International Journal of
Technology and
Systems
(IJTS)

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Journal of Technology and Systems
ISSN : 2788 -6344 (Online)
Vol. 6, Issue No. 3, pp 78 – 86 2024
www.carijournals.org

Impact of Blockchain on FinTech and Payment Systems

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Accepted: 28th May, 2024 Received in Revised Form: 12th June, 2024 Published: 26th June, 2024

Abstract

Purpose: FinTech, which is all about using technology in finance, has been changing a lot lately because of something called blockchain. Blockchain was first used for Bitcoin but has become important in finance and other areas. This paper argues that block chain technology addresses these concerns by enhancing the safety and speed of transactions. Through blockchain and tokenization, financial services are becoming more efficient and user-friendly.

Methodology: This paper talks about theories and uses different kinds of sources like books, articles, and online materials. It focuses on Blockchain Technology, looking at its features, functions, and types. Different websites of different companies working on blockchain have been checked to see the impact of blockchain in today's world.

Findings: Blockchain technology is changing financial technology (FinTech) by making payments and transactions more secure and transparent. Its decentralized design improves security and benefits both consumers and financial institutions.

Unique Contribution to theory, practice and policy(recommendations): The potential of blockchain interoperability protocols to securely transfer data and value between legacy systems and a myriad of blockchains, driving innovation and efficiency in the financial industry. The partnership between Swift, major financial institutions, and Chain link highlights the importance of making different blockchain networks work together smoothly. This is crucial for the next stage of digital asset adoption in the global financial system. It shows that even the largest banks and financial infrastructures can achieve interoperability between various blockchains with minimal resources.

Keywords: *Fintech, Blockchain, Bitcoin, Financial Services, Tokenization*

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I. Introduction (Blockchain in finance)

The rise of fintech shows how technology can solve problems in our financial system. Digital finance improves transparency and cuts costs by reducing the number of middlemen in transactions. It also makes financial services more accessible. Blockchain, created by Satoshi Nakamoto in 2009 for bitcoin, is a decentralized digital ledger that records transactions securely without a central authority. Each block in the blockchain contains a list of transactions, and once verified, it can't be changed without altering all following blocks.[1] Blockchain offers many opportunities in fintech by making online transactions more secure. It allows users to store data safely without external parties, enhancing e-commerce security. For example, BitPay uses blockchain to allow secure cryptocurrency payments, removing the need for credit card information. Blockchain's encryption and identity verification also help prevent fraud. Its unique structure provides strong defense against cyber threats, as its decentralized nature makes it hard for hackers to attack all nodes at once. Therefore, blockchain technology is key to securing e-commerce transactions and protecting against cyber-attacks. The future is great for blockchain technology. Blockchain market size can grow from 3 billion USD to 39.7 billion USD by 2025. Thirty percent of blockchain projects might go live this year. There is another prediction that 90% of those projects might have a substitute solution. Twenty-five percent of Forbes Global 2000 might start implementing blockchain for improving digital trust. The implementations might not use tokenization, smart contracts, decentralized consensus, and other features. The latest solutions during COVID-19 lockdown are becoming the reference solutions for the blockchain initiatives. The number of enterprises that are part of the blockchain networks has significantly increased. On the other hand, long-term blockchain implementations are on hold. Future projects are focusing on creating a digital platform for post-pandemic scenarios. Private blockchains are becoming popular, and they will have a bigger market share compared to public blockchains. European countries are coming up with their cryptocurrency, and China is ready with its crypto yuan.[6]

A. Types of Blockchain Systems

Ongoing technological advancements have resulted in fundamental differences between various blockchain systems. Public Blockchain is a major type of Blockchain, and that is not only open but also decentralized in nature. And in this type of Blockchain technology computer networks are basically accessible to anyone interested in transactions. Here based on validation the validated person basically receives the transaction rewards and furthermore, two kinds of Proof-of-work and Proof-of-stake models are being used. [5] The Public Blockchain is furthermore a non-restrictive and distributed ledger system which is doesn’t seek any kind of permission, and anyone having access can be authorized one to get the data or part pf the Blockchain. [5] However, a significant drawback of public blockchains lies in their often tenuous connection to existing regulatory frameworks, leading to limited acceptance and adoption across various use cases. In response to this challenge, many companies are turning to private blockchain solutions. These platforms afford

companies the ability to establish their own rules and ensure adherence to legal requirements. Furthermore, they grant control over both the data stored on the blockchain and the participants involved in transactions. In certain scenarios, neither public nor private blockchains may be optimal. In such cases, consortium blockchains emerge as a potential solution. Consortium blockchains enable authorized entities to enforce rules, govern transactions, and ensure compliance with regulations. Meanwhile, users retain control over activities through a consensus mechanism. When appropriately designed, a regulated blockchain can offer a balance between the benefits of public and private systems, making it an ideal solution for specific use cases. The following table compares major properties of traditional databases with different blockchain architectures.

	TRADITIONAL DATABASE	PRIVATE BLOCKCHAIN	CONSORTIUM BLOCKCHAIN	PUBLIC BLOCKCHAIN
EXAMPLE	MS SQL Server	Hyperledger	Corda (DLT)	Bitcoin
ARCHITECTURE	Client-server	Closed P2P	Closed P2P	Open P2P
ACCESS	Private	Private	Public/private	Public
CONTROL	Centralized	Partly centralized	Partly centralized	Decentralized
DATA SECURITY	Non-persistent	Partly immutable	Partly immutable	Immutable
FAILURE SAFETY	Low	Medium	Medium-high	High
PERFORMANCE	Fast	Medium	Medium	Slow
ENERGY USAGE	Low	Low	Low	High

Fig.1 Comparison of traditional databases with different blockchain architectures

B. Integration of Emerging Technologies

The integration of blockchain with other emerging technologies such as artificial intelligence (AI), Internet of Things (IoT), and machine learning (ML) holds immense potential for enhancing payment processes.[11] AI-powered fraud detection, IoT-enabled supply chain payments, and ML-driven credit scoring are just a few examples of how blockchain can synergize with other technologies to create innovative payment solutions. As these technologies mature and converge, blockchain-powered payment systems will become more intelligent, efficient, and secure.

II. Tokenization in Fintech industry

Tokenization is a technique where sensitive payment information such as a 16-digit credit card number or cardholder name is replaced with another set of symbols, known as "tokens," that have no meaning outside the system. These tokens serve a value only within certain defined conditions, similar to casino chips which are valid only within casino premises, offering control over cash transactions. [8] These tokens are typically random strings of characters that hold no intrinsic value and are generated using encryption algorithms. Though tokenization is indeed a major contribution to digital payments ensuring high levels of security and being user-friendly, one must first understand the key participants in the ecosystem and how tokenization introduces new dynamics to this environment. [8] When a user initiates a transaction, their sensitive payment card details are replaced with a token generated by a tokenization service provider. This token is transmitted during the transaction process instead of the actual card information, effectively shielding the user's financial data from potential threats. While commonly associated with credit card transactions, tokenization extends its application beyond just credit cards. It can be employed across various types of sensitive data and payment methods, serving as a safeguard for any information requiring secure handling during transactions. This technique fortifies security across diverse payment methods, spanning debit cards, bank transfers, cryptocurrencies, and digital wallets. In mobile payment platforms like Apple Pay and Google Pay, as well as in e-commerce settings, tokenization takes the place of sensitive details with encrypted tokens. Moreover, tokenization extends its protective mantle to personal identification information and loyalty program data, effectively thwarting unauthorized access.

A. *How Data Tokenization Works*

Tokenization in payment processing involves replacing a credit card or account number with a token, which serves no functional purpose and isn't linked to any specific account or individual. During this process, the customer's 16-digit primary account number (PAN) is substituted with a randomly generated alphanumeric ID. By doing so, tokenization severs any ties between the transaction and sensitive data, thereby reducing the risk of exposure to breaches, particularly in credit card processing. Tokenization functions as a protective measure for data, shielding credit card and bank account numbers within a virtual vault. This enables organizations to securely transmit data over wireless networks. To ensure the effectiveness of tokenization, organizations must utilize a payment gateway to securely store sensitive information. A payment gateway, provided by e-commerce application service providers, facilitates direct payments and credit card processing. This gateway securely stores credit card numbers and generates the random tokens required for tokenization.

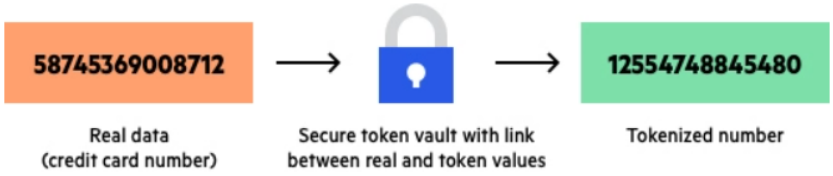

Fig-2. Tokenization in a nutshell

Payment tokenization example

When a merchant processes a customer's credit card, the primary account number (PAN) is substituted with a token. For instance, a PAN like 1234-4321-8765-5678 might be replaced with a token such as 6f7%gf38hfUa. The merchant may associate this token ID with the customer's information, such as linking the token 6f7%gf38hfUa to John Smith for record-keeping purposes. Subsequently, the token is transmitted to the payment processor, which then decrypts the token and verifies the payment. Thus, 6f7%gf38hfUa would revert to the original PAN, 1234-4321-8765-5678. Crucially, only the payment processor has the capability to decipher the token; it remains unintelligible to anyone else. Additionally, the token is only valid within the context of that specific merchant, ensuring its usefulness is confined to the transaction at hand.

B. Benefits of Tokenization

Tokenization brings several advantages to financial technology (FinTech). It enhances security by replacing sensitive data like credit card numbers with tokens that are useless if intercepted. This reduces fraud risk since intercepted tokens can't reveal original data. Tokenization also helps companies comply with regulations like PCI DSS and GDPR by minimizing the handling of sensitive information. It streamlines payment processes, making transactions faster and more secure, which improves customer experiences.[10] By protecting customer data, it boosts trust and loyalty. Tokenization is flexible and can be used in various financial services, allowing companies to scale and adapt. It also leads to cost savings by preventing expensive security breaches and regulatory fines, while making operations more efficient.

III. Investments and Payments

A. Crypto Payments

In 2008, Satoshi Nakamoto outlined a new protocol for a peer-to-peer electronic cash system using a cryptocurrency called bitcoin. Cryptocurrencies (digital currencies) are different from traditional fiat currencies because they are not created or controlled by countries. This protocol established a set of rules—in the form of distributed computations—that ensured the integrity of the data exchanged among these billions of devices without going through a trusted third party.[3] Bitcoin includes an important incentive mechanism that encourages mining activity and thus indirectly increases the system's resilience. [4] The list of companies accepting crypto payments is steadily expanding, with big names like Microsoft, Starbucks, and AXA insurance leading the

way. Additionally, rumors abound regarding crypto payment projects from Amazon, Paypal, and Apple. Despite this progress, adoption for payments remains limited due to several key factors. Price volatility dissuades both consumers and merchants from using crypto assets for transactions, while the supposed anonymity of crypto transactions has been disproven, with holdings and transactions traceable to real-world owners. Moreover, the lingering association of crypto with criminal activity deters many from embracing it. However, with growing popularity, legal clarity, and adoption by global companies, the landscape is changing. Stablecoins offer a solution to volatility concerns, and plans for their implementation are underway. As a result, crypto-based payment options are expected to become prevalent in high-income countries within the next few years. In contrast, adoption in lower-income countries may be hindered by technical infrastructure limitations, high internet access costs, and legal and regulatory uncertainties. Despite this, tech-savvy segments of the population are likely to adopt crypto payments, leading to the emergence of shadow crypto payment systems. Blockchain technology presents a solution to the challenges faced by traditional banking systems, particularly in handling microtransactions. With blockchain-based payment systems, micropayments become cost-effective, quick, and secure, offering a promising alternative for cross-border transactions. However, the increased use of blockchain-based payment systems raises regulatory concerns, particularly regarding capital control, taxation, and anti-money laundering measures. The Financial Action Task Force (FATF) has already updated its guidance to address these challenges. While crypto-based payments are expected to grow, they are unlikely to replace fiat currencies in the midterm. Instead, they will complement existing systems either through gateways or by creating parallel systems. Finally, the adoption of crypto-based payment systems carries geostrategic implications, with some countries exploring options to reduce dependence on established international payment systems to mitigate political vulnerabilities.

B. Remittances

Blockchain technology has changed the transfer of remittances fundamentally in the last few years. Between July 2020 and June 2021, Africa as a whole received USD $105.6 billion in cryptocurrency, according to Chainalysis18. Africa had a bigger percentage of the market's total transaction volume measured in transactions below 10k USD, indicating a high adoption among private or small retail transfers. Around 7 percent for Africa compared for to the worldwide average of 5.5 percent.[9] Additionally, peer-to-peer services such as Paxful and LocalBitcoins account for 1.2 percent of all cryptocurrency transactions in Africa. Because cryptocurrency platforms bypass traditional banking services by introducing decentralized peer-to-peer lending services, they can help level the economic playing field and expand finance options to underserved customer markets. [16]

IV. Related experiments and findings

Society for Worldwide Interbank Financial Telecommunication (SWIFT), is actively engaged in industry experiments aimed at developing a blockchain interoperability model. SWIFT is collaborating with global community to explore how institutions can leverage their Swift connections to seamlessly interact with the multitude of emerging blockchain networks worldwide. With a focus on streamlining international transactions, partnering with major financial institutions and FMIs to test the transfer of tokenized value across public and private blockchain networks. These experiments, building on successful trials in 2022, will address operational and regulatory challenges inherent in blockchain environments. Tom Zschach, Chief Innovation Officer at SWIFT, underscores the inevitability of a diverse range of blockchain platforms and the impracticality of connecting to each individually. As a global cooperative dedicated to enabling frictionless transactions, we're uniquely positioned to develop an interoperability model that provides global access to various platforms. Jonathan Ehrenfeld, Head of Securities Strategy, emphasizes that these experiments will enhance the industry's understanding of technical and business requirements in interacting across multiple blockchain networks. They will also highlight the potential of blockchain interoperability protocols to securely transfer data and value between legacy systems and a myriad of blockchains, driving innovation and efficiency in the financial industry. Bitcoin's developer Nakamoto has shown in his original analysis that as long as an attacker possesses less than 50% of the computational power in the network, he produces blocks at a lower expected rate than the rest of the nodes, and so the probability of a successful attack on a given transaction decreases exponentially as more blocks are added to the chain on top of it. Each block added is thus considered to add a "confirmation" to all the transactions in preceding blocks as it supports their inclusion in the ledger.[4]

Alexandre Kech, Head Digital Securities at SIX Digital Exchange (SDX), emphasizes the importance of interoperability in realizing the potential of blockchain technology for institutional business. He underscores the need for a multi-party, regulated global infrastructure that supports digital asset trading, settlement, and asset servicing around the clock, catering to the needs of both issuers and investors. Sergey Nazarov, Co-Founder at Chainlink, echoes this sentiment, highlighting the growing belief among top global banks and market infrastructures in the widespread adoption of digital assets. The collaboration between Swift, major financial institutions, and Chainlink underscores the critical role of interoperability across different blockchain networks in facilitating the next phase of digital asset adoption in the global financial system. This collaboration demonstrates that achieving interoperability across various blockchains is feasible, even for the largest banks and market infrastructures, with minimal resources.

V. Conclusion

Study: Blockchain technology is transforming financial technology (FinTech), changing how payments and transactions are done with its decentralized and secure design. It improves security and transparency, benefiting both consumers and financial institutions.

Conclusions: Future trends like decentralized finance (DeFi) and central bank digital currencies (CBDCs) will further boost blockchain's use in payments. Blockchain is speeding up cross-border transactions and allowing the digitization of real-world assets through tokenization. Integration with AI, IoT, and machine learning (ML) is making blockchain payment systems smarter and more efficient. Despite challenges such as price volatility and regulatory concerns, crypto-based payment systems are gaining traction, offering an alternative for traditional banking systems, especially in handling microtransactions and cross-border transactions. As adoption continues to grow, blockchain technology is set to play a pivotal role in shaping the future of financial services.

Recommendation: Partnerships like those led by SWIFT are helping different blockchain networks work together better. By using this technology, we can create a financial system that is more inclusive, efficient, and transparent.

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