

Blockchain Technology Empowers China's Green Finance Innovation Development

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Abstract: Financial technology and green finance have an irreplaceable position in today's society. The relationship between the two is becoming increasingly close due to the diversification of economic development. For a long time, with the main support of national banks, China's green finance has been initially developed, but there are still many defects in its development, mainly facing five major challenges of imperfect information sharing, high riskiness of green projects, low participation of green industry, lack of effective regulatory mechanism and too single green financial products. By systematically analyzing the problems faced in the development of green finance in China, this paper aims to propose five specific suggestions and solutions by combining the four characteristics of blockchain: distributed ledger, decentralization, de-trust and non-tamperability, as well as its three application types of public chain, private chain and alliance chain to improve the information sharing system, use smart contracts to reduce risks, promote the transformation of small and micro enterprises through inclusive finance, introduce sandbox supervision mechanism and increase supervision, and enrich green financial service products. The use of blockchain features can provide feasibility for solving the current dilemma of green finance development and empower the innovative development of green finance.

Keywords: financial technology, blockchain, green financial innovation

1. Introduction

Against the background of increasingly serious environmental pollution, it is urgent to solve environmental problems and take the road to sustainable development. Among them, green finance is one of the important initiatives to promote the sustainable development of ecological environment and reduce environmental pollution. In the report of the 20th Party Congress, the importance of green development is emphasized. To promote the transformation of industrial structure, it is necessary to improve the financial policy and standard system to support green development [1].

Blockchain technology, as a disruptive technology, has had a deep integration with the financial sector. Compared with traditional financial products, the innovative development of green finance must overcome five major obstacles: information asymmetry, higher riskiness, lower industry participation, imperfect regulation and lack of innovation in green financial products [2]. Blockchain technology is decentralized, de-trusted, and distributed ledger [3], as well as public, private, and federated chains [4], which can provide a path and reference for solving many difficulties in green

finance. In view of this, based on the perspective of blockchain, this paper promotes the effective combination of blockchain and the development of green finance in China in a one-to-one or many-to-one manner by exploring its features such as decentralization, de-trusting, tamper-evident, and combination with smart contracts to match the development problems of green finance in China. We strive to enrich the theoretical research on the application of blockchain in the development of green finance, and provide reference and policy suggestions for the innovation and development of green finance in China.

2. Development Status of Green Finance

2.1. Development Achievements of Green Finance

Green finance consists of two aspects: "green" and "financial". "green" is the requirement that financial institutions should consider the impact of their choices on the social environment in their daily business activities, and "financial" is still the essence that financial institutions can use the environmental benefits of green projects to promote financial development while promoting green development [5]. In order to establish a resource-saving and environment-friendly society, China has introduced a series of environmental protection measures, and has achieved milestones in the protection and improvement of ecological environment, with the balance of green credit exceeding 11 trillion yuan, ranking first in the world; the stock of green bonds is 1.2 trillion yuan, ranking second in the world. At the same time, China's green finance gradually formed (Figure 1) by the green financial supervision, capital information supply and demand side, green financial market, intermediary and service center constitute the embryonic system structure, laid the foundation for the development of green finance.

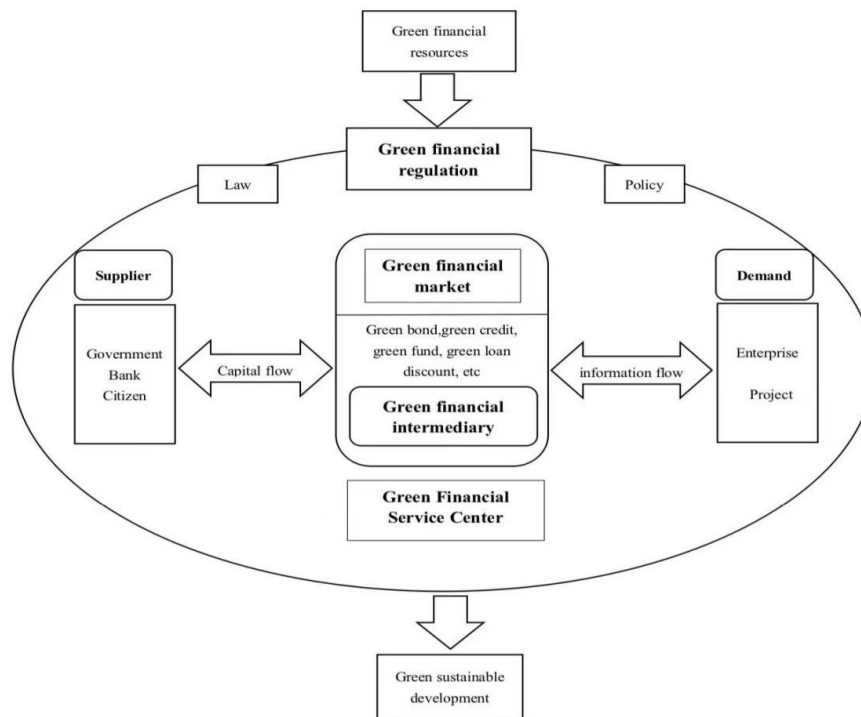


Figure 1: Green finance system.

2.2. Challenges to the Development of Green Finance

2.2.1. Incomplete information sharing

The government has introduced a series of policies to address the issue of green finance information sharing, requiring the construction of information sharing centers among various entities, but the effect is very limited, and information asymmetry and inefficient communication are more obvious [6]. First, there is information asymmetry between financial institutions and environmental protection enterprises. Financial institutions do not have the authority to obtain more information about green projects, so they have to send special people to supervise the implementation of green projects, which undoubtedly increases the cost of financial institutions in terms of human and material resources and time, leading to an increase in the risk of green projects. Secondly, enterprises are not very active in disclosing and sharing information. Due to the imperfect information protection mechanism, information can be easily leaked in the process of sharing, and the ownership of information is not clear, which seriously infringes on the interests of information sharers.

2.2.2. High investment risk in green projects

Green projects are mainly for public benefit and only secondarily for profit. Therefore, there is often a mismatch between risk and return for green projects [7]. In terms of green credit, green projects have larger credit lines and longer investment return cycles, which, combined with the information asymmetry between financial institutions and environmental companies, necessitates financial institutions to take greater risks. The mismatch between risk and return reduces the motivation of financial institutions to participate in green projects. At present, China's green industry is in the initial development stage, due to the lack of a perfect green certification system and norms, giving rise to a large number of ordinary projects in the guise of green projects, that is, the phenomenon of "greenwashing", which also greatly increases the investment risk of green projects.

2.2.3. Low participation in the green industry

The greater risk, lower profitability and high technical threshold of green projects themselves have led to low awareness and participation of most companies and people in the green sector [8]. At the social level, the lack of expertise related to green projects has led to a lack of means for a part of the general public with a sense of responsibility to participate in green finance. Micro and small enterprises are the focus of the development of green finance, and only if the majority of micro and small enterprises in China have a successful green economy transition, can China's green finance develop sustainably. However, the financial information of some micro and small enterprises is confusing and there are tax evasion and gray industry chain, therefore, when financial institutions approve loans to micro and small enterprises, they often appear to "shy away from loans", which causes difficulties in the development of green finance.

2.2.4. Lack of effective regulatory mechanisms

It is difficult for regulators to assess green projects accurately because there is no unified standard, and this phenomenon exists not only in one regulator or financial institution, but also different regulators have different assessments for the same green project, which hinders the long-term development of green finance [9]. In the process of green credit issuance, some non-green projects disguise as green projects, cheat to obtain preferential loans in the name of developing green projects, and use the funds supporting the development of green projects for other non-green projects, which

damages the national interests and also indirectly leads to the lack of sufficient financial support for real green projects.

2.2.5. Lack of innovation in green finance products

At present, only one bank in China has indicated that it follows the "Equator Principles", and most banks have failed to establish a perfect green financial service system and lack supporting measures for the development of green finance [10]. At present, the development of green finance is still led by the government, and the green finance market is not yet attractive to market investors, which is also a major factor that has been restricting the development of green finance in China. In addition, the lack of innovation of green financial products in China, the small number of products and narrow coverage, the lack of attractiveness to private capital, resulting in few financing channels for green projects, hinder the development of green finance.

3. The Main Characteristics and Application Types of Blockchain Technology

3.1. The Main Characteristics of Blockchain

3.1.1. Decentralization

The status of each node in the blockchain is equal, and each node has a complete backup record of the existing blockchain data, so even if some nodes fail, it will not affect the operation of the whole system. Decentralization can directly complete peer-to-peer transactions, which can effectively improve transaction efficiency and reduce transaction costs [11].

3.1.2. De-trusting

In the blockchain system, all transactions need to be authenticated by consensus before they are considered legitimate and valid. Therefore, the trust basis of the blockchain system is based on users' trust recognition of the whole system, rather than on mutual trust among users, which can successfully solve the mutual trust problem in the financial industry and establish a multilateral credibility system [12].

3.1.3. Tamperability

Blockchain is a decentralized distributed ledger where any node has equal rights and the same data records. If someone modifies the data of a block, he must control at least 51% of the nodes in the whole system. Otherwise, modifications to the database by a single user are invalid, thus ensuring the authenticity of the data and greatly reducing the risk of default [13].

3.1.4. Distributed Bookkeeping

Under the blockchain technology system, all transactions are authenticated by the consensus algorithm, and only transactions that pass the consensus are considered legitimate and thus recorded in the common ledger. On the blockchain, each node has a complete backup record of the existing blockchain, and all nodes jointly maintain the system data, and each node has the same rights and obligations, which prevents the loss of ledger data caused by the failure of the central system [14].

3.2. Application Types of Blockchain

According to different application scenarios, blockchain systems are generally divided into public chains, private chains and alliance chains. The public chain is the early form of blockchain. It is

completely open, and all nodes on the chain can freely enter and exit the network without authorization and can read and write data on the chain, and there is no centralized privileged node in the network. The private chain is not open to the public, and the access of each node and the maintenance of the data require authorization. Private chains are mostly used for data management and auditing within enterprises and certain organizations. Alliance chain is a kind of block chain between private chain and public chain, in which the nodes are usually specific entities. Node organizations need to be authorized to join or withdraw, and system data is only allowed to be read, written and transmitted by organizations within the system. With the features of good fault tolerance, supervisability, and high bookkeeping efficiency, the federated chain is suitable for inter-institutional transactions and settlements, and has good application prospects in the financial industry [15]. In the financial field, the core roles of federated blockchain technology are: collaboration, deposition, and regulation. The federated blockchain technology can help financial institutions collaborate with each other, improve service efficiency and enhance inter-business transparency through distributed bookkeeping and smart contracts; protect the privacy of user identity information and transaction sensitive information through symmetric/asymmetric encryption, zero-knowledge proof, and private channels, etc., and carry out data uniqueness, non-tamperability, and privacy security under the premise of It supports one-key deployment, dynamic addition and deletion of nodes, and provides multiple access methods and network-wide visual monitoring, so that financial regulators can monitor the transaction process in real time through node access.

4. Application of Blockchain Technology in Green Finance

4.1. Building a Perfect Information Sharing System

The information asymmetry problem of green finance can be solved by using blockchain technology. The decentralization function of blockchain can effectively eliminate the information barrier and establish a perfect information sharing system. Using the public chain in the blockchain, the reading and writing privileges are open to all enterprises or institutions, and all information can be reflected in the public chain, and the information cannot be artificially modified, and it is suitable for loading common information in the public chain, while some core information can be stored in the alliance chain, and the scope of the alliance chain is smaller, and the reading and writing privileges are only open to the enterprises or institutions within the alliance to prevent the outflow of core information, and the information of Environmental data, project information, and capital dynamics are shared in the alliance chain, so that financial institutions, environmental protection departments, enterprises, and investors can get objective and accurate data in the information sharing platform, which improves the quality of information and reduces the cost of obtaining information for all parties due to the openness and uniqueness of data, and eliminates the hidden danger of information asymmetry [16].

4.2. Using Smart Contracts to Prevent Risks

Green finance uses blockchain technology to eliminate information asymmetry, reduce credit risk, and enable investors to use information to judge green projects comprehensively, thus strengthening investment confidence. With the use of blockchain technology, green project information is transparent and project companies cannot conceal themselves, which greatly reduces the situation of "greenwashing". In addition, the use of blockchain technology generates smart contracts, which are programmed to set automatic transaction conditions, and once the generation conditions are triggered, the contracts will be automatically executed, which is conducive to investors' investment in green finance and reduces the risk of uncertainty in the process. At the same time, the smart contract approach eliminates the supervision of third parties and avoids the previous procedures and links, reduces the interference of human factors, enhances the security and timeliness, realizes the reduction

of costs and efficiency of green finance, helps to gather more investors and funds into the green finance field, and promotes the benign development of green finance [17].

4.3. Relying on Inclusive Finance to Promote the Transformation of Small and Micro Enterprises

Relying on inclusive finance, micro and small enterprises are the key point to realize green finance, but the green economic development of micro and small enterprises needs the favorable support of inclusive finance, and the use of blockchain can reduce the phenomenon of "shying away from loans" of financial institutions to micro and small enterprises. Every business information of micro and small enterprises is reflected in the blockchain model, and the business information is irreversible and non-falsifiable. Through blockchain, inclusive financial institutions can understand various information of micro and small enterprises, including credit status, financial status and business status of enterprises, and inclusive financial institutions can conduct credit business in a safe manner. In addition, blockchain is not restricted by geography and can record the information of green enterprises and green projects across regions and fields, which is convenient to track the positive and negative records of green enterprises in the process of engaging in green business in a timely manner, establish the public credit system of green enterprises, and build a benign and multi-party participation green financial credit ecology [18].

4.4. Introduce Sandbox Supervision Mechanism and Strengthen Supervision

Accelerate the establishment of a regulatory sandbox system for "blockchain technology + green finance" and allow financial enterprises using blockchain and other new technologies to conduct experimental business tests within a specific scope and gradually achieve compliance under the guidance of relevant regulatory authorities. Establish a fault-tolerance and error-correction mechanism to provide a relaxed innovation environment for financial enterprises. At the same time, we should strengthen the fight against "pseudo-innovation" in the name of blockchain, and continue to purify the blockchain ecosystem to ensure the healthy development of the green finance industry based on blockchain technology. The adoption of the "sandbox regulation" model of inclusive regulation while continuing to consolidate the conventional regulation model can leave more ample space for the continuous progress of the blockchain technology industry and better lead the benign development of fintech and innovative economy while preventing risks [19].

4.5. Enrich Green Financial Products and Services

The open source design of blockchain makes its data open to all, and anyone can query blockchain data and develop related applications through the public interface, which can accelerate the speed of innovation in the market. It can broaden financing channels, diversify financial products and green financial services through the Internet financial platform. The combination of blockchain and various derivatives such as commercial paper, stocks, funds and futures will further expand the diversification process of green finance. The data sharing platform built based on blockchain technology can reconstruct the information sharing model, build a data trust network, optimize the trusted collaboration process, and realize the trusted flow of data to solve the data problem in the process of financial product innovation [20].

5. Conclusion

At present, China is still in the preliminary development stage in green finance, with problems such as imperfect information sharing, high riskiness, low industry participation, imperfect regulatory

mechanism and lack of innovation in green finance products. This paper argues that blockchain technology can show disruptive potential in the financial field, therefore, based on the research perspective of blockchain technology, by studying the distributed ledger, decentralization, de-trust and non-tamperability of blockchain and its application types of public chain, private chain and alliance chain applied to different fields, five major countermeasures to cope with the current green finance dilemma are proposed: improving the information sharing system, The use of smart contracts to reduce risks, promote the transformation of small and micro enterprises through inclusive finance, introduce sandbox supervision mechanism and increase supervision, and enrich green financial service products. As the development of blockchain technology becomes more mature, the research and practice of applying blockchain technology to the development of green finance will be on the rise. Future research will also focus on the specific technical and conceptual paths of blockchain technology to promote the development of green finance, helping blockchain technology to play a real role in the field of green finance.

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