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Research on Infrastructure Construction Based on Chain Network Cooperation

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Abstract

Blockchain technology is a scientific and technological project that countries have been paying close attention to, researching, and developing in recent years. It is one of the most popular technologies in the world. Blockchain is a bookkeeping technology that multiple parties jointly maintain, uses cryptography to ensure transmission and access security, can achieve consistent data storage, is difficult to tamper with, and prevents denial. It is also called distributed ledger technology and has distributed credibility—technical characteristics such as not being easy to tamper with and multi-party maintenance. The new infrastructure of chain network collaboration will use network identification as a key digital resource as a breakthrough point to promote blockchain application and development and realize the new infrastructure's engine role. Through the collaborative development of blockchain and the industrial internet, the new infrastructure of chain network collaboration is committed to building a national-level distributed trusted application innovation carrier. Provide a unified identity authentication mechanism, object identification mechanism, and value exchange mechanism for digital applications to reduce digital technology costs.

Keywords: *Blockchain, Industrial internet, New infrastructure*

1. Introduction

Blockchain is a bookkeeping technology that multiple parties jointly maintain. It uses cryptography to ensure transmission and access security, can achieve consistent data storage, is difficult to tamper with, and prevents repudiation. It is also called distributed ledger technology. It has the technical characteristics of distributed credibility, resistance to tampering, and multi-party maintenance. With its unique trust establishment mechanism, blockchain has become another major technological innovation after cloud computing, the Internet of Things, and big data. It is changing the application scenarios and operating rules of many industries. It is one of the indispensable technologies for the future development of the digital economy and the construction of a new trust system. Blockchain, as a general-purpose technical attribute, has become recognized and has gradually become a basic technology for identifying, transferring, and exchanging value in the digital economy era.

Countries worldwide regard blockchain as an important breakthrough for independent innovation of core technologies and accelerate the development of blockchain technology and industrial innovation. Countries attach great importance to the potential value of blockchain technology in building network power, developing a digital economy, and helping economic

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and social development. As an emerging technology, blockchain technology and industry are still in the process of gradual improvement. To truly make the blockchain an important breakthrough in the independent innovation of the country's core technology, the national blockchain network infrastructure will serve the country's major mission. Become the key to national strategic investment, implement the national will, and give play to the superiority of the centralized system [1]. To continue to promote the digital transformation of the industry and further enhance the independent innovation capabilities of the blockchain, deep integration of the industrial internet, which represents the digital transformation of the industry, is the main application scenario—an important infrastructure for realizing the development of industry digitization, networking, and intelligence. Proposed the coordinated development of blockchain and industrial internet for the digital economy-the new infrastructure of chain network collaboration [2].

2. Overview of basic concepts

2.1. New infrastructure concept for chain network collaboration

Blockchain technology is a ledger technology maintained by multiple parties. It comprises consensus mechanisms, cryptographic algorithms, distributed networks, contract scripts, and other technologies. It has the technical characteristics of distributed credibility, resistance to tampering, and multi-party maintenance. These technical characteristics make blockchain one of the most disruptive technologies since the popularization of the internet, and it has attracted great attention from all parties around the world.

At present, the integrated application of blockchain technology is showing a strong momentum of development on a global scale, playing an important role in the new technological revolution and industrial transformation and becoming a powerful tool to accelerate the recovery of the global economy. Since Internet technology entered the civilian field, it has greatly promoted the development of the global economy and played an important role in improving the structure of the national economy. Global informatization has entered a new stage of full penetration, cross-border integration, accelerated innovation, and leading development. The regional and industry-leading role of blockchain technology is obvious. Blockchain technology will innovate data-driven production and consumption models to become a key engine for deepening structural reforms and promoting sustainable development [3].

The new infrastructure of chain-network collaboration is a national top node based on the industrial Internet logo. The country's major strategic needs guide the continued promotion of the digital transformation of the industry. Take core technological innovation breakthroughs as traction, industrial integration and innovative applications as incentives, and logos as a breakthrough. To further enhance the independent innovation capability of the blockchain, a national-level blockchain infrastructure must be built [4]. The new chain-network collaboration infrastructure builds a relatively complete industrial infrastructure system covering core technologies, key systems, logo analysis, support platforms, and integrated applications. As a result, a national-level blockchain network infrastructure with global influence will be built, and the important role of blockchain in building network power, developing a digital economy, and helping economic and social development can be better utilized [5].

At present, the blockchain technology system and industrial system are not yet complete. Countries have stepped up their blockchain strategies to seize the high ground of the

blockchain technology industry. Countries with a good development foundation have a rare historic opportunity and a window of development for overtaking new tracks through the construction of chain-network coordinated infrastructure.

2.2. Chain network collaborative infrastructure construction goals, planning, and significance

The new infrastructure of chain network collaboration follows the overall goal of "equality, co-governance, openness, and controllability." Take the "Chain Network Synergy New Infrastructure Alliance" as the carrier. It is identified by the "Licensed Public Chain Core Platform of the Underlying Blockchain." Relying on the core platform of blockchain distributed identification. Build an industry cluster platform for "blockchain industry applications" [6]. Build an integrated innovation platform for "blockchain next-generation information technology." Create " a blockchain operation monitoring" Network security assurance platform. Build and form a national-level blockchain network infrastructure with global influence. Build a relatively complete blockchain industry system covering core technologies, key systems, logo analysis, support platforms, and integrated applications. Better Give full play to the important role of blockchain in building a network power, developing a digital economy, and helping economic and social development [7].

(1) Guided by top-level planning, create a value system with interconnected chains. From a global perspective, fully integrate the application requirements of blockchain in various fields and industries and rationally lay out the new infrastructure ecosystem for chain network collaboration. Form an interoperable blockchain ecosystem, break the value, data, and business barriers between chains, and realize the effective transfer of value.

(2) Build a blockchain industry ecosystem by Taking industrial applications as the traction. Application-oriented, with Wanchain as the mainline, uniting upstream and downstream enterprises in the industry. Create an industry gathering platform for "blockchain and industry, people's livelihood, finance, and energy." Accelerate industrial integration, build a blockchain industry ecology, play to the advantages of large-scale blockchain applications, and develop a digital economy.

(3) Improve the regulatory system based on the permission public chain structure. Relying on the technical architecture of the licensed public chain. Based on the top-level planning of the new infrastructure in collaboration with the chain network, the regulatory nodes are formed at different levels, regions, and industries. Build a brand-new transparent supervision service and automated compliance engine, standardize blockchain services and operating mechanisms, and ensure the stable operation of the new infrastructure in collaboration with the chain network.

(4) Actively explore the commercial operation mechanism using the logo as a starting point. Relying on the endogenous Spark logo technology, we will create a smart connection of all things logo system, build a new space for multi-party governance, fairness, credibility, and intelligent operation of the digital economy, innovate data-driven production and consumption models, and explore new mechanisms for business operations in the digital economy era.

The new infrastructure of chain network collaboration is an important starting point for promoting the high-quality development of the digital economy. The essence of economic development is the effective matching of supply and demand and efficient circulation based on supply and demand. Consensus and trust are key to matching supply and demand and data circulation. The new infrastructure of the chain network has greatly reduced the cost of trust

establishment and created a social trust system based on blockchain technology. Eliminating intermediate links, supporting large-scale end-to-end direct connection scenario applications, and greatly improving the efficiency of social operation and capital flow have become the keys to promoting economic development, thus spawning new business models [8].

The new infrastructure of chain-network collaboration is a key engine for promoting economic and social development. Global informatization has entered a new stage of full penetration, cross-border integration, accelerated innovation, and leading development. The real world and the digital world are increasingly converging. The new chain-network collaboration infrastructure establishes a sense of digital social trust for developing the digital economy, which can realize cross-device, cross-system, cross-plant, and chain-network collaboration. The new infrastructure is a key engine for promoting economic and social development [9]. Global informatization has entered a new stage of full penetration, cross-border integration, accelerated innovation, and leading development. The real world and the digital world are increasingly converging. In collaboration with the chain network, the new infrastructure establishes a sense of digital social trust for developing the digital economy. It can realize cross-device, cross-system, cross-plant, cross-regional resource credible connection and efficient collaboration. Breaking industry barriers, realizing data interconnection and resource sharing in various industries have become a key engine for deepening social structural reforms and promoting sustainable development, speeding up breaking through the industrial system, leading organizational changes, and optimizing resource allocation [10].

3. Spark blockchain

3.1. Concept

The underlying core blockchain system of the new chain network infrastructure is called Spark Blockchain. Spark Chain is a blockchain identification infrastructure built using licensed public blockchain technology. The Spark Chain has a built-in logo, providing basic services such as logo registration analysis, digital identity, digital asset management, public data services, monitoring, and supervision for people, enterprises, equipment, and digital objects. Spark chain uses the "main chain sub-chain" chain group architecture. The main chain is responsible for chain group management, regulatory rules, public data, and value anchoring among them. The sub-chain is independently designed for different business scenarios to achieve data security isolation and high-performance operation [11].

A licensed public blockchain is a blockchain technology system compatible with public blockchains' open access, flexibility, and scalability. It integrates the characteristics of easy supervision, high performance, security, and controllability of alliance blockchains.

The Spark logo is a new type of logo analysis system built on the Spark Chain, that is, the Spark logo analysis system. Based on the Spark logo, Spark Chain has achieved compatibility with multiple logo resolution systems, such as DNS and Handle, as well as cross-system and cross-chain interconnection [12].

3.2. Spark chain

The bottom layer of the Spark chain adopts the “$1 + N$” main-sub-chain group architecture, which can support homogeneous and heterogeneous blocks to be linked into the main chain. The main sub-chain group structure of the Spark chain is shown in Figure 1.

(1) Main chain function: The main chain provides basic services externally by injecting core assets, including public data, identification resources, identification analysis, and regulatory rules. Building interoperability at the national level and "penetrating" supervision methods escort the efficient operation of the chain group and the stable and healthy development of the entire chain group ecology.

(2) Sub-chain function: The sub-chain is mainly designed independently for different business scenarios, giving full play to the industrial advantages and the existing foundation of the blockchain and promoting the cumulative development of the blockchain in more scenarios and on a larger scale. According to different business scenarios, the sub-chain supports its specific personalized business activities and independent implementation of consensus, achieving data security isolation and high-performance operation.

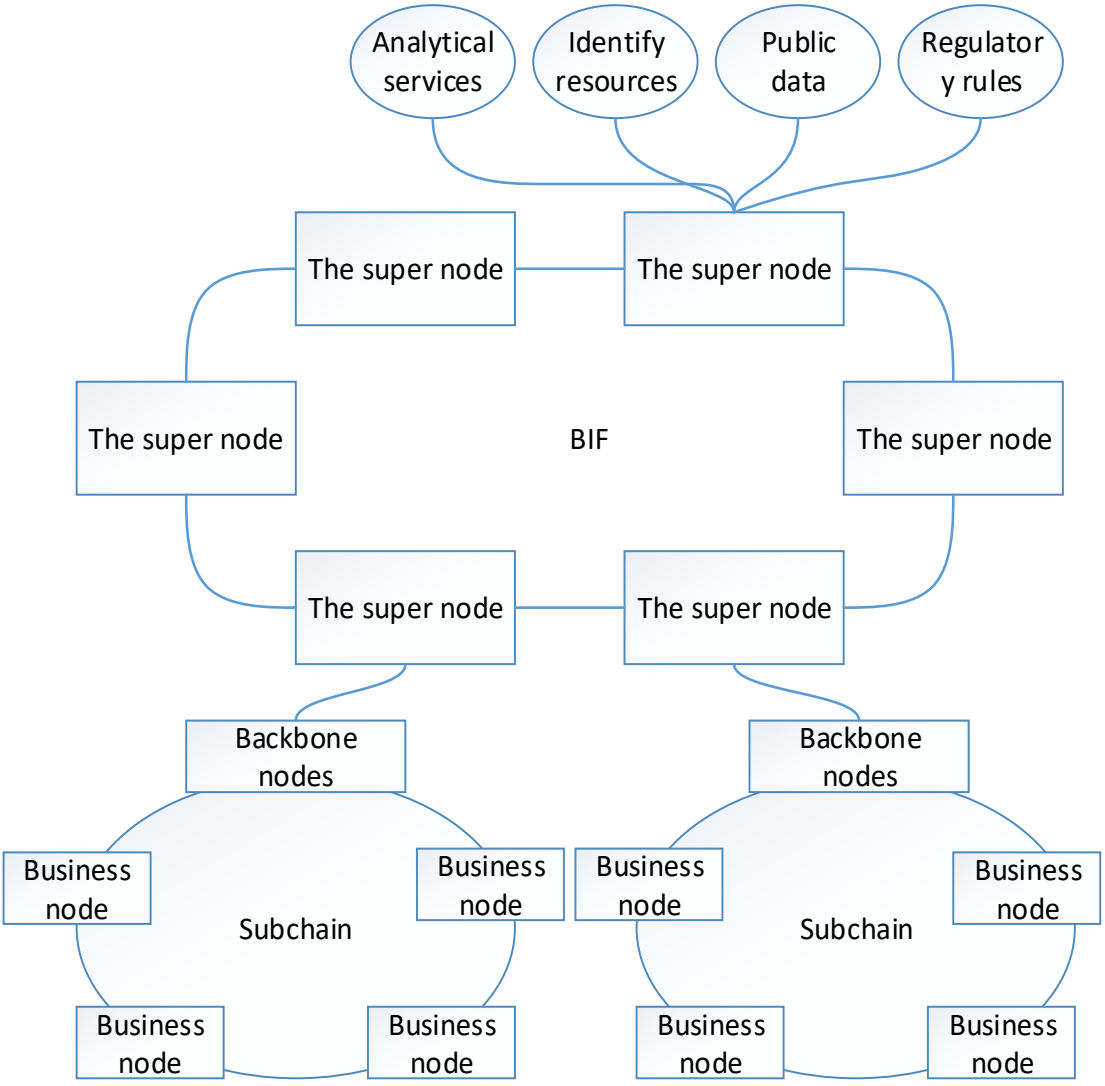

Figure 1. The main-sub-chain group structure of the Spark chain

The key technologies of Spark Chain include the following aspects:

(1) Transactions. The transaction types of Spark Chain are divided into three types: ordinary on-chain transactions, ordinary contract transactions, and system contract transactions. Spark Chain supports the configuration of cache transaction priority, concurrent transaction operations, and private transaction functions.

(2) Consensus. Combined with the requirements of blockchain and commercial application, the spark chain consensus algorithm is applied in the fields of delegated proof of stake, Verified Random Function (VRF), and practical Byzantine fault tolerance. Based on the above, we design an innovative two-layer consensus algorithm suitable for a licensed public blockchain. The spark sub-chain can choose to replace the consensus algorithm according to the actual situation and the needs of the scene, and the sub-chain can also deploy the consensus algorithm of the main chain. When the sub-chain fails, the main chain can be entrusted to reach a consensus [13].

(3) Storage. The new infrastructure of the chain network collaboration supports the distributed storage function of the data chain on and off the chain and realizes the functions of data isolation between the main and sub-chains and cross-platform parallel data reading and writing support.

(4) Network. Spark Chain uses hierarchical distributed hash table technology to implement routing addressing in P2P networks. With this technology, the target node can be quickly found in the network without a central server. The layered architecture can support the flexible deployment of new infrastructure management strategies in collaboration with the chain network to ensure scalability; finally, the backbone nodes connect to the main and sub-chain networks to ensure the effectiveness of cross-chain services [14].

(5) Cross-chain agreement. In the rapid development of blockchain technology, a wide variety of chains have emerged: public, alliance, and private chains. They have different technical characteristics and can be applied to different business scenarios. The public chain has established a broadly transparent and unified consensus network, while the alliance and private chains allow different organizations to have their blockchain networks. These networks are isolated, like independent islands of value, leading to many business scenarios such as identity verification, asset digitization, and compliance. Their assets and data cannot be transferred, exchanged, and interoperated between different blockchains. With the development of business, cross-chain requirements will be everywhere. The value interoperability between chains must be securely realized to break the value isolation dilemma between blockchains. Spark Chain proposes a flexible cross-chain approach with pluggable components in the relay mode to realize the cross-chain process of different business scenarios.

(6) Distributed application support. It provides EVM, JVM, WASM, and other virtual machine support for distributed applications and realizes the intelligent pluggability of virtual machines, which is convenient for third-party application development.

(7) Built-in high-precision clock service. In Spark Chain, data block synchronization depends on the consistency and accuracy of the clock. The time of Spark Chain is obtained from the National Time Service Center, which also supports time service. The supernodes in the Spark chain will take on the "time server" task. All nodes connected to the chain network to collaborate with the new infrastructure will obtain the standard time from the "time server" and do not need to synchronize with the clock outside the system. All verification nodes on the Spark chain will obtain the time from the supernode and synchronize the time before packaging the verification block. Also, the node can synchronize the system time with the supernode manually or regularly so that the node's clock is consistent with the supernode

source server. The time error between the node clock synchronization and the error between the supernode clock source server is maintained at the millisecond level.

4. Spark logo

4.1 Spark logo concept and management plan

Identification is an identity symbol that can uniquely identify physical objects such as machines and products and digital objects such as algorithms and processes; through identification analysis and query, the network location or related information of the target object can be obtained, and cross-chain or interoperability between target objects can be realized. The logo is the glue that promotes the integration and development of the real economy and the digital economy and is also an essential foundation for the digital transformation and development of enterprises. The logo and its analysis service are the core basic service components of the new infrastructure of chain network collaboration.

The new infrastructure of Chain Net collaborates to provide two types of identification distribution and analysis services, including distributed identification (BID) and international VAA identification. BID is a verifiable distributed identifier based on the W3 DID protocol; BID realizes self-registration and management based on the Spark Chain and has the characteristics of permanence, global resolvability, encryption verifiability, and decentralization.

Spark Chain Network provides distributed BID identification, international VAA identification, and other identification distribution and analysis services. China Academy of Information and Communications Technology will carry out BID and VAA logo registrations worldwide based on the Spark Chain. Services, such as identification analysis and data sharing, guarantee global uniqueness and mutual recognition. Help enterprises solve the problem of data islands in the digitalization process, promote the sharing and use of heterogeneous, heterogeneous, and remote data, and solve cross-chain secure and trusted connections, Interaction, and interoperability to create an industrial ecology of "Internet of Everything."

The industrial ecology of Lian ": (1) Identification code. The BID method specification complies with the requirements of the DID specification currently issued by W3C. According to the W3C naming rules, the DID method namespace of BID identification starts with "bid," and the DID of this method is used. must start with the prefix "did: bid." The BID logo is also used as the Spark Chain's account address. Its identification coding scheme is: did: bid: contract method. The VAA code is based on the ISO/IEC 15459 standard. The code only allows Uppercase Letters (A～Z) and numbers (0～9) to meet the existing AIDC technology. (2) The chain code specification of Spark Chain. The main chain and sub-chains of Spark Chain adopt an autonomous form for easy identification and analysis. The main chain assigns a unique sub-chain chain code to each sub-chain. VAA or BID identifies the sub-chain chain code. To ensure the versatility of the VAA or BID identification in the main chain and the sub-chains, to ensure the interconnection in the entire chain group, In the VAA or BID encoding, the corresponding sub-chain chain code needs to be added according to the different sub-chains.

The Spark logo system will realize the docking with the national top-level nodes of the industrial Internet identification analysis, making the national top-level nodes of the industrial Internet identification analysis compatible with the Spark identification system, further

improving and expanding the service capabilities and service scope of the national top nodes, and greatly expanding the Spark logo Application range.

5. Application ecology and governance system

5.1. Basic service components

The new infrastructure of chain network collaboration provides basic service components to support developers and users; basic components mainly include identity resolution, digital identity, trust framework, cross-chain operations, and public data.

Based on the Spark logo provides an identifiable "identity" for the interconnection of everything. The supplier realizes the digital twin of all things based on the registration model of identification as an entity and digital object. The consumer can parse the identifier and obtain object information. This function can be widely used in item traceability, equipment interconnection, and supply chain scenarios.

Digital identity provides security authentication for data flow and storage and is a basic component of cyberspace governance. The new infrastructure of the chain network collaboration provides full life cycle management functions of digital identities for people, enterprises, and equipment (distribution, verification, authorization, management, and cancellation of digital identities). Authorization management and trusted access can be performed based on digital identity, which is suitable for KYC, access control, and other scenarios. They can be widely used in finance, medicine, the Internet of Things, and the Internet of Vehicles.

The new infrastructure trust framework of chain network collaboration uses the Spark logo as a unique identifier and builds a trust framework based on trusted sources (trust anchors), trusted data storage (distributed storage), and trusted verification processes (secure computing). The policy is oriented to the three elements of trusted users, trusted devices, and trusted applications. Grant the minimum access authority to the visiting subject and encrypt and monitor the access of the whole link to protect the data security of the visitor and the interviewee and realize distributed trust. The new infrastructure trust framework of Chain Net collaboration supports multi-source identity authentication and introduces multiple trust anchors to promote sound and healthy development of trust ecology.

The new chain network collaboration infrastructure realizes the flexible cross-chain of homogeneous and heterogeneous chains through relays and pluggable components. This can support rapid adaptation and access to various chains. And realize the transfer of cross-chain data and assets. It can be applied to data collaboration and transaction scenarios such as digital government affairs, smart cities, and commodity transactions.

The new chain network collaboration infrastructure is based on the World Wide Web Consortium (W3C) Distributed Identification Specification (DID) framework, which provides the industrial ecology with a public based on functions such as trusted identity, trusted declaration, trusted storage, secure multi-party computing, smart contracts, etc. data service. The new chain-network collaboration infrastructure will establish security protection, privacy protection, and other data flow, verification, and transaction measures and attract institutions that provide public data services. Based on these public data services, the circulation of data production factors can be promoted, and a new digital economy model can be constructed.

5.2. Build a new infrastructure ecosystem and open-chain network collaboration

Relying on the China Blockchain Innovation Promotion Forum, the new chain-network collaboration infrastructure will build ecosystem support services for the application of the

new chain-network collaboration infrastructure, and provide platforms for open-source organizations, alliances, regulatory governance, and standardization. Relying on the underlying technology and infrastructure and ecological support services, absorbing application and technology providers, forming an industry application layer and a common component and technology expansion layer, and jointly building a new infrastructure ecosystem for chain network collaboration.

The new chain network collaboration infrastructure will open standard protocol documents and interfaces such as distributed applications, Spark logos, BaaS services, and cross-chain operations for application developers and blockchain developers, forming an open community and creating an open application and sub-chain ecosystem. For application developers, in addition to providing basic service components of Spark Chain, the new chain-net collaboration infrastructure also builds a developer platform and an official Dapp Store to facilitate the development and release of distributed applications.

For blockchain developers, Chain Net collaborates with the new infrastructure to support underlying protocols, development tools, etc., so developers can focus on solving industry pain points for blockchain-customized development without paying attention to the underlying protocols and smoothly connecting to the host. The chain becomes the new infrastructure sub-chain of chain network collaboration. At the same time, it provides security audits, application audits, and evaluation mechanisms for smart contracts to improve the quality of sub-chain development and create a good development environment. By establishing developer communities, holding application development conferences, publishing application white papers and cases, and working with application developers and blockchain developers from all walks of life, we will jointly promote the construction of new infrastructure and an open application ecosystem for chain network collaboration.

5.3 Chain network Collaboration new infrastructure governance system

The new infrastructure of chain-network collaboration will adhere to the principles of openness, transparency, democracy, and high efficiency and extensively invite political, industry, academic, research, and application entities to form a multi-party community. Establish a broad consensus governance system around infrastructure management, technology research and development, application promotion, innovation cultivation, and security assurance of the new infrastructure of chain network collaboration. Promote blockchain integration and innovation with the concept of tolerance and prudence. The co-governance and sharing model stimulates the development potential of new infrastructure for chain-network collaboration.

The chain network governance system will be built around four main aspects: infrastructure management, industrial ecological development, exchange, and cooperation promotion, as well as innovation and entrepreneurship cultivation.

(1) Infrastructure management. Focus on chain-network node management, basic service operations, and the openness and compatibility of chain-network systems to form a chain-network infrastructure partnership. Carry out the construction and management of the chain network infrastructure, promote the innovation, evolution, and standardization of the underlying technology of the chain network, and build the key public basic service system.

(2) Industrial ecological development. Focus on-chain network technology, applications, and standards, and build an industrial exchange and consensus platform around chain network component development, platform operations, technical services, and industrial applications. Unite various industry entities to promote the development of core key technology standards

such as consensus algorithms, smart contracts, cross-chain interoperability, and data protection. Cultivate industry application solutions and best practices for typical scenarios such as finance, supply chain, healthcare, and education, and promote the continuous improvement of the chain and network industry ecology in an open, transparent, and inclusive manner.

(3) Exchange, cooperation, and promotion. Focus on the industry development, standard formulation, and industrial governance around the chain network, and build an open and representative platform carrier. Organize extensive seminars and carry out public propaganda, community discussions, research cooperation, and knowledge training around key issues in developing the chain network. Expand the influence of Chain Net and promote the formation of the Chain Net brand.

(4) Cultivation of innovation and entrepreneurship. Establish a platform for fostering innovation and entrepreneurship in the chain network and organize the advantageous resources of the China Academy of Information and Communications Technology and chain network partners in innovation and entrepreneurship. Inject infrastructure and services, talents, and funds for innovation and entrepreneurship, and accelerate the transformation of technology and application innovation. Guide and promote the integrated development of large, medium, and small enterprises in the chain network ecology.

Chain network governance will refer to the internationally recognized multi-stakeholder model, and a wide range of organizations include, but are not limited to, government agencies, enterprises, technical communities, industry experts, social groups, universities and research institutions, and users. Based on different issues, different governance mechanisms are formed. Chain network governance will follow the concepts of inclusiveness, openness, coordination, co-governance, transparency, and accountability. All parties to the organization will effectively give play to their respective advantages, fully express the wishes of multiple parties, and promote the development of the chain network with consensus. The organizational principles to be adopted for chain network governance are as follows.

(1) Government guidance. Chain Net will invite representatives of relevant industry authorities to form steering committees at all levels to gain an in-depth understanding of the operation of the chain network, guide the development of blockchain technology guidance and specifications, and ensure the healthy and orderly innovation of the chain network.

(2) Expert argumentation. Chain Network will hire well-known domestic and foreign experts in the fields of technology, management, economy, policy, etc., to form expert committees at all levels to demonstrate and review the technological and policy output of Chain Network and ensure that the development of Chain Network is scientific and reasonable.

(3) Extensive participation in the blockchain network will remain open to all parties involved in the construction of new collaborative infrastructure of the blockchain network, related to the development of the blockchain network, committed to promoting the innovation of the blockchain network, and all interested in the innovative development of the blockchain. Gather the relevant forces of the chain and network to ensure the progress of the consensus of chain network governance.

(4) Peer-to-peer co-governance. The chain network will promote various entities to form working groups, committees, and other government organizations, promote the realization of equal co-governance among stakeholders on different topics and in different scopes, realize the self-determination and autonomy of technology and rules, and ensure the prosperity of the chain network ecology.

(5) Orderly collaboration. Chain network governance will be based on the characteristics of different topics to set up participating entities, work processes, decision-making mechanisms, the scope of responsibility, and other matching organizational forms. Different chain network governance organizations will use personnel appointments, cooperation mechanisms, funding, commissioned operations, etc., to Form an orderly, collaborative, organic, and unified chain network governance system.

6. Conclusion

This article first discusses the important role of a new type of chain-network collaboration infrastructure constructed by the coordinated development of blockchain and the industrial internet in playing the role of the new infrastructure engine and the significance of promoting the development of industrial digital transformation. Secondly, it introduces in detail the application ecology and governance system of the Spark blockchain, the Spark logo, and the new infrastructure of chain-network collaboration. At present, the research and development of chain network collaboration with new infrastructure key software and hardware systems, breakthroughs in the core technology of blockchain infrastructure such as licensed public chains, and gradual building and deploying Spark chain super-nodes in various places, thereby building chain network coordination new infrastructure service network. In the future, we will build a series of application projects in key areas of blockchain around the new infrastructure of the chain network and carry out experimental verification, innovate economic operation models, cultivate the application ecology of the blockchain industry, promote the high-quality development of digital economy, and upgrade my country's digital transformation Development to provide a new infrastructure engine.

References

[1] M. Sakakibara, “Knowledge sharing in cooperative research and development,” Managerial and Decision Economics, vol.24, no.2, pp.117-132, **(2003)**

[2] Y. M. Li and J. H. Jhang-Li, “Knowledge sharing in communities of practice: A game theoretic analysis,” European Journal of Operational Research, vol.207, no.2, pp.1052-1064, **(2010)**

[3] J. N. Cummings, “Work groups, structural diversity, and knowledge sharing in a global organization,” Management Science, vol.50, no.3, pp.352-364, **(2004)**

[4] G. Szulanski, R. Cappetta, and R. J. Jensen, “When and how trustworthiness matters: Knowledge transfer and the moderating effect of causal ambiguity,” Organization Science, vol.15, no.5, pp.600-613, **(2004)**

[5] C. M. Chiu, M. H. Hsu, and E. T. G. Wang, “Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories,” Decision Support Systems, vol.42, no.3, pp.1872-1888, **(2006)**

[6] L. Luu, V. Narayanan, and C. Zheng, “A secure sharding protocol for open blockchains,” Proceedings of the ACM SIGSAC Conference on Computer and Communications Security. New York: ACM, pp.17-30, **(2016)**

[7] J. Garay, A. Kiayias, and N. Leonardos, “The Bitcoin backbone protocol: Analysis and applications,” Annual International Conference on the Theory and Applications of Cryptographic Techniques. Berlin: Springer, pp.281-310, **(2015)**

[8] I. Eyal, A. E. Gencer, and E. G. Sirer, “Bitcoin-ng: A scalable blockchain protocol,” Proceedings of the 13th Usenix Conference on Networked Systems Design and Implementation. Berkeley: USENIX Association, pp.45-59, **(2016)**

[9] E. K. Kogias, P. Jovanovic, and N. Gailly, “Enhancing Bitcoin security and performance with strong consistency via collective signing,” Proceedings of the 25Th Usenix Security Symposium. Berkeley: USENIX Association, pp.279-296, **(2016)**

[10] H. Kantur and C. Bamuleseyo, “How smart contracts can change the insurance industry: Benefits and challenges of using Blockchain technology,” Jönköping: Jönköping University, **(2018)**

[11] N. Nizamuddin, H. Hasan, and K. Salah, “Blockchain-based framework for protecting author royalty of digital assets,” Arabian Journal for Science and Engineering, vol.44, no.4, pp.3849-3866, **(2019)**

[12] J. Sun, J. Yan, and K. Z. K. Zhang, “Blockchain-based sharing services: What blockchain technology can contribute to smart cities,” Financial Innovation, vol.2, no.1, pp.1-9, **(2016)**

[13] K. N. Griggs, O. Ossipova, and C. P. Kohlios, “Healthcare blockchain system using smart contracts for secure automated remote patient monitoring,” Journal of Medical Systems, vol.42, no.7, pp.130, **(2018)**

[14] H. Hasan, E. AlHadhrami, and A. AlDhaheri, “Smart contract-based approach for efficient shipment management,” Computers and Industrial Engineering, vol.136, pp.149-159, **(2019)**