Research on the Application of Blockchain Technology in Discipline Inspection and Supervision in China

Lili Wei and Bin Gu*

School of Economics and Commerce, South China University of Technology, Guangzhou, China

*Corresponding author email: gubin@scut.edu.cn

Abstract. This paper studied how Chinese discipline inspection and supervision agencies used blockchain technology to optimize the path of discipline inspection and supervision, while improving the efficiency of their discipline inspection and supervision. It combined with the actual situation of the reform of the discipline inspection and supervision system in China. Based on the essential characteristics of blockchain technology, this paper drew a new disciplinary inspection and supervision information sharing model that based on blockchain technology. Also, it gave a new system framework and work flow. According to this technology, China's disciplinary inspection and supervision agencies might use blockchain technology in the future to optimize the workflow of disciplinary inspection and supervision.

Keywords: Blockchain; Discipline inspection and supervision; Work flow optimization.

1. Introduction

Chinese Communist Party President Xi Jinping called out that Chinese government should explore and use the blockchain data sharing model to achieve the cross-departmental and cross-regional maintenance and utilization of government data, and promote collaborative business processing during the eighteenth collective study of the Political Bureau of the Central Committee [2]. To implement the spirit of President Xi's series of important speeches[1], deepening the original intention of the reform of the national supervision system, and improving the discipline inspection and supervision system and mechanism could be achieved through corresponding laws, regulations and technical means. As blockchain technology has achieved in some outstanding results in social fields, such as finance, logistics, and government affairs. Its application in government affairs is also expanding gradually. By using of blockchain technology, the discipline inspection and supervision department structure could be optimized and improved, and their workflow would be more scientific, standardized and efficient. The application of blockchain technology to discipline inspection and supervision could enhance the full coverage and effectiveness of supervision of public power and public officials. Simultaneously, the state has established a disciplinary inspection and supervision system including supervision and management mechanism, power restriction mechanism and accountability mechanism, which is conducive to covering the vacuum zone of power supervision, reducing the willful space for the exercise of power, standardizing and properly exercising the state supervision power, and improving discipline inspection overall efficiency and modernization of the governance system.

Blockchain technology is a newly emerging technology in the past 10 years. It was first proposed by a person named Satoshi Nakamoto in Bitcoin: A peer-to-peer Electronic Cash System. The blockchain contains a collection of multiple technologies, including distributed data storage, peer-to-peer transactions, hash encryption algorithms, and consensus mechanisms [3]. Decentralization is the core
advantage of blockchain [4]. In terms of international research, many scholars have done a lot of research on the scope of blockchain applications [5]. The blockchain has transitioned from stage 1.0 (mainly used in digital currencies) to stage 2.0 (mainly used in financial fields), and has now reached stage 3.0[9]. The 3.0 stage of the blockchain is mainly after the year of 2017. Blockchain technology has become a bottom-level protocol for Internet of Everything, which has generated multiple mainstream applications of blockchain [6]. Therefore, blockchain technology has great potential in building smart government services [10][11]. Based on blockchain technology, a decentralized, secure and reliable E-government information infrastructure can be established in China [7][8]. Many scholars have conducted research on the innovative application of blockchain technology in government governance [8]. First, some scholars summarized the impact of blockchain technology on the governance innovation of the Chinese government, and then established various application models based on blockchain technology, including the blockchain-based collaborative innovation model for government affairs systems[13], the basic information collaborative sharing model[14][12] and government affairs Information resource sharing model[15], etc. In addition, some scholars have proposed the construction of a data sharing platform with blockchain technology as the core to effectively achieve consistent information coordination and mutual trust among multiple government entities [17]. It would enable cross-sector paperless approval between multiple government departments.

The research results above have theoretically continuously enriched the theoretical basis of blockchain application in e-government management, and built different data sharing models. However, there are relatively few studies on the application of blockchain in discipline inspection and supervision. In 2016, the China Blockchain Development White Paper was released. In the year of 2019, the Central Political Bureau of China have made important instructions on the application of blockchain technology. All over the country have made active and fruitful explorations in the field of blockchain applications.

2. Method

Based on the blockchain technology, this paper studies and designs the core consensus mechanism of the blockchain system for the information management of the discipline inspection and supervision department. At the same time, the paper constructs a data-sharing system based on smart contract technology. At last, a theoretical framework of discipline inspection and supervision workflow based on blockchain technology is proposed, and it is compared with the original workflow.

3. The Complexity of Disciplinary Inspection and Supervision and Its Practical Problems

3.1. The Complexity of Disciplinary Inspections

Since the 18th National Congress of the Communist Party of China, the party has been governed rigorously in an all-round way and has achieved new and significant results. Its anti-corruption struggle has achieved excellent results. However, the Chinese government and the leaders have to aware soberly that the party affairs must always be controlled strictly, and the situation of the anti-corruption struggle is still grim and complicated. With the popularization of modern Internet and communication and information technology applications, various illegal and criminal means have become more and more advanced and hidden. Disciplinary inspection and supervision are facing business challenges in the new era with new responsibilities and capabilities.

Judging from the current report, patrol inspection, there are still some people who do not converge. The task of reducing stocks and curbing the increase is still arduous. After the completion of the reform of the supervision system, the discipline inspection and supervision organs still have some weak links in their work under the new tasks and requirements. For example, some people do not have a good understanding of the performance of their supervisory duties. They are afraid of difficulties and challenges. Their working methods are not in place, which makes the supervision effect unsatisfactory. they lack knowledge and ability, and lack the discrimination skills for high-tech crimes; In some cases, law enforcement personnel use the right to hear cases for personal gain. They know the law and break
the law. As law enforcers, they still do illegal things. Aiming at the above-mentioned illegal acts, they all pose new challenges to the discipline inspection and supervision in the new period. These challenges require that disciplinary inspection and supervision cadres must do well in using modern science and technology to improve the governance capacity of disciplinary inspection and supervision, and to provide guarantee for the development of the reform in China.

3.2. Outstanding Problems in Discipline Inspection and Supervision

3.2.1. Weak management of case leads. The main manifestations are as follows: (1) The cases can be handled by multiple departments at the same time, resulting in scattered cases when handling cases. (2) Due to the large number of departments involved, the transfer was not smooth and the time for transferring the case was delayed. In particular, some evidence are quite clear and valuable to report clues. If the handover process is not smooth, it will easily lead to the loss of the best time to investigate the case clues, which will affect the effectiveness of the investigation. (3) The classification management of cases is not perfect and the management is not strong enough.

3.2.2. Case handling procedures are very cumbersome. The case approval process is complicated. Each link needs to be confirmed and signed for approval by multiple departments and leaders, then filed. All approval procedures require paper signatures, and the steps are time-consuming and labor-intensive. In the actual case handling process, in order to avoid missing the case, the case handling staff will speed up the case handling process and complete the task within the time limit. Some case-handlers will finish the case first, and the formalities for the approval and filing of documents will often be resubmitted after the fact. This situation will cause chaos in the program.

3.2.3. Application of information technology lags. This problem mainly manifested in the lagging construction of clue information intelligence analysis system. Disciplinary inspection agencies and public security, procuratorial, industrial and commercial, auditing, market supervision, financial and other departments have not yet established information sharing mechanisms.

3.3. Feasibility Analysis of Applying Blockchain Technology to Discipline Inspection and Supervision

In the context of big data, the characteristics and advantages of blockchain technology can make up for the shortcomings in disciplinary inspection and supervision effectively, and provide new ways to solve problems. (Table 1)

| Characteristics of blockchain | Objectives of Discipline Inspection and Supervision |
|-------------------------------|---------------------------------------------------|
| Distributed architecture      | Improve the efficiency of disciplinary inspection and case handling improve real-time verification and comparison |
| Unmodifiable                  | Guarantee the authenticity of evidence data during the review process |
| Traceable                     | Trace and supervise the operation records of case handlers |
| Timestamp                     | Clear case clues and investigation order |

3.3.1. Conducive to the unification of standardized and scientific. Disciplinary inspection and supervision agencies have a lot of business, covering a wide range and being highly standardized. The application system of the blockchain technology should emphasize unity, cover the entire discipline inspection and supervision agency's business processes, and meet the needs of law enforcement handling cases. At the same time, it is also necessary to meet the needs of the continuous expansion of the procuratorial business and carry out scientific configuration. The application of blockchain technology can be based on the revised *Criminal Procedure Law of the People's Republic of China, Monitoring Law of the People's Republic of China* and other laws and judicial interpretations, through
the configuration process, documents, clues, data items, and discipline inspection. The organizing and law enforcement activities of the organs are streamlined and standardized. The technical characteristics of the blockchain can be reasonably decomposed in the discipline inspection and supervision workflow, and play an important role in business processes, case data, system roles, and system permissions. It can provide a solid technical foundation for the future construction of discipline inspection and monitoring information.

3.3.2. Conducive to improving the efficiency of discipline review. Disciplinary review is the central work of disciplinary inspection and supervision agencies. The technical characteristics of blockchain can effectively become a powerful assistant for disciplinary review and provide convenience for business departments and case undertakers. By establishing an information platform for data sharing and collaboration, information can be ensured and effective and comprehensive exchange of case data can be effectively achieved. It can also achieve the vertical connection between the modal direction communication between various departments and the upper and lower levels, and improve the efficiency of discipline inspection and supervision.

3.3.3. Conducive to strengthening supervision of discipline inspection. After the reform of the supervision system, the discipline inspection and supervision agency involved in a wider range of business. Blockchain technology could store records safely which collected, issued, and certified by the discipline inspection and supervision agency. It ensures the existence and authenticity of certain data. Every step of the process of data information collection, transaction and circulation can be tracked on the blockchain which could avoid being tampered by human factors. Based on the characteristics of the above blockchain, the application of blockchain technology can solve the problems in discipline inspection and supervision effectively. At the same time, system optimization, reasonable allocation and efficient management of monitoring information resources are achieved.

4. Application Innovation of Discipline Inspection and Supervision Based on Blockchain Technology

4.1. Construction of Case Clue Information Management System Based on Blockchain Technology

The clue information is the basis of case handling, and the management of case clues is the guarantee for the smooth progress of case investigation. Blockchain technology is a digital application based on encryption technology, which is immutable and traceable. If a set of case clues information management system based on this technology can be established and the log records of the blockchain can be used, the process of case handling can be traced to the source and the information of each link of the case handling can be recorded from beginning to end. At the same time, it effectively avoids problems such as disclosure of reporting information, modification by handlers, and illegal disposal of case clues during the workflow process.

The case clue information management system of discipline inspection and supervision institutions based on blockchain technology is mainly composed of the data layer, the basic network layer, the core consensus layer, the smart contract layer and the application layer. (Figure 1).

The data layer is composed of the blockchain's management nodes and each authentication node; The data layer records information in a chain-structured data block through a hash function. In order to verify that the block header is effectively time stamped, the data is encrypted using an asymmetric encryption algorithm. In the basic network layer, through distributed algorithms, each node interacts in a point-to-point mode. In a public network environment, enabling nodes that cannot trust each other to effectively reach consensus is a key issue that needs to be resolved in building a blockchain system. So the core consensus layer includes the Proof Of Work, the Proof of Stake and the Practical Byzantine Fault Tolerance. The smart contract layer includes smart contract deployment, contract testing, and management logging. It programs the authority and rules of each department in electronic form and turns it into machine language. The application layer will provide a visual interface. It is mainly oriented to the business process platform for disciplinary inspection and supervision, involving the
case management department, the trial department and the case handling department. It uses smart contracts for data sharing.

In this blockchain-based system, each department can view records, modify records, and accept data. Digital signatures are used to ensure the Completeness and source authenticity technology. Digital signature can prove that the message is indeed signed and sent by the sender of the message, and it is non-tamperable. In case lead management, relevant departments have their own private keys. When verifying the signature, the public key is used for verification. Since the clue information is handed over, the private key signature of both parties is required. After the verification is successful, the data information could be retrieved. After querying, receiving, and modifying the information, and verified by the consensus mechanism, the log would be uploaded to the data block, and finally backed up on the blockchain. At the same time, you would query all the log records in the system to pinpoint the problem in the process of thread circulation. Next, each business unit on the chain is linked together through blockchain technology. The accuracy and authenticity of the transaction data information is verified by each node through a consensus mechanism to ensure the authenticity and reliability of the data information. After the clue data information is uploaded to the
blockchain through the case clue processing system, no matter which node is attacked, it will not affect the normal operation of the entire blockchain. (Figure 3)

![Flow Chart of Block Information Recording](image)

Figure 3. Flow Chart of Block Information Recording

It can prevent some staff members effectively from using the black box of authority to tamper with the case information. Simultaneously, it would avoid some problems such as information omission and staff concealment of information during the multiple circulation of case materials. Therefore, disciplinary inspection and supervision agencies could use the platform to establish information exchange or sharing mechanisms with financial institutions such as public, auditing, market supervision, and banks to achieve the goal of saving case handling costs and improving case handling efficiency.

4.2. Construction of Discipline Inspection and Supervision Business Process Platform Based on Blockchain Technology

In view of the complexity of the approval process and the low efficiency, the discipline inspection and supervision department can adopt a faster open-source-project to build a discipline inspection and supervision platform. The platform would be able to deliver information relatively quickly and in time. Entering all kinds of case-handling documents in the form of templates, and providing guidance and assistance to the case-handling staff by making various document templates and filling out instructions, can solve the problem of inefficient case handling and irregular case handling effectively. Especially in the document approval process, cross-department online business interactions could be conducted to reduce the overlap of hierarchical functions in the investigation process and reduce the labor and material consumption caused by repeated approval of documents. For instance, there are many approval links and complicated procedures from the disposal of case leads to the conclusion of a case. It requires multiple face-to-face signatures. Also, it approvals by relevant personnel of functional departments, deputy leaders, and principals (Figure 4). If one of the leaders is on a business trip and he/she cannot approve this business. Then this business would not proceed to the next step.
Figure 4. Flow Chart of Traditional Discipline Inspection and Supervision Work
With the help of the blockchain smart contract, the authority of the department and personnel can be set. After the program and content meet the prescribed authority and procedure of the prescribed smart contract, the information will be transmitted to the next receiving department. Departments and department approval leaders could use digital signatures instead of paper signatures, and implement online approvals to facilitate query and feedback (Figure 5). In Figure 5, the shaded red part indicates that the business is processed online.

Figure 5. Discipline Inspection and Supervision Business Flow Based on Blockchain Technology
4.3. Building a Smart Discipline Inspection and Supervision System Based on Blockchain Technology

At present, the flow of information resources and human resources of discipline inspection and supervision departments is restricted by departments and regions. It has not formed a completely smart monitoring system yet. Building a smart surveillance ecosystem with blockchain technology and integration with the surveillance system will become a significant task for the development of disciplinary inspections in China in the future. Establishing an integrated information ecosystem is the first step. The disciplinary inspection and supervision information management system based on blockchain and the disciplinary inspection and supervision business process platform based on blockchain technology can realize point-to-point transmission between multiple departments. Relying on the existing disciplinary inspection and supervision of the internal network, a private chain + alliance chain mode could be adopted. Each department establishes a private chain, and then builds an alliance chain on the basis. It would improve the security of data information. Then, the information management department of the disciplinary inspection and supervision agency should manage the data accurately. They should conduct intelligent analysis of the collected data in accordance with the principle of case by case. Case clue databases and monitoring object information databases covering discipline inspection and supervision agencies at all levels throughout the country can be established. All kinds of case clues are entered into the system and solidified into data, and then uploaded and backed up to the blockchain for the convenience of reference and citation by discipline inspection and supervision agencies at all levels throughout the country. Relevant departments should make full use of smart contract technology and implement intelligent management of discipline inspection and supervision based on big data processing technology. Meanwhile, they should provide the comprehensive, accurate and reliable data support for disciplinary inspection and supervision. At last, training professional technicians is also an important step. With the widespread application of big data technology, the information platform of discipline inspection and supervision agencies will become more intelligent. It is necessary to increase the training of business operators' knowledge in information system management and data analysis, improve their ability to operate and manage information systems, and ensure the smooth entry and transmission of case information data. In addition, in terms of information processing and system maintenance, business managers also need to verify the results uploaded by the system, identify and mark the wrong data in time, and avoid low-quality and wrong data flowing into the blockchain. Also, they must update, improve, maintain information databases to control and improve data quality punctually.

5. Conclusion

This paper provides a new model for the informatization development of the disciplinary inspection and supervision work process. At the same time, it come up with a new idea for China to deepen the reform of the national inspection system. Blockchain technology, big data, and artificial intelligence are playing significant roles in promoting the level of government intelligence increasingly. However, we also need to realize that blockchain is not a master key. While accelerating the construction of disciplinary inspection and supervision informationization, it is also necessary to resolve issues systematically, such as case handling safety and personnel quality, and continue to improve the effectiveness of discipline inspection and supervision. Although China has a good foundation in the field of blockchain application technology, large-scale application practices covering the social level are still in the initial stage. With the improvement of blockchain technology and the continuous improvement of relevant governance and regulatory laws and regulations, this technology will be able to use its advantages to inject a strong impetus into the building of a clean government and anti-corruption work. It would continue to promote the high quality of discipline inspection and supervision.

References

[1] Xi Jinping 2019 Deepening the Reform of the State Supervision System at a New Starting Point (Qiushi)
[2] Official Website of the Central People's Government of the People's Republic of China 2019 http://www.gov.cn/xinwen/2019-10/25/content_5444957.htm
[3] Nakamoto S 2009 *Bitcoin: A peer-to-peer electronic cash system* (Consulted) p1042-1048.
[4] Yong Y and Feiyue W 2016 *Blockchain: The State of the Art and Future Trends* (ACTA AUTOMATICA SINICA) P 481-494.
[5] Ølnes S., Jolien U., Marijn J. 2017 *Blockchain in government: Benefits and implications of distributed ledger technology for information sharing* (Government Information Quarterly) p355-364.
[6] Jiaming Z, Sheng G and Meijiao D 2018 *Blockchain Technology and Application* (First Edition) (Beijing: Mechanical Industry Press) p120
[7] Ministry of Industry and Information Technology of the People's Republic of China 2016 *China Blockchain Technology and Application Development White Paper* (2016)
[8] Ruixiang B 2016 *Research on E-government Based on Blockchain* (China Management Informationization) p 148-151
[9] Swan M. 2015 *Blockchain: Blueprint for a New Economy*. (USA:O’Reilly Media Inc.)
[10] Ølnes S 2016 *Beyond Bitcoin Enabling Smart Government Using Blockchain Technology* (in International Conference on Electronic Government and the Information Systems Perspective) p 253–264
[11] Ølnes S and Jansen A 2018 *Blockchain Technology as Infrastructure in Public Sector-an Analytical Framework*. (Proceedings of the 19th Annual International Conference on Digital Government Research: Governance in the Data Age, DG.O 2018)
[12] Kailin Z, Na W, Lei H, Ying W and Hankun Z 2013 *Constructing Collaborative Public Services: Research on Top-level Design Methods of Government Informationization* (Management World) p91-100
[13] Jiong-En X and Yingliang W 2018 *Research on Application of Collaborative Innovation in Government Affairs System Based on Blockchain* (Modernization of Management) p60-65
[14] Guowei G, Zhangli G and Yongxian L2018 *Research on the Cooperative Sharing Model of Government's Basic Information Based on Blockchain* (E-Government) p15-25
[15] Yimin Y, Taowei C, Zhentai D and Kun Z 2019 *Research on Government Information Resource Sharing Model Based on Blockchain* (E-Government) p58-67
[16] Zhujing L 2018 *Conception of Blockchain and Anti-Corruption Lead Management* (Prosecutorial View) p36
[17] Lu M and Jingyi L 2018 *Research on Blockchain Technology and Its Application in Government Governance* (E-Government):2-14