Research on Chinese Strategies for Developing Blockchain Payment Systems

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This book is dedicated to my family and the new order of the world.

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PREFACE

In 2008, the birth of Bitcoin began with Satoshi Nakamoto's book "Bitcoin: a peer-to-peer electronic cash system". As a pioneering work, Satoshi Nakamoto elaborated the framework concept of e-cash system based on P2P network technology, encryption technology, timestamp technology, etc. Since then, Bitcoin and its underlying technology blockchain have attracted increasing attention. Blockchain technology is the basic technology for the implementation of Bitcoin. It is a chained data structure that combines data blocks in chronological order and ensures the tamper proof and forgeable distributed ledger in an asymmetric cryptography way. In essence, it is a technology that can maintain a set of tamper proof ledger records between participants who do not trust each other or who do not trust each other without intermediary participation. The characteristics of blockchains, such as decentralization, data tamperability, traceability, and transparent and open information, can effectively solve the pain points of trust and information asymmetry in many traditional industries. So, at present, blockchains have been widely used in finance, supply chains, internet of things, regulations and other fields, and blockchains have become an important breakthrough in the innovation and development of the financial fields.

At the same time, relevant data show that the global cross-border payment volume has reached $39 trillion in 2022, accounting for about one third of the global GDP. It is expected that the cross-border payment market will have broader development space in the future. However, in the face of such a broad cross-border payment market and demand, the development level of the existing cross-border payment system does not match it. Cross-border payments face many problems, such as long payment chains, high cross-border payment costs, opaque information, financial risks and hidden dangers, which cannot meet people's growing demands for cross-border payments. In 2019, the international financial community began to comprehensively study how to improve cross-border payment services, and at the same time started to explore how to use the best cutting-edge financial science and technology in the cross-border payment systems to change the existing situations and help develop the cross-border payment systems. The characteristics of the blockchain technology, such as decentralization and data tamperability, have a natural fit with financial

payments, which can effectively solve the current pain points in the field of cross-border payments and help build a faster, safer and more transparent cross-border payment mode. JPMorgan Chase Bank, HSBC, Ant Finance and other financial and commercial giants have invested heavily in the research and development of blockchains, and plan to improve financial infrastructures and develop cross-border payment businesses with the help of the latest financial technology. This book integrates our researches and experiences in blockchain principles, mechanisms, comparative advantages, practical insights, application prospects, national policies and other aspects, and explores the application modes of the blockchain technology in the field of cross-border payments, in order to provide unique insights and suggestions of the strategies and policies for the development of the blockchain technology in China's cross-border payment businesses.

This book is a comprehensive reference for experts engaged in the blockchain researches, and also has the unique value for future development strategies and for policy makers of blockchains in China and all other countries.

The main content of this book is based on the three major economic theories of "the ternary paradox theory", "the free currency theory" and "the transaction cost theory". Starting from the problems existing in the traditional cross-border payment, it analyzes the pain points. Taking the Ripple cross-border payment system as an example, it compares the differences, advantages and disadvantages between the Ripple mode and the traditional cross-border payment swift mode around the three major economic theories. It also analyzes the effect, mechanism and constraints of blockchain applied to cross-border payment from the three dimensions of payment efficiency, payment cost and payment risk, and puts forward policy suggestions for the development of blockchain cross-border payments in China.

This paper is divided into five chapters

(1) Preface. It summarizes the background, significance, key research contents, readers and structure of this book.

(2) Blockchain principles. This chapter reviews the literature at home and abroad, and discusses the basic principles of blockchain operation and three economic theories related to blockchain, including free money theory, ternary paradox theory and transaction cost theory.

(3) Blockchain mechanisms. This chapter summarizes the emergence, development and characteristics of Ripple, and describes in detail the Ripple operation mode based on the Ripple digital cryptocurrency bill settlement and the Ripple system based on the non-digital cryptocurrency cross-border payment, and analyzes the characteristics of the blockchain cross-border payment mode innovation.

(4) Research on comparative advantages of blockchain. The business operation modes of the Ripple and traditional cross-border payment system swift are compared one by one, and the differentiation analysis is carried out to summarize and extract the application characteristics of blockchain in the field of cross-border payments.

(5) Research on blockchain development strategies and China's blockchain policies. It puts forward corresponding policy suggestions for the application of blockchains in cross-border payments.

(6) Summary and conclusions. This chapter summarizes what we have done in this book and what should be done in the future development of the blockchain technology and its payment systems.

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CHAPTER 1

BLOCKCHAIN FUNDAMENTAL MECHANISM AND PRINCIPLES

1 Introduction and Overview of Blockchain

In 2008, after Nakamoto's Bitcoin, a peer-to-peer e-cash system, was published, blockchain began to attract public attention [1-4,9]. Yermack D (2017), believes that blockchain is a sequence information database that ensures security through encryption [5]. These blocks are connected through the network and have the same structure. This architecture makes the whole system more stable and reliable. Blockchain provides an alternative to financial ledgers. Neyer G (2017) believes that the blockchain's distributed ledger technology ensures that each node in the network can obtain a true copy of the ledger, and any changes to the ledger will be synchronized with the copies of the ledger, which is maintained and updated by the participants [6]. With the development of blockchain technology, further breakthroughs have been made in smart contracts and consensus mechanisms. Vitalik Buterin (2014) proposed the Ethereum blockchain model based on Bitcoin. Its core technology is smart contracts. The emergence of smart contracts has laid the foundation for the large-scale commercialization of blockchain technology [8]. As for the blockchain consensus mechanism, due to the drawbacks of the proof of work (POW) consensus mechanism adopted by Bitcoin, such as high computational power and power resource consumption, and slow confirmation speed, the blockchain led by Ethereum has made a new breakthrough in the consensus mechanism and proposed the proof of stake (POS) method. The different consensus mechanisms that have emerged since then have also led to the differentiation of different technology paths of the blockchain, including public chain, private chain and alliance chain. Kshetri N (2017) has done relevant research on blockchain to strengthen network security and protect privacy [7]. He compared the differences between blockchain and cloud data center in terms of security and privacy, and believed that blockchain based solutions were superior to the current

IOT ecosystem in many aspects. In China, the research on blockchain technology is mostly based on foreign research theories. Shen X, Pei Q and Liu X (2016) pointed out that blockchain originated from Bitcoin and is the underlying technology of Bitcoin [10]. On the basis of Bitcoin and Ethereum, blockchain is divided into six levels. He Pu et al. (2017) comprehensively elaborated the blockchain workload proof mechanism, P2P distributed network technology, timestamp, hash algorithm and asymmetric encryption technology [11]. Han X and Liu Y (2017) summarized and analyzed the current mainstream consensus mechanism, and proposed that by organically combining different consensus mechanisms and improving them, the problems and defects of a single consensus mechanism can be repaired and the role of consensus mechanism should be better played [12].

The blockchain was first accompanied by the emergence of Bitcoin. The basic storage unit in the blockchain is called the block. The block stores all transaction data. Each block is linked in chronological order. Since each block header forms a data chain through a unique hash value as the unique identification value, so it is called the blockchain. Blockchain is the comprehensive integration and innovation of a series of technologies such as encryption technology, P2P network technology, timestamp technology, distributed data storage technology, consensus mechanism and smart contract. It is a new distributed collaboration and application model for information transmission, storage and intelligent transaction execution. Blockchain has the following characteristics:

(1) Decentralization

Decentralization is the most prominent feature of blockchain. The traditional database uses centralized recording and storage. Even if there is disaster recovery backup or cloud storage, it is still a traditional database only with a change from one place to many places in the physical location. The difference between local and cloud does not change the centralization of the central server. Once the central server fails, disaster recovery and cloud will also fail. The blockchain relies on distributed accounting and distributed storage to verify and manage the information of each node. There is no absolute central organization or hardware equipment. If any node is damaged, other nodes can still continue to operate, and the operation of the whole system will not be affected. Through this decentralized approach, data integrity, reliability and system stability can be guaranteed.

(2) To trust

The blockchain relies on the consensus algorithm to ensure the authenticity and integrity of the data between the nodes. Without the participation of trust intermediaries, the nodes on the blockchain can interact freely and verify smoothly. All of the data is open, transparent and tamper proof, which fully realizes the operation of data and self-management.

(3) Openness

In addition to the encrypted private information on the blockchain, all participants can freely query the information on the chain. The information of all participating nodes is open and transparent to the outside world, and it is unanimously confirmed by the whole network that any participating node can access data through the public interface. Therefore, the information of the whole blockchain is highly transparent.

(4) Data reliability

The blockchain's distributed ledgers enables each node to obtain a complete copy of the ledgers, and under the protection of the consensus mechanism, data tampering at a single node is invalid, and data modification must be agreed by most nodes in the system. Therefore, generally speaking, the more nodes in the system, the less likely it is to tamper with the data, and the higher the security of the system.

(5) Traceability

Each transaction in the blockchain can track the source and destination of the transaction through the time stamp and unique ID in the block. Through the complete tracking chain of blockchain, transaction activities can be clearly and easily tracked.

(6) Highly intelligent

Intelligence mainly relies on the blockchain's "smart contract" technology, which means that the blockchain program supports preset execution conditions. Once the agreed conditions are met, the system will automatically execute as required, and all nodes will witness and record this process.

2 Classification of Blockchain

Blockchains are divided into three categories: public chain, alliance chain and private chain. The classification is mainly based on the degree of decentralization. Among the three types of chains, the public chain is completely decentralized, which is the chain with the highest degree of decentralization. The rights of each participant are the same, that is, they can freely obtain information and conduct transactions, and the transaction information is completely open and transparent. Compared with the public chain, the private chain is a fully centralized blockchain, which is generally only used internally. The alliance chain is a multi-centralized or partially decentralized blockchain.

Public chain, private chain and alliance chain have different characteristics and application scenarios. The specific comparison is shown in the table below:

Table 2-1 Comparison of three types of blockchains.

Comparison Items	Public Chain	Private Chain	Alliance Chain
Participant	Any member	Company or individual	Alliance
Consensus mechanism	POW/POS/DPOS	Distributed consistency algorithm	Distributed consistency algorithm
Bookkeeper	All participants	Discretionary	Participants negotiate and decide
Decision speed	Slow	Fast	Medium
Excitation mechanism	Need	Optional	No need
Data capacity	30000-200000 trades/second	10-10000 transactions/second	10-100000 trades/second
Degree of centralization	Complete decentralization	Centralization	Polycentrism
Data disclosure	Open	Private	Private
Applicable network	P2P network	High Speed Network	High Speed Network

Significant features	Build trust and credit completely and autonomously	Data transparency and traceability	High efficiency and cost optimization
Principal representative	Bitcoin, Ethereum, Qtum, EOS, TrueChain	Linux Foundations	R3 Blockchain alliance
Advantage	High degree of decentralization	High speed, low operation and maintenance costs, and strong ability to resist malicious attacks	Give consideration to the decentralization of public chain and the efficiency and low transaction cost of private chain
Inferiority	High requirements for hardware performance and slow processing speed	It is not open at all. The control over private nodes is highly centralized, and there is a risk of joint fraud by members	Partial decentralization, limited nodes
Main application scenarios	Virtual currency	Audit, enterprise database and other internal work links	It is widely used in electronic forensics, supply chain finance, payment and settlement

3 Blockchain Core Technology

The core technologies of blockchain include consensus mechanism, distributed ledgers, cryptography technology and smart contracts, which support the wide application of blockchain.

(1) Distributed ledgers

The distributed ledgers are the foundation for the decentralization and distrust of blockchain. In the blockchain, all transactions and operations are recorded in tamper proof blocks. All accounting information of network participants is stored in the blockchain, and the transactions are guaranteed and verified through the consensus mechanism. In the blockchain, each node maintains a complete copy of the ledgers. If a node adds a new transaction, other nodes will need to synchronize the transaction data, and verify and record it locally. Multiple nodes always have complete copies of the same ledgers, thus ensuring the validity of the transaction and data consistency.

The distributed ledgers make the transaction data transmission and storage of the blockchain more reliable, secure and transparent, and greatly improve the efficiency of data sharing and exchange.

(2) Consensus mechanism

Consensus mechanism is an important part of the decentralization of blockchain which is ensuring that the data is not tampered with. The so-called consensus mechanism is a way to determine and maintain consistency. For example, under a certain consensus mechanism, a transaction reaches the recognition degree within the agreed time and agreed scope, that is to say that it is considered to be the final transaction and can be recorded as the final record of the whole network recognition. Therefore, different blockchains can have different consensus algorithms based on different recognition degrees. Under the role of consensus mechanism, the operation between the trading parties follows a set of automatic and autonomous processes and specifications, rather than relying on the supervision and scheduling coordination of a central institution or intermediary institution.

At present, the workload proof, equity certificate, equity authorization certificate and Byzantine consensus agreement are the four most typical consensus mechanisms of blockchain. None of the four consensus mechanisms can meet the requirements of efficiency, security and fairness at the same time. Generally speaking, the higher the degree of decentralization, the higher the security and the slower the speed. The lower the degree of decentralization, the lower the security and the faster the speed. The comparison of four typical consensus mechanisms is shown in the table below:

Table 2-2 comparison of four typical blockchain consensus mechanisms

Comparison items	**PoW**	**PoS**	**DPoS**	**PBFT**
Name	Proof of work	Proof of stake	Certificate of equity authorization	Byzantine consensus agreement
Degree of decentralization	Complete centralization	Complete centralization	Semi centralization	Semi centralization
Bookkeeping node	Whole network	Whole network	Election of several agents	Elected leaders
Confirm speed	<100s	<100s	<10s	<10s
Resource consumption	High	Medium	Low	Low
Capacity of transaction volume	Small	Small	Large	Large
Fault tolerance rate	50%	50%	50%	33%
Scalability	Strong	Strong	Strong	Weak
Regulatory compliance	Low	Low	Low	High

Characteristics	Determine bookkeeping rights based on workload	Determine the bookkeeping right according to the owner's equity held	Consensus algorithm based on voting	When there are wrong nodes, all correct nodes in the system can reach an agreement on an input value
Advantage	Complete decentralization, free access of nodes	Reduce the waste of pow resources and improve the computing speed	It is an upgraded version of PoS, which greatly improves the data processing capacity and greatly reduces the maintenance cost	Effectively avoid resource waste
Shortcoming	Large waste of computing power and energy, long settlement cycle	The concentration of rights leads to the loss of impartiality	The degree of decentralization is weak, and the fairness is lower than that of POS	Poor security and scalability
Applicable scenarios	Public chain	Public chain, alliance chain	Alliance chain	Alliance chain

(3) Cryptography technology

Blockchains use asymmetric encryption technology in cryptography to ensure the security and privacy of transactions. The reason why it is called asymmetric encryption is that the password of the blockchains contains two keys, the public keys and the private keys, which generally appear in pairs. If the transaction is encrypted with the public key, only the corresponding private key can unlock the password. For example, in the transaction of Bitcoin, the public key is generally used in the participant's digital currency address. Similar to the account number of the traditional Banking system, the Bank account number is provided to the other party. After the other party remits, only the private key can be provided to decrypt the withdrawal. Asymmetric encryption technology is crucial to ensure the correctness and integrity of blockchain data.

(4) Smart contracts

Smart contracts are contracts written in the form of code, which can be automatically enforced on the blockchain according to the agreed conditions and requirements without the intervention of a third party. Through the setting of smart contracts, transactions can be automatically executed without a centralized control mechanism, and the execution results are jointly verified by all nodes on the blockchain, which cannot be tampered with, Smart contracts are effectively ensure the fairness and security of transactions, and improving the efficiency of business processing. The emergence of smart contracts has expanded the commercial application scenarios of blockchain. For example, smart contracts can be widely used in the fields of transfer, authentication, election voting, social assistance and so on.

4 The Principles Behind the Blockchain Technology

In this section, the three key principles lying the development of Blockchain payment systems are thoroughly investigated.

4.1 Ternary Paradox Theory

The Mendelian trilemma, also known as the impossible trinity, was put forward by American economists Mundell and Paul Krugman. Its meaning is that in an open economy, a country cannot achieve a fixed exchange rate, free flow of capital and independent monetary policy at the same

time. An open economy can only meet two goals at the same time and give up the other goal. In the application of blockchain, there are also "three paradoxes" of "decentralization", "security" and "high efficiency and low energy of scalability", i.e., a blockchain cannot achieve these three goals at the same time.

(1) The pursuit of "security" and "decentralization" cannot achieve "scalability"

Bitcoin blockchain is a technology combination that pursues "security" and "decentralization". In order to make full participation, ensure the consistency of information and realize full democratic autonomy of the network, each node on the Bitcoin blockchain should participate in information query and verification, and each node downloads and stores all transaction data to fully realize "security" and "decentralization". However, in this mode, Bitcoin blockchain can only process seven transactions per second, which is a relatively inefficient processing mode, and it will also bring huge storage space loss and verification costs. It is far from meeting the needs of the global monetary payment scenario, nor can it support the requirements of large-scale commercial use. Therefore, Bitcoin blockchain technology has achieved the goals of "security" and "decentralization", but it cannot achieve the goal of "scalability".

(2) The pursuit of "scalability" and "security" cannot completely fulfill "decentralization"

From the perspective of consensus mechanism, in order to solve the problem of scalability (high energy and low efficiency) of Bitcoin workload certification under the premise of ensuring "security", blockchain has gradually developed mechanisms such as equity certification and share authorization certification. However, both equity certification and share authorization certification are actually concessions to decentralization and form partial centralization. Partial centralization refers to setting some central points on the blockchain, which are responsible for maintaining the stable operation of the blockchain, so as to achieve the goal of scalability.

(3) Pursuing "scalability" and "decentralization" needs to sacrifice "security",

From the perspective of storage, in order to solve the scalability problem under the premise of ensuring "decentralization", Ethereum blockchain

adopts a fragmented storage scheme, allowing each node to store only a subset. In this way, it can significantly improve the efficiency of business processing, greatly improve the carrying capacity of the system, and will not bring too much pressure on node storage and network transmission. However, this fragmentation scheme of Ethereum is actually equivalent to a semi-independent multi chain, and the direct consequence of multi chain is the dispersion of computing power, which will sacrifice "security" in part, resulting in the problems prone to wrong data. Once the wrong data is recognized, it will cause irreparable losses due to the inability to tamper with the data. Therefore, from the perspective of blockchain storage, "scalability" and "decentralization" are realized, but "security" is sacrificed.

At present, the "Impossible Triangle" of the three goals of blockchain technology, i.e., the scalability, security and decentralization of blockchain systems has not been perfectly solved. In the financial payment field in which "data is king", data errors will lead to the collapse of the entire system with unimaginable consequences. Therefore, the application of blockchain in the field of cross-border payment generally gives priority to the guarantee of the goals of "security" and "scalability", and gives up the goal of complete "decentralization". For example, Ripple, a typical representative of blockchain cross-border payment, adopts the consensus mechanism of alliance chain and PRCA. Technically, in order to ensure the safety and efficiency of payment, it adopts the form of "partial centralization" to give way to the goal of complete "decentralization".

4.2 Free Money Theory

The theory of free currency advocates the non-nationalization of currency, so it is also called "the theory of non-nationalization of currency". The representative of this theory is Hayek of Austria, the representative of Neo liberalism. The theory of free currency advocates the realization of freedom and openness of the market in currency trading. It emphasizes the free choice and autonomy of individuals in currency trading, and believes that currency trading should be carried out in a free competitive market environment without the intervention and restriction of the government or other central institutions. The core concepts of free money theory include free circulation of money, free choice of market participants, free exchange of money and open market competition. The theory holds that by establishing an open, transparent and competitive market environment, individuals can freely choose different currencies for trading, and

determine the value of money according to the relationship between market supply and demand.

In the traditional category, money is monopolized by the central Bank or other financial institutions, while the digital cryptocurrency on the blockchains is self-issued and managed through algorithms. The characteristics of blockchain technology can release monetary control, promote the free flow of money to a certain extent, and thus promote free monetization. Blockchain technology allows the creation of a new form of currency, namely cryptocurrency. These currencies are decentralized and not controlled by any governments or central Banks, which means that their value is no longer determined by a single policy, but by market supplies and demands. The emergence of this new currency has further promoted free monetization. In the applications of blockchain technology, the realizations of free money theory can not only promote the speed and efficiency of money circulation, but also improve the stability of money value. For example, based on blockchain technology, people can protect their assets through smart contracts, thereby reducing risks in transactions. The theory of free money is of great significance for the application of blockchain technology.

In the case studied in this book, the theory of free money has played an important role. The theory of free money emphasizes the free choice and autonomy of market participants in currency transactions, and is not limited by the restrictions of traditional financial institutions. In the Ripple cross-border payment system, the digital cryptocurrency, the Ripple coin, which is based on the Ripple protocol has free liquidity, and users can freely choose to exchange it with other legal currencies. Ripple forms a unified digital market for multiple market makers by introducing an intelligent market maker system. In this market, enterprises can choose the best quotation to exchange according to the market bidding mechanism to realize real-time currency exchange. The application of this market maker system makes the circulation of money more flexible and efficient, improves the liquidity of the market, and reduces the transaction cost. In addition, Ripple adopts a point-to-point organizational structure, which does not need to rely on traditional intermediaries for payment. This means that participants can directly conduct transactions in the network without transferring and authorizing through intermediaries such as Banks. This decentralization makes currency trading freer, and participants can control their own funds and trading behavior more directly.

4.3 Transaction Cost Theory

Coase, the Nobel Prize winner in economics, put forward the transaction cost theory in 1937. He believed that people need to pay a certain cost in the process of social interactions and cooperation, that is to say, all human interaction and exchange activities will produce transaction costs. In the traditional trading mode, the complexity and speculation of the transaction will lead to the increase of various transaction costs, but to a large extent, the transaction costs are mainly caused by information asymmetry and mistrust between the two sides of a transaction. Blockchains have the characteristics of decentralization, to trust, openness and transparent data. These technical characteristics determine that blockchains can effectively solve the problems of information asymmetry and trust from the bottom, so as to reduce a series of transaction costs.

(1) Search and information costs: decentralized networks reduce this cost because trusted information can easily flow on the public blockchains. The information is always stored in publicly accessible, auditable and immutable ledgers, and there is no information asymmetry. Blockchains realize information sharing through the decentralized way, which reduces the time and cost of information collection and information exchange. Eventually, blockchains lower the corresponding search and information costs.

(2) Negotiation decision cost: negotiation is a process of finding and receiving signals, which occurs between willing buyers and sellers. All transaction information on the blockchains is open and transparent on the chains. Both parties can fully grasp the information and accurately understand the other party's needs and intentions, so as to better formulate the direction of negotiation and decision-making, which greatly improves the transparency of transactions and reduces the transaction cost of negotiation and decision-making.

(3) Supervision and execution costs: compliance inspection and supervision are always carried out before and after the completion of the transaction. In traditional transactions, regulators need to spend a lot of manpower and energy to supervise and inspect related transactions, while as the regulated party, it also needs to spend a lot of manpower and material resources to meet regulatory requirements. When blockchain technology is introduced, the regulator can be used as a node in the chains. According to the consensus mechanism and smart contract, all information on the chain is open and tamper proof, and is automatically executed

according to the preset contract. The relevant regulatory and compliance conditions are pre standardized throughout the process. Then the completed business must meet the regulatory and compliance requirements. The regulators do not need to carry out extra investigation work, and the enterprises do not need to cooperate with the regulatory investigation and pay relevant regulatory investigation fees. The built-in, standardization and automation of regulatory standards can reduce the cost of regulation and implementation very well.

In specific application scenarios, Ripple, as a cross-border payment system based on blockchain technology, aims to solve the problems of time consuming and high-cost cross-border remittance between traditional Banks. Compared with the traditional cross-border payment system, Swift and Ripple can bring more convenient and low-cost transfer services. For example, in the Ripple system, there is no need to rely on the agent Banks, and the transaction subjects can conduct point-to-point transactions, which improves efficiency and reduces the handling charge of the agent Banks and the reserve fund of the agent Banks. As the Ripple network is adopted, it does not need to use the Swift system, so the high fees such as Swift membership fees, telecommunication fees, system maintenance and upgrade can also be avoided. The Ripple distributed ledger technology enables both parties to maintain the same set of ledgers, maintains the consistency and tamperability of information, saves a lot of reconciliation work, and thus reduces the comprehensive operation costs.

It is shown that blockchain technology can effectively solve the problems of information asymmetry and distrust in the transaction processes, thereby reduce the resulting trust costs, operation costs, search costs, supervision costs and other transaction costs. The recent fast growing quantum computing and information storage technology should provide the much-needed ultra-high computing and large information storage space to release all the potential applications in the future.

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CHAPTER 2

RESEARCH ON THE MECHANISMS OF BLOCKCHAIN CROSS-BORDER PAYMENT SYSTEMS

1 Introduction

Since the advent of blockchain technology, a large number of blockchain payment systems have emerged, such as Bitcoin, Ripple, Litecoin, Libra, etc. World famous traditional financial institutions and industry giants have also begun to study blockchain technology to promote their cross-border payment business [1,2,3]. Among many blockchain cross-border payment systems, Ripple, as the earliest blockchain cross-border payment enterprise, is representative of its cross-border payment system in terms of technology scalability, compatibility and business processing mode. It is the benchmark of cross-border payment systems, and its business model has been applied in a large range of matters [4]. For the above considerations, this book selects Ripple as the case study object to elaborate and explore the application characteristics and internal mechanisms of blockchains in the field of cross-border payments [5,6,7].

Ripple, founded in 2012, is an American company focusing on blockchain technology and digital cryptocurrency. Headquartered in San Francisco, it is a private financial technology company. Ripple cross border payment system is an open-source payment agreement developed by Ripple company [2,3,4]. Its goal is to establish a fast, effective and low-cost global payment system to help customers of Banks and other financial institutions make global payments faster, more reliable and cheaper. The Ripple cross-border payment system has a large market share in the field of blockchain payments. As of May 2023, more than 200 financial institutions around the world have established cooperative relations with Ripple. Banking institutions and remittance institutions such as Bank of America