The Construction of Blockchain Infrastructure to the Digital Economy

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ABSTRACT

As the basic technology of cryptocurrency, blockchain continues to develop and is used in all walks of life. At present, the growth rate of the digital economy model is accelerating, and the blockchain infrastructure promotes the development of the digital economy. This article presents the blockchain infrastructure and its role in shaping the digital economy and puts forward some future development trends and challenges.

Keywords: Blockchain; Digital economy.

1. INTRODUCTION

With the rapid development of computers, blockchain as a disruptive technology has attracted the attention of different industries. It emerged as a technology that supports Bitcoin, an encryption currency. It effectively guarantees the integrity and security of transactions, improves people's trust in the network system, and innovates business models. [1] The blockchain adopts a peer-to-peer approach to integrate a unique distributed database to realize a decentralized system. It is distinguished from traditional databases through consensus mechanisms, encryption algorithms and distributed data, so now blockchain technology is also used in other fields besides encrypted currencies. In different scenarios, using blockchain as an open and transparent third-party system trusted by participants has achieved a breakthrough in blockchain technology from the 1.0 era to the 3.0 era. [2]

At present, the application of blockchain technology from individuals to organizations has created a new type of digital infrastructure. It is based on the Internet, from the value exchange blockchain to the program exchange blockchain and finally to Interchain to provide participants with a digital platform. [3] Based on the security of blockchain technology, it is difficult to tamper with and transparent to develop digital platform services, which improves productivity and reduces transaction costs. It uses a distributed data infrastructure to make the platform more advantageous in exchanging and storing value. [4]

Blockchain infrastructure currently has unique advantages in the construction of the digital economy. This article will introduce blockchain's basic concepts and technology in the second section and systematically discuss its current infrastructure and technology in the third section. The fourth section studies how the blockchain infrastructure can promote the construction of the digital economy. Finally, the fifth section proposes some future development trends and possible challenges. Finally, the sixth section summarizes this article.

2. BLOCKCHAIN OVERVIEW

2.1 How blockchain works

The essence of the blockchain is a distributed electronic account book. Each block represents one or more transactions. These blocks are linked together in chronological order. As shown in Figure 1, each of these blocks contains four important working principles.
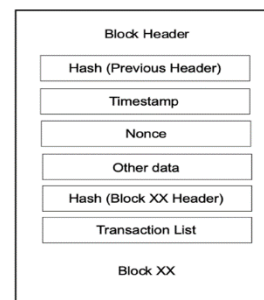

Figure 1 Block working principles.

(1) Block header, the header of each block in the entire blockchain is hashed, the code after the hash is used to link the whole blockchain, only the previous hash code of the next block when the hash code of the previous block is the same, they can be linked together. Therefore, when the data of a block is modified in the blockchain, it cannot be connected to the previous block unless the blocks in the entire blockchain are modified, which can effectively prevent the blockchain from being tampered with.

(2) Hash, an encryption algorithm. The original text and the hash code will only have a one-to-one correspondence. It is a one-way function, the hash function calculates the hash value, and it is usually irreversible after the function is converted. If the data information tampers with the blockchain, it will not be able to pass the hash verification.

(3) The transaction, every transaction in the blockchain will be recorded formally, using a particular programming language to record what happened. It is also the core of Bitcoin and the sole purpose of the blockchain. Once a transaction is created, no one can modify or delete it, and each block must store at least one transaction.

(4) An electronic signature, using a public key and private key authentication to ensure the encryption nature of the blockchain and prevent malicious theft of information by others.
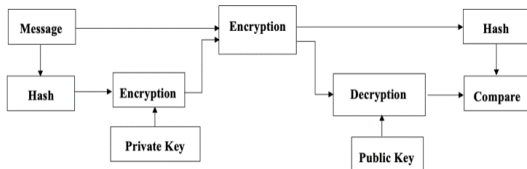

Figure 2 Using public key encryption

Therefore, compared to traditional databases, blockchain can be used to solve some more complex problems. At the same time, because of its high transparency and difficulty to tamper with, the blockchain is also used to meet the needs of security, automation, and decentralization. [5] Blockchain as a peer-to-peer network can effectively solve the problem of trust for third-party participants and reduce the problem of centralized management. [6]

2.2. Blockchain technology

The blockchain adopts a peer-to-peer communication method, in which each block is related to the transaction of the related user. Participants are independent of each other. Each participant represents each network node. They jointly manage and maintain this distributed database. There is no intermediate node, and each network can directly communicate with each other. They are scattered in the network, but the information recorded in each block is synchronized in real-time throughout the network, and each node can access the database. The data that can be obtained is entirely consistent. [7]
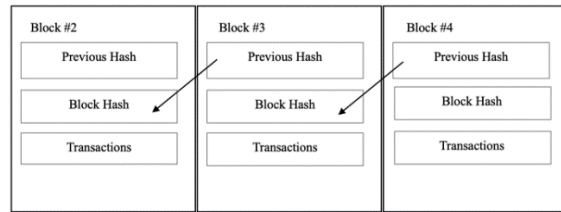

Figure 3 Blockchain

Since the blockchain is decentralized, the process of updating data needs to meet the consensus mechanism between participants. Starting from the cause of the blockchain, it continues to connect backwards, and each newly added block needs to reach a consensus, and then the block will be connected to the previous block and published on the network. The consensus mechanism ensures that the agreement satisfies most of the group. An effective block agreement can be reached in a Pow-based network when it has 51% of the proportion. [8] In the blockchain, the transaction can be generated only when all network nodes uniformly verify that the hash block provided by the miner is correct and start mining the next valid block.

3. BLOCKCHAIN INFRASTRUCTURE

The blockchain infrastructure is based on the network and information to show a new trend of digitization. At present, artificial intelligence, cloud computing, the Internet of Things, and blockchain are used as the infrastructure of new technologies. Among them, the blockchain uses distributed database technology to build a safe, transparent, and data-sharing platform that does not require third-party verification. At present, blockchain technology is no longer limited to the direction of cryptocurrency. It has applied existing technologies to e-government services, financial services, healthcare services and agricultural services, bringing new forms of infrastructure to all walks of life, optimize the business development needs of different industries. Among them, the development of blockchain has been widely used in the commercial market. [9] According to Nina [10], Paxos, a company that provides encryption services for PayPal, raised many funds to expand its blockchain infrastructure. The company applies blockchain technology to the stock market, securities market, and other investment products. Distributed storage technology based on blockchain, adopting a consensus mechanism, effectively solves the security, reliability, and data consistency in data storage prevents the system from being destroyed, strengthens data management, and enhances the trust problem in network data. [11]

3.1 Blockchain infrastructure architecture

The functional architecture of the blockchain infrastructure is divided into three layers, the data layer, the network layer, and the consensus layer. The data layer is the basic layer, mainly collecting, recording, and storing data. Utilize hash algorithm and encryption technology to ensure the security and integrity of data. The network layer is the active mechanism layer. Participants jointly maintain the update of the data in the blockchain in the network layer. In the consensus layer, participants reach consensus in a distributed system and establish a trust system. They provide the necessary core technology for the blockchain to ensure the authenticity of data, maintain a decentralized structure and guarantee a consensus mechanism. This hierarchical structure is conducive to creating a distributed data sharing system based on blockchain technology. The system provides services for participants, provides a transparent and secure data exchange and data storage, and realizes mutual trust between nodes. [12]

Blockchain builds an autonomous credit system. It uses blocks as the infrastructure, adopts a peer-to-peer approach in the architecture, provides a shared data model, strengthens the trust between transactions, and builds an efficient business network. The blockchain infrastructure confirms that the consensus mechanism builds a reliable data system, with blockchain technology as the core, provides distributed management, and produces a new intelligent computer network. Bitcoin, Ethereum and smart contracts are systems built with blockchain technology as the infrastructure. With the introduction of programmable codes, through programming, smart contracts can also be used as automatic execution agreements under certain conditions, such as payment. Based on blockchain technology, establish a collectively maintained digital credit system to ensure the openness, transparency, traceability, and immutability of information. The two parties to the transaction use this system to complete the transaction, increase the reliability of the transaction, and eliminate the third-party intermediaries in traditional transactions, such as credit bureaus. In addition, as the core technology of the blockchain 2.0 era, smart contracts have increased the trust among Internet users. At the same time, the digitalization of assets has also occurred. The digital economy is built through blockchain technology, and smart technology is led. Through continuous improvement, the encryption algorithm, consensus mechanism and distributed management will promote the development of the information technology era. [13] Virtualization of Internet accounts and online transactions, technological advancements meet the real-time needs of users, but they are still bringing some new hidden risks to users, and more issues about network security have emerged.

4. BLOCKCHAIN PROMOTES THE CONSTRUCTION OF THE DIGITAL ECONOMY

4.1 Blockchain infrastructure is the cornerstone of the digital economy

Blockchain is the infrastructure to realize the digital economy. With the development of artificial intelligence and informatization, digital platforms continue to expand the market, especially the current lockdown caused by COVID-19 that affects the growth model of the digital economy chain, which has accelerated the development of digital infrastructure and formed a new digital transformation. [14] Blockchain solves the problems existing in traditional economic markets. Due to its immutability and distributed storage data technology, every transaction is difficult to tamper with the digital economy platform and can be traced. Through blockchain technology to accelerate the process of digital economic transformation, start point-to-point transactions with digital platforms, and use blockchain technology to cancel the original middlemen, users all over the world can conduct online transactions in real-time, reducing transaction costs. [15] A digital platform is established with blockchain infrastructure. Every transaction can be verified, and its status cannot be changed. Participants in the transaction can query the transaction history online, and the transaction is no longer limited to region and time.

The digital economy based on blockchain technology has changed the business model of the financial industry. A set of intelligent distributed business systems is built through the blockchain infrastructure, and with its decentralized characteristics, the system can operate more effectively and thoroughly. Taking commercial banks as an example, through blockchain, banks can perform more comprehensive credit evaluations of borrowers and reasonably avoid the risks that banks may encounter in borrowing in the past. The blockchain's distributed ledger technology has established digital accounts for participants, and the digitization of users' assets has formed a new account system. In addition, a distributed network based on the blockchain can reduce the risk of network operation in the financial industry. The Bank of Russia designed a distributed messaging model based on blockchain technology for data storage and processing. [16] Transaction and storage of data based on blockchain technology can help to improve the transparency of financial markets. In public networks, blockchain technology can support bank regulatory agencies to detect transactions in real-time, prevent the occurrence of illegal transactions, and reduce the overall credit risk. During the COVID-19 period, banks created new products and services based on blockchain technology, and many countries began to plan to implement digital currencies to promote the development of digital assets. [17] In the Internet era, distributed systems based on the blockchain

can effectively support the output of the digital economy and promote the formation of new business models.

4.2 Blockchain infrastructure ensures trust and security in the digital economy

Blockchain technology solves the trust problem in the digital economy. In blockchain technology, it is difficult for participants to forge or tamper with data. A smart contract based on blockchain technology is a distributed program. When used as an infrastructure for cross-border trade, it can improve the transparency, accuracy, and security of trade data. [18] The blockchain infrastructure combines traditional economics with mathematical algorithms. It does not require the certification of an intermediary agency and implements a framework through a consensus mechanism. Blockchain technology uses a distributed database to establish a platform that can be verified and governed in real-time. Every data and transaction update needs to follow a consensus mechanism. Data information in the digital economy is shared internally, and the blockchain uses a consensus mechanism to enable participants to trust each other.

The main consensus mechanism of the blockchain is the independent verification of transactions. In the transaction of the blockchain, when receiving each transaction, the node will first verify the validity of the transaction according to the judgment criteria. When the transaction is valid, the node will broadcast this transaction, and all nodes in the blockchain will receive this valid transaction. The consensus mechanism can verify the creation of each transaction and block in the blockchain, so in essence, the consensus mechanism determines which one is responsible for which new block is generated in the blockchain system.

The digital economy relies on blockchain infrastructure to enhance security. According to the hash function of the blockchain, the integrity of the data is guaranteed, and the security can be improved through essential control and encryption algorithms to prevent hacker attacks. Each participant needs a public key and a private key to verify their identity and complete the transaction based on their private key. Moreover, when the digital economy is built with the blockchain infrastructure, the identity verification information is encrypted and verified, reducing the risk of personal information disclosure and ensuring the account's security and uniqueness. [19] In addition, the data in the blockchain is irreversible, and due to its distributed node management, the same information can be obtained on each node. Each node can query the transaction, which ensures the safety of the transaction process. Finally, the blockchain has the characteristics of traceability of historical data. Establishing a digital economy with blockchain infrastructure can check illegal transactions and past data problems to ensure transaction security.

5. FUTURE DEVELOPMENT TRENDS AND CHALLENGES

5.1 Future development trends

From the era of blockchain 1.0 to the age of 3.0, blockchain technology has helped all walks of life solve many problems with its distributed system, data encryption, timestamp, and consensus algorithm. Blockchain promotes digital value, realizes cross-system data sharing, and builds a new digital economy in the digital age. In addition, as an emerging technology, blockchain technology is still under continuous development. In the future, in building a digital economy with blockchain infrastructure, it can also be combined with artificial intelligence to handle more and more complex data, create a new type of infrastructure to increase information security, develop a high-quality digital economy, and bring new business models. [20]

5.2 Challenges

However, due to the 51% attack of the blockchain consensus mechanism, when an attacker initiates a 51% attack, the attacker can master the blockchain and modify and operate transactions. In addition, the private key used as a user to verify identity also has security loopholes. Once the user's private key is stolen, its account will be at risk. [21] As the cornerstone of the construction of the digital economy, blockchain needs to develop a more effective consensus mechanism to reduce the risk of privacy disclosure and security breaches and establish a more efficient data system.

6. CONCLUSION

This article focuses on the role of blockchain infrastructure in promoting the construction of the digital economy. The paper first introduces the basic concept of the blockchain and its leading technology. Then by studying the current blockchain infrastructure, we can know that the blockchain infrastructure is the cornerstone of the construction of the digital economy and has changed the economic model of the past. It solves the potential trust issues in previous transactions and ensures the security of the digital economy. Finally, the construction of blockchain technology as the digital economy's infrastructure will bring new development and business models in the future. However, it is still necessary to establish a more efficient system to avoid security vulnerabilities.

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