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BLOCKCHAIN TECHNOLOGY IN FINANCIAL INDUSTRY: TRANSFORMING THE LANDSCAPE

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ABSTRACT

Blockchain has recently become a widely used information system technology because of its effectiveness as an intermediary-free platform. While the use of blockchain in various fields, such as finance, supply chains, healthcare, education, and energy consumption, is increasingly enabling the development of Internet-enabled "distributed databases," few exploratory studies are available to understand how the field is progressing. Therefore, it is imperative to explore the review of blockchain technology in the finance industry, particularly highlighting the concept, the characteristics and types of blockchain technology, and opportunities and challenges in implementation; hence, blockchain is indispensable in financial industries.

KEYWORDS

Blockchain technology, financial industry, bitcoin, internet, banking

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INTRODUCTION

Blockchain technology, a new technique that emerged in recent years, has been a widespread concern from all sectors of society, especially financial institutions and high-technology corporations (Swan, 2015). Blockchain technology was first invented by Satoshi Nakamoto in 2008, who tried to design a decentralised electronic cash transaction system to solve the double payment problem and improve the security of information verification (Underwood, 2016). For this reason, blockchain technology is quickly used in the financial field. At the same time, the advantages of blockchain technology, such as deconcentration, openness, autonomy, tamper-resistant information and anonymity, can reduce the operation cost of commercial banks and

improve the efficiency of capital utilisation to some extent (Huumo *et al*., 2016 Binghui & Tingting, 2019).

Over time, the progressive advancement of cutting-edge digital technology has made a significant contribution to the growth in the number of service options that are currently available. Since conventional business practices are rendered outdated by digitisation, new competitors have been able to enter the market (Feyen *et al*., 2021). The Organization for Economic Cooperation and Development (OECD) published a report not too long ago that investigates the impact that several emerging innovative data-oriented technologies, such as Big Data, the Internet of Things, Artificial Intelligence, and others, will have on various operations and services in the financial sector such as payment transactions, financial investments, lending and others (Casino, Dasaklis & Patsakis, 2019).

Blockchain technology is the only new technology to significantly impact financial sector operations and services, which underpins cryptocurrencies like Bitcoin. According to Ceremeno (2016), blockchain technology is the new revolution in banking and finance and should be widely adopted. Although blockchain technology was first designed to facilitate the creation of cryptocurrencies, its current potential applications go well beyond this. The distributed ledger technology known as blockchain paves the way for secure and intermediary-free digital currency, assets, and information transfers (Swan, 2019). From international payments and cryptocurrencies (Ilk *et al*., 2021) to supply chain finance and insurance, blockchain has emerged as a new research frontier in the financial industry and academia (Gomber *et al*., 2018; Goldstein *et al*., 2019). Since there are no middlemen and no counterparty risk, the decentralised structure of blockchain technology has significant implications for institutional economics, according to Davidson et al. (2016).

The blockchain technology has the potential to be used in the future to develop operational tools and to develop new services. Financial institutions like banks are eager to incorporate cutting-edge fintech technologies like blockchain to remain competitive in the growing fierce competition within the global financial sector. Vovchenko *et al*. (2017) observed that many commercial banks worldwide are turning to blockchain technology to gain competitive advantages in financial contracts by dropping the costs of economic agent interaction, offering data transparency, and controlling and minimising financial transaction costs. Crosby *et al*. (2016) observed Blockchain

applications in stock markets and organisations like American Express in their transaction systems (Amrinder *et al*., 2023). This paper explores the impact and challenges of implementing blockchain in the financial industry.

Blockchain Characteristics

First, blockchain technology, which is a decentralised information system, depends in its mechanism of action on decentralisation in data storage, auditing, processing and transmission. This technology allows all parties to enter information after verifying its validity. This chain is connected, and all its links cannot be excluded, as each unit or block contains base data, numeric sequence and timestamp (AlSafri, 2019). Second, blockchain technology, which is also a direct peer-to-peer value exchange system, adopts the idea of smart contracts, which are computerised protocols for transactions that can be verified automatically instead of traditional methods and without the need for an intermediary such as banks (Bayram, 2018). Smart contracts aim to provide information security that is superior to traditional contracts and reduce the costs of coordination and execution transactions, as they can be used in multiple areas bad for simple economic transactions such as sending money from X - Y or registering any property such as land records, intellectual property, or intelligent asset control management (Sabir & Yasmeen, 2021).

Types of Blockchain

Businesses need to understand the different types of blockchain before implementing it. The differences can be significant, and businesses should adopt the most suitable system for their business model. (Thompson 2016.) The three main types of blockchain are discussed below:

A public blockchain

This is a fully decentralised blockchain that anyone with a minimum resource can use. The main purpose of a public blockchain is to remove the intermediaries and facilitate peer-to-peer transactions. The typical examples of public blockchains are Bitcoin, Ethereum, and other cryptocurrencies, which are openly available to anyone. The network verifies each transaction before it is recorded, so they are highly secured. A public blockchain is expensive and slow compared to a private blockchain, but it still outperforms the current systems used for recording. (Thompson 2016.

A Private blockchain

This is a permission-based type, meaning that participants need permission from central authority (to some level) to perform the task. It is not entirely decentralised and is controlled by the intermediary. The authority verifies each transaction before it is recorded. A private blockchain is faster and cheaper compared to a public blockchain. It is mostly suitable for corporate business and governance models. It has enormous potential to increase the efficiency and decrease the operation costs. The use case of private blockchain can be an online voting system. (Thompson 2016.)

Consortium blockchain

A subcategory of private blockchain is consortium blockchain, which has the same characteristics as private blockchain, except that a group of entities owns it (Dragonchain, 2019). As the name suggests, a hybrid blockchain combines private and public blockchain. It provides a decentralised environment in a private network. It offers excellent flexibility and control over the data. It is mostly suitable for highly regulated companies. XinFin is an example of a hybrid blockchain built by combining Ethereum (public) and Quorum (private). It provides global trade, finance, and supply chain solutions (Freuden, 2018; Sabir & Yasmeen, 2021).

Blockchain Technology

Blockchain technology is described as a revolutionary technology or a genius technology. Blockchain is a particular type of database, different from previous databases, as it relies on a decentralised system to store, process and save data. Indeed, this technology's primary task is to eliminate the existing mediation model through previous databases. Blockchain technology became famous with the emergence of virtual currencies, such as Bitcoin, which is simply an open record of information which can be used to record and track transactions through a peer-to-peer system to ensure the transparency and reliability of the record through collective control of all parties participating in the process, without requiring a central authority (Clark, 2018).

Blockchain is a term that means: "blockchain", "chain of trust", or "chained data." the reason for such a name is due to its mechanism of work and the method of recording and saving transactions; it records every transaction that takes place within the network in a block. The blocks

are connected to form a chain of blocks that is difficult to penetrate and manipulate (Alrahili & Aldahawi, 2020).

Blockchain technology is defined as a long chain of encrypted data distributed to millions of computers and people around the world, allowing all parties to enter information after verifying its authenticity and each "block" of this chain containing base data, numeric sequence, timestamp, encryption key using (hash function) and encryption key for the previous unit in the chain (Adnan & Al-Marhabi, 2018). It is also defined as a distributed and open digital record that allows transferring ownership of assets from one party to another simultaneously (in real-time) without needing a third party, ensuring maximum security. They are multiple global ledgers, shared by all people worldwide, that enable them to do all kinds of transactions in real-time without falling prey to fraud or manipulation. Besides, they are known to be the most significant data databases that anyone can access, verify, and securely exchange.

Furthermore, blockchain is also defined as a distributed database of records or a general ledger of all digital transactions or events that are executed and shared between the participating parties so that each transaction is verified separately by the consensus of the majority of participants in the system. Once the information is entered into the database, it becomes indelible (Crosby, 2015). Some studies define blockchain as a database collecting data that relies mainly on the encryption mechanism (Cryptography) to build a decentralised electronic ledger record of such data, distributed in a spread that is not adjustable or tampered, characterised by transparency, speed and ease in conducting operations. It also provides the possibility for the parties involved in its construction to validate the data entered in it in an autonomous manner (Sarmah, 2018).

It is also known as a distributed database that can manage a constantly growing list of records called (blocks) so that each block contains the timestamp, with a link to a previous block, so that a series of interconnected blocks is formed. The goal of creating this chain is to make this data available for all users while maintaining their security without the ability to modify those blocks (Ashraf *et al*., 2018). Based on these definitions, the following three main results are highlighted as follows: Technically, blockchain technology is a modern information network that relies on the participation of all parties in its preservation, storage and exchange without the intervention of a third "intermediary" party, which gives this technology an additional value that

makes it more secure and private than previous technologies and makes hacking this technology impossible.

Functionally, it is clear from these definitions that Blockchain technology is an exchange network that performs a dual function. The role of the blockchain is not limited to transmitting data and information only; this technology can also exchange value and assets. Legally, according to the previous definitions, it is clear that this technology can verify the validity of data and ensure the integrity of transactions. This means there is no need for a third "intermediary" to transfer data or exchange value, which is the role that all parties involved in this technology take care of (Sabir & Yasmeen, 2021).

The traditional ways of recording transactions are centralised, inefficient, expensive, and redundant, which is where blockchain comes into use. One famous example of Blockchain is Bitcoin, a decentralised peer-to-peer digital currency. Blockchain is the technology behind Bitcoin. Blockchain provides the foundation and means for recording Bitcoin transactions, which can be used to record anything (Gupta, 2018). Blockchain technology provides such trust through asymmetric cryptography and consensus processes (Kaur et al., 2021). Asymmetric cryptography is employed to build them to verify their authenticity. In this case, private and public keys are often used to create a one-way link between them.

To achieve this, the sender uses her private key and any other key to encrypt her transaction. The sender's public key may be used to decrypt the transaction, allowing anybody on the network to confirm that it came from the sender. Ultimately, the purpose is to secure the transaction's legitimacy and integrity, allowing the sender to be identified at any moment and preventing the transaction from being tampered with (Rutland, 2018). Khan *et al*. (2021) illustrated the substantial part of consensus knowledge in managing the next node to send its block to the blockchain. Nodes that collect the new transactions are reviewed and packed in order to be able to add the following block to the current chain (the so-called miners), and a payment is provided so that a sufficient number of nodes participate in this stage. Only blocks contain genuine transactions that do not conflict with themselves, or the rest of the blockchain should be created by knots. Yaga *et al*. (2018) noticed that no transactions using the same asset should be included more than once should be included.

The Bitcoin network depends on the most famous proof of work consensus process, which is the most widely used. Sobti & Geetha (20 2) noted that Bitcoin's Blockchain (256 bits) apply a hash function to encapsulate a vast quantity of data into a small amount (the hash value) of fixed size. The number of leading zeros in a hash value on the Bitcoin blockchain now defines a maximum value. This is achieved by adding a time being to a chunk of information. A process of trial and error is now being used to adjust the hash value until the requirements are met. The hash rate measures how many tries are made to discover a valid solution per unit of time (Rutland, 2018).

Finally, all other nodes may check that the work has been completed. It is as simple as entering the block with the nonce into the hash function and checking whether the hash value fits the specifications (Zheng *et al*., 2017). The blockchain is made up of a series of blocks, each of which contains the hash value of the prior block. Any attempt to tamper with the blockchain would result in a new hash value for that block, affecting subsequent blocks (Marbouh *et al*., 2020), (Amrinder *et al*., 2023).

Blockchain in the Financial Industry

In the financial sector, interest in blockchain has grown. Blockchain technology in finance to conduct money transfers, cross-border payments, identity confirmation, contractual agreements, trade, finance, insurance, smart contracts, auctions, and currency trading has led to its exponential growth. Western countries, for example, the USA, Australia, Canada, South Korea, Russia, and Israel) have been encouraged to invest in blockchain-oriented application development (Zhang et al, 2020). The three main blockchain applications in finance that have been identified include cryptocurrencies and their trading platforms, digital asset registers and management, and cross-border payments. According to Deloitte (2019), blockchain applications can transform finance processes: "intercompany transactions, procure to pay, order to cash, rebates, warranties, and trade financing." Trust is the primary factor in financial transactions that contributes to the success of a financial institution and the effective use of an application (Deloitte, 2019).

Blockchain establishes trust, instructs the Internet on transferring money or other assets via secured intelligent networks using a cryptographic algorithm, and guarantees that the money is spent only once. The current legal channels used in remittances are banking services, automated

teller machine (ATM) withdrawals abroad, money transfer operators (MTOs), cash transfers (through informal couriers), and carrying cash when returning home (Kasiyanto, 2016; Rashikala *et al*., 2023). Blockchain technology can be used in various functions in the financial sector. Financial sectors, typically banks and financial markets, depend fully on technologies. So, blockchain technology has unlimited prospects to change the whole financial industry. Among the various impacts analysed from the data analysis, the five major impacts related to the financial industry are:

1. Cross-border payments

Banks have played a pivotal role in cross-border payment since establishing monetary transactions. With the rise of tech companies like PayPal and TransferWise, banks have lost significant market share in the payment business. They exceed the BA's speed, cost, flexibility, and transparency performance and significantly threaten a bank's payment service. Banks use the SWIFT (Society for Worldwide Interbank Financial Telecommunications) network to send and receive international payments. SWIFT is a messaging network that allows banks and other financial institutions to send and receive financial information through secured codes (Isaksen, 2018). SWIFT is the most secure and reliable way of making cross-border payments.

However, it is a lengthy and costly process. (Isaksen 2018; Guo & Liang, 2016.) The average transfer time is 1-5 business days, and the average cost is $40- $50 (Transfer-Wise). To solve these problems, banks are testing blockchain technology for faster and better solutions (Isaksen, 2018). Blockchain technology can facilitate banks to make direct international payments economically and efficiently (Isaksen, 2018; Guo & Liang, 2016). First, banks must have blockchain networks to transfer funds directly to another bank's network. All the transactions are recorded in the block and are unchangeable. The ledger will be available to the parties involved; no middleman is required. This way, blockchain technology can reduce the time and cost associated with SWIFT (Isaksen, 2018).

Blockchain technology can help solve current problems in global payments by bringing new solutions. A third party will not be required to make an international payment. Payment records and bookkeeping are self-initiated, which reduces operational costs. The transactions will be performed faster. It will make payment easy and transparent for the customer (Petrov, 2019).

2. Trade finance

Banks play an important role in financing the global flow of goods. World Trade Organization (WTO) estimates that around 80 - 90% of global trade is supported by trade finance. Trade finance is a credit support, and payment guarantee financial intermediaries provide to satisfy the trade transaction. One of the common forms of trade finance is a Letter of Credit. Letter 20 of Credit is a written document produced by the bank on behalf of the buyer promising the seller that the purchase amount will be paid on the due date; if not, banks will be liable to pay the amount.

Like the cross-border payment, drafting a Letter of Credit is complex and lengthy (Gupta & Gupta, 2018). It still involves lots of paperwork and manual inspection, which increases the cost and time. Blockchain technology could help increase efficiency and cut the operation cost with smart contracts. (Gupta & Gupta 2018; Guo & Liang 2016; Collomb & Sok 2016; Petrov 2019.) Blockchain can simplify the extensive process of drafting the Letter of Credit. Once the parties involved in the trade have their blockchain network, the information can be shared on a privately distributed ledger, and the agreement can be done with smart contracts (Gupta & Gupta, 2018). Different concepts have been initiated to solve trade finance problems, such as Skuchain10. Skuchain10 facilitates B2B commerce and its financing by providing intelligent contract solutions and tracking all phases of trade deals, from order and shipment to final payments (Collomb & Sok, 2016).

3. Know your customer

Know your customer (KYC) is another critical use of blockchain in banking. Banks' average time to complete the KYC process is around 26 days (Petrov, 2019). The bank's responsibility and mandatory task is to record the customer's details and verify them before establishing any financial transactions. KYC is governed by a legal framework to avoid money laundering and terrorism financing (ECB, 2018). Customers must submit the details to each bank to open an account. The data are stored in the bank's centralised system and only accessible to them. With blockchain technology, customer data can be stored in a block, and the block can be shared between the banks (Gupta & Gupta, 2018). It increases the efficiency of operations and removes repetitive work (Gupta & Gupta, 2018; Guo & Liang, 2016). The data stored in blocks are immutable, and ensure the information is correct. This way, once the data is stored, it can be used by other banks (Guo & Liang, 2016).

4. Capital markets

Blockchain technology has great potential to transform the capital market trading system. The capital market involves a heavy procedure and often takes a long time to settle the accounts. There are many intermediaries in capital markets, such as banks (mostly investment), brokers, investors, credit agencies and others who actively participate in the market. At present, these participants keep their ledger themselves and make the changes. This process is time- and money-consuming (Gupta & Gupta, 2018). The current problem with the capital market is different clearing and settlement systems. Since there are many parties involved, it has a high counterparty risk. The defaulting in one party can impact the whole market. The procedure could be faster and more efficient (Petrov, 2019).

Blockchain can be used to increase the efficiency of trade and custody securities services. If the participating companies have a shared blockchain platform, the transaction can be performed in real time with greater efficiency and transparency. It can maintain the KYC process and remove the third person. It can also be used in Initial Public Offering (I.P.O). National Association of Securities Dealers Automated Quotations (NASDAQ) has successfully tested a Blockchain named "Linq" to facilitate trading and transparency concerns with regulators and customers (Gupta & Gupta, 2018). The research conducted by Goldman Sachs Investment Bank shows that blockchain can save $ 6 billion yearly in the capital market. The study was done on four instruments only. So, the real saving is expected to be more. Blockchain can change the way of issuing activity, recording the balances, clearing and settlement and reporting using intelligent contracts (Petrov, 2019).

4. Financial reporting and compliance

Blockchain also has the potential to transform financial reporting and compliance. Banks and other financial institutions must perform reporting such as tax reports, audits, and other financial reports regularly. Every bank must submit the reports promptly, and controlling fraud and anti-money laundering activities is essential. Preparing the repo ts regularly based on the regulation consumes time and workforce. A blockchain could automate reporting and save time and money. With blockchain, all the paperwork can be eliminated. The transactions could be recorded and updated automatically. This would ease the work of both banks and the regulation board. The transactions can be monitored, which can help in activities related to anti-money laundering (Petrov, 2019).

Blockchain's ability to record transactions and track their history will facilitate the auditors' and regulators' work. This could help backs automate financial reporting and compliance. Many banks and regulators are testing how to implement Blockchain (Collomb & Sok, 2016), (Roshan, 2020).

Challenges in Implementation

Though the future looks bright for blockchain in financial industries, many challenges are associated with it. Without accessing these challenges, blockchain technology cannot be used in practice. Some of the challenges in implementing blockchain are described below:

Regulation: Regulation is one of the main problems with the blockchain. Since blockchain is based on the concept of decentralisation, how to regulate the blockchain has been a big topic of discussion among regulators. A fully decentralised system is almost impossible to achieve, and there must be authority (to some extent) to control the financial institution (Guo & Liang, 2016). Blockchain does not have any national or international rules. Although governments are looking for a way to control blockchain, its legal aspect still needs clarification (Gupta & Gupta, 2018).

It also raises the question of who will act as an authority during the crisis. Having no authority means no one can act as a shock absorber during a bad period. This can lead to an economic problem. That is why regulators must understand the overall picture before implementing it (Deloitte, 2016). Also, with regular, it is clear how the dispute between two financial institutions will be solved, and thus, it creates a problem for rapid adoption (Petrov, 2019).

6. Security and privacy

Although blockchain technology is considered the most secure technology to date, there are still questions about the security and privacy of data. In public blockchains, the data is accessible to all parties involved, increasing the risk of data misuse. The private blockchain provides a better solution for security and privacy (Gupta & Gupta, 2018). Security and privacy concerns are high among the institutions. The technology should be tested thoroughly before implementation (Guo & Liang, 2016). MIT's (Massachusetts Institute of Technology) technology review reported that around $2 billion of cryptocurrency has been stolen since 2017. More and more security problems are appearing, and the popular exchanges are frequently under attack. To control a network, a

hacker should possess the most mining power, known as the 51% attack rule. Therefore, this can lead to a fatal vulnerability and should be considered beforehand (Orcutt, 2019).

7. Energy consumption

Another problem with blockchain technology is that it uses much energy and leaves a massive carbon footprint (Gupta & Gupta, 2018). A new online tool from the University of Cambridge estimates that Bitcoin uses the same amount of energy as Switzerland. A new online tool from the University of Cambridge estimates that Bitcoin uses the same amount of energy as Switzerland. A study published in the scientific journal Joule estimated that Bitcoin accounts for approximately 22 megatons of Carbon dioxide (CO2) emissions annually (Baraniuk, 2019).

8. Lack of understanding and trust in technology

Though it possesses enormous potential, there needs to be a more proper understanding of what it is and how it works. PeopleNew ideas and investments can be explored without, and organisations need to know blockchain and its significance. This is one of the hurdles to pass before implementing Blockchain (Deloitte, 2016).

9. Cost and efficiency

Blockchain technology has high costs and efficiency problems. The cost and efficiency largely depend upon the type of blockchain used and the participants in the network. The inefficiency problem arises because all the nodes in a network have to perform the validation of each transaction. As the nodes increase, the security increases, but transaction speed decreases (Guo & Liang, 2016). The total cost for recording the transaction in Bitcoin is estimated to be more than $600 million a year and rising based on users. So, companies should properly evaluate the costs before implementing the technology (Deloitte, 2016; Roshan, 2020).

CONCLUSION

Blockchain technology seems promising to solve the inefficiency problems of the financial sector by removing third parties, increasing efficiency, and decreasing cost. The main promising areas blockchain will impact are cross-border payment, trade finance, knowing your customer, capital market, and regulation and compliance. Banks and other financial sectors can perform cross-border transactions faster and more economically with blockchain than with current services such as Swift. The reduction of third parties makes the transaction efficient and transparent to customers.

Trade finance can be done efficiently and economically by drafting agreements with the help of smart contracts.

Moreover, it can also help track trade delivery and reduce risk. Similarly, smart contracts can be used to record, verify, and distribute the identity of customers within the banks in a blockchain network. This will save bans a lot of time and money and help regulation authorities control money laundering and other terrorist activities. In the capital market, trade settlement can be done efficiently and transparently in real time. The data recorded in blocks is immutable and trusted by regulators; thus, blockchain technology has great potential to transform the financial industry.

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