

Prospects for the Application of Blockchain Technology in the Financial Sector and Regulatory Challenges

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Abstract: This paper discusses the application prospects and regulatory challenges of blockchain technology in the financial field. It describes the advantages of blockchain technology's application in supply chain finance, trade finance, cross-border payment, securities trading and insurance, including promoting the flow of funds, reducing financial risks and improving transaction efficiency. At the same time, it points out the regulatory challenges it faces, such as the unclear domestic regulatory framework, the lack of universal rules for the technology, the contradiction between the protection of customer privacy and the application of data, and the "two-sidedness" of the application by commercial banks. Finally, it is proposed that joint efforts should be made at the levels of policy regulation, industry organisations and practitioners to achieve the safe, stable and sustainable development of blockchain technology in the financial sector.

Keywords: Blockchain technology, Financial sector, Application prospects, Regulatory challenges.

1. Introduction

Blockchain technology, as an emerging distributed ledger technology with features such as decentralisation, non-tampering, security and transparency, has attracted a lot of attention in the financial field in recent years. The report released by China Internet Finance Association shows that the applicable scenarios and application logic of blockchain technology in the financial field have gradually become clear, the exploration of related applications has continued to deepen, and practice cases have become increasingly abundant.

The application of this technology in the financial field is mainly characterised by three aspects: firstly, there are many application explorations, which are closely combined with business needs and involve many fields such as supply chain finance, trade finance, insurance technology, cross-border payment, asset securitisation, etc.; secondly, there is a diversity of participating subjects, including fintech service providers, banks, fund companies, insurance companies and other types; thirdly, the underlying technological research and development has been strengthened, and information security and performance innovation has received widespread attention, and some platforms have achieved transaction processing speeds of 10,000 per second.

However, the integration and development of blockchain and finance is still in the primary stage, facing challenges in terms of technological maturity, degree of independent innovation, degree of scenario fit and degree of completeness of institutional rules [1]. In order to realise the reliable, controllable and trustworthy application of blockchain technology in the financial field, and to promote its deep integration with finance, the financial industry needs to do a solid job of all the groundwork. This will help promote the wide application of blockchain technology in the financial sector and bring more innovation and development opportunities to the financial industry.

2. Application of Blockchain Technology in The Financial Field

2.1. Supply Chain Finance

(1) Pain points of traditional supply chain finance

In traditional supply chain finance, upstream and downstream small and medium-sized enterprises (SMEs) often face problems such as weak capital and long billing periods. This makes enterprises in the operation process of capital pressure, difficult to meet the needs of daily production and business expansion. At the same time, banks and other financial institutions in the traditional supply chain finance model, it is difficult to fully grasp the financial situation of enterprises and risk information. Due to the asymmetry of information, banks need to invest a lot of manpower and time in investigation and audit, which increases the operating costs [2]. Moreover, this uncertainty also leads banks to be more cautious in providing financing, making it difficult for SMEs to raise funds.

(2) Application advantages of blockchain technology

Through the establishment of a distributed ledger, transaction information in the supply chain is recorded in real time and cannot be tampered with, and the credit of the core enterprise can be more effectively transmitted to upstream and downstream SMEs. This provides SMEs with more financing opportunities and facilitates the flow of capital through the supply chain.

The blockchain's immutability and transparency ensure the authenticity and reliability of the credit of the core enterprise. Financial institutions can have a clear understanding of the transactional relationships between core enterprises and upstream and downstream enterprises through the blockchain platform, thus reducing the difficulty of risk assessment for SMEs and improving the feasibility of financing.

The application of smart contracts can automatically execute the terms of the contract, and when the preset conditions are met, the funds are automatically released or the transaction is automatically completed, reducing the possibility of human intervention and operational errors [3]. Meanwhile, blockchain's encryption technology and

distributed storage ensure data security and reduce the risk of data tampering or leakage.

All participants can view and share transaction information on the blockchain platform, and banks are able to have a more comprehensive grasp of an enterprise's operations, financial condition and credit level, so as to make more accurate risk assessments and financing decisions. In addition, blockchain technology can also enhance the ability of industry chain cooperation. Through real-time information sharing and transparency, enterprises in the supply chain can better collaborate, optimise production processes and improve overall efficiency.



Figure 1. Supply Chain Finance

2.2. Trade Finance

(1) Disadvantages of traditional trade finance

Traditional trade financing has many disadvantages, the verification process is cumbersome, involving a large number of document review and data verification work, consuming a lot of time and human resources; low rate, due to the complexity of the verification process, resulting in the whole process of trade financing is time-consuming, affecting the speed of the enterprise's capital turnover; information is not open, the parties in the trade financing is difficult to fully grasp the transaction information, prone to information asymmetric problems. Increased financing risks.

(2) Blockchain technology solutions

Blockchain technology provides a brand new solution for trade financing, and blockchain can cover all parties in trade financing and achieve data interoperability. By establishing a distributed ledger, all parties can share transaction information in real time, reducing information asymmetry and improving financing efficiency. Blockchain can simplify the flow of documents [4]. In traditional trade financing, the transmission and review of documents takes a lot of time, while blockchain technology can digitise the documents to achieve automated circulation and verification, greatly reducing the processing time of documents. In addition, banks can more easily identify the authenticity of data through blockchain technology. The non-tamperability of blockchain ensures the authenticity of transaction data, and banks can more accurately assess the credit status and risk level of enterprises and prevent financing fraud.

2.3. Cross-border Payments

Traditional cross-border payments face challenges such as lengthy processes, high fees and complex interfaces. Synchronisation of local database reconciliations reduces transaction efficiency, while large reserves and payment information processing costs increase the burden of cross-border payments.

Blockchain technology brings innovation to cross-border payments, establishing a decentralised transaction system, reducing settlement costs and enhancing transaction security. Instant confirmation enables near real-time settlement of

funds, such as the Ripple protocol, which takes only 5 seconds to clear payments, much faster than the 2 days for traditional SWIFT or 24 hours for intra-bank transfers. Blockchain removes the middleman and complex settlement networks, leaving banks with a single reserve account, saving costs and reducing processing and reconciliation fees [5]. Transactions are publicly visible, enhancing transparency and traceability, and facilitating regulatory compliance. The Ripple protocol supports anonymous transactions, protecting the privacy of traders, enabling free, real-time payments with low risk of rejection, and support for multiple currencies, enabling banks to transfer funds directly and settle them instantly.

The Central Bank Digital Currency Bridge Project is also a successful application of blockchain technology, creating a cross-border payment solution centred on the Central Bank Digital Currency, following the principles of "no loss", "compliance" and "interoperability". Following the principles of "non-destructive", "compliance" and "interoperability", it significantly improves transaction efficiency and reduces costs by at least 50 per cent, demonstrating the huge potential of blockchain in the field of cross-border payments.



Figure 2. Cross-border payments

3. Prospects for the Application of Blockchain Technology in The Financial Field

3.1. Improvement of the Payment Clearing System

The application of blockchain technology in payment clearing systems has significant advantages. Traditional payment clearing systems often involve multiple intermediaries, and the process is cumbersome, time-consuming and costly. The blockchain-based payment clearing system is able to realise direct point-to-point transactions, removing intermediate links, greatly improving payment efficiency and reducing costs.

For example, the Ripple (Ripple) network is a distributed ledger network that integrates information transmission and fund clearing into a flat network, which is mainly used in cross-border payment and settlement scenarios. It removes the intermediaries in the original cross-border payment and settlement model through the formation of consensus by many network nodes, and uses the blockchain network to conduct direct peer-to-peer transactions, which achieves instantaneous clearing and low cost.

The Monetary Authority of Singapore's Ubin project is also a successful attempt to use blockchain technology in payment clearing. The project has gone through several stages of development, exploring the use of distributed ledger technology for inter-bank payments, transfers and cross-

border settlements, providing new ideas and solutions for innovation in payment clearing systems.

The application of blockchain technology in payment clearing systems not only improves payment efficiency and reduces costs, but also enhances the security and transparency of transactions. Due to the immutability and traceability of the blockchain, every transaction is recorded on the blockchain and cannot be tampered with by anyone, which greatly reduces the probability of fraud and risk. At the same time, all transactions are publicly visible on the blockchain, which enhances the transparency of transactions and helps with regulation and compliance.

3.2. Optimising Securities Trading

In the area of securities trading, blockchain technology offers significant advantages in streamlining processes, increasing transparency and security, and automating transactions.

While traditional securities transactions require the use of intermediaries for transaction verification, payment and other intermediate links, blockchain technology can record transactions directly and securely on the blockchain, removing unnecessary intermediary links and ensuring transparency and certainty of transactions [6]. All participants can view transaction information on the blockchain, realising open sharing of information and reducing information asymmetry.

Traditional securities trading involves multiple intermediaries and suffers from high time and transaction costs. Blockchain technology, on the other hand, can reduce transaction costs through de-intermediation and automation. For example, the issuer can complete the issuance through smart contracts, reducing the involvement of intermediaries, automating the issuance process and improving efficiency.

The blockchain's non-tamperability and encryption technology ensures the security of transaction data and reduces the risk of data tampering or leakage. At the same time, the application of smart contracts can automatically execute the terms of the contract, reducing the possibility of human intervention and operational errors and further improving the security of the transaction.

Every transaction will be recorded on the blockchain, which cannot be tampered with by anyone, and every transaction can be traced, effectively avoiding the problems of inaccurate records and information asymmetry. This not only helps regulators to carry out supervision, but also improves the fairness and transparency of the market.

3.3. Fuelling Supply Chain Finance

Blockchain technology plays a key role in supply chain finance, opening up new financing channels for small and medium-sized enterprises (SMEs) by improving information transparency and reducing risk. It enables decentralised storage and sharing of information, solves the problem of information asymmetry in traditional supply chain finance, and enhances the trust between the participants. The non-tamperability of blockchain technology ensures the security and authenticity of data, and all documents can be permanently stored on the blockchain, facilitating dispute resolution and contract enforcement. In addition, blockchain reduces transaction and time costs, enables peer-to-peer transactions, and realises automation and intelligence of transactions through smart contract technology. Together, these features build a more robust and transparent business

ecology, making supply chain finance more secure and reliable.

3.4. Innovative Insurance Areas

Blockchain technology in the insurance sector also shows great potential to streamline the claims process, prevent fraud and improve management efficiency. The traditional insurance claims process is cumbersome and involves multiple steps and a large number of documents to review. Blockchain technology enables claims information to be recorded on a distributed ledger in real time, so that participants can quickly access the information they need, reducing the transmission of documents and the review process. In parametric insurance, smart contracts can automatically execute claims, which greatly reduces claim settlement time. The blockchain's transaction immutability ensures accountability, transparency and fraud prevention in the claims process. All insurance transaction records are fully recorded on the blockchain and cannot be tampered with by anyone, reducing the risk of fraud. Meanwhile, the automatic execution of smart contracts reduces the risk of human operation and ensures the fairness and accuracy of claims. By digitising and storing policy documents, endorsements and other management records on the blockchain, insurance companies can streamline management processes, reduce paperwork and improve data accuracy. Efficient data sharing on the blockchain platform also improves co-operation between stakeholders such as insurers, reinsurers and brokers, enhances trust, speeds up the decision-making process and promotes innovation in the insurance industry.

4. Regulatory Challenges Facing Blockchain Technology in the Financial Sector

4.1. Unclear Domestic Regulatory Framework

Currently, blockchain technology is increasingly used in the financial sector, but the domestic regulatory framework is not yet clear, which poses certain challenges to the development of blockchain technology in the financial sector. One important issue is the lack of an international regulatory synergy mechanism.

Blockchain technology is cross-border and decentralised, and financial activities often involve multiple countries and regions. In the absence of an international regulatory synergy mechanism, there may be differences in regulatory policies and standards in different countries, which exposes cross-border financial transactions to regulatory uncertainty. For example, in the area of cross-border payments, different countries have different regulatory attitudes towards digital currencies, which may lead to compliance risks in the payment and settlement process.

In addition, the lack of international regulatory synergy mechanisms may also affect the development of financial innovation. When conducting blockchain business, financial institutions need to consider the regulatory requirements of different countries, which increases the complexity and cost of the business. Meanwhile, the lack of uniform regulatory standards may also hinder the promotion and application of blockchain technology globally.

In order to address the lack of clarity in the domestic regulatory framework and the absence of an international regulatory synergy mechanism, joint efforts by the government, regulators and the industry are needed. The

government can strengthen research and policy formulation on blockchain technology and clarify regulatory principles and directions. Regulators can strengthen cooperation with international counterparts and establish an international regulatory synergy mechanism to jointly address the challenges posed by blockchain technology. Industry associations and enterprises can also actively participate in the formulation and implementation of regulatory policies, strengthen self-regulation, and promote the healthy development of blockchain technology in the financial sector.

4.2. Uncertainty about the Impact on The Global Economy

Blockchain technology has great potential for application in the financial field, but currently lacks universal rules and application scenarios are segmented. In supply chain finance, trade finance, cross-border payment and other fields, blockchain technology needs and application methods are different, requiring different technical solutions and business process designs. Financial institutions and enterprises are working on their own, and the lack of unified standards and specifications has led to fragmentation of applications, making it difficult to bring the maximum value into play. In addition, blockchain technology is still in the process of development and improvement, and there are compatibility issues between different platforms, making data interoperability and sharing difficult. Tsinghua Financial Review points out that the global commercial bank blockchain technology application is in the exploration stage, and needs broad industry consensus. China's commercial banks should actively participate in the development of rules, accumulate talents and scientific research power, explore the application of some fields, maintain technical sensitivity and prevent business risks. This reflects the status quo of blockchain technology application in the financial field, i.e., the lack of universal rules and segmentation of application scenarios.

4.3. Customer Privacy Protection and Data Application Conflicts

In the financial application of blockchain technology, there is an obvious contradiction between customer privacy protection and data application. Although blockchain technology can guarantee the security and privacy of data, it is not absolutely safe. In terms of technical risks, blockchain technology is still developing and improving, and there are loopholes and hidden dangers, such as smart contract code errors or 51% attacks, which may pose a threat to network security [7]. Meanwhile, hackers may take advantage of network loopholes to attack the blockchain system and steal information or destroy data. In addition, the rapid development of technology also puts existing solutions at risk of becoming obsolete.

In terms of privacy protection, the open and transparent nature of blockchain leads to the disclosure of user transaction information, which poses a privacy risk. In the case of Bitcoin, for example, although transaction records can be anonymised, there is still the possibility of privacy leakage. In distributed authentication scenarios, the protection of user identity information is also a challenge, which will affect the competitiveness of enterprises in the market if not handled properly. Decentralised identity systems have advantages, but still face privacy protection challenges, and it is difficult to ensure the accuracy and real-time availability of identity

information.

However, the demand for data applications in the financial sector continues to grow, and the contradiction between data sharing and privacy protection is highlighted. Financial One Account uses cutting-edge cryptography technology to create solutions such as blockchain full encryption framework and 3D zero-knowledge proof to ensure data security, while realising computation and cross-validation between encrypted data to solve blockchain privacy pain points. Point Rong is also actively involved in the construction of trusted blockchain, launching commercial BaaS services and blockchain cloud service platforms, and maximising user data security by not preserving the user's private key and other means.



Figure 3. Customer privacy protection and data application conflicts

4.4. The "Double-Sidedness" of Commercial Banking Applications

The application of blockchain technology in commercial banks has "double-sidedness". Its advantages are significant, in payment and clearing, it can improve efficiency and reduce costs by removing intermediate links, such as Ripple Networks and the Singapore Ubin project to help cross-border payments; securities trading can optimise the process by removing intermediaries; supply chain finance can make the flow of funds and logistics transparent, and provide financing for small and medium-sized enterprises; and in insurance, it can simplify claims processing and prevent fraud, and improve management efficiency.

However, commercial bank applications also face challenges. Domestic regulatory frameworks are unclear and international synergies are missing, and there is uncertainty in the regulation of cross-border transactions; the lack of universal rules for technology has led to fragmented application scenarios, making it difficult to maximise value; customer privacy protection is in conflict with the application of data, and the underlying technology is at risk of being attacked and slow to reach consensus, while the demand for the application of financial data is growing.

At the policy and regulatory level, it is necessary to conduct in-depth research on the dynamic trends of technology, pay attention to the challenges of new changes in financial applications, and strengthen security risk research to ensure timely and effective supervision. The use of regulatory technology should be used to enhance effectiveness, and personnel should be trained to establish an adapted regulatory system. Continuously track international developments, participate in the formulation of cross-border rules and standards, and co-operate with other countries to address regulatory challenges. Maintain a high-pressure crackdown on unscrupulous behaviour and curb speculation and other

illegal activities. Guide and regulate financial and technology enterprises, implement regulatory provisions, and promote the reliable, controllable and trustworthy application and deep integration of blockchain technology in the financial sector.

5. Countermeasures Suggestions to Address the Regulatory Challenges of Blockchain Technology

5.1. Policy Regulatory Level

Policy regulation is crucial to the sound development of blockchain technology in the financial sector. Regulators need to conduct in-depth and continuous research on blockchain technology, grasp its iterative changes, and analyse the risks in scenarios such as cryptocurrencies and smart contracts, in order to lay the foundation for regulatory policies. For example, to accurately predict its impact on financial market stability and consumer rights. At the same time, with the help of regulatory technology, big data and artificial intelligence should be used to monitor blockchain financial transactions in real time, warn of risks, detect abnormal behaviours such as money laundering in a timely manner and intervene swiftly to stop the spread of risks. In view of the transnational nature of blockchain finance, the regulatory differences between countries are prone to give rise to arbitrage space, therefore, it is necessary to actively build an international regulatory coordination mechanism, and cooperate with other countries' regulatory agencies to formulate unified principles, standards and frameworks in cross-border payments and international financial asset transactions, so as to ensure the compliant operation of transnational business. At the same time, we should maintain high pressure on illegal practices in blockchain applications, crack down on speculation, financial fraud and illegal fund-raising and other chaotic phenomena, so as to maintain the order of the financial market and investor confidence.

5.2. Industry Organisational Level

Industry organisations are a bridge for blockchain financial regulation, on the one hand, building an exchange platform to promote regular communication and information exchange between financial institutions, technology enterprises and regulatory authorities. Through seminars and other activities, they can share technology application experience, discuss the direction of regulation, enhance mutual trust among all parties, and gather industry development synergy; on the other hand, based on application scenarios such as supply chain finance, securities trading, etc., they can formulate targeted and operable standards for business processes, data security and technical performance, provide practical guidelines for financial and technology enterprises, and promote industry standardisation. In addition, industry organisations should also carry out professional training and knowledge dissemination. For financial practitioners, they should enhance their blockchain application capabilities and risk awareness; for the public, they should enhance their knowledge of blockchain finance and reduce misunderstandings and risks caused by information asymmetry.

5.3. Practitioner Level

As the direct applicators of blockchain finance, practitioners have a great responsibility to increase investment in core technology research and development,

overcome technical problems, and improve system performance, security and stability. For example, they should optimise the consensus algorithm to improve transaction speed, save energy and reduce consumption, strengthen cryptography research to protect data privacy, and prevent hacker attacks and data leakage. In supply chain finance, we have expanded the application of accounts receivable and inventory pledge financing; in trade finance, we have realised the digital flow of documents and intelligent auditing; and in cross-border payment, we have joined hands with international partners to build a convenient and secure network. Follow the principle of minimisation to collect data, adopt encryption, anonymisation and other means to safeguard the "triple nature" of data, and establish a sound security management system and emergency response mechanism to deal with data security incidents. Consciously comply with regulatory requirements, improve the compliance review mechanism, and review blockchain application projects in the whole process to ensure that the business is legal and compliant, and maintain the industry reputation and market order.

6. Conclusion

The application of blockchain technology in the financial sector is promising and faces regulatory challenges. Its application prospects include: improving efficiency and reducing costs in payment and clearing, such as Ripple network and other projects with remarkable results; disintermediating and optimising the process of securities trading; supply chain finance, which makes the flow of funds and logistics transparent and helps SMEs to raise funds; and simplifying the settlement of claims in the field of insurance. However, the regulatory challenges should not be underestimated, as the domestic regulatory framework is unclear and international synergy is missing, the lack of universal rules of technology has led to the fragmentation of application scenarios, there are contradictions between customer privacy and data application, and the application of commercial banks has a "double-sided nature". In this regard, the policy and regulatory levels need to strengthen research and tracking and international synergy, and use regulatory technology to regulate the application; industry organisations should build platforms, formulate standards, and carry out training; and practitioners should explore the core technology, balance privacy and data application, and deepen the application of scenarios. All parties should make concerted efforts to promote the safe, stable and sustainable development of blockchain technology in the financial sector.

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