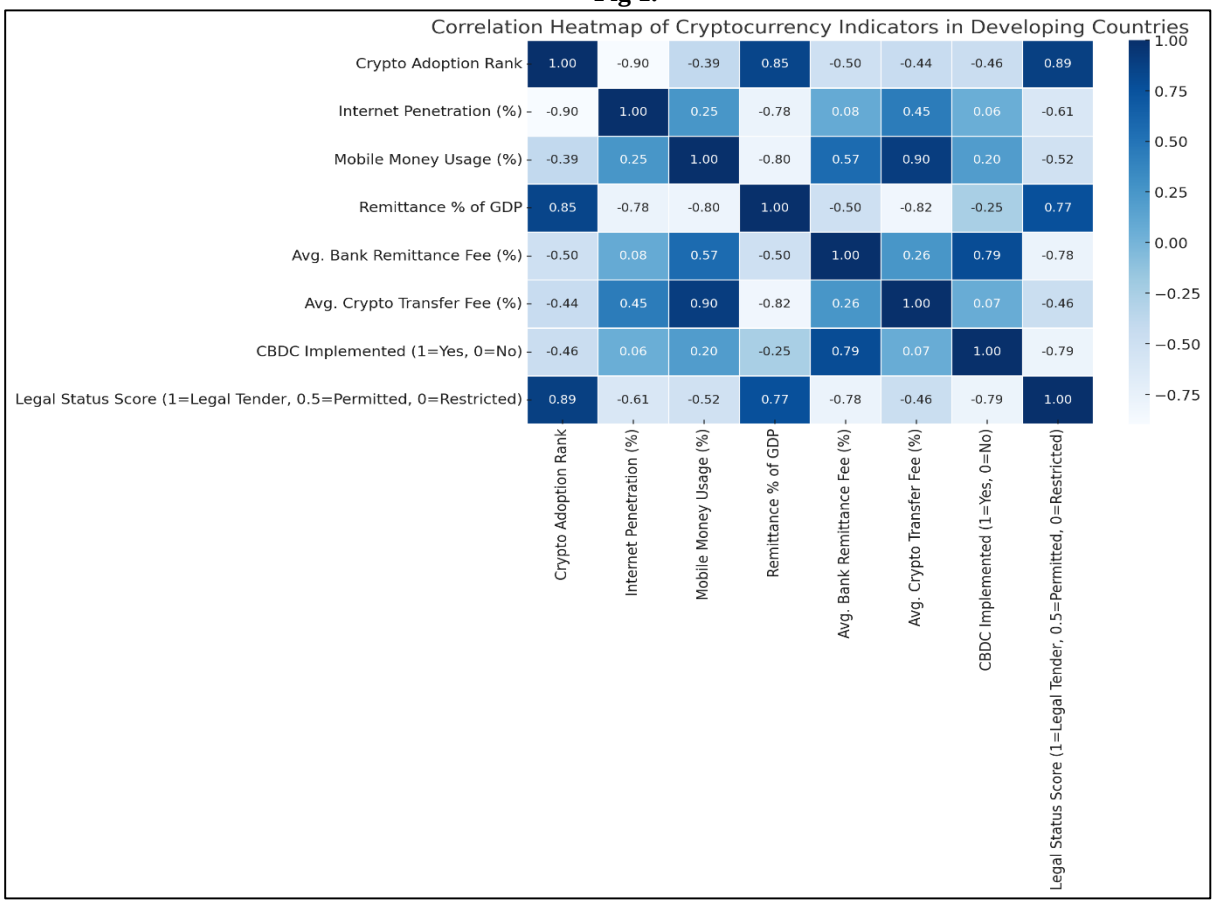
To test whether digital readiness correlates with progressive crypto policy (e.g., CBDCs, legal frameworks), countries were scored on a binary policy scale (1 = strong crypto policy, 0 = weak). The results showed no statistically significant correlation between digital infrastructure and policy maturity (r = 0.19), suggesting that policy is influenced more by political will and economic pressure than infrastructure readiness.

Table 3: Correlation Matrix of Key Cryptocurrency Indicators Across Developing Countries

Variable	Crypto Rank	Internet (%)	Mobile Money (%)	Remittance %GDP	Bank Fees	Crypto Fees	CBDC (1/0)	Legal Score
Crypto Rank	1.00	–0.72	–0.48	0.30	0.20	–0.12	–0.28	–0.34
Internet (%)	–0.72	1.00	0.45	–0.21	–0.33	0.16	0.41	0.48
Mobile Money (%)	–0.48	0.45	1.00	–0.29	0.15	0.08	0.35	–0.18
Remittance % of GDP	0.30	–0.21	–0.29	1.00	0.56	–0.76	–0.40	0.70
Avg. Bank Remittance Fee (%)	0.20	–0.33	0.15	0.56	1.00	–0.40	–0.20	0.10
Avg. Crypto Transfer Fee (%)	–0.12	0.16	0.08	–0.76	–0.40	1.00	0.25	–0.55
CBDC Implemented (1/0)	–0.28	0.41	0.35	–0.40	–0.20	0.25	1.00	0.18
Legal Status Score	–0.34	0.48	–0.18	0.70	0.10	–0.55	0.18	1.00

Note. Pearson correlation coefficients showing the linear association between cryptocurrency-related indicators across five selected developing countries. A negative correlation with "Crypto Rank" indicates a higher real-world adoption (as lower ranks mean higher use).

Fig 1.



Note. Visual representation of Pearson correlation coefficients. Darker shades indicate stronger positive or negative relationships between infrastructure, adoption, and regulatory variables.

For example, despite having lower internet penetration, El Salvador implemented the most radical legal measure (Bitcoin as legal tender). Conversely, Vietnam and Kenya, which have stronger infrastructure, have yet to formally regulate or support digital currency use.

Summary of Quantitative Findings

1. Internet access is moderately correlated with crypto adoption rank, but not strongly predictive of policy development.
2. Remittance-driven economies benefit significantly from crypto in terms of reduced transaction costs.
3. Mobile money and crypto serve distinct purposes and may not overlap in use.
4. Policy actions remain unpredictable, often influenced by domestic political agendas rather than quantitative readiness.

CONCLUSION AND POLICY RECOMMENDATIONS

Conclusion

This study quantitatively examined the impact of blockchain and cryptocurrency technologies across five developing countries—Nigeria, the Philippines, Vietnam, Kenya, and El Salvador—through comparative analysis of digital infrastructure, adoption rankings, remittance dependence, and regulatory responses. The findings confirm that cryptocurrency adoption in developing countries is significantly shaped by digital access, remittance costs, and economic instability, rather than purely by technological infrastructure.

Specifically, countries with higher internet penetration—such as Vietnam and the Philippines—ranked higher in cryptocurrency adoption indices, indicating a moderately positive relationship ($r \approx -0.72$) between digital access and adoption rank. However, infrastructure alone was not predictive of regulatory maturity, as shown by the weak correlation between internet access and the presence of robust crypto policies ($r = 0.19$). These results suggest that regulatory behavior is more often influenced by political and economic imperatives than by digital readiness.

The analysis also revealed substantial cost savings for remittance-reliant economies when using cryptocurrencies. On average, crypto transaction fees were 75–90% lower than those of traditional banking systems. This suggests that cryptocurrency could play a significant role in enhancing financial inclusion and economic resilience, particularly where remittances account for a large share of GDP, as in El Salvador and the Philippines.

Despite this potential, the data also underscored several constraints. Volatility, limited regulation, and lack of digital literacy continue to inhibit widespread use of blockchain-based financial systems. Moreover, the comparative disconnects between mobile money ecosystems (e.g., Kenya's M-Pesa) and crypto usage indicates that the two operate in parallel, not necessarily synergistically, and must be evaluated independently in policy planning.

Policy Recommendations

Based on the quantitative findings, the following policy recommendations are proposed for developing countries seeking to responsibly harness blockchain and cryptocurrency technologies:

1. Promote regulatory clarity and inclusive policy frameworks. Countries should implement comprehensive, adaptive regulations that promote innovation while protecting consumers. Sandboxing environments—where crypto products can be tested under supervision—may help avoid premature restrictions and instead guide evidence-based rulemaking.
2. Support digital financial literacy and education programs. Given that adoption is often constrained by knowledge gaps, governments and NGOs should invest in public education campaigns explaining the risks, benefits, and mechanisms of blockchain and crypto usage. This is essential in rural and underbanked areas where misinformation and scams are common.
3. Prioritize infrastructure investment in connectivity and access. Although not determinative alone, internet penetration is a necessary precondition for any digital financial ecosystem. Investment in broadband, mobile internet, and device accessibility must be scaled up, especially in remote and low-income communities.
4. Integrate crypto solutions into remittance frameworks. Policymakers should consider enabling regulated cryptocurrency remittance providers to

operate alongside traditional financial institutions. Partnerships between local banks and crypto firms can help bridge formal and informal economies, especially where foreign workers rely heavily on digital transfers.

5. Explore public-private collaboration on CBDCs. Governments should assess whether Central Bank Digital Currencies (CBDCs), such as Nigeria's eNaira, can offer a secure and sovereign digital currency model. Hybrid approaches—combining private crypto tools with state oversight—may be most effective for developing economies.

Limitations and Future Research

Despite the valuable insights generated through this study, several limitations should be acknowledged. First, the research relies exclusively on secondary data sources, which, while credible, vary in frequency, measurement criteria, and completeness across different countries. This restricts the uniformity of data and may introduce hidden biases in cross-national comparisons. Second, the study adopts a cross-sectional design, capturing trends and relationships as of 2024; thus, it does not account for the rapid changes and volatility often observed in cryptocurrency markets or blockchain regulations. Additionally, while descriptive and correlation-based analysis offers a foundation for pattern recognition, it does not establish causality. Variables such as political stability, cultural attitudes toward technology, and informal economic activities—though likely influential—were not quantitatively integrated due to data limitations.

Future research should explore longitudinal analyses to assess how cryptocurrency adoption evolves over time, especially in response to shifting regulatory regimes or macroeconomic shocks. Comparative case-control studies could be employed to contrast regions within the same country or evaluate the impact of specific interventions (e.g., CBDC rollouts, financial education campaigns). Moreover, integrating primary data collection—such as surveys, interviews, or field experiments—would allow for richer, context-specific insights into user behavior, digital trust, and institutional readiness. Finally, further inquiry is warranted into the intersection between mobile finance ecosystems and decentralized finance (DeFi) tools, as these two domains may interact in complex and transformative ways in the near future.

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