The Application of Blockchain Technology in the Financial Field

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Abstract: The advent of the digital age has made innovative technologies exceptionally important, many research institutions and businesses are continuously increasing their investments in the field of new digital technologies. Blockchain, as one of the significant breakthrough inventions, has sparked widespread attention in both academia and society. The key reason that truly determines the disruptive strategic position of blockchain lies in its unique features of decentralization, transparency, immutability, and its powerful applicability across various industries. In this paper, we aim to explore the practical applications of blockchain technology in the financial sector based on an interpretation of its characteristics. We will delve deeper into how blockchain technology, within its decentralized framework, plays specific roles in aspects such as data security, identity verification, cryptocurrencies, transaction efficiency, and market fairness. Furthermore, we will combine case studies to analyze the existing achievements in the application of blockchain technology, the regulatory issues it faces, and the practical implementation challenges.

Keywords: Blockchain, Application of Blockchain, Finance

1. Introduction

Recently, with the promotion of various digital currencies, the use of blockchain technology has once again drawn our attention to this emerging technology which has experienced long-term development and had a huge impact on social production and life. After three iterations, time has proven to us the effectiveness of blockchain technology in the financial field: from the first use of Bitcoin in 2010 to the use of blockchain technology in digital renminbi in 2022; and from the Bank of Finland in 2012 Recognizing Bitcoin as legal until 2016, the Japanese government officially classified Bitcoin as an asset. In the 14 years since the birth of Bitcoin, we believe it is necessary to sort out the results of the application of blockchain technology in the financial field.

2. Literature Review

2.1. Overview of Blockchain Technology

Liang Zhang, Baixiang Liu, Ruyi Zhang, et al, analyzed the working principles of blockchain, using Bitcoin as an example, and detailed the storage models and ledger classifications of blockchain from the perspective of a distributed ledger. They contended that in the absence of third-party authoritative institutions, blockchain technology, through the amalgamation of disciplines such as cryptography, economics, and sociology, ensures the security of data content while simultaneously reducing collaboration costs and enhancing collaboration efficiency [1]. On another front, Shiqin Zeng, Ru Huo, Tao Huang, et al, designed a hierarchical architecture for blockchain technology. They systematically summarized the technological choices and characteristics of typical blockchain projects. They argued that by adhering to a hierarchical analysis approach for blockchain, it becomes possible to intuitively differentiate the technological trajectories and characteristics of different projects. This approach provides diverse perspectives for optimizing blockchain technology and sets the stage for the deep integration of scenario applications, thereby fostering subsequent research [2].

2.2. How does blockchain technology affect the financial sector

Mohd Javaid, Abid Haleem, and Ravi Pratap Singh have funded the superior security of blockchain-based credit reporting over conventional server-based reporting. Blockchain-based systems enable the faster, more cost-effective, and more customised issuance of digital securities. With its adoption, the market for investors can be expanded, costs for issuers can be reduced, and counterparty risk can be reduced due to the ability to customise digital financial instruments to the demands of investors. It uses mutualised standards, protocols, and shared procedures to give network users a single common source of truth [3].

Xingxiong Zhu and Dong Wang, approaching from a technical perspective, contend that the advantages of blockchain application lie in optimizing business processes, reducing operational costs, and enhancing collaborative efficiency. The application of blockchain technology can streamline processes and operational frameworks, concurrently constructing an intelligent, real-time, user-friendly, highly efficient, and secure blockchain e-commerce system. This enhances user experiences, promotes the secure and stable operation of the system through incentive mechanisms, and provides member management functions for consortium and private chains [4].

Abhishek T, and Benarji D C focus keenly on issues relating to the manipulation of KYC and the financial burden on banks while also addressing AML policies. They believe emerging technology can help in mitigating money laundering and other financial crimes. In the financial sector, Blockchain can change many processes, payments between peer-to-peer, trade agreements and tracking of supply chains. Emerging technology can be used in many ways in financial services and can change many processes, peer-to-peer payments, trade agreements, and the tracking of supply chains [5].

2.3. Application of Blockchain Technology in Supply Chain Finance

Jue Guo and Chen Chen analyzed the breakthrough pathways of blockchain technology in overcoming obstacles in supply chain finance. They argue that by leveraging the characteristics and management mechanisms of blockchain technology, it is possible to address a series of issues arising from the unique characteristics of supply chain finance. This includes achieving four major objectives: supporting effective coordination among diverse participants in supply chain finance, tracing information transmission trajectories, enhancing the financial regulatory framework, and improving risk management capabilities [6].

Xingxiong Zhu, Qingsu He, and Shanqi Guo, et al, integrated the theories of blockchain supply chain finance. They conducted an analysis of each link in the blockchain-based system model and concluded that blockchain plays a significant role in activities such as coordinating procurement, purchasing, production, sales, order processing, inventory control, customer service, and outsourcing. It also facilitates the collaborative operations among participants in the supply chain, including suppliers, intermediaries, third-party service providers, and customers [7].

Qiang Gong, Mingyuan Ban, and Yilin Zhang, et al, constructed a theoretical framework for supply chain networks. Through systematic analysis, they found that blockchain's consensus mechanism is beneficial in ensuring market fairness only when there is a sufficient number of enterprises in the supply chain and the quality of information reaches a certain level. In such cases, blockchain can enable lending institutions to provide accessible and cost-effective financing services to enterprises. However, when there are fewer enterprises in the supply chain or the quality of on-chain information cannot be guaranteed, traditional offline due diligence methods are more suitable for risk control by banks [8].

Saberi S, Kouhizadeh M, and Sarkis J proposed and discussed the adoption of blockchain technology in supply chain networks. They fund the barriers of blockchain adoption in supply chain are reviewed as multi-faceted issues which affect not only the relationship between supply chain partners but also partners' employees and their stakeholders. In addition, the technological barriers pertaining to blockchain adoption are included and many stem from blockchain technology immaturity. System-related issues of blockchain technology, which can limit its adoption, requires more focus in future research [9].

2.4. Key Challenges in Implementing Blockchain Technology in the Financial Sector

Jue Guo and Chen Chen argue that three prerequisites are essential for the successful implementation of blockchain in the financial sector. First, gaining user support and fostering a willingness to actively participate in blockchain transactions. Second, focused technological development to ensure information security. Third, the establishment of unified blockchain standards to enhance cross-chain expansion.[6]

Zhiwei Cui contends that a complete decentralization model should not be blindly applied to the financial sector. When technology cannot guarantee a balance between security and efficiency, security should take precedence. Financial regulation must always play a crucial role, and a weakly centralized consortium blockchain is the optimal choice for the financial sector. Additionally, the transnational nature of blockchain applications necessitates global regulatory coordination, and anonymity of nodes is not advisable [10].

Liqing Zhang and Tong Wu point out that blockchain technology currently faces limitations, including immature governance mechanisms, challenges in the full execution of smart contracts, excessive volatility in digital asset prices, and an inability to support secure commercial applications. These limitations significantly impede the further adoption of blockchain technology. The factors contributing to these limitations include not only the need for improved technological maturity but also inadequate governance mechanisms and infrastructure, rampant speculation, and weak societal acceptance and understanding [11].

2.5. Prospects for the Application of Blockchain Technology in the Financial Sector

Scholar Xiaowei Ding examines the transition from internet finance to digital finance and proposes that the next generation of digital finance should embody six key technological characteristics: trustworthiness, security, privacy protection, social responsibility, intelligence, and efficiency. This entails replacing "human governance" with "code governance" to redefine theories and methods for

financial risk management. It also involves building a programmable, embedded, and self-regulating digital financial regulatory system and being open to learning from international best practices for the benefit of China [12].

3. The origin and development of blockchain

It is generally believed that the development of blockchain has gone through three stages, namely blockchain 1.0 to 3.0. This article will give a general overview of these three stages.

3.1. Blockchain 1.0

In October 2008, blockchain technology was first proposed by Satoshi Nakamoto in a paper describing Bitcoin. Blockchain structure, encryption algorithm, distributed ledger and other technologies constitute the basis of blockchain technology, but at that time, it did not attract much attention, and the blockchain technology was still immature. At this stage, Bitcoin mining pools and Bitcoin wallets appeared one after another, and the Bank of Finland also recognized the legitimacy of Bitcoin.

3.2. Blockchain 2.0

In 2013, marked by the birth of Ethereum, the blockchain entered the 2.0 era. At this stage, the blockchain technology is gradually separated from the Bitcoin system; it is already possible to perform single-machine multi-task calculations; and its underlying software and upper-level digital currency applications are decoupled and separated. The blockchain is gradually regarded as an Internet Technology. The proposal of the consensus mechanism guarantees the security of blockchain data; the research and development of the virtual machine (EVM) realizes the "smart contract" function; that is, once the conditions of the contract are met, the contract will be Execute automatically. People now have already recognized the "decentralized" interaction mode through blockchain technology.

3.3. Blockchain 3.0

In 2015, IMB led the establishment of the open source organization Hyperleger, which gave birth to the world's first alliance chain. Then, blockchain technology entered the 3.0 era. At this stage, blockchain technology began to be gradually applied to various industries in different fields. China also independently developed the alliance chain Hyperchain to provide commercial-level support capabilities, making possible for point-to-point payment functions. ICO fundraising is also gradually moving to the world--a large-scale collaborative society is gradually built. In 2017, China's digital currency trading platform was successfully operated, a platform which based on blockchain technology. And at the same time, Japan accepted Bitcoin as a legal payment method.

4. Characteristics of blockchain

From the perspective of the application in blockchain technology, blockchain is a decentralized distributed shared database with high security. Under the core framework of decentralized blockchain, this article introduces the characteristics of blockchain--it can be roughly divided into three categories namely, transparency, security, and efficiency. This article will give priority to introducing these three types of characteristics, so that the follow-up can better combine the case analysis of the application of blockchain technology in the financial field.

4.1. Transparency

The data on the blockchain is open to everyone, and users on the chain can participate in the development and use of the blockchain, from writing transaction records in the blockchain, to confirmation and verification by many nodes in turn, and finally directly recorded on the distributed ledger of the blockchain. Whole the operation process and transaction records of the entire blockchain are publicly visible. Participants can use the blockchain structure to view and trace historical transaction records, sharing information, and ensure information openness and transparency. At the same time, since the blockchain technology is an open source, anyone can participate in the development and the use of a certain blockchain system, establishing trust through shared data. Different blockchain systems can also achieve interoperability through standardized protocols.

4.2. Security

Blockchain technology has built a relatively complete security system through the application of mathematics and cryptography theory. This security system mainly has the following mechanisms or characteristics:

4.2.1. Distributed ledger

Blockchain is a decentralized distributed network composed of multiple nodes. Each participating node will confirm, verify and maintain the data. And it will obtain a complete copy of the data and store it for a long time, which indicates no single centralized organization can control the entire transaction process, but multiple nodes in the network jointly verify and record transactions.

4.2.2. Consensus mechanism

Blockchain technology has established a unique consensus mechanism to ensure the validity and consistency of transactions. In blockchain technology, the consensus mechanisms are mainly Proof of Work and Proof of Stake. The former requires every node that participates to solve complex mathematical problems continuously, and judge according to the amount of completed questions; while the latter requires holding a certain amount of cryptocurrency to participate in transaction verification, and judges according to the amount and duration of the currency held. The unique consensus mechanism of the blockchain can ensure that only legal nodes can add new transactions to the blockchain and maintain the stability of the block generation speed. With the continuous improvement of blockchain theory and the continuous development of technology, more advanced consensus mechanisms may be born in the future.

4.2.3. Encryption algorithm

Blockchain technology will use certain cryptographic algorithms (hash function and elliptic curve cryptography, etc.) to encrypt and verify transactions. Each transaction has a unique digital signature to verify the authenticity and integrity of transactions. A valid transaction on the blockchain has one corresponding valid digital signature for the signature of the transaction initiator's private key. And the signature of the transaction can be verified by using the transaction initiator's public key, which can be calculated from the private key through an algorithm. However, the private key cannot be deduced from the public key. Only users with the correct private key can sign the transaction, which greatly ensures the security of the transaction.

4.2.4. Difficult to tamper with

Due to the structure of the blockchain, once data is confirmed and added to the blockchain, it becomes a fixed record that is difficult to tamper with. Because each block contains the hash value of the previous block, any tampering with the transaction will cause the hash value of the subsequent block to change, which will be rejected by other nodes. Once you try to tamper with the data on the blockchain, you need to control more than 50% of the nodes at the same time, which further increases the difficulty and cost of tampering with the data. This chain structure makes the transaction records on the blockchain highly secure and tamper-proof. And such characteristics will increase with participating nodes increasing.

4.3. Efficiency

Blockchain technology can effectively reduce the intermediate links and the costs of original transactions through the unique "smart contract" function, improving transaction efficiency. Blockchain technology automatically establishes trust in a quasi-real-time manner, and converts traded assets into smart contracts. These contracts, as pre-written code fragments, are disseminated through informatization. Without the intervention of a third party, corresponding operations can be automatically performed once specific conditions, and point-to-point real-time transactions, clearing and settlement are completed, eliminating middlemen and unnecessary human intervention. Smart Contracts on the blockchain can significantly reduce the cost of value transfer, thereby greatly improving the efficiency of liquidation and settlement processes, shortening the time of liquidation and settlement, and also easy to track and difficult to reverse. With the improvement of efficiency and transparency, investors' confidence is also enhanced.

5. The application of blockchain technology in the financial field

It needs to be clear that the application of blockchain in the financial field is not only based on the characteristics of the above-mentioned blockchain, but also benefits from these characteristics that allow blockchain to provide more extensive data sharing and surpass traditional credit mechanisms. In terms of data sharing, blockchain data sharing can maximize data sharing on the premise of protecting the privacy of participants. Therefore, the blockchain makes it possible to establish cross-departmental, cross-industry, and cross-regional databases; alleviate the problem of data islands; and at the same time carry out data on-chain Confirmation and transfer of rights, protection and maintenance of intellectual property rights. In terms of credit mechanism, based on the application of mathematical and economic theory systems, the blockchain establishes technical endorsement through a preset consensus mechanism, constrains the behavior of participants, and increases the cost of violations, thereby ensuring the overall credit level of participants.

5.1. Main application aspects

5.1.1. Ensure data security

Blockchain technology can be used to protect the security of data. By dispersing and storing data on multiple nodes and using encryption algorithms to protect the data, blockchain technology can effectively prevent the stored data from being tampered with or leaked.

5.1.2. Perform identity verification

Blockchain technology can be used to verify and manage user identities. As part of the data, the user's personal identity information can also be encrypted and stored on the blockchain to ensure the authenticity and integrity of the identity information, thereby protecting user privacy.

5.1.3. Composition of cryptocurrency

Blockchain technology can be used in cryptocurrencies such as Bitcoin and Ethereum. By using cryptographic algorithms (hash functions, elliptic curve cryptography, etc.) and distributed ledgers, blockchain ensures transaction security and tamper-proof.

5.1.4. Improve transaction efficiency

Blockchain technology can be used to improve transaction efficiency and reduce transaction costs. Different from the traditional central transaction model, the decentralized blockchain connects all the nodes that record data in series, shortening the time span and reducing transaction costs.

5.1.5. Maintain market fairness

Blockchain technology can be used to disclose transaction information and ensure fair transactions. While disclosing transaction information, it provides a more accurate traceability and proof mechanism to maintain market fairness through the selective disclosure of distributed ledger record information and information traceability.

5.2. Specific application areas and cases

This article is refined through the logic and classification criteria provided by the Blockchain White Paper 2018[13], and elaborates on the use and cases of blockchain technology in five areas, including trade finance, supply chain finance, securities, taxation, digital currency, and financial regulation.

5.2.1. Trade Finance

In the field of trade finance, blockchain technology effectively realizes the decentralisation of value transfer, and its application is currently mainly focused on five aspects of letters of credit, letters of guarantee, forfeiture, factoring, and bills, which are mainly based on guarantee certificates.

5.2.1.1. Letter of Credit

A letter of credit is a written document issued by a bank to a seller based on the buyer's request to guarantee the responsibility of paying a loan. Blockchain technology can make the letter of credit a digital certificate, which can be transmitted through electronic channels between banks, facilitating the adjustment of letter of credit information and further guaranteeing its security.

In July 2017, Cloud Elephant Blockchain assisted CITIC Bank and Minsheng Bank in launching a blockchain-based domestic letter of credit information transmission system (BCLC), which significantly improved the efficiency of letter of credit business processing. In September 2017, following CITIC Bank and Minsheng Bank, Suning Financial led the relevant departments of the bank to go online with the blockchain-based domestic letter of credit information transmission system, and became the third bank in China that will blockchain technology be bank that applies it to the field of letter of credit settlement. The system realises the functions of strictly compliant, no third party required, real-time opening, full encryption, online opening, notification, delivery, arrival, acceptance, payment and closing of domestic letters of credit.

5.2.1.2. Letter of Guarantee

Letter of Guarantee refers to a written credit guarantee certificate issued by a bank, insurance company, guarantee company or individual to a third party at the request of the applicant. Blockchain technology can facilitate data sharing and interoperability of various processes in the letter of guarantee business, reduce labour costs and improve efficiency, reduce the possibility of counterfeiting, maintain the credit mechanism and protect the interests of customers.

The blockchain technology-based bidding guarantee system cooperated by Funchain Technology and Societe Generale Bank is on-line, which innovates the traditional bidding guarantee in business channels, interaction methods and underlying technology, realises the whole process of online operation and handling of bidding guarantee business, and improves customer experience while guaranteeing the truthfulness and trustworthiness of the business data.

5.2.1.3. Forfaiting

Forfaiting, i.e. outstanding debt sale and purchase, also known as package purchase bill or bill buyout, is a form of capital financing in large-scale equipment trade with deferred payment, in which the exporter sells the forward bill of exchange accepted by the importer or guaranteed by the third party with a term of half a year to five or six years without recourse to the bank or large financial company where the exporter is located to obtain the cash in advance, and it is a type of export letter goods. Blockchain technology can establish a public quotation platform, reduce the cost of inquiry, and guarantee the authenticity and legitimacy of the relevant information.

BOC Bank, Bank of China, Minsheng Bank and Ping An Bank simultaneously went online with the expanded and upgraded blockchain Fufeyan trading platform, which has now become the largest blockchain trade finance trading platform in the domestic banking industry.

5.2.1.4. Factoring

Factoring is the act of entrusting a third party to manage accounts receivable, which belongs to a part of supply chain finance and is a kind of transfer between vouchers. The cross-border factoring financing credit management platform established based on blockchain technology can further ensure the real-time update of order information and facilitate the information enquiry and transaction preparation of all parties involved.

The head office of the central bank had a layout in 2015, and such a bill trading platform was officially launched in 2017, which can achieve the management of the full life cycle of the bill and make use of the privacy protection scheme developed by the same-table encryption and zero-knowledge proof, that is, to achieve data sharing under the premise of privacy protection.

5.2.1.5. Bills

At the level of note transactions, blockchain technology helps to guarantee the security, convenience and intelligence of digital notes, and China has also constructed a relatively complete digital note trading platform based on blockchain technology.

In January 2018, the trading platform was arranged and deployed by the head office of the People's Bank of China, led by the Shanghai Bills Exchange and the Digital Currency Research Institute, undertaken by the China Banknote Blockchain Technology Research Institute, and co-developed by the Industrial and Commercial Bank of China, the Bank of China, the Pudong Development Bank, and the Hangzhou Bank.

The platform adopts alliance chain technology, and the central bank, digital bill exchange, commercial banks and other participating institutions access the digital bill network with permission

in the form of alliance chain nodes. Different nodes can be granted different on-chain operating privileges, including voting privileges, bookkeeping privileges and read-only privileges, according to their different roles and business needs. After the issuance of digital notes, they are registered on the alliance chain in the form of smart contracts, and the digital note exchange acts as a trust intermediary in the transaction settlement process, and the transaction aggregation is completed by the participants based on the shared data of the alliance chain.

The system implements the full life cycle functions of traditional notes and develops privacy protection solutions based on homomorphic encryption + zero-knowledge proof technology. It supports that information is visible to the counterparty and the regulator has the ability to see through it, has a powerful and flexible regulatory privacy protection mechanism, obtains detailed information about the currently conducted transactions in real time, monitors suspicious or abnormal note operations, and ensures the financial security of digital notes through restrictions on operating privileges or access privileges of the system's participants, and so on.

5.2.2. Supply Chain Finance

In the field of supply chain finance, due to the complexity of traditional supply chain credit granting, credit is often unable to be split for multi-level transmission, while the ERP systems of all parties in the supply chain are not interoperable, and the data are not interoperable, which has the problems of slower fulfilment speed, complicated clearing process, and high transaction cost, etc. If blockchain technology is adopted, it will be able to ensure the financial security of digital bills. If blockchain technology is adopted to link the information of all parties in the supply chain with the supply chain cloud platform, form a decentralised multi-chain structure of all parties in the supply chain, establish an alliance platform for all parties to share information, guarantee real-time data transmission and sharing, and provide services to all participants and processes in the supply chain finance, it can greatly reduce the complexity of financing and credit granting and the transaction costs of all parties, and promote the improvement of capital liquidity while increasing the volume of online transactions. of online transactions while increasing the volume of online transactions.

Hua Song, Qiang Lu and other scholars pointed out that supply chain finance can make the organic combination of finance and the real economy, form an emerging industry involving multiple parties, and make the financial system effectively support the real economy. At the same time, supply chain network connection can have a positive impact on the financing performance of SMEs through their external supply chain integration capability [14]. Ju'e Guo, Chen Chen and other scholars believe that blockchain technology achieves the four major goals of supply chain finance, such as supporting the effective coordination of multiple subjects, perspective information transfer trajectory, improving the financial regulatory system, and improving the ability of risk management and control [6].

5.2.2.1. The use of supply chain

Xingxiong Zhu, Qingsu He, and Shanqi Guo believe that blockchain plays a great role in coordinating the activities of incoming goods, purchasing, production, sales, order processing, inventory control, customer service, and outsourcing, all of which lend their characteristics, and also include the collaborative operation among the participating parties in the supply chain, such as suppliers, intermediaries, third-party service providers, and customers [7].

In the procurement stage, in order to identify the information and characteristics of raw materials, suppliers need to provide production information and proof of all materials, and the authenticity of the materials is particularly important, and the blockchain can record the information of these materials, and in the case of the information is too long, it can guarantee the adequacy and truthfulness of the information by recording only the hash value of each chain.

In the manufacturing stage, the input information is the output information of the procurement stage mentioned above. If more raw materials are needed for product manufacturing, each raw material can be used as input information, and real-time records of manufacturing parties, manufacturing stamps and other information can be recorded, and the final output is the product.

In the sales stage, the blockchain will output a unique tag for each product, such as QR code, near field communication technology, radio frequency identification tags in the form of linking to the product, and the consumer can understand all the specific processes of the product in the procurement stage and manufacturing stage by scanning the product tag.

5.2.2.2. Trade-offs in Supply Chain Finance Models

Qiang Gong, Mingyuan Ban, Yilin Zhang found that only when the number of enterprises in the supply chain reaches a sufficient number and the quality of the information reaches a certain level, the consensus mechanism of the blockchain will help to guarantee the market fairness, so that the lending institutions can provide the enterprises with the financing services with high accessibility and low cost. When the number of enterprises in the supply chain is small or the quality of the uplinked information cannot be guaranteed, it is more suitable for banks to prevent and control risks through traditional offline due diligence and other methods [8].

Nowadays, a large number of Chinese enterprises and capital have already laid out a large number of them: Tencent's "micro-enterprise chain" is committed to realising the split transfer of debt certificates, Ant Blockchain's "Double Chain" focuses on solving the financing problems of micro and small enterprises, and Ping An's "Financial One Ledger" has been used to provide financial services for the supply chain. "Financial One Account" focuses on guaranteeing the truthfulness and effectiveness of product transaction process information. In the future, with the further improvement of blockchain technology theory and the further popularity of the supply chain, it will greatly promote the enhancement of the digital level of enterprises, and supply chain finance based on blockchain technology will also become a more efficient and inclusive means of financial support.

5.2.3. Securities

In the field of securities, blockchain technology can boost the penetration of the underlying assets of ABS, and use the smart contract function to complete automatic transfer of funds, asset cycle purchase, and automatic income distribution and other functions. It can also reduce labor cost and error rate, improving the management efficiency of cash flow. Applying the blockchain to securities improves the cash flow management of ABS, because the blockchain has the characteristics of immutability and information security, and also has the function of automatic ledger synchronization and auditing. Therefore, it can effectively alleviate the problem of information asymmetry, thereby improving efficiency.

In January 2018, Qulian Technology cooperated with Debon Securities and Fuxing Hengli Securities. Using the traceability, decentralization, security and trust characteristics of blockchain technology can achieve data sharing and asset source visualization. Labor costs and errors are greatly reduced because the entire process is processed by the blockchain as the main body. At the same time, the transaction data of each institution platform is thus unified, which improves the efficiency of liquidation.

In January 2022, the Asian Development Bank formed an alliance with China, Japan, South Korea and some Southeast Asian countries, aiming to use blockchain technology to improve the efficiency and security of cross-border securities transactions in the Asia-Pacific region. Enterprise cooperation has achieved the interconnection of data between the central bank and securities institutions in the

"10+3" region. And there is going to be more studies about the interoperability of regional systems and the feasibility of the central bank's digital currency.

5.2.4. Taxation

In the field of taxation, blockchain technology opens up the whole process of invoice application, invoicing, reimbursement and tax declaration, starting the functions of traceability of all links of tax authorities, business decentralization, online tax payment processing and paperless reimbursement circulation. At the same time, the use of blockchain electronic invoices can avoid fake invoices, fake or repeated tax numbers, because this kind of electronic invoices have unique and unchangeable characteristics, completing safe and effective smart contracts which also makes it possible for the comprehensive application of blockchain technology in the tax field.

In August 2018, the State Administration of Taxation authorized the Shenzhen Water Affairs Bureau to try out blockchain electronic invoices. The Shenzhen Municipal Taxation Bureau defined the administrative issuance standards and the use of taxpayer invoices. Tencent provided blockchain technical support. Later, according to government statistics, a total of 6 million blockchain electronic invoices have been issued this time with an accumulated invoice amount of 4 billion, covering 110 detailed enterprises at the same time.

5.2.5. Digital currency

Blockchain technology provides technical support for the issuance and use of digital currency. Thanks to the application of blockchain technology in distributed ledgers and encryption algorithms, the security and stability of digital currency are greatly guaranteed.

5.2.5.1. E-CNY

The e-CNY is the digital form of China's legal tender. In the process of promoting digital renminbi in China, blockchain technology has also been effectively used. Due to the centralized management requirements of sovereign currencies, blockchain technology is generally used in the issuance layer of the e-CNY payment management system. Scholars Xu Xiubin, Liang Xiaomin, Zou Jun (2022) believe that the characteristics of blockchain, which are difficult to tamper with and easy to trace, are suitable for risk prevention and compliance supervision of digital RMB, and its distributed ledger and smart contract functions can be compared with e-CNY. Combined with the programmability of the system, it plays a role in payment and settlement, value transfer, etc., achieving more functions such as the simultaneous delivery of product funds.[15]

In August 2022, the first e-CNY pass-through payment service launched by China Construction Bank was successfully launched in Xiong'an New District, making a new breakthrough in the application scenario of digital renminbi in the blockchain payment field of the new district, and providing enterprises with the ability to pay employees' wages. The "penetrating" payment of wages greatly simplifies the intermediate payment process, improves the efficiency of payment, and avoids the arrears and deductions of wages in the intermediate process.

5.2.5.2. Stable currency

In the past, the prices of cryptocurrencies, such as Bitcoin and Ethereum, fluctuated, making it difficult to perform the payment function of traditional currencies. The launch of stablecoins effectively solved the problem of cryptocurrency price fluctuations and guaranteed currency holders that Asset security has become a new "weapon" for investors to hedge risks. Stablecoins generally track the price of a certain real currency or asset. By anchoring these currencies or assets, the

stablecoin and the anchor can be maintained in a roughly controllable swap range, but this also shows that the stablecoin itself cannot completely Avoid value fluctuations depend on whether there is a scientific and reasonable risk avoidance and regulation mechanism under the stablecoin system to ensure that the stablecoin price remains within a reasonable range or not.

In August 2023, Paxos Trust, the first trust platform promoted by the mainstream financial institution PayPal and the blockchain, launched an Ethereum-based stablecoin. Equivalents are backed at a 1:1 ratio and allow for instant settlement of digital transactions. This kind of stable currency takes advantage of the decentralized characteristics of the blockchain to weaken the degree of centralization intervention, and maintains its price stability while ensuring the liquidity of the stable currency. It has become one of the few stable coins approved by New York Department of Financial Services, the most stringent regulatory agency.

5.2.6. Financial supervision

In the field of financial supervision, under the application of blockchain technology, the movement of each fund is completely transparent and shared with all parties involved in the transaction, which can greatly improve the efficiency of the supervision of financial activities. Taking anti-money laundering as an example, since each transaction completed by the blockchain will leave a permanent record that cannot be tampered with, regulators can monitor, verify and record the complete history of each transaction through blockchain technology. Blockchain technology can be used as a tool for supervision, management, and recording to ensure that all stages of each transaction can be traced and verified.

Based on the blockchain anti-money laundering platform, fraud detection in the system can be automatically performed in smart contracts. Built-in algorithms continuously check each transaction, compare all modifications and detect any unauthorized tampering, automatically generate suspicious transaction alerts, and immediately block transactions. Therefore, implementing blockchain in anti-money laundering can gain oversight over all transactions.

Armalytix, a blockchain financial services anti-money laundering compliance company, announced the completion of a new round of financing of US$1 million. Angel investors from HSBC, UBS, Bank of America and Goldman Sachs participated in the investment. Armalytix software helps companies in industries such as blockchain, financial services and accounting comply with anti-money laundering compliance requirements and avoid fines from regulators.

But we also need to note that in the long run, the impact of blockchain technology on the financial sector is two-sided: on the one hand, the positive impact on the financial sector as mentioned in this article will be implemented; on the other hand , once the reconstruction of credit in the financial sector based on blockchain technology is successful, it will also have a huge impact on the existing financial system. It will fundamentally change the financial industry and business model, leading to huge changes in relevant institutions.

Ding Xiaowei (2021) believes that the next generation of digital finance should realize the six major technical characteristics of credibility, security, privacy protection, social responsibility, intelligence, and high efficiency, and use "code governance" instead of "human governance" to reconstruct financial risk management theories and methods, building a programmable, embedded, self-regulatory digital financial regulatory system [12].

6. Key Ongoing Challenges in Blockchain Technology

We also need to emphasize the importance of regulating the use of blockchain technology, while considering the legal frameworks and regulatory stances of different countries regarding blockchain technology. Among these considerations, striking a balance between innovation and risk remains a

critical aspect. This paper attempts to pragmatically explore the latent pitfalls, broadly categorizing the issues into the following:

6.1. Policy Disputes (Legal Jurisdiction in Cross-Border Transactions)

Cross-border transactions involve legal systems from multiple countries, each with different regulations on issues such as contracts and property rights. When conducting transactions on the blockchain, conflicts between different legal systems are inevitable. For instance, consider two companies located in the United Kingdom and China engaging in cross-border supply chain financing transactions via blockchain. In the event of a dispute involving contract performance and liability determination, the legal systems of both countries may have divergent provisions, resulting in legal conflicts that are difficult to resolve satisfactorily. Scholars such as Guo Jue and Chen Chen (2020) argue that the lack of a rigorous, standardized mechanism, including but not limited to programming languages, consensus mechanisms, and privacy protection measures, poses significant obstacles to eliminating these uncertainties [6].

Addressing these issues requires efforts from various angles, including international coordination, legal innovation, and contract design. It is challenging to ensure that blockchain-based cross-border transactions proceed smoothly within a legal framework without such efforts.

6.2. Risks Arising from Weaknesses in Technological Development Stage

The risks stemming from technological weaknesses manifest when the technology under development is not yet fully matured. Any coding vulnerabilities can potentially have devastating consequences for the market, as demonstrated in May 2021 when a hacker attack resulted in the loss of $200 million worth of cryptocurrency assets. Therefore, the utility of blockchain still faces the challenge of balancing security and performance. Existing technology for building blockchain platforms may not provide complete protection that aligns perfectly with various assets and transaction information. Even though quantum computing technology poses certain barriers in specialized fields, blockchain cannot establish itself as a completely unbreakable digital data processing center. It is evident that information protected by blockchain privacy measures still carries the risk of being tampered with and leaked.

6.3. Potential Issues in the Protection of Digital Assets

(1) Intellectual Property Protection: Even if records exist on the blockchain, digital assets cannot rely solely on this technology for protection unless recognized and validated by legal means.

(2) Digital Identity Verification: While digital identity verification can be implemented on the blockchain, it may also lead to the disclosure of personal privacy. Additionally, if the identity verification system is compromised or experiences a malfunction, it could disrupt the identity verification of a large number of users. Despite the gradual proliferation of blockchain technology, there are still technical usability barriers. Not every user can accurately and proficiently use such identity verification systems. Furthermore, user-initiated on-chain transactions are a prerequisite for the practical application of this technology in supply chain finance. The distributed ledger of blockchain technology requires that every user actively and willingly shares information. Without achieving this prerequisite, the goals of decentralization and the development of market scalability cannot be realized.

(3) Limitations in Smart Contract Execution: Smart contracts may have coding vulnerabilities or other security issues that can lead to malicious attacks and execution, resulting in outcomes that diverge from expectations. Additionally, smart contract execution cannot adapt to all situations, particularly in matters involving legal and ethical considerations, as they lack the cognitive abilities

and flexibility of human thinking. This has been an ongoing challenge for such automated tools. Consequently, in some transactions, disputes or significant risks may arise due to non-human or human-related factors.

It is evident that the characteristics of decentralization and transparency in blockchain may conflict with regulations related to personal data privacy protection. How to protect personal privacy on the blockchain, ensuring compliance with various national and regional legal requirements while maximizing its utility, remains a formidable challenge.

7.   Conclusion

According to the relevant research, it can be found that, due to the openness, security, and efficiency, since the birth of Ethereum technology, block chain technology has had the possibility of being applied in the financial field. With further development, the application scope of block chain has also been expanding in the financial field, initially covering trade finance, supply chain finance, securities, taxation, digital currency Six major aspects including financial institutions. However, there are still issues in the application of block chain technology, such as the potential for policy disputes caused by uncoordinated cross-border policies, technical risks caused by relatively weak technology, and financial risks caused by limitations in digital asset protection. In the future, whether it is block chain technology or its specific application in the financial field, relevant scholars still have a long way to go, which also reflects that block chain technology still has a long way to go for further development.

References

[1] ZHANG Liang, LIU Baixiang,ZHANG Ruyi,et al. Overview of blockchain technology [J]. Computer Engineering, 2019, 45 (5): 1-12.

[2] Shiqin Zeng, Ru Huo, Tao Huang et al. Review of Blockchain Technology Research: Principles, Advancements, and Applications [J]. Journal on Communications, 2020,41(01):134-151.

[3] Mohd Javaid, Abid Haleem, Ravi Pratap Singh, Rajiv Suman, Shahbaz Khan. A review of Blockchain Technology applications for financial services. Bench Council Transactions on Benchmarks, Standards and Evaluations, Volume 2, Issue 3, 2022, 100073, ISSN 2772-4859, https://doi.org/10.1016/j.tbench.2022.100073.

[4] Xingxiong Zhu and Dong Wang. Research on Blockchain Application for E-Commerce, Finance and Energy. 2019 IOP Conf. Ser.: Earth Environ. Sci. 252 042126, DOI 10.1088/1755-1315/252/4/042126.

[5] Saberi S,Kouhizadeh M,Sarkis J, et al. Blockchain technology and its relationships to sustainable supply chain management[J]. International Journal of Production Research,2019,57(7).

[6] Ju e Goo, Chen Chen,Blockchain technology drives the development of supply chain finance innovation research [J]. Journal of Xi'an Jiaotong University (Social Science Edition), 2020,40(03):46-54.DOI:10.15896/j.xjtuskxb.202003006.

[7] Xingxiong Zhu, Qingsu He, Shanxi Guo. Application of blockchain technology in supply chain finance [J]. China's circulation economy, 2018,32(03):111-119.DOI:10.14089/j.cnki.cn11-3664/f.2018.03.013.

[8] Qiang Gong, Mingyuan Ban, Yilin Zhang. Blockchain, enterprise digitalization and supply chain finance innovation [J]. Journal of Management World,2021,37(02):22-34+3.DOI:10.19744/j.cnki.11-1235/f.2021.0017.

[9] Saberi S,Kouhizadeh M,Sarkis J, et al. Blockchain technology and its relationships to sustainable supply chain management[J]. International Journal of Production Research,2019,57(7).

[10] Zhiwei Cui, Blockchain Finance: Innovation, Risk and Its Legal Regulation [J]. Eastern Methodology, 2019(03):87-98.DOI:10.19404/j.cnki.dffx.20190307.011.

[11] Liqing Zhang, Tong Wu. Application of blockchain in the financial field: theoretical basis, practical dilemma and cracking strategy [J]. Reform,2019(12):65-75.

[12] Xiaowei Ding. From Internet Finance to Digital Finance: Development Trends, characteristics and Concepts [J]. Journal of Nanjing University (Philosophy, Humanities, Social Sciences),2021,58(06):28-44+162.

[13] Blockchain white paper 2018 [BD/OL] http://www.caict.ac.cn/kxyj/qwfb/bps/201809/t20180905_184515.htm

[14] Hua Song, Qiang Lu. What kind of SMEs can benefit from supply chain finance ?—— based on the perspective of networks and capabilities [J]. Journal of Management World,2017(06):104-121.DOI:10.19744/j.cnki.11-1235/f.2017.06.009.

[15] Xiubin Xu, Xiaomin Liang, Jun Zou et al. Application and research of digital RMB based on blockchain technology [J]. China-Arab States Science and Technology Forum,2022(12):99-104.