

Technology R&D and Innovation of Blockchain in China

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ABSTRACT: The creation and development of modern computer technology has greatly promoted the progress of human civilization, science and technology and the social economy. Internet technology originated in the United States, but China boasts a good foundation in the field of blockchain now. Although it started late, China has made blockchain research and development as a core technology through policy, talent and capital focus. And China has achieved innovation and breakthroughs independently, which are now at the same level as the world. China has the confidence to compete with its counterparts from other countries on this track, inspire and integrate with each other, realizing the prosperity of the high-performance public blockchain system.

KEYWORDS blockchain in China, technology research and development, technological innovation.

Date of Submission: 18-08-2022

Date of acceptance: 02-09-2022

I. INTRODUCTION

Blockchain originated from Bitcoin. On November 1, 2008, a man named Satoshi Nakamoto published the article "Bitcoin: A Peer-to-Peer Electronic Cash System", which elaborated on the framework concept of electronic cash system based on P2P network technology, encryption technology, timestamp technology and blockchain technology. This is the first time that the concept of Bitcoin and blockchain has been put forward, which marks the birth of Bitcoin. On January 3, 2009, on the server in Helsinki, Finland, Satoshi Nakamoto generated the first Bitcoin block with serial number 0, which is the Genesis Block. Meanwhile, he put the Bitcoin network on the Internet, making Bitcoin a practical blockchain system. On January 9, the block with serial number 1 was generated, and connected with the Genesis Block to form a chain, marking the birth of the blockchain. At the moment, technology is iterating at a fast rate. As the core technology of public blockchain, Web 3.0 has become the most popular track in 2022, and is the forthcoming next-generation Internet. That means, in the future, everything will no longer be platform-centric, but user-centric, forming a decentralized pattern. Web 3.0 represents the future, and it will address the issues of user information security and content ownership. It is not only a smart Internet, but also a three-dimensional holographic value Internet. In February 2021, China's public blockchain system "tree-graph (Conflux)" with completely independent intellectual property rights released in Shanghai, which quickly became the "headline news" in the global blockchain field. In the near future, with the improvement of blockchain performance, blockchain technology will surely change the political and economic structure of human society just like the Internet.

II. EVOLUTION AND MAIN FEATURES OF BLOCKCHAIN

(I). Three stages of blockchain

The blockchain technology represented by Bitcoin has only been developed for 13 years. The technology is iterating at a fast speed. In the Internet era, the blockchain technology has gone through three stages, and the representative technologies of these three stages are: Bitcoin, Ethereum and Polkadot.

Blockchain Web 1.0 Era: Bitcoin Stage. On January 3, 2009, the first Bitcoin block with serial number 0 was generated, that is, the Genesis Block^[1]. At the same time, the Bitcoin network was launched on the Internet to make Bitcoin an actual blockchain system. Based on a peer-to-peer network, each node in the blockchain network processes transactions, and the data of each node is independently recorded and stored^[2]. The formulation of consensus also comes from node proof of work. In the blockchain network, there is

no “central authority” to restrict the normal operation of nodes. That’s why blockchain is completely decentralized.

Blockchain Web 2.0 Era: Ethereum Stage. The most widely used public blockchain in the world is Ethereum, which is an ecological smart contract platform that can be applied on a large scale, realizing the transformation from digital cash to digital asset management. Its core drawback is the monopoly of platform-based enterprises. For this reason, people have placed many expectations on Web 3.0, among which breaking the monopoly of Web 2.0 is the grandest ultimate goal of these expectations.

Blockchain Web 3.0 Era: Polkadot Stage. At the moment, the two most representative public blockchains in the world are the Bitcoin system and the Ethereum system. Monopoly is not so much a drawback of Web 2.0 as it is a drawback of centralization in essence. As for Web 3.0, public blockchains usually encourage the diversified development of ecological projects to create a fair and open competition environment. With the emergence and maturity of cross-chain tools, all public blockchains are in a state of harmonious coexistence and cooperation, and more excellent people will have access to the industry. Only in this way can blockchain technology empower all industries. At the moment, the application of public chain technology is on the eve of flourishing.

What the above three have in common are: they are all chain structures composed of information blocks, and all of which are decentralized. The Polkadot enables communication between chains, which is a big leap in blockchain technology. The “White Paper 2016 on China’s Blockchain Technology and Application Development” issued by the Ministry of Industry and Information Technology of China interprets blockchain technology in a broad sense: Blockchain technology is a brand-new distributed infrastructure and computing paradigm. It adopts block chain data structure to verify and store data, uses distributed node consensus algorithm to generate and update data, takes cryptography to ensure the security of data transmission and access, and applies smart contract composed of automated script codes to program and manipulate data^[3].

(II). Features of blockchain

1. Decentralization. Blockchain technology does not rely on additional third-party management agencies or hardware facilities, and there is no central control. Apart from the self-contained blockchain itself, through distributed accounting and storage, each node realizes information self-verification, transmission and management. Decentralization is the most prominent and essential feature of the blockchain.

2. Openness. The foundation of blockchain technology is an accessible source. Except for the encrypted private information of transaction parties, blockchain data is available to everyone. Anyone can search for blockchain data and develop related applications through the open interface. That means, the information in the entire system is highly transparent.

3. Independence. Based on agreed specifications and protocols (similar to various mathematical algorithms such as the hash algorithm adopted by Bitcoin), the whole blockchain system does not depend on other third parties, and all nodes can automatically and securely verify and exchange data within the system without any human intervention.

4. Safety. As long as you cannot control 51% of all data nodes, you cannot arbitrarily manipulate and modify network data^[4]. In this way, the blockchain is relatively safe, and it can avoid subjective and artificial data changes.

5. Anonymity. Unless required by laws and regulations, technically speaking, the identity information of each block node does not need to be disclosed or verified, because it can transmit information anonymously.

III. CHINA’S BLOCKCHAIN INDUSTRY HAS MADE REMARKABLE ACHIEVEMENTS

(I). China’s blockchain has made tremendous progress

At the moment, many countries are accelerating the development of blockchain technology. China has a solid foundation in the field of blockchains, and has the conditions and ability to use blockchain as an important breakthrough for independent innovation of core technologies^[5]. “The White Paper on Blockchain in 2019” published by China Academy of Information and Communication Technology mentioned a number: in 2018, there were more than 18,000 applications for open blockchain patents in the world, and China accounted for more than half of them, ranking first in the world. In August 2018, China’s first blockchain e-invoice was issued in Shenzhen, making Shenzhen the first pilot city of blockchain e-invoice in China.

Shanghai is one of the fastest growing regions in China for blockchain technology. According to the data released by the Shanghai Blockchain Technology Association, there are more than 400 enterprises engaged in the research and development and application of blockchain technology, such as Wanxiang Blockchain, Onchain, Ginkgo, Dianrong Chain and other blockchain underlying technology platforms. The application scenarios cover various fields such as finance, medical and health, shipping and logistics, supply chain management, culture and entertainment, etc. In January, 2022, the “first order” of the global public blockchain in people’s livelihood was launched--the “Housing Rental Service Platform” was jointly launched by Shanghai

Association of Real Estate Brokers and Shanghai Tree-graph Blockchain Research Institute, and about 3,000 sets of public rental housing information will be “chained” one after another. Because the blockchain is transparent and cannot be tampered with, the listing information of this public rental housing network platform will not be distorted by real estate agents, so that landlords and tenants can benefit from it. It is expected that Shanghai will be one of the main engines to promote the rapid development of China’s blockchain industry in the future.

(II). The main characteristics of China’s blockchain technology development

1. Blockchain technology has entered a period of engineering development. The creation and development of contemporary computer technology has greatly promoted the progress of modern human civilization, science and technology and social economy. At the moment, the blockchain technology is evolving towards multi-level integrated innovation and business-driven optimization. The basic functional architecture of blockchain has become stable, and the optimization of engineering technology for business scenarios has been an industry consensus.

2. Pursuit of the development goals of “efficiency, safety and convenience”. The optimization of core technologies, the integration of extension technologies and the breakthrough of cross-chain technologies are becoming the key directions of blockchain technology evolution. Internet technology started in the United States, but now China is on the same starting line as the international community in terms of blockchain technology. China is confident that it will compete with its counterparts from other countries on this runway, inspire each other and integrate with each other.

3. In terms of application, Blockchain is accelerating integration with the real economy. Blockchain technology has strongly supported China’s major strategies, and its application fields have continued to expand. The depth and scale of blockchain applications continue to increase, and the trend from virtual reality to reality is obvious. The value of blockchain application in key areas such as smart agriculture, judicial evidence storage, epidemic prevention and control, and digital government, as well as major national strategic directions such as “peak carbon dioxide emissions and carbon neutrality” is constantly increasing, which provides a new driving force for the digital transformation of various industries.

4. In terms of industrial ecology, a pattern of blockchain industry consortium and ecologicalization has taken shape. In recent years, the foundation, chain, environment and ecology of China’s blockchain have been increasingly advanced. Regional and industry-level blockchain infrastructure has been created constantly. And industrial business models have sought new opportunities in the alliance of business operations and the openness of technology applications. Apart from that, the construction of an open-source system has accelerated. At the same time, China is booming the accessible source blockchain community and accelerating the formation of a blockchain ecosystem.

(III). The launch of the “Conflux Tree-graph Public Blockchain System 2.0”

Throughout the development of blockchain in the past two years, many countries and regions have carried out public blockchain projects, such as Solana, Polygon, Avax, and Tezos, which have achieved considerable outcomes. In February 2022, Shanghai Tree-graph Blockchain Research Institute released the world-leading “Conflux Tree-graph Public Blockchain System 2.0”, which embodies stronger security, compatibility and applicability, providing a secure and solid digital base for the development of digital economy in China and the rest of the world and various forms of “metaverse” and “Web 3.0”. Up to now, the number of accounts on the tree-graph public chain has exceeded 20 million. The number of smart contracts deployed in the system is nearly reaching 12,000, and the daily processing of transactions is reaching 300,000 to 500,000, with users all over China, Japan, North America, Europe, Southeast Asia and other countries and territories. More than 70 Web 3.0-related ecological enterprises have been created, with over 260 cooperative brand IPs. In addition, more than 4.6 million digital certificates/collections have been issued that meet the standards. The past two years have witnessed that the public blockchain system in Conflux tree-graph breaking through the performance technical bottleneck of the completely decentralized public blockchain system, surprising the world with leading high throughput of 3,000 to 6000TPS.

It is particularly worth mentioning that, relying on the breakthrough of the underlying technology of the public blockchain, the tree-graph is in a leading position in the field of global blockchain technology. It has been recognized by the Institute of Electrical and Electronic Engineers (IEEE), and has led the formulation of the IEEE P3217 standard. Only the leaders in this field are eligible to participate in the formulation of rules and standards. The IEEE P3217 international blockchain system application interface specification standard will define and standardize the interaction interface between the blockchain layer and the application layer of the blockchain system, and liberate the application layer developers from the details of the underlying consensus system. That means, they only need to focus on the business logic instead of being familiar with the differences of each blockchain system, thus greatly improving the efficiency of cross-platform development, deployment,

operation and maintenance of blockchain applications, which has a profound impact on the landscape and long-term development of the entire blockchain industry. This “Shanghai original” blockchain underlying operating system has broken the monopoly of the underlying code of European and American computer systems, making China become the international public blockchain technology rule maker for the first time.

IV. PROMOTION OF BLOCKCHAIN TECHNOLOGY AND INDUSTRIAL INNOVATION

(I). The Chinese government attaches considerable importance to the blockchain industry

According to the US “Forbes” bi-weekly report, blockchain technology is innovating in five ways: (1) Ensuring price stability for encryption proactively; (2) Strengthening the marketing management of the Initial Coin Offering (ICO) market through the “Block Exchange Platform” (BlockEx); (3) Implementing the advantages of blockchain into traditional asset management; (4) Building an ecosystem of digital services that attract consumers; (5) Developing an online community where users are rewarded for helping each other, and where users can buy digital products from websites.

Blockchain is a technology aimed at complete decentralization, a consensus mechanism in the Internet era and a guarantee mechanism to prevent false information transmission. The integrated application of blockchain technology will play an important role in new technological innovations and industrial changes in the future, with immense development potential and broad application prospects. The Chinese government attaches enormous significance to the development of the blockchain industry, and has written the development of the blockchain industry into the “14th Five-Year Plan” outline, and proactively introduced relevant policies to promote the development of blockchain technology in all fields. All departments of the State Council are actively exploring the development direction of blockchain. In 2021, more than 60 blockchain-related policies have been issued by various ministries and commissions. They emphasize the combination of various fields and blockchain technology, and accelerate the development of blockchain technology and industrial innovation. As we can see, the blockchain industry policy environment continues to develop in a positive way.

(II). China should take the core technology of blockchain Web 3.0 as an essential breakthrough for independent innovation

The essence of the blockchain is a distributed database or a distributed ledger system that is difficult to tamper with. The blockchain system must not have a central server, and the system is jointly maintained by many computers distributed on the system (on the chain). The core technology of Web 3.0 is the public blockchain technology. As the underlying technology of the Metaverse and Web 3.0, only by mastering blockchain technology can Web 3.0 be realized. The Web 3.0 public blockchain enables tens of millions of computers distributed all over the world to reach consensus and establish mutual trust according to the established rules, bringing unprecedented consensus and trust mechanism to humankind. Consensus and trust serve as the cornerstones of human civilization and social development. This is the core value of blockchain technology. It can be said that it is the Internet of Value.

In the era of Web 3.0, users will truly enjoy data autonomy. At that time, personal information will become a data asset under the control of users. In the era of Web 3.0, we no longer need to set up various accounts and passwords, nor do we need to worry about the leakage of account names and passwords. Instead, we manage a unified blockchain account through private keys or mnemonic phrases, which serve as a digital identity for integrating with Web 3.0. In order to develop Web 3.0 public blockchain technology, according to the December 2021 report of Galaxy Digital, by the end of 2021, the investment volume of venture capital companies in the encryption industry and Web 3.0 related enterprises reached as high as 33 billion US dollars, exceeding the sum of the investment scale in this field in previous years. Shanghai Tree-graph Blockchain Research Institute team developed the underlying “open source” system public blockchain of the Conflux blockchain, using the “Original Chinese” blockchain underlying operating system. It has not only become the world’s most advanced fully decentralized and underlying public blockchain system, but also broke the monopoly of European and American countries in the underlying technology codes of computers, and has become the third-generation public blockchain recognized by the world.

(III). China should advance blockchain technology and industrial innovation

Blockchain technology is a disruptive technology that changes production relations. It helps to form a flat management model and make transactions more efficient and secure. For a long period, the performance of the blockchain system has been the bottleneck restricting its development and popularization. Especially in public blockchains, due to performance limitations, users must bid against each other. Only the one with the highest price can record his transactions on the blockchain. We must take blockchain as an essential breakthrough for independent innovation of core technologies. The state should promptly issue policies to support blockchain technology and industrial development, clarify research directions, increase investment, and strive to form a group of core technologies through collaboration.

Blockchain technology is an emerging interdisciplinary subject in information science, covering a series of computer subfields such as distributed computing, cryptography, system security, game theory, and programming languages^[6]. It requires a number of top young scientists in distributed computing, cryptography, game theory, computer systems, and world-class development investors to complement each other in technology and jointly develop the underlying technology framework of the next-generation blockchain. Firstly, China should build up research on blockchain standardization, enhance the international right of speech and rule-making power, and further open up the innovation chain, application chain, and value chain. Secondly, domestic major enterprises, scientific research, universities and user units should strengthen cooperation, in order to speed up the research on core key technologies such as consensus mechanism, programmable contracts, distributed storage, and digital signatures. Thirdly, China should accelerate the deep integration of blockchain and cutting-edge information technologies such as artificial intelligence, big data and the Internet of Things. And we should also advocate combined innovation and converged applications. It is believed that China's new development practice will boost the technological and theoretical innovation of the blockchain, and promote the integrated development of the blockchain and the economy and society. Therefore, the blockchain technology will play a greater part in building a network powerhouse, developing the digital economy, and assisting economic and social development.

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Chen Xinguang, et. al. "Technology R&D and Innovation of Blockchain in China." *American Journal of Engineering Research (AJER)*, vol. 11(08), 2022, pp. 166-170.