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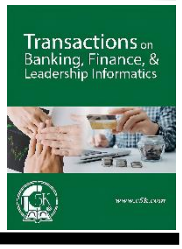

Research Article

Blockchain Based Security Solutions for Banking Information Technology

Syed Nazmul Hasan[1,*], Mst. Khadijatul Kubra Shinfa[2], Oli Ahammed Sarker[3], Md Redwan Hussain[3], Jarin Tias Meraj[3]
[1]*College of Technology & Engineering, Westcliff University, CA 92614, USA*
[2]*Undergraduate Student, Department of Computer Science and Engineering, North Western University, Khulna, Bangladesh*
[3]*Department of Computer Science Engineering, Daffodil International University, Birulia, Savar, Dhaka-1216.*
**Corresponding Author: s.hasan.104@westcliff.edu*

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ABSTRACT

Blockchain technology is a fundamental and essential technology that shows great potential for use in the financial industry. The banking industry in China is currently dealing with the consequences of interest rate liberalization and a decrease in profits due to a reduction in the interest-rate spread. Additionally, it is influenced by economic restructuring, advancements in Internet technology, and financial advancements. Therefore, the banking industry is in need of immediate reform and is actively searching for new opportunities for expansion. Blockchains have the potential to completely overhaul the technology that supports payment clearing and credit information systems in banks, leading to significant upgrades and improvements. Blockchain applications facilitate the development of "multi-center, weakly intermediated" scenarios, hence improving the efficiency of the banking industry. Nevertheless, even if blockchains are characterized by their permissionless and self-governing nature, the challenges of regulating and effectively implementing a decentralized system still need to be addressed. Hence, we suggest the immediate creation of a "regulatory sandbox" and the formulation of industry benchmarks.

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1. Introduction

At the moment, the idea of a blockchain is getting a lot of traction in the FinTech industry. Distributed ledger technology, point-to-point transmission, consensus procedures, and encryption techniques are all part of it. A game-changing invention of the Internet age, it has also been named (Aditto et al., 2023; Kabbo et al., 2023; Sobuz, Khan, et al., 2024). But, considering blockchain's revolutionary data storage and transmission capabilities, it has the potential to radically alter the current economic and financial operating models. This, in turn, might spark a fresh wave of technological advancements and a sea change in the FinTech sector (Javaid et al., 2022).

In recent times, developed nations like the US, UK, and Japan, along with international organizations like the UN and the IMF, have closely monitored the progress of blockchains and investigated their potential uses in different domains (The First Digital Currency Report of the International Monetary Fund (Park & Park, 2017). In addition, some nations have effectively begun studying blockchain technology, including China, Russia, India, and South Africa. Accordingly, PBOC has invested much in studying blockchain's potential uses. The "Chinese Blockchain Technology and Application Development was released on October 18, 2016, by the Ministry of Industry and Information Technology (Singh, 2020). It examines the present state of blockchain technology and makes suggestions for its future development (Guo & Liang, 2016).

Due to its decentralized and permissionless nature, blockchain technology has the potential to significantly alter the financial industry, particularly payment clearing. Many large multinational banks have been planning their blockchain initiatives since 2015 (Shah & Jani, 2018).

A number of large financial institutions have set up blockchain research labs, including Goldman Sachs, J.P. Morgan, and UBS. These labs have produced a number of papers on the subject and work closely with blockchain platforms. In fact, Goldman Sachs has gone so far as to submit a patent for a blockchain-based method of transaction settling (Hasan et al., 2023; Zhang et al., 2020). Furthermore,

*Corresponding author: s.hasan.104@westcliff.edu (Syed Nazmul Hasan)

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other national stock exchanges, like the New York Stock Exchange and the Nasdaq Stock Market, have also undertaken extensive study on blockchain technology. The first securities transaction utilizing the blockchain transaction platform Linq was disclosed by Nasdaq on December 30, 2015. Some such organizations that have increased their focus on blockchain technology include Visa, the Society for Worldwide Interbank Financial Telecommunication, the US Depository Trust & Clearing Corporation, and others (Pulkkis et al., 2018).

A number of blockchain industrial consortiums have evolved to advance blockchain technology and its uses; the most prominent of them is the R3 blockchain consortium. It has united more than 40 of the most prestigious financial institutions in the world, such as Barclays Bank, Bank of America, Morgan Stanley, and Citigroup (Ogiela & Majcher, 2018). With the addition of Ping an Bank and China Merchants Bank (CMB) to the R3 blockchain consortium in related information among leading financial institutions has been further enhanced. As an added bonus, the China Financial Blockchain Consortium was founded by many institutions, including WeBank, Ping An Bank, and CMB Network Technology. Increasing blockchain's efficiency in back-end processing and lowering operating expenses are two areas where the big financial institutions are looking favorably (Yoo, 2017).

The potential use of blockchain technology in the financial sector has also generated a lot of enthusiasm. Half of the executives surveyed by McKinsey in May 2016 think blockchain would have a major influence within three years, and some even think it will happen within 18 months. This is according to the poll, which was performed by McKinsey (Berdik et al., 2021). According to another poll of 200 international banks, 15% of those institutions will have heavily used blockchain technology by the end of the next year. In addition, according to IBM, 66 percent of banks will have a large-scale commercial blockchain implementation within four years.

Therefore, blockchains have started to get more attention and priority from banks (Hammi et al., 2021). For that reason, why is the banking sector now so intent on using blockchain strategies? In what kinds of situations may blockchain technology be useful? When putting blockchain technology into practice, what are the most common issues that arise? The next parts of this article address these issues sequentially.

2. Banking sector with blockchain

The banking sector is anticipated to undergo a significant transformation due to the use of blockchain technology. The banking sector is now encountering several challenges, such as a decrease in profitability and an escalation in risk, and is undergoing a period of transformation and advancement. The rapid growth of Internet finance has presented various issues for the conventional banking industry. Therefore, commercial banks must depend on emerging technologies to expedite the development of new products and services, in order to adjust to changing consumer needs and competitive landscapes (Ghosh, 2019).

2.1 The market share of internet finance

The rapid growth of Internet finance in recent years has expedited the process of marketizing the financial industry. The proliferation of Internet financial products has resulted in a significant diversion of household savings deposits and an increase in banks' cost of borrowing.

Based on the monitoring statistics of national Internet FinTech platforms, as of August 2016, there were a total of 8490 platforms and 618 million active users. According to the most recent statistics from the China Internet Network Information Center, the number of Internet users in China reached 710 million as of June 2016. Therefore, the proportion of individuals using Internet financial services is 87% of the whole number of Internet users in China. Three The rapid and significant achievement of Internet finance may be attributed to four key advantages: infrastructure, platforms, channels, and scenarios. Furthermore, specific information is shown in Table 1.

Internet finance organizations recognize that finance is not a standalone entity, but rather is integrated into many real-life situations. Hence, the most effective approach to broaden the target market is to create platforms on mobile devices and provide applications for diverse situations to capture the customer's attention. Currently, out of the 20 mobile phone companies that are mostly utilized by Chinese customers, Baidu, Alibaba, and Tencent have purchased or invested in 17 of them. BAT4, which refers to apps owned by Baidu, Alibaba, and Tencent, account for around 40% of the total monthly length of mobile phone use. This figure may further climb to 60% if applications funded by Baidu, Alibaba, and Tencent are also taken into consideration.

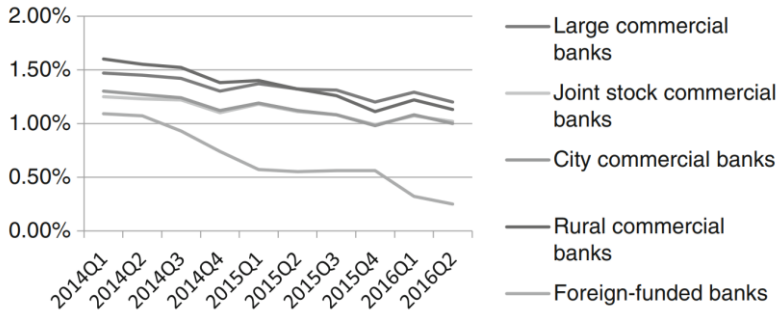

Fig. 1. Commercial banks' Return on Assets (Shah & Jani, 2018).

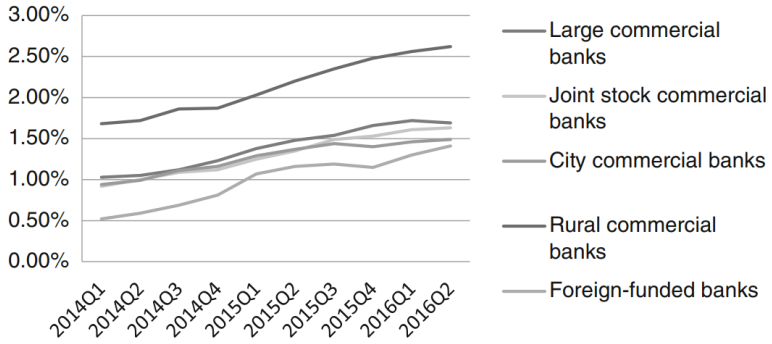

Fig. 2. Commercial banks' non-performing assets (Shah & Jani, 2018)

Fig. 1 shows Commercial banks' Return on Assets and Fig. 2 shows commercial banks' non-performing assets .

2.2. Continual development of new financial strategies and expansion of investment

Recently, there has been a significant growth in the financial markets, accompanied by an expansion in product options and ongoing financial advancements. The scope of capital markets include derivatives, asset securitization, as well as P2P lending, crowdfunding, and other related activities.

In 2015, the Central Depository & Clearing Co. Ltd. Reported that the total value of asset securitization products issued countrywide was RMB 603.24 billion, representing an increase of 84%. The market stock of these products was RMB 770.395 billion, reflecting a growth of 129%.6 The asset securitization industry is expected to reach a trillion RMBs in 2016.

The crowdfunding business has also attained outstanding outcomes. Based on inadequate data, by the end of 2015, there were 283 crowdfunding platforms that were functioning properly. In 2015, the national crowdfunding business raised a total of RMB 11.424 billion. For the first time ever, the total amount reached over RMB 10 billion this year, showing a significant growth of 429.38% compared to 2014.7 In addition, the Securities Regulatory Commission has indicated that it will conduct an equity crowdfunding trial this year.

Financial innovations may provide capital market players, particularly small and medium-sized firms (SMEs), with more choices, hence offering more convenient and tailored services. This generates substantial rivalry inside the conventional banking sector.

Table 1. The four key pillars of internet finance (Zhang et al., 2020).

Infrastructure	Payment system (medium): Alipay, WeChat Pay, Tenpay Credit system: Sesame Credit Underlying asset matching platform: Renrendai
Platform	Service integration: Encompasses payment, financial management, fee payment, and other services Navigation: Helping customers to find the required applications Personalization: Providing services based on the personal characteristics of the customers Social interaction: WeChat, Alipay Living
Channel	Multi-channel integration: Banking Transformation Toolkit (BTT) by IBM
Scenario	Application scenario and product: WeChat Red Envelope, Alipay School Life

2.3. Bank financial systems for information

The inefficiency of bank credit information systems primarily stems from three factors. Firstly, there is a lack of sufficient and high-quality data, making it challenging to assess personal credit situations. Secondly, there are obstacles in sharing data between different institutions. Lastly, the ownership of user data is unclear, resulting in concerns about privacy and security, which hinder its circulation. While resolving these difficulties necessitates collaboration and involvement from many stakeholders, blockchain technology may provide aid in tackling these concerns.

2.3.1. Determining ownership of data

Each person generates substantial quantities of data on the Internet, which has significant value as evidence of their credit status. However, this data are now being controlled exclusively by major Internet corporations. Consequently, people are unable to assert their ownership or make use of this data. Furthermore, to safeguard user privacy, establishing data flow between these organizations is challenging, resulting in the creation of isolated data repositories known as data islands.

Blockchain technology enables data encryption, allowing individuals to maintain control over their own extensive data

and establish ownership. This will ensure that the information is authentic and trustworthy, while also decreasing the expenses associated with data collecting by credit agencies.

By using blockchain technology, massive data may be transformed into credit resources that have transparent individual ownership, and might potentially serve as the basis for future credit systems.

2.3.2. Advocating for the exchange of information

Blockchain technology enables the automated documentation of large amounts of data by credit agencies, while also securely storing and exchanging encrypted versions of the customer's credit information across other organizations.

This facilitates the exchange of credit data. A proposed approach for blockchain credit involves banks storing client information in their own database during the "know your customer" (KYC) procedure. Subsequently, encryption technology is used to upload a condensed version of the information onto the blockchain for storage. When query requests are received, the blockchain may be used to notify the original data supplier and initiate a query. Encryption technology can guarantee the integrity of both the summary and original material, so preventing the dissemination of misleading information that may deceive its recipients.

Peers. Under client information protection standards, the blockchain may automate the encryption and transfer of consumer data. Data pertaining to information and transactions. This aids in the elimination of duplicative efforts associated with Know Your Customer (KYC) processes across banks.

3. Challenges in using blockchain in financial sector

Complete decentralization is the fundamental need for true disintermediation. Decentralization does occur in some models when viewed just from a technological standpoint. For instance, in the case of Bitcoin and other digital currencies, its total decentralization allows them to carry out activities without any middlemen. Nevertheless, several real-world situations need a certain level of centralization, particularly when implemented in the financial industry. Therefore, it is necessary to transition from a technological viewpoint to a regulatory one. Attaining genuine decentralization is an exceedingly arduous task and may perhaps be unattainable; hence, achieving actual disintermediation is not conceivable.

Hence, it is important to carefully address this aspect when utilizing blockchain technology (Sobuz, Joy, et al., 2024). To address practical requirements, it is possible to create more centralized consortiums and private blockchains based on fully decentralized public blockchains. Table 2 presents a comparative analysis of several sorts of blockchains.

R3 is a multi-centralized consortium blockchain formed by a collaboration of several banks and financial organizations, making it the biggest of its kind in the world. Presently, this model stands as the most auspicious prospect in the banking sector.

While blockchains do possess a technical edge over banks in terms of serving as credit intermediates, it is now premature for this technology to entirely upend the established financial system.

According to Yoo (2017), it is probable that a paradigm characterized by several centers and poor intermediation would arise. Banks use blockchain technology in order to enhance their payment clearing systems and solve specific challenges in information transmission. Additionally, they establish consortiums to strengthen their position.

The issue of efficiency in blockchains will need a two-part discussion. Technology and the level of centralization have an impact on the effectiveness of individual transactions. Since transaction and clearing happen at the same time, every transaction must be authenticated by all nodes in the network, which negatively impacts its performance. This effect will be more noticeable as the number of nodes in the blockchain grows. Conversely, the reduction in the efficiency of individual transactions would enhance transaction security. Furthermore, the occurrence of transactions and clearing at the same time would resolve the issues associated with eventual reconciliation. Overall, this undeniably enhances the overall efficiency of institutions.

Table 2. Blockchain types for financing (Zhang et al., 2020).

	Public blockchains	Consortium blockchains	Private blockchains
Degree of centralization	Decentralized	Multi-centralized	Decentralized
Participants	Anyone can freely participate and leave	Specific group of people who agree to enter an alliance	Central controller decides members that can participate
Credit mechanism	Proof of work	Collective endorsement	Self-endorsement
Bookkeeper	All participants	Participants decide in negotiation	Self-determined
Incentive mechanism	Needed	Optional	Not needed
Prominent advantage	Self-established credit	Efficiency and cost optimization	Transparency and traceability
Typical application scenario	Bitcoin	Clearing	Audits
Load capacity	3–20 times/second	1000–10000 times/second	-

The decentralization of Bitcoin has a significant impact on its transaction speed. Consortium blockchains, which are more suited for the banking sector, have a lesser amount of decentralization, resulting in just a little decrease in speed. Recent experiments have shown that cross-border transactions may be completed in under 10 seconds.

4. Conclusions

Banks' payment clearing and credit systems for information might undergo a radical upgrade and transformation if blockchain technology were to radically alter their underlying technology. In addition to improving banking sector efficiency, blockchain applications encourage the emergence of "multi-center, weakly intermediated" situations.

Note that with every major financial invention, there has been heated controversy about issues of regulation, efficiency, and security. Nevertheless, the present challenges do not halt the course of history, as blockchain technology's technological, regulatory, and other issues will be overcome in due time. So, it's safe to say that the financial sector will certainly include blockchain technology soon.

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