Blockchain Innovation in Finance: Leveraging Distributed Ledger Technology for Competitive Advantage in Banking and Financial Services

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ABSTRACT
This paper explores the current applications of blockchain technology within the financial and banking sectors, with a particular focus on its impact in developing countries like Vietnam. Employing a qualitative research methodology, including synthesis and comparative analysis, the paper clarifies the fundamental concepts, operational principles, and the potential applicability of blockchain in traditional financial systems. Key blockchain applications such as equity crowdfunding via smart contracts, cross-border remittance, decentralized payment services, peer-to-peer (P2P) lending, and supply chain finance are examined in detail. These blockchain-driven innovations are compared with traditional financial models to highlight their advantages in terms of transparency, cost efficiency, and operational efficiency. The findings indicate that blockchain technology not only addresses the limitations of existing financial models but also provides new opportunities for enhancing the competitiveness and sustainability of financial services, particularly in emerging markets. The study offers valuable insights into the future direction of blockchain adoption in finance, while also recognizing challenges that need further exploration.

Keywords: *Blockchain Technology, Decentralized Payment Systems, Financial Innovation, Peer-to-Peer Lending, Smart Contracts*

1. INTRODUCTION

The backwardness of financial services affects the development of modern financial markets. In the era of science and technology being the leading factor, financial technology (Fintech) becomes an important source of power promoting the overall transformation process between generations of the financial industry.

Financial inclusion in developing countries is still poor. Developing countries need more financial technology to promote the development of the financial sector (Wang et al., 2020). In Vietnam, many people do not have bank accounts and have limited access to traditional financial services and rely heavily on informal credit activities (Uyen & Ha, 2017). The data analysis results of Uyen & Ha (2017) show that nearly 90% of respondents have lent or borrowed directly without going through financial intermediaries such as banks. More than 70% were found to be people who have never borrowed money from any strangers. Thanks to its huge potential, Vietnam's consumer finance has so far attracted many foreign investors, and financial technology has also contributed to creating a breakthrough business model for financial companies. These are inseparable from the promotion of blockchain technology, a financial innovation that creates new business models, processes and products.

Blockchain technology is a powerful driving force for the development of financial technology. The potential of blockchain technology is extremely vast. Many useful technologies are still being explored and expanded (Wang et al., 2020). The distributed structure and consensus mechanism of blockchain technology provide new solutions and roadmaps to optimize the problems that need to be solved in the traditional banking and finance sector.

A major challenge to overcome in developing the financial market in the traditional financial model is the cost barrier. The cost of providing financial services for small loans and small remittance services to vulnerable customer groups of financial institutions is relatively high. Credit institutions must realize economies of scale, reduce costs and improve efficiency. This helps to establish a large enough infrastructure system to reduce transaction costs, expand the scope of financial services and improve the transparency of financial services.

Reviewing the credit profiles of small and micro enterprises, as well as individuals with unstable incomes, is time-consuming and labor-intensive, making credit institutions reluctant to engage in risky economic games (Le et al., 2019). Smart Contract is an application of blockchain technology, inheriting the properties of the basic

blockchain. Unlike traditional paper contracts that rely on intermediaries and third parties for execution, smart contracts automate contract procedures, minimize interactions between parties, and contribute to reducing administrative costs compared to traditional financial models (Wang et al., 2020).

Finding and exploiting all applications of blockchain technology is a long-term work in the future. This study attempts to outline some popular blockchain technology applications in the world today, including crowdfunding, cross-border money transfer, distributed payment services, peer-to-peer lending, and supply chain finance. Through that, it provides objective and suggestive comments on the application trends of blockchain technology in the finance and banking sector in Vietnam in the future.

The next part of the study will present the concepts and operating principles of blockchain technology. Section 3 will detail the research methodology used. The research results will be discussed in detail in Section 4. Finally, Section 5 will summarize the research results and propose directions for further research development.

2. OVERVIEW OF BLOCK CHAIN TECHNOLOGY

2.1. Basic concepts of blockchain technology

Blockchain technology is a practical application of the distributed ledger framework and can be described as a continuously updated database in which all transactions are recorded and stored in a decentralized manner (Pinna & Ruttenberg, 2016). A distributed ledger is a digital record or database that is synchronized and shared across a network of websites. Most importantly, the distributed ledger is completely decentralized and built in a similar fashion to a peer-to-peer network. The first original model of blockchain technology was designed by Japanese computer scientist Satoshi Nakamoto.

Basically, each block contains the main information about Data, Hash, Hash of previous block. The data in each block depends on the type of blockchain technology. Each block has a hash code to identify a block and the data in it. The hash code is unique, any change in the block will change the hash. The hash helps to link the blocks together and form a chain.

When a transaction is initiated, it is broadcast across the network to all nodes, or participating computers, and confirms acceptance of the block by using its hash as input to create the next block. A cryptographic hash represents the process by which participating computers perform computations on each block of data, including verifying and timestamping the transaction. The records in the timestamped block are displayed sequentially in a chain (Deloitte, 2016)

2.2. How blockchain technology works

2.2.1 Asymmetric encryption algorithm

In fact, blockchain technology is always maintained by computers in a peer-to-peer network connected to each other. In the banking system, you only know your transactions and your account balance. But in the blockchain technology system, you can see all the transactions of everyone. The blocks of information are protected by a special encryption method that uses a pair of unique security keys: a private key and a public key.

When you encrypt a transaction request with your Private Key, you create a digital signature that is used by computers on the blockchain network to confirm the sender and authenticity of transactions.

Diffie – Hellman (1976) invented an encryption algorithm that establishes a pair of keys in which one key is used to unlock the private key, and one key is used to unlock the public key. This type of encryption algorithm is called asymmetric encryption algorithm.

The specific operation process of the algorithm in the blockchain network is described for the transaction between A and B as follows. A pair of keys, a public key and a private key is generated through a specific mathematical method, and the public key is broadcast, while the Private key is kept secret. If B wants to send encrypted information to A, B needs to obtain the public key to encrypt the information with the public key and return the public key to A. After receiving it, A uses its private key to decrypt the returned public key to get the encrypted information. In this process, because A's private key is completely secure, even if the public key is stolen by a third party during the key transfer process, the encrypted information is still safe.

2.2.2. Peer-to-peer network system (P2P Network)

A peer-to-peer network transmits information through nodes, or computers, without the need for a central server. Nodes act not only as clients to retrieve information from the blockchain network, but also as servers to provide data. All computers in a peer-to-peer network are connected to each other, and any computer can publish transmitted data information to any other computer (Parameswaran et al., 2001).

2.2.3. Consensus mechanism

Consensus mechanism can be understood as the way that every administrator of the blockchain system can agree that a transaction took place in the system, and the administrator will be responsible for confirming that no changes or forgeries have occurred.

Proof of Work (PoW) algorithm: The mechanism of PoW is to slow down the process of forming new blocks. With the PoW mechanism, tampering seems impossible, because when changing the data of a block, the tamper will have to recalculate the entire proof of work of the following blocks. We can imagine how much time it will take if hundreds or thousands of blocks must be recalculated.

Proof of Stake (PoS) algorithm: the creator of a new block is randomly selected based on the value of their stake. This person is responsible for confirming the validity of new blocks. To become a validator, this person must deposit a certain amount of money. When a block is successfully confirmed, the validator will receive a reward in the form of the fees associated with the corresponding transactions in that block. If this person does not want to continue being a validator, after a certain period to verify that this person has not made any fake confirmations, the stake and money earned will be returned.

3. RESEARCH METHODS

The article uses qualitative research methods, including synthesis and comparison to clarify the basic concepts, operating principles and applicability of blockchain technology in the field of finance and banking. Through that, the article attempts to outline a panoramic picture of blockchain technology application in the field of finance and banking in the world and orient the development trend in Vietnam.

The data presented in the study is collected from research works of prestigious journals on topics related to blockchain technology. Each application of blockchain technology in the field of finance and banking will be studied in detail such as Crowdfunding by smart contracts; Cross-border money transfer; Decentralized payment services; Peer-to-Peer Credit; and Supply Chain Finance.

In addition, the article also outlines the corresponding traditional activities to show the operational loopholes and potential for developing those blockchain technology applications in the future.

4. RESULTS AND DISCUSSION

4.1. Equity Crowdfunding by Smart Contract

Belleflamme et al. (2014) define Equity Crowdfunding as an open-ended method of raising funds, primarily through a global network, to provide funds in the form of donations or in exchange for rewards or voting rights to support specific projects, usually projects that address social issues and are beneficial to the community. Overall, 60% of all crowdfunding calls fail to receive sufficient funding. One of the reasons for the high failure rate is that there must be enough donors supporting the same project for the project to reach a certain threshold for the project to be realized (Kuppuswamy & Bayus, 2017).

Traditional crowdfunding methods require a third party, a non-profit organization or a government agency, to participate in the crowdfunding process to evaluate the quality of the project to reduce information asymmetry between founders and potential funders and facilitate coordination beyond the funding threshold (Courtney et al., 2017). Therefore, the effectiveness of third-party evaluation has an impact on the crowdfunding environment (Moss et al., 2015).

Blockchain-based crowdfunding primarily supports startups to create their own cryptocurrencies to raise funds and distribute cryptocurrency capital to investors (Ivashchenko et al., 2018). These digital currencies act as Proof-of-Work to support capital for startups or individuals. When a fundraiser initiates crowdfunding to implement a project, he or she can also become an investor and earn equity in cryptocurrency. The smart contract will automatically set up

the crowdfunding project. If a crowdfunding project fails to reach its predetermined goal, funds can be automatically returned to investors without the need for third-party assistance.

The advantage of blockchain technology lies in the fact that a huge amount of information is automatically recorded by program algorithms and stored in each computer on the blockchain network, where information is transparent and falsification becomes difficult, and the cost of use is reduced.

4.2. Cross-Border Remittance

The most reliable and secure method of cross-border money transfer is bank transfer through the Society for Worldwide Interbank Financial Telecommunications (SWIFT). SWIFT members send more than 24 million messages to about 10,000 different organizations every day. According to the process, information about the processing of electricity at banks is private, and the subjects in the chain cannot know the status of the message being processed from the time it is originated until it is completed. The problem of authenticating information between other banks in the chain is very time-consuming and incurs additional costs (Wang et al., 2020).

The increase in remittances each year has also attracted companies from other sectors to enter the sector. A well-known example of a web-based international money transfer platform is PayPal. TransferWise and WorldRemit are the largest online international money transfer service providers.

If blockchain technology is adopted, banks can process transactions directly and track them better using an existing protocol such as SWIFT (Metzger et al., 2019). Based on the principle of distributed ledger, blockchain transactions can allow banks keep track of all transactions openly and transparently. Cross-border money transfers do not need to rely on a network of custodians and regulators like SWIFT. Fintech companies like Bitspark and CoinPip are examples of using blockchain technology to make instant, direct money transfers between parties, and have proven to be cheaper than SWIFT.

4.3. Decentralized Payment Service

Luther & Stein (2020) illustrated the distinction between centralized payment mechanism and distributed payment mechanism. Centralized payment mechanism processes transactions based on the reputation of a third party. Decentralized payment mechanism processes transactions between transaction participants without the involvement of a third party. The distributed payment mechanism is a form of decentralized payment mechanism that relies on a network of users to process transactions on a shared ledger.

When two parties engage in a transaction using a centralized payment mechanism, they rely on some third party to process the transaction. The third-party acts as a central node through which payments and information about those payments must be transmitted. Thus, the two parties to the exchange must place a certain amount of trust in the third party. Each black node corresponds to an individual sending or receiving money. The white node is a centralized clearinghouse. The black connections represent payments sent from an individual node, through the centralized clearinghouse, to another individual node. The transaction activity corresponds to debits and credits to the respective accounts of the third party. Risks that may arise when relying on the reputation of a third party in a transaction include: delays in money transfers, problems with payment documents, the sender's money being blocked, information about the payment being leaked, etc.

Most digital payments today are processed by banks using centralized payment mechanisms. Payments made by debit card, credit card or e-wallet are common examples of centralized payment methods.

While centralized payments are cleared by a few trusted third parties, decentralized payment mechanisms rely on a network of users to debit and credit the respective accounts. Distributed payment mechanisms use a shared ledger and a protocol to update that ledger. Any individual user could update the ledger. However, the updates, and the corresponding transactions, are only recognized as legitimate after confirmation from the network of users.

As before, each black node corresponds to an individual sending or receiving money. The black connections represent payments sent from one node in an individual node to another individual node. However, in the case of decentralized clearing, the payment and information about the payment will pass through all other nodes, as the money is debited and credited by the system on the common ledger.

Decentralized payment mechanisms allow a person to send money without trusting a third party to execute the transaction. However, they require the parties to trust the decentralized payment mechanism, the shared ledger, and the protocol for updating the ledger. Like centralized payment mechanisms, decentralized payment mechanisms do not eliminate the need to trust the trading partner completely. Decentralized payments mean that the transaction

cannot be reversed without the consent of the recipient. Both parties must trust each other to keep the details of the transaction secret.

By establishing a decentralized payment channel, banks can provide their customers with faster and cheaper payment services. Thanks to blockchain technology, the need for third-party verification is reduced and transfer processing times are accelerated compared to traditional centralized payment mechanisms.

4.4. Peer to Peer lending service

Peer-to-peer (P2P) lending is an alternative to traditional bank credit. Traditional P2P platforms use an online global network to match borrowers' financial needs (amount, term, interest rate on the cost of capital they are willing to bear) with lenders without going through financial intermediaries. If both parties reach a loan transaction, they will pay a portion of the fee to the P2P platform.

The P2P platform is not a product provider and therefore is not responsible for establishing financial products. The P2P platform acts as an information intermediary, not a credit intermediary, for capital demand relationships. Traditional P2P platforms still have a third party, a custodian, to ensure the safety of funds and control the risk of borrower financing.

When using blockchain technologies to serve P2P lending business, blockchain technology still only plays the role of information platform without participating in transactions.

When starting a financial transaction, the borrower and the lender download the blockchain technology application and connect their computers to this network. The borrower requests funding with the funding amount, term, interest rate, and digital collateral and other information related to the verification items for the counterparty to accept. The lender calls up the borrower's credit history in the blockchain technology platform and decides to lend through P2P. The contract signing creates a smart contract in which transactions are completed automatically through the smart contract in real time, without the involvement of a third party, such as a credit information center or a custodian. The transaction records of each node can be queried and are linked to the network nodes. The real identity information is hidden behind the network nodes to protect privacy.

4.5. Supply Chain Finance

Supply Chain Finance (SCF) is a set of financial solutions that aim to optimize the management of working capital associated with supply chain processes and transactions. It is essentially a collaborative approach between buyers, manufacturers, suppliers, and financial institutions to improve efficiency, reduce risk, and increase liquidity in the supply chain. Effective supply chain finance allows buyers to optimize their working capital by extending payment terms. Suppliers can access capital earlier, improving operating cash flow. Supply chain finance also helps minimize the risk of supply chain disruptions due to supplier defaults. This also reduces the reliance on traditional trade credit and bank loans. (Nguema et al., 2021).

In traditional trade finance systems, all participating parties maintain their own databases of transaction-related documents. And all these databases must be continuously reconciled with each other. In the entire supply chain finance system, there will be obvious disadvantages such as the involvement of multiple counterparties, the existence of asymmetric information, and imperfect credit mechanisms.

Many management systems allow you to conduct supply chain finance operations online, but this process is time-consuming. Blockchain-based business trends will simplify the transaction process by eliminating these manual and time-consuming processes.

Applying blockchain technology in supply chain finance is the use of technical means to link participating components and organizations together. Sales, deposits, loans, purchase guarantees and other financial activities in the business and financing process are integrated into a complete transaction. Transaction records can be tracked from start to finish, can be verified, and are convenient for inspection and supervision.

This is the core problem that can be solved by distributed ledgers. Everyone can read and write transaction data in a supply chain financial link. The financial information and value of the supply chain carried by the shared ledger can be freely branched and merged for circulation and transmission.

5. CONCLUSION

Finance and banking are businesses based on trust, but there is no trust because there is always an intermediary to a third party, and unforeseen risks that arise during the contract process. Blockchain technology contributes to

solving this problem because everything is done based on the principles of transparency, consensus and automation. Blockchain technology is formed and operates at its core based on increasing the trust of participating entities and minimizing costs when there is a third party involved.

This study has summarized and generalized the basic concepts and operating principles of blockchain technology. At the same time, the study also shows the obstacles of traditional technology and suggests the possibility of applying blockchain technology in Vietnam in the future.

Current applications of blockchain technology in the financial and banking sector have been discussed, including Equity Crowdfunding by Smart Contract; Cross-Border Remittance; Decentralized Payment Service; Peer to Peer Lending; and Supply Chain Finance. The research results have provided a comprehensive view of the future and application environment of blockchain technology. However, the research results also have certain limitations. The development potential of blockchain technology is much greater than what is mentioned in this study. The basic operating principles and benefits of blockchain technology have been specified and compared to solve the problems of traditional applications. Furthermore, the limitation of third-party participation also poses significant challenges to the legal system in inspecting, monitoring and managing the activities of the participating parties. These limitations need to be further studied and discussed in future research work.

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