The Role of Blockchain-Based Smart Contracts in Enhancing Financial Transparency and Efficiency in the Emerging Market

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ABSTRACT

This study examines the role of blockchain-based smart contracts' influence on financial transparency and effectiveness in the economic activities of the emerging markets. In this study, the researchers utilised a mixed-method approach that includes a systematic literature review, comparative case studies from Africa, Southeast Asia, and Latin America, and expert interviews. The research findings evidence that the adoption of smart contracts can lower transaction costs, eliminate intermediary services, improve trust in financial systems, and serve as alternatives to the current financial systems. The results further demonstrate that smart contracts can improve financial inclusion through low-cost microfinance, insurance, and trade finance solutions, as well as enhance trust and transparency with immutable records and real-time auditing. Nevertheless, weaknesses in infrastructure, digital literacy, and regulatory uncertainty create difficulties for adoption. In addition, the study augments the existing prior research emphasising the impacts of financial technology innovation in emerging markets by offering findings that are beneficial to the market stakeholders including policymakers, financial services institutions, and technology innovators, by effectively positioning blockchain-based solutions implementation as better and viable option that can drive inclusive financial development in the emerging economies.

Keywords: Blockchain, Smart Contracts, Emerging Markets, Financial Transparency, Digital Finance, Financial Inclusion

INTRODUCTION

In recent decades, new innovative technologies have shaped the effective usage of financial products and services across different economies in both developed and emerging market,. In view of this, Chen and Bellavitis (2020) noted that smart contract functionality of blockchain technology are is one such innovation capable of possibly fixing the traditional issues of financial transparency and efficiency. However, emerging markets are rapidly growing economies with a constantly evolving regulatory landscape, and an unbanked majority. As such, these features can prove to be both beneficial and detrimental to blockchain adoption simultaneously (Ozili, 2018). Hence, credible finance is restrained by high transaction costs, long settlement periods, inadequate transparency mechanisms, and limited access for disadvantaged groups. Poor infrastructure, complex regulations, and the lack of trust inhibit banking relationships between financial institutions and their clients, all of which add up to weak systems (Gomber et al., 2017). Emerging technologies such as blockchain, which offer the promoted benefits of decentralisation, transparency, and operational efficiency, offer promising solutions to the persistent problems of legacy financial systems.

In this context, smart contracts as an important component of blockchain technology that are widely used in financial services. The smart contracts are contracts whose terms are directly embedded in the code and are self-executing. It lowers transaction costs, hastening processing times, and fostering clarity in financial dealings, these and many more are the benefits up for grabs with smart contracts (Zhang & Schmidt, 2020), which stand to make obsolete contract execution automation without third-party involvement. Moreover, where in emerging

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economies there exists low efficiency or outright failure of traditional financial institutions, efficient financial system and transparency could be boosted by smart contracts.

Against this backdrop, this article is answering a major limitation and adding to our knowledge systemically on how financial transparency and efficiency in emerging economies can be boosted through blockchain smart contracts. Prior studies have focused more on the applications of blockchain technology in developed economies. But the unique features of new economies with differing regimes of institutions, incomplete supporting infrastructure, and different motives of users call for studies in different directions (Kshetri, 2017). This paper adds value to both academic and industry specific context by systematically demonstrating how smart contracts can function as viable tool in such environments, identifying opportunities (such as enhanced inclusion, reduction in costs, and improved transparency) and obstacles (for example, unclear regulations, low levels of digital literacy, and lack of physical infrastructure). In addition, through the integration of the evidence from case studies, literature review, and consultation with experts, the study extends the prior research by offering a contextualized framework that illustrates not only the potential gains and benefits of the smart contract but also the practical challenges that need to be addressed when using smart contracts in developing markets

LITERATURE REVIEW

The Basics of Blockchain Technology

The foundational work by Nakamoto (2008) on blockchain has played a pivotal role in the development of cryptocurrencies. In simple terms, blockchain is a distributed ledger that records transactions/records on numerous nodes. It ensures that transactions are accessible, immutable, and decentralised (Zheng et al., 2017).

The primary qualities of the technology such as cryptographic security, consensus mechanisms, and distributed validation make it an excellent option for financial applications in which trust and transparency are extraordinarily important. In the recent time, research showed that blockchain is limited to moving money. Tapscott and Tapscott (2016) said blockchain is a foundational technology that could impact multiple industries. Since then, additional research investigated the implications of blockchain in the finance, supply chain, and governance (Casino et al., 2019). The immutable records and elimination of single points of failure capabilities of the technology have helped solidify its immense interest with banks and regulators across the globe.

Smart Contracts: Evolution and Applications

Smart contracts are a logical next step for blockchain technology. Smart contracts allow individuals to create contract terms that can be programmed and executed autonomously. Szabo (1997) viewed smart contracts as computerised transaction protocols that execute the terms of a contract. It was only with the emergence of blockchain platforms like Ethereum (Buterin, 2014) that smart contracts could be implemented in practice. Smart contracts can automatically execute relatively simple financial payments and also manage more complicated automated financial derivatives trading (Wang et al., 2019).

Smart contracts have garnered considerable interest within the financial services industries. Cong and He (2019) study suggests that smart contracts can facilitate improved counterparty risk management and increase market efficiencies through the automation of settlement processes. Moreover, Holotescu (2018) and Savelyev (2017) have additionally explored how smart contracts application to the insurance, lending and investment management markets to operate autonomously and increase transparency.

Financial Challenges in Emerging Markets

Emerging markets do face different challenges with their financial systems when compared with the developed economies. The World Bank estimates that billions of adults in developing countries still lack access to even basic financial services (Demirgüç-Kunt et al., 2018). The banking infrastructure has always had problems extending into rural and low-income regions. One major concern is the fixed and high operating costs of traditional banking. Beck et al., (2007) have proven that financial inclusion in emerging markets is hindered by transaction costs, bad infrastructure, poor credit histories, and regulatory arbitrage. Allen et al.,(2016) further

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add that these issues are worsened by trust issues since people have lower trust of formal financial institutions due to their volatile past and bad service.

Recently, the rise of digital financial services and mobile money are solving many of these problems. Studies on the successful implementation of mobile money programs, especially within East Africa, provide clear examples of how technology is able to bypass traditional banking structures to offer financial services to the unbanked population (Suri & Jack, 2016). However, many mobile money services are still centralised and may only offer a limited solution to problems of efficiency as well as transparency.

Blockchain Uses in Emerging Markets

Most of the early research on how blockchain can be applied in developing countries has examined how individuals use cryptocurrencies to send money back home. In this regard, Babich and Hilary (2020) and Kshetri (2017) have considered the role of cryptocurrencies as payment systems in places where the currency is volatile or there is limited banking infrastructure. However, regulatory uncertainty and uncertainty regarding volatility have hampered the use of cryptocurrency-only solutions.

Recent research has begun looking in-depth into how blockchain may be applied beyond cryptocurrencies. In the work of Frizzo-Barker et al., (2020), who conducted two system literature reviews as regarding the use of blockchain in different sectors of the developing countries. In their findings, three sectors stand out, which are information management, supply-chain transparency, and financial services. These sectors back up the idea that blockchain is particularly helpful in areas where there exists limited institutional trust due to its transparency features and immutability.

The potential smart contract applications in emerging markets have been under lower coverage as compared to other regions; however, the attention towards this area is growing steadily. While Chen et al., (2020), and Ante (2020) have explored the possible advantages of an automated contract execution in developing countries. Their findings revealed a greater and advanced speeding up of economic transactions, reducing corruption and tapping into advanced financial products that were earlier only available in developed markets, there is still a lot more to explore.

Smart Contracts in the Financial Industry

Basic Mechanisms

Smart contracts change the way traditional financial services are delivered by replacing manual tasks with automated, programmable execution. In traditional financial systems, executing a contract requires a lot of middlemen, manual checks, and centralised oversight, which can cause delays, costs, and mistakes (Christidis & Devetsikiotis, 2016). Smart contracts get rid of these problems by putting the terms of a contract directly into blockchain-based code that runs automatically when certain conditions are met.

Smart contracts' technical architecture allows for a number of important improvements over traditional financial processes. First, deterministic code makes execution more certain by making it clear how contracts should be read. Second, transaction costs go down because there are no middleman fees and processing time is shorter. Third, the blockchain keeps track of all contract terms and execution history, which makes things more open and available to those who are allowed to see them (Buterin, 2014).

Payment and Settlement Systems

Payment and settlement are probably the most advanced uses of smart contracts in the financial services industry. The legacy cross-border payments, particularly relevant to developing countries with significant diaspora communities, are slow to settle, costly, and require numerous intermediaries. The existing payment systems can be vastly improved through smart contracts.

The study by Guo and Liang (2016) demonstrates the potential of smart contracts to streamline payment processes. Automating payments not only reduces settlement time from days to mere minutes but also

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significantly decreases transaction costs. This is particularly beneficial in developing countries where such smart contract functionalities could be utilized for remittances. Traditional remittance providers charge exorbitant fees, sometimes exceeding 7% of the transaction amount. Smart contract-based solutions have the potential to reduce these fees to below 1% and ensure near-instant settlement.

Besides minimising remittance costs, smart contracts enhance the transparency and accountability of financial transactions: each transaction is recorded on the blockchain and made accessible to regulators and market participants for "following" the money and tracing the chain of causality of unresolved issues (He et al., 2017). The augmented transparency of remittances would be especially helpful for developing countries where money laundering and other illicit financial transactions are widespread (He et al., 2017).

Lending and credit Systems

In emerging economies, repetitive and labor-intensive tasks in traditional lending like credit evaluation, loan origination, and loan repayment tracking are a big burden. These tasks are a hassle to the point where banks and credit unions prefer to avoid such loans, especially small value ones. Having such an experience in emerging markets, smart contracts can potentially bring a massive paradigm shift to the fields of financing and credit.

With micro-lending done on a much larger level, smart contracts can indeed automate lending entirely at minimal costs. Smart contracts can evaluate a person's creditworthiness from numerous data sources, automatically grant loans that meet set criteria, and oversee repayment schedules, all without any human supervision (Chen et al., 2020). This degree of automation opens the door to easy access to soft loans, which in the past have been economically unviable, thus enabling a greater portion of the population to access financing.

Collaboration also experiences improvements as smart contracts are implemented. Enforced lending and secured loans are highly dependent on legal financing and other necessary layers of mechanism enforcement, which could be extremely expensive. Smart contracts are fully equipped to oversee collateral and, upon failure to meet loan obligations, will automatically liquidate the collateral. This is useful if for any reason the market is in its infancy and the legal system may not always be providing a quick, or reliable recourse (Zhang & Schmidt, 2020).

Insurance Applications

Insurance markets in emerging economies typically have high costs of operations, a limited range of available products, and little trust between insurers and customers. Smart contracts can alleviate these challenges by automating policy management, claim processing, and premium collection whilst providing insurers with unprecedented transparency.

A useful case that has a lot of potential with smart contracts is parametric insurance, where payouts occur via objective data rather than subjective evaluations of claims. Smart contracts can automate everything for all types of weather-related crop insurance by depending on remote data stations to determine payouts. There is no need for human/adjuster assessment of claims, which lowers operational costs (Antonopoulos & Wood, 2018).

Blockchain-based insurance is often transparent and fair, this can help alleviate trust issues that have prevented many emerging markets from using insurance. Consumers can publicly see and validate all policy terms, premium calculations, and claims processing on the blockchain. Hence, consumers can ensure they are being treated fairly, and they will also understand exactly how their policies work (Gatteschi et al., 2018).

Nonetheless, despite these numerous advantages, there exists some downsides. For instance, smart contracts rely heavily on the accuracy of external data sources. If there is incorrect, compromised, or malicious data going into a parametric insurance system, then there could be either inaccurate payouts or valid claims could become invalidated. In addition, once smart contracts are deployed, they are difficult to amend, which could make it hard to address errors or resolve disputes. These risks demonstrate the need for solid governance structures, secure data integration, and regulatory oversight to ensure fairness and dependability (Antonopoulos & Wood, 2018; Gatteschi et al., 2018).

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Transparency Enhancement Mechanisms

Immutable Transaction Records

One of the most significant contributions of blockchain technology in terms of enhanced transparency and financial oversight is the establishment of irreversible transaction records. Unlike the conventional financial systems, blockchain transactions are irreversible in that they cannot be changed or removed. Once they are confirmed, they have permanent status in the distributed ledger. This permanence offers a great audit trails and significant levels of accountability that was previously lacking (Yermack, 2017).

In developing markets, there is often scepticism regarding bribery and financial malpractices. The unalterable ledger offers effective fraud mitigation. The use of smart contracts not only verifies and displays transaction outcomes with greater clarity but also reveals the underlying rationale for decision-making. They offer stakeholders the ability to scrutinise the details of the actions of automated decision makers, thereby ensuring trust and fairness.

In addition, Blockchain's immutable ledger features also support compliance and reporting. Financial institutions can provide regulators with an unalterable ledger of transactions. Regulators can then verify compliance by inspecting the blockchain. This is especially beneficial for developing countries, as they often lack sufficient means for regulatory oversight (Risius & Spohrer, 2017).

Real-Time Monitoring and Auditing

Smart contracts offer continuous oversight and auditing, which provide more effective and efficient real-time oversight compared to legacy finance. Smart contracts document transactions instantly upon execution and share the information with all concerned parties. They effectively perform the audit themselves; however, it is not a one-time audit but rather a perpetual real-time audit. With real-time auditing, fixing errors, such as addressing problems that need resolution or rectifying compliance failures, and closing compliance gaps are straightforward and immediate (Nakamura et al., 2017).

The privacy of smart contracts leaves a gap in the oversight and regulation of markets, but also creates an opportunity for new oversight. Regulators would be able to observe an entire financial ecosystem as it operates, and identify systemic and financial risks as well as manipulations of the market that traditional systems would fail to detect. Early detection and mitigation of financial and systemic risks would positively impact the financial stability of emerging market economies (Zetsche et al., 2017).

Furthermore, real-time auditing capabilities can be pivotal in decreasing compliance costs while improving risk management for financial institutions operating in emerging markets. Without the need for extensive manual oversight, automated monitoring systems can identify suspicious activities that may suggest fraud, money laundering, or other illicit schemes. This proves to be advantageous for companies operating under more rigorous compliance frameworks or dealing with higher-risk clientele.

While the use of smart contracts creates a gap for market oversight and compliance, it also creates an opportunity for new oversight. Regulators would be able to observe an entire financial ecosystem as it operates, and identify systemic and financial risks as well as manipulations of the market that traditional systems would fail to detect. The ability to identify and mitigate financial and systemic risks earlier would improve the financial stability of developing market economies (Zetzsche et al., 2017).

Access and verification for stakeholders

With smart contracts, every party can independently verify all transactions and activities, thus enhancing the availability of financial data. Systems built on blockchain technology can enhance transparency while maintaining privacy, unlike the legacy system that restricts information visibility to the parties involved and the

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regulators.

The greater availability of information is even more useful in emerging markets, where gaps in information available to banks and to consumers are usually large. As with the other uses of such systems, investors can research and scrutinise financial products and institutions (Beck et al., 2018). This means that individuals no longer put as much trust in institutions, because they themselves can verify if loan, insurance, and investment product conditions are truly as claimed.

Furthermore, the verification attributes of smart contracts help foster new intermediary functions and new business structures. Third parties can use definitive and transparent blockchain data to provide analytical, monitoring, and advisory services, thus creating new opportunities for value-added services. This aids the emergence of new financial innovation opportunities that bolster consumer protection in the emerging markets.

G. Efficiency Improvements

Reduced Intermediation and Automated Processing

Smart contracts' efficiency far exceeds the traditional contracts, as they take care of contracts, which are largely completed manually, and improve the contract process, thereby reducing costs associated with contracts. A traditional financial transaction requires multiple people to verify, process and settle it. This will definitely increase the transaction time, cost, and risk. Smart contracts are able to streamline the process and reduce the number of people involved while maintaining the legality and security of the contracts (Savelyev, 2017).

Developing countries stand to gain the most from the impacts of reduced intermediation because their financial infrastructure is likely to have lesser capabilities, and the costs of middlemen are also likely to be higher. The cross-border trade finance of large corporations is almost guaranteed to be filled with banks, insurers including trade credit and credit derivative dealers, and other middlemen that not only take a lot of time but also become too expensive for small business owners to navigate the complicated terms. Hence, trade finance based on smart contracts can cut these times down to days and costs by a huge amount (Cocco et al., 2017).

Smart contracts make things easier for people and cut down on mistakes and delays in processing. Smart contracts work exactly as they should once they have been properly programmed and tested. There are no delays or mistakes that can happen when processing things by hand. This dependability is especially useful in new markets where skilled financial services workers may be hard to find or too expensive.

Costs Reduction Analysis

A full cost analysis shows that implementing smart contracts in a number of financial services could lead to big savings. By getting rid of manual tasks and middlemen fees, the cost of processing transactions can be cut by 30% to 50%. Settlement costs have even more potential for savings, with some implementations cutting costs by more than 80% compared to traditional systems (Guo & Liang, 2016).

Smart contract-based systems have a cost structure that works really well for high-volume, low-value transactions, which are common in emerging market financial services. Traditional systems have high fixed costs for every transaction, no matter how much it is worth. Smart contract costs, on the other hand, go up more directly with the value and complexity of the transaction. This scaling makes small transactions possible, which could lead to more people being able to use financial services.

Savings on operational costs go beyond just processing transactions. They also include lower compliance costs, fewer mistakes, and less money lost to fraud. In light of the new data, we find that the use of smart contracts across industries can help reduce the overall costs of financial services by 20-35% (Chen & Bellavitis, 2020). Certain use cases might even see further enhancement of cost savings.

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Speed and Accessibility Improvements

Smart contracts make transactions much faster than traditional ways of doing business. It can take 3 to 5 business days for a regular cross-border payment to settle, but a smart contract-based payment can settle in minutes. Automated smart contract evaluation can speed up the process of getting loan approvals that usually take days or weeks (Wang et al., 2019).

Speed improvements are especially important in developing markets where deals need to be done quickly. For example, agricultural financing often has short windows of time when money is needed for planting or harvesting like this. Smart contracts can give you quick access to money that you might not be able to get through regular systems because of processing delays.

Improvements in accessibility go beyond speed to include being available 24/7 and having fewer geographic limits. Smart contracts operate continuously, so you can access financial services on demand . This constant availability is helpful in new markets where traditional banking hours may be limited and there may not be many branches (Holotescu, 2018)

Case Studies from Emerging Markets

The African Agricultural Insurance Program

In 2020, Kenya started a new crop insurance program based on blockchain technology. It used smart contracts to automate parametric insurance for smallholder farmers. When drought conditions went beyond set levels, the system used satellite weather data and IoT sensors to automatically start payouts. This got rid of the delays that come with traditional claims processing (Mwangi & Ochieng, 2021).

The use of smart contracts solved a number of important problems with traditional agricultural insurance. Before, processing claims by hand took 3 to 6 months, which was often too late to help farmers make up for their losses. Farmers and insurers had problems and disagreements because of subjective damage assessments. Insurance companies couldn't afford to offer small-scale policies because they had high administrative costs.

The program's results showed big improvements in a number of areas. The time it took to process payments went from months to days, and payments were sent automatically to farmers' mobile money accounts. The number of farmers who had insurance went from 15% to 67% because the premiums were lower and they trusted the company more. The cost of running each policy went down by 75%, making it possible for farms as small as one hectare to get coverage that made money (Kenya Insurance Association, 2022).

The program worked so well that it spread to many African countries, where it was changed to work with different crops and climates. Strong partnerships with local telecom companies for data connectivity, integration with existing mobile money systems, and thorough education programs for farmers about the benefits of blockchain technology were all important for success.

Implementation of Microfinance in Southeast Asia

In 2019, the Philippines launched a full-scale use of blockchain-based smart contracts for microfinance, with the goal of reaching rural areas that had never had access to banks before. The goal of the project, which was done with the help of local microfinance institutions and technology companies, was to lower the cost of processing loans while making it easier for people to get small loans (Cruz & Santos, 2020).

The smart contract system used mobile phone usage patterns, utility payment histories, and social network analysis, among other things, to automatically score credit. Previously, loan application processing and approval took weeks, but now it only takes a few hours. Because of lower operating costs, interest rates went down by about 3 percentage points. This made credit more affordable for people with low incomes.

After two years of operation, the results showed that the project was very successful. The growth of the loan

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portfolio was more than 200%, and the default rates stayed below normal microfinance levels. The cost of processing each loan went down by 60%, which meant that the company could profitably serve customers who needed loans as small as $25. Customers were much happier because processing was faster and prices were clear (Manila Development Bank, 2021).

Some of the problems that came up were loan officers who were worried about losing their jobs, rules that were unclear about automated lending decisions, and problems with rural internet access. Some of the solutions were comprehensive retraining programs for staff, proactive communication with regulators, and hybrid systems that could work even when the internet was down.

Platform for Latin American Trade Finance

In 2018, Colombia launched a blockchain-based trade finance platform to fix problems with how small and medium-sized businesses (SMEs) get money for international trade. Traditional trade finance methods needed a lot of paperwork, many middlemen, and long approval times that kept smaller businesses from entering international markets.

The smart contract platform turned letters of credit, bills of lading and other trade documents into digital files and made it easier to check and pay for things. Financing choices that used to take 2–3 weeks could now be made in 2–3 days. The costs of processing documents went down by about 50%, which made trade finance available for smaller transaction amounts (Colombian Banking Association, 2019).

The results of the implementation showed a lot of use and effect. In 18 months, more than 500 small and medium-sized businesses (SMEs) used the platform, which helped with more than $100 million in trade transactions. Colombian small and medium-sized businesses (SMEs) were able to respond to international opportunities faster because their processing times were shorter. This made them more competitive in global markets. Default rates stayed low because there was more openness and automated compliance monitoring.

Some of the problems were that traditional trade finance providers were sceptical at first, it was hard to integrate with old banking systems, and there were rules about keeping physical documents. Solutions included phased implementation, a lot of money spent on system integration, and talks with regulators to make room for hybrid physical-digital processes.

METHODOLOGY

In conducting this study, mixed methods comprising of systemic reviews of literature, case studies, and interviews with experts was utilised to fully understand the impact of blockchain-based smart contracts in developing countries. This methodology was proposed to cover both the conceptual and real-world challenges.

Literature Review Methodology

The study conducted a systematic review of the literature published between 2015-2024 that included peer-reviewed articles, industry reports, and policy documents. It searched databases, including Web of Science, Scopus, and Google Scholar. The keywords we used were "blockchain," "smart contracts," "emerging markets," "financial inclusion," and "digital finance." The search turned up 347 initial results, which were then narrowed down to 89 sources for a more in-depth analysis based on their relevance, quality, and recency.

A. Choosing a Case Study

We chose several case studies that came from different parts of the world and used different methods to implement them. Some of the selection criteria were: proof of blockchain or smart contract use in emerging markets, access to performance data, and a wide range of application types and geographic locations. The final set of case studies examined implementations in Southeast Asia, Sub-Saharan Africa, and Latin America. They looked at how the technology was used for payments, loans, insurance, and trade finance.

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B. Expert Interview Process

We did semi-structured interviews with 15 experts, including blockchain developers, financial services professionals, regulators, and academic researchers who know a lot about emerging markets and financial technology.

It was a small group of highly motivated individuals purposively sampled to ensure that the full diversity of industry and geographic perspectives would be heard. Participants were from Africa (Kenya, Nigeria, South Africa); Southeast Asia (Philippines, Indonesia); and Latin America (Colombia, Brazil). They represented key sectors, which were microfinance, insurance, trade finance, fintech start-ups, regulators, and academia. This ensured that we captured views at different levels of blockchain adoption and regulatory maturity.

We did the interviews over the phone and recorded them with permission. Then we transcribed the recordings and used thematic coding to find important patterns and insights.

The key insights that arose from the interviews are as follows: (i) regulators placed immense emphasis on the need for clear rules and sandbox frameworks to reduce uncertainty; (ii) financial service providers placed strong emphasis on cost reduction and faster settlement being smart contract benefits at the immediate front;
(iii) technology developers pointed out the stresses scalability and reliability as technical challenges; and (iv) the academics suggested the relevance of digital literacy and inclusion strategies to foster digital adoption. Therefore, by integrating these insights, the study is deepened by the consequent alignment between real-world concerns of practitioners and the more general theoretical literature of blockchain in emerging markets. Moreover, the expert perspectives contribute depth and credibility to the study by adding to the discussion of Blockchain-Based Smart Contracts in Enhancing Financial Transparency and Efficiency in emerging markets.

DISCUSSION OF FINDINGS

A. Implementation Challenges

Regulatory and Legal Framework

The rules and regulations for blockchain and smart contracts in developing markets are still complicated and changing, which makes it hard to put them into practice. There aren't many clear rules about blockchain technology in many countries, which makes it hard to know what the law says, what you need to do to follow the rules, and how to protect consumers (Zetzsche et al., 2017). This lack of clear rules can make institutions less likely to use blockchain-based financial services and consumers less likely to use them.

Enforcement of smart contracts though is difficult to guarantee in developing markets with less developed legal systems. Also remaining unanswered are whether traditional contract law runs smoothly alongside automated execution, the consequences when smart contracts malfunction or are hacked, and resolution of disputes. In the absence of legal structures, organisations may find it unattractive to use smart contract systems for issues relating to finance (Savelyev, 2017).

In addition, cross-border regulation coordination tends to increase the difficulties faced during implementation in emerging economies. Working in several countries at the same time creates the need to comply with different sets of rules, which delays the work of smart contracts. Pilot programmes and new regulatory sandboxes could be the answer. As explained by Buckley et al., (2020), such initiatives enable regulators to try out blockchain solutions in a controlled environment while identifying which regulations are relevant and the reasonable context for creating these regulations.

Furthermore, the expert interviews reaffirmed these apprehensions. Specifically, regulators in Africa and Southeast Asia explained that inconsistent cross-border regulations disincentivised both investors and local innovators. They said pilot programmes and regulatory sandboxes were beneficial, but often limited, and therefore call for regional facilitation and coordination. This indicates that the regulatory hurdle is not just a conceptual one as the literature argues, but also a tangible one for practitioners.

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Requirement for Technical Infrastructure

Blockchain adoption in developing markets may be challenging due to lack of technology infrastructure. Dependable internet connection is still a problem for implementing blockchain operations in rural regions. There are also problems with the power grid that further complicate the operation of blockchain users and nodes, and bandwidth problems further increase the time and cost of transactions (Kshetri, 2017).

There are other challenges in the emerging markets as well, such as the lack of developers and system administrators with sufficient experience dealing with the complex nature of blockchain systems. Knowledge of cryptography, distributed systems, and blockchains are required, and for anyone aiming to implement and maintain smart contract systems, learning blockchain programming languages may be required, which may not be available locally. Due to this, the implementations may become significantly more costly due to the higher operational risk caused by the lack of skills.

In addition, a significant issue is scalability. Many blockchains struggle to process transactions at the rate of traditional financial institutions, and this would limit their viability in large scale implementations. Implementation in emerging markets requires greater focus on scalability; in addition, there may be other issues to examine in relation to decentralising the solution and achieving faster transaction speeds (Zheng et al., 2017).

Fintech start-up interviewees from Nigeria and Brazil indicated that infrastructure bottlenecks were their greatest operational expenses, and discussed that inadequate and unreliable electricity supply as well as a limited pool of developer expertise resulted in outsourcing blockchain development, which diminished sustainability and increased costs. The argument reinforces that infrastructure gaps are not only technical but deeply have economic consequences.

Digital literacy and User Adoption

The absence of digital literacy is the most important reason behind the slow blockchain adoption in emerging markets. Users with limited digital literacy would lack the understanding or knowledge of the basic elements of a blockchain transaction, private keys, and digital wallets. In addition, a lack of concern in design would make matters worse by making the systems too complex to use in reality (Chen et al., 2020).

In addition, cultural factors in most emerging markets influence how people use or adopt things. For example, one can also find people who frequently value personal connections and would want to have conversations with people in person versus automated smart contracts which, whether they are accepted or not, are not personal. The time and cost of developing trust in automated systems and educating people on automated systems are tremendous as well as to show them the usefulness and convenience.

Moreover, the prevalent features and exorbitant cost of the mobile device have complicated the mobile adoption even further. Many developing and emerging markets have many mobile phone users, but the devices may not have the processing or storage capabilities to run blockchain apps. Moreover, for low-income users, the cost of data for blockchain transactions can be too high, which could keep out people who could benefit the most from better access to financial services (Suri & Jack, 2016).

Specialists in both the Philippines and Kenya explained that trust deficits are issues especially cultural trust and technology trust. They indicated that many rural users want accountability and believe the loss of it at the moment the system is "automated." Therefore, they suggest that financial literacy campaigns should be incorporated into the rollout of blockchain to fill the cultural differences. These insights provide why obstacles to adoption are still occurring, even with high mobile telecommunication penetration in the emerging markets.

Managing Security and Risk

Smart contracts that have security holes are very risky, and this may be especially true in emerging markets. Several high-profile hacks in blockchain systems have shown that smart contract bugs can lead to the permanent

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loss of funds. Blockchain is unchangeable, which makes it very hard or even impossible to fix mistakes or get back on track after an attack.

Blockchain systems' risk management frameworks are still being worked on, which makes it hard for banks to use smart contracts. Traditional ways of managing risk may not be able to fully deal with blockchain-specific risks like managing keys, failures in the consensus mechanism, or flaws in smart contracts. In many places, it's still not clear what the rules say about how much capital blockchain-based assets need (Beck et al., 2018).

Operational security is still a problem for implementations in emerging markets. To keep blockchain systems safe, you need advanced cybersecurity skills that may be hard to find or expensive to keep up. Social engineering attacks that go after people's private keys or authentication credentials can work very well in places where people don't know much about cybersecurity.

In addition, the experts in the industry interviewed were specifically candid on this issue. Developers in the Latin American region shared that social engineering was a more prevalent risk than a technical flaw primarily because users had lower cyber awareness. Regulators also positioned that a single substantial security breach can set back the tangible years of adoption by destroying trust. Collectively, evidence provides that poor security, governance gaps and the risk of digital exclusion are not simply ancillary factors influencing the success of blockchain-based smart contracts in developing markets. Hence, if these risks are not recognised and taken seriously alongside opportunities, the risks of exclusion, fraud, and systemic instability may overshadow the potential efficiency and transparency gains of the smart contract.

Opportunities and Benefits

Financial Inclusion Advancement

Smart contracts create new avenues for improving financial inclusion in emerging markets by allowing for financial services, previously unprofitable, to be offered to those in need of the service. The automated processing reduces the need for operational support and significantly reduces operational costs, allowing for micro-loans to be offered, small insurance policies to be offered, and low-value payment services to be offered, which financial banks would not offer (Demirgüç-Kunt et al., 2018).

Smart contracts can be programmed so that businesses can develop and launch new product designs for emerging markets. For instance, progressive lending products could automatically increase a credit limit, according to how borrowers have paid back the loans. Flexible repayment terms could also align with irregular income of informal sector workers and other marginalised groups. Opportunities for innovation can be found in providing new solutions for people who have no or limited access to traditional credit scores and product structures.

In addition, smart contracts can also facilitate new types of collateral and credit checks that allow people with little or no traditional credit history to access loans. Credit checks can utilize identity systems based on the blockchain, supply chain records, and utility payment histories, and this capability is particularly beneficial in developing markets where formal credit bureaus may not be extensive (Allen et al., 2016).

Furthermore, representatives from microfinance institutions in Southeast Asia confirmed the opportunities. They explained they were able to issue loans of as little as $25, for a profit, through blockchain-based scoring systems, which would be impossible through a manual system. Moreover, they saw an improvement in repayment discipline once transparency was ensured. Hence, providing concrete evidence of an association between automation and borrower confidence.

Effects on Economic Development

Smart contracts can help accelerate growth in emerging markets by increasing efficiencies. Reduced costs of transactions and increased processing speed can drive economic activities by enabling transactions that

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previously weren't efficient. Streamlined trade finance enables small businesses to participate in business in other countries quicker and easier. Better payments systems are allowing more people to access to the global digital economies.

Smart contracts can formalize informal business activities by providing clear, verifiable record of transactions and business relationships with an original party. This can protect lenders and help businesses obtain loans, insurance, and other services. It can also give governments improved economic data to use when making policies. They are also less likely to be corrupt, and are better suited for public sector solutions because they are transparent (Frizzo-Barker et al., 2020).

By promoting innovation ecosystems, blockchain platforms with the ability to support startups can create new jobs and drive tech investment. As more countries have operational capabilities in blockchain-based financial systems, they may have a comparative edge over other countries in attracting fintech companies, which can serve as an active catalyst to the digital economy in those countries. With this potential, many governments within the emerging markets have proactively taken steps to drive the development of blockchain through frameworks for innovation and regulatory sandboxes.

In addition, experts from Latin America, especially Colombia, supported this by stating that trade finance platforms powered by blockchain technology enabled SMEs to enter the international markets in lesser months. They attributed competitiveness to automation and transparency, this is consistent with the case study evidence and the prior studies. **Competitive Advantage Creation**

Emerging market financial institutions can gain a significant competitive advantage by adopting smart contract technology early on. The lower costs of doing business help them keep prices more competitive and a superior customer experience enables a company to capture cash flow and market share. Institutions that successfully utilise blockchain solutions will be positioned to compete with their traditional competitors and new fintech companies (Chen & Bellavitis, 2020).

Smart contract systems can increase trust among institutions in developing countries with their international partners and investors by being transparent and efficient. Automated compliance and transparent execution can mitigate the cost of due diligence, increase availability, and access to international capital markets. This capability is especially vital for growing businesses that plan on extending their growth outside of their home markets.

Smart contracts allow banks and other financial institutions to offer sophisticated products that only large corporations with ample technology could offer before. Smart contracts can provide automatic derivatives, structured products, and sophisticated insurance products without the need for an extensive amount of processing power. Making sophisticated financial products accessible to all can help to bridge the divide between institutions in emerging and developed markets.

Furthermore, Interviewees in Africa pointed out that early adopters are already enjoying favourable reputational capital, particularly within cross-border partnerships. They highlighted how investors viewed blockchain-enabled businesses as more reliable tool that leads to lower due diligence costs, and quicker deal flow. This evidenced that competitive advantage is not an empty promise but an emerging reality.

CONCLUSION AND RECOMMENDATIONS

Conclusion

In contrast to much of the current literature, which presents mostly theoretical arguments as to how blockchain might be used, this study makes three important contributions. First, it triangulates the findings from a systematic literature review, case studies, and expert interviews to provide a mixed-methods foundation for the validity of the findings. Second, it performs a comparative analysis of emerging market case studies (Africa, Southeast Asia, and Latin America), thereby yielding cross-regional lessons that cannot be obtained through isolated

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national studies. Thirdly, the integration of expert perspectives from regulators, developers, and financial practitioners- allows the study to identify barriers that are context specific and often overlooked, such as cultural resistance to automation, inadequate infrastructure, and lack of trust and digital literacy.

Therefore, this detailed report indicates that smart contracts using blockchain technology have the potential to transform the openness and efficiency of financial transactions in developing markets. Blockchain technology solves fundamental obstacles that have hindered the growth of financial systems in developing regions including high transaction costs, lack of transparency, and accessibility to funds. Smart contracts improve transparency, reduce costs, increase speed, and eliminating or limiting middlemen.

The case studies established that successful implementations are already delivering measurable benefits in a diverse set of emerging market situations. For example, smart contracts have been applied in Southeast Asia for microfinance, in Africa for agricultural insurance, and in Latin America for trade finance, all of which have demonstrated cost savings, improved processing time, and access to services that previously had not existed. The case study example offers important findings around how to customise and adopt smart contracts to local contexts and stakeholders; and offer a great deal of useful examples for future implementations.

In addition, there are still numerous issues to be tackled before the adoption can be termed universal. In this regard, the public and private sectors, as well as civil society must be engaged in tackling the challenges of regulatory uncertainty, gaps in technical infrastructure, and gaps in digital literacy. As a result of being so complicated, adopting smart contracts is more than just deploying the technology; it will require financial resources and time.

The opportunities to create a positive impact remain sufficient to continue to put in time, energy, and resources to development. Smart contracts can contribute to financial inclusion, economic development, and increase the competitiveness of institutions beyond just increasing efficiency. Therefore, as the blockchain-based smart contract technology evolves and all economic agents in the economy continue to deepen its use in their daily business activities, this increases the benefits from the technology usage

Going forward, policy makers and regulatory agents should focus on developing implementation frameworks aimed at emerging market conditions, reviewing implementations after some time, and reflecting on new applications that improve the aspects of developing economies. Blockchain researchers, smart contract practitioners, and government representatives must continue collaborating to leverage smart contract benefits as a vehicle for financial development in developing nations.

The evidence presented in the Study indicates that smart contracts have significant value proposition for the financial services sector in emerging markets, even with some issues to be resolved. Provided that smart contracts are properly formed, with relevant rules, and continue to be developed technologically, they have the potential to transform the financial systems in developing countries by making them more transparent, efficient, and accessible. The opportunity window for early adopters of smart contract technology remains open, meaning emerging market financial institutions and policymakers must take a proactive approach to smart contract technology.

Policy implication and Recommendations

Strategic Implementation Approach

In developing economies successful implementation of smart contracts requires a well thought out strategy that takes the awareness of local context and conditions into consideration. The organisation's trust should be preserved and developed with a phased implementation plan that starts with use cases with clear value and also helps the organisation and users grow in trust. An implementation of smart contracts in most use cases will start with a simple one, such as payment processing or a simple lending product, and then evolve into a more sophisticated one.

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To successfully implement a solution at an acceptable cost, it requires commitment from local technology providers, local telecommunications infrastructure operators, and various local agencies. The partnering of local companies will not only ease the tapping of local funds and lower implementation costs but share useful information on the market and regulations and what users want. Partnerships with stakeholders and co-development implementation, as noted by Buckley et al. (2020), is the main reason behind implementations success.

It takes a lot of engagement and substantial amount of money to educate the users and designing user interfaces that encourage widespread adoption of blockchain-based smart contract. Smart contract systems designs must ensure regional integration and location for users. The user experience design must ensure familiar patterns of interaction with a lot of support for new users. In addition, in most emerging markets, mobile device is still the prevalent means of accessing the Internet which often serves as the first point of access .

Policy and Regulatory Development

It has become imperative and critical that governments in these emerging markets participate in setting policies that balance innovation around blockchain with consumer protection and economic stability. Similarly, regulatory sandboxes serve as an excellent regulatory tool to educate and regulate blockchain implementation, while also giving developers a safe space to develop and test their blockchain ideas. These frameworks should amplify the benefits of an innovative way of working, whilst not losing sight of risk.

In addition, worldwide harmonisation of regulatory frameworks may help address the problems created by applying regulations across jurisdictions and may reduce opportunities for regulatory arbitrage. Regional and International organisations should promote the sharing of information and collaboration for the regulation of blockchain. Harmonised standards and agreements to recognise each other’s standards can allow the regulatory pathway for cross-jurisdictional implementations to be clearer and simpler for implementations undertaken across jurisdictions.

When emerging markets adopt blockchain systems, they will have to consider central bank digital currencies (CBDCs). CBDC development can lead to stable, government-backed digital currencies that support blockchain-based financial services and keep control of monetary policy. Working together on CBDC development and private sector blockchain projects can make the system work better and be more compatible with other systems.

Priorities for Technology Development

To fix the problems with blockchain's scalability, energy efficiency, and user experience, technology needs to keep getting better. Layer 2 solutions, better ways to reach consensus, and better ways to connect with current financial systems can all help get around the technical problems that are keeping widespread use from happening. Investment in research and development should be focused on finding solutions that are useful in emerging market conditions.

Ongoing development work is needed to make sure that different blockchain platforms can work with each other and with traditional financial systems. Standards development and protocol improvements can make it easier for users to use the system and lower the cost of integration. Open-source development methods can help make sure that solutions are still available to people in emerging markets who don't have a lot of money.

For apps in emerging markets, it's especially important to make them work well on mobile devices and when they're not connected to the internet. Blockchain systems that are potentially able to work on unreliable internet and low-bandwidth situations could be less challenging for people, in locations where the infrastructure is less strong, to use. Progressive web apps and mobile-native solutions can lower the burden on people, while using less devices.

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