



Research on the Framework of the Project Management System for the Reconstruction of Old Residential Areas Based on Blockchain Technology-Take the Xishan District of Kunming as an Example

Zheng Niu¹, Houhui Yu¹, Xiaosong Wu^{2(✉)}, Qitao Liu³, and Tao Zhou¹

¹ Information Institute, Yunnan University of Finance and Economics, Kunming, Yunnan, China

² Laboratory and Experimental Teaching Management Center, Yunnan University of Finance and Economics, Kunming, Yunnan, China
1403044553@qq.com

³ International Business School, Yunnan University of Finance and Economics, Kunming, Yunnan, China

Abstract. In recent years, blockchain has been concerned by all walks of life. Because of non-tampering, traceability, and decentralization, the blockchain provides a credit creation mechanism, which is different from the previous mechanism. In the past, the integration of data and information was often difficult and the construction period was delayed in the reconstruction of the old community, because of the large amount of funds, cumbersome procedures, many participating units and different databases in different government departments. The trust problem of multi-party participation will be solved by data encryption and uploading to the blockchain based on old community renovation project management system with blockchain. Blockchain records the results of all important nodes, and the whole transformation process can be traced. The transparency and efficiency of the project can be improved by optimizing the project process, transformation process nodes, business data, participants and supervision methods.

Keywords: Blockchain technology · Old community renovation · Project management system

1 Introduction

In the eighteenth collective learning of the Central Committee of the Communist Party of China on the current situation and trend of the blockchain technology, Xi Jinping, general secretary of the CPC Central Committee, stressed that the integrated application of blockchain technology played an important role in the new technological innovation and industrial transformation [3]. We should take blockchain as an important breakthrough for independent innovation of core technology, clarify the main direction, increase investment, strive to conquer a number of key core technologies, and accelerate

the innovation and development of blockchain technology and industry [2]. Xi Jinping also pointed out that we should seize the opportunity of technology integration, functional expansion and industrial segmentation of blockchain technology, and play the role of blockchain in promoting data sharing, optimizing business processes, reducing operating costs, enhancing collaborative efficiency, and building a credible system [5]. In the process of old residential renovation project management, there are also problems, such as large amount of funds, cumbersome procedures and many units involved in the renovation work. Therefore, this paper introduces the blockchain technology, analyzes the characteristics of the blockchain technology, and uses the blockchain technology to solve the practical application problems in the old residential renovation management.

2 Overview of Blockchain

2.1 Concept

Blockchain is a chain composed of a small block that records various information. It can be interpreted as “block” + “chain”, and “block” is a place where information is stored. It stores all information of a transaction, and the informations are connected with each other through “chain”, thus forming an information network. Each node in the blockchain has the same status, and the node with central status does not exist. If one of the nodes produces data, the data must be verified by other nodes and stored after passing, and other nodes will copy and store the data synchronously [1].

2.2 Blockchain Characteristics

Blockchain is an integrated innovation of known technologies which is mainly used to realize multitrust and efficient cooperation. Generally speaking, blockchain has the characteristics of decentralization, tamper proof, traceability and anonymity.

2.2.1 Decentralization

In the whole blockchain system, all participating nodes are peer-to-peer nodes, and they have bookkeeping rights in theory (different consensus algorithms and different accounting rights methods). These nodes maintain an account book together, and the whole system is transparent to each node. This is in sharp contrast with the centralized system, and there is an information asymmetry between different nodes of the centralized system.

2.2.2 Tamper Proof

Tamper prevention is not to say that the data stored in the blockchain cannot be tampered, but that it takes a great price to tamper with the data recorded in the blockchain. In bitcoin system, if an attacker wants to tamper with data on the blockchain, he or she needs to control at least 51% of the computing power of the whole network.

2.2.3 Traceable

Traceability refers to the complete record of any transaction initiated on the blockchain. The blocks and blocks are connected by hash pointers, and the block header of the latter block always contains the hash value of the previous block, so that the block is connected and formed a main chain in turn. When the user node needs to find a transaction content, it is only necessary to search forward from the last block of the main chain.

2.2.4 Anonymity

The decentralization feature naturally brings about the characteristic of anti-trust. Any node user initiates a transaction on the blockchain network, only the public-private key of the account is required. The receiver of the transaction does not need to verify who the transaction originator is, but only to judge the validity of the transaction. This provides the premise for blockchain system to protect user privacy.

3 Problems in the Management of the Old Community Reconstruction Project

The reconstruction of old residential areas is a complex system project which needs to coordinate the participation of residents, government departments, enterprises and other aspects in the process of reconstruction. In addition, involving multiple departments and units to participate in management, there will inevitably be various problems. The main problems in the process of transformation are as follows.

3.1 The Problem of the Direction of Funds

In the process of the old community reconstruction, the whole reconstruction project involves a large amount of funds, including special funds from the central government and local government and the funds raised by the users of the community. The cost of funds in the process of transformation has become one of the main concerns of the people. How to make the people better understand the direction of each fund, improve the credibility of the government, has become one of the problems urgently needed to be solved.

3.2 The Construction Time Limit

In the process of old residential reconstruction, the preliminary procedures are complicated, and the joint approval permission of multiple departments is required which leads to the extension of the construction time limit of the project. In the early stage of project implementation, feasibility study and preliminary design of the project need to pass the approval of the government, and then a series of permits such as construction land planning license, construction project planning license and construction permit are required to be handled before the construction can be officially started which greatly lengthens the whole project construction time.

3.3 Filing of Documents and Data of Each Unit

In the process of the old community transformation, there are many units involved in the transformation, including development companies, construction companies, property companies, development and reform, finance, natural resources, public security, fire protection and other departments. It is difficult for all departments to coordinate and communicate with each other. Moreover, from the beginning to the end of the whole transformation project, there are many files involved and most of them are scattered in various departments. It is difficult to summarize and sort out in the later stage. After the reconstruction of old residential areas, the management of the rehabilitation and community management should be carried out in the later period. While managing, it is inevitable to need some data in the process of pre-transformation. Often these data are not summarized, which brings great inconvenience to the later management.

4 The Design Requirements of the Project Management System for the Old Residential Reconstruction Based on Blockchain

The reconstruction of old residential areas is a complex system project, which needs to coordinate the participation of residents, government departments, enterprises and other aspects in the process of reconstruction; In addition, involving multiple departments and units to participate in management, there will inevitably be various problems. In the past, the old residential reconstruction process, because of the large amount of funds, complicated procedures, more participating units, independent databases of different government departments, the difficulty of data information integration, has delayed the end of the reconstruction project. The application of blockchain technology to the old community transformation management can greatly improve and improve the efficiency of the reconstruction project.

4.1 Optimization of Project Flow by Blockchain

The important data of construction transformation nodes are recorded in the block by using the technology of block chain distributed storage, time stamp and digital signature; Combined with intelligent contract technology, the payment of project funds and other construction funds is completed on the blockchain platform, and each payment expense is recorded, which provides the basis for the later accounting; Government departments and community representatives can join in as independent nodes to master a series of information related to the transformation project, such as the progress of the project in real time. We can process the whole transformation project, and the detailed process is shown in Fig. 1.

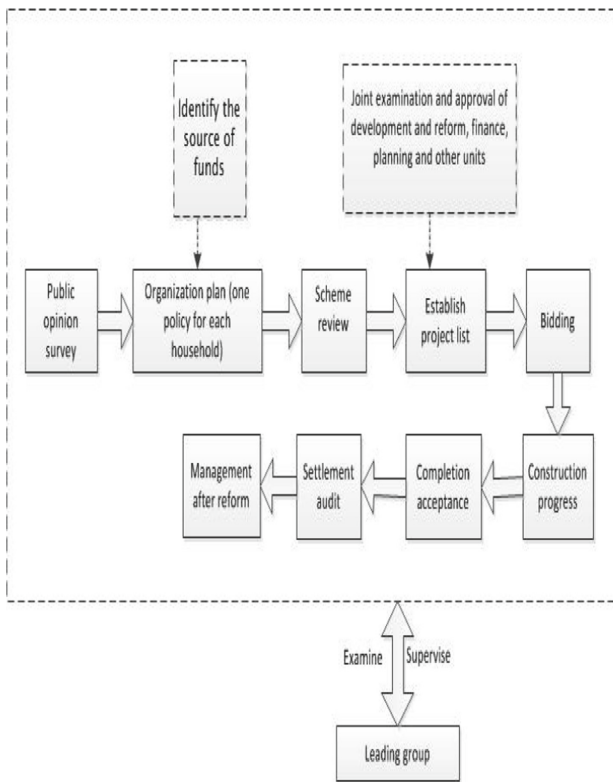


Fig. 1. Flow chart of transformation project

4.2 Optimization of Block Chain to Nodes in the Process of Transformation

Using block chain technology, the important node information in the project transformation process: the results of public opinion questionnaire, the transformation plan of “one household and one policy”, the result of scheme review, the project list (approval result of the unit), bidding information, construction progress in each period, acceptance result information, payment of work process funds, maintenance management information after the transformation And the results information such as the opinions of the government leading group are recorded on the blockchain. Each community has a relatively complete record of the transformation, each step of the important link results on the chain, strengthen the control of the process, each use of funds and payments, there are records, to ensure the use of each fund in place. During and after the transformation, the whole transformation process can be traced back.

4.3 Optimization of Business Data in Blockchain

Business data is trusted [1]. Blockchain relies on distributed ledger technology, cryptography, consensus mechanism, intelligent contract and other technologies to realize the decentralization of the system, which naturally ensures the transparency of information.

Anyone who wants to access only needs to log in to the blockchain account for online query. Users also need not worry about whether the data of query is correct or not, because the data on the whole blockchain is highly consistent, and all nodes agree with each other; And once the data is recorded on the blockchain, no node can be undone or tampered with. In the reconstruction of old urban residential areas, through the important milestone result data chain, the paper document can be electronic and electronic information credible, the friction cost of mistrust between multiple subjects can be reduced, and the problem of traditional business mode consuming a lot of manpower and material resources for document and bill authenticity audit can be solved, which also ensures that the national regulatory department can implement the supervision means.

4.4 Optimization of the Blockchain to the Participants

The participants are equal. The unified distributed ledger technology of blockchain solves the problem of “business sovereignty” naturally, effectively realizes the identity, responsibility, power and benefit of each participant, and realizes the real-time synchronous update of data among all participants. In the reconstruction of old urban residential areas, it is necessary to involve the city’s sub district offices, Financial Bureau, development and Reform Bureau, news center, housing and Urban Rural Construction Bureau, retired military Bureau, renewal and transformation Bureau, public security branch, organ Affairs Bureau, Civil Affairs Bureau, science and technology information Bureau, education and Sports Bureau, natural resources bureau, Water Bureau, audit bureau, market supervision bureau, Transportation Bureau, urban administration bureau The disabled federation, power supply bureau, gas company, water supply company and other departments make use of the advantages of the participants of block chain technology to realize the synchronous update of data, making cooperation between all parties more convenient and fast, and the enthusiasm of the partners can be improved.

4.5 Optimization of the Supervision Means in Blockchain

The supervision means are multidimensional [1]. The regulatory department can assume the functions of auditors on the blockchain platform, realize the supervision and audit of transactions, customize the granularity and statistical caliber of financial supervision, timely obtain the regulatory data and realize rapid audit. Meanwhile, the intelligent contract and other programmable scripts are used to add corresponding regulatory rules. In the reconstruction of old urban residential areas, urban housing and Urban Rural Construction Bureau, as the supervisor and coordinator, can understand the project progress and node data of each project from the blockchain platform, realize the statistical analysis of the progress of the whole area transformation, and realize the supervision and management system of the whole process in advance, in the event and after.

5 Framework Design of Management System for Old Community Renovation Project in Xishan District, Kunming Based on Blockchain Technology

According to the preliminary investigation, the construction area of the old community built before 2000 in Xishan District is about 3.5 million square meters, 1.12 million square meters will be renovated in 2020, 300,000 square meters will be renovated in 2021, and the remaining part will be completed by classification in the “14th Five-Year Plan”. In 2020, the old community in Xishan District will be renovated with a building area of 1.12 million square meters, 16,785 households, 534 buildings and 48 communities. The renovation involves 6 sub-district offices and some units.

Renovation content: water, electricity, gas, one household, one meter, sanitation facilities, water supply and drainage, fire protection facilities, solar energy, roads, walls, facades, greening, etc.

- (1) The estimated design budget of Jinbi Street Reconstruction Project is 48.5241 million yuan. A total of 22 courtyards have been upgraded for roads, renovation of water supply for one household and one meter, renovation of power supply for one household and one meter, flooded water treatment, renovation of old drainage facilities, and greening renovation. 70% of the total project is currently completed.
- (2) Organ reconstruction project, the design budget is 2.8 million yuan. The building area is 6,800 m², with 96 households and 3 buildings. The old community renovation project has a design budget of 28.443 million yuan. The building area is 124,000 m², with 1,424 households and 59 buildings.
- (3) The Xiyuan Sub-district Office’s 4 old community renovation projects in 2020 have an estimated design budget of 30.8364 million yuan. The building area is 316,100 m², with 4,734 households and 126 buildings.
- (4) The 2020 old community renovation project of Zongshuying Sub-district Office has an estimated design budget of 5.15 million yuan. The building area is 273,000 m², with 4,545 households and 155 buildings.

Blockchain technology has three major nodes in the design of the old community renovation project management system in Xishan District, Kunming City. To carry out the framework design of the management system of the old community renovation project in Xishan District.

5.1 Government Node

The government node is the most important node of the old community transformation management system, in order to better coordinate the old community transformation project. This node mainly includes access review and management module of other nodes, fund distribution module, data encryption module [4], data sending and receiving module and other node modules of supervision blockchain network.

The node access review and management module is mainly to complete the review and management of nodes, and maintain the topology of the whole blockchain network.

When a new identity node requests access or exit, the government node will update the result to the whole network topology in time.

In the fund distribution module, the blockchain is used to record the payment of each fund in the process of transformation, and the size, whereabouts and application process of each fund are clear. If there are problems such as fund interception, detention, misappropriation and so on, query the nodes of the blockchain to know the problem of fund flow. On the basis of the original policy, the block chain is used to record the specific fund payment process to further ensure the fund security.

The government supervision module uses the blockchain to record the changes and results before and after the implementation of each urban old community reconstruction project. The construction party, project effect, project acceptance and later project audit are recorded on the blockchain. When necessary, the digital signature technology can be combined. After completing their respective tasks, the construction party, the acceptance party and the audit party can sign the uploaded data. When the unqualified personnel need to be investigated for responsibility according to law, the blockchain can provide the node data of the whole process, so that speculators have no place to escape, and the accountability can be traced with rules to follow and reasons to follow.

5.2 Construction Node

As the specific implementer of the whole old community reconstruction project, the construction party is mainly responsible for uploading the real construction progress, materials used in the construction process and other information to the blockchain network in time, and forming a new block after the consensus of other nodes is passed. In the construction process, the construction party completes the reconstruction project according to the initial given time and date, and directly allocates funds through the smart contract technology avoiding the delay of the later project payment and other disputes. When payment is made through smart contract technology, records will also be left on the blockchain which is also convenient for later fund accounting and public supervision.

5.3 Expert Node

The expert node mainly uploads the “one family one policy” scheme, project evaluation scheme, bidding and other information to the blockchain network. When uploading each message, the identity information of the scheme participants is packed and encrypted together with a time stamp. When the consensus of other nodes in the blockchain network is obtained, a new block is formed. Using the blockchain to record the plan of “one household, one policy” for the transformation of old urban residential areas. As for each residential area, as for each unit building and each household, the transformation scheme is different. Such huge transformation scheme data can be recorded on the block for backup.

6 Conclusion

Using blockchain technology to build a management platform for the renovation of old communities in Xishan District, Kunming City, compared with the previous management

system, it has effectively increased the credibility of the people in Xishan District to the government; it has reduced the manpower and material resources brought about by the previous management system. It also brings a more convenient way of data traceability for the completion of the Kunming renovation project.

With the development of Internet information technology, the government system will also bring changes, and the use of blockchain technology to build a government system will become more and more popular. Blockchain technology can not only be used in the field of government offices, but there are also many applications in various fields that have already been implemented. For example: credit reporting + blockchain, supply chain finance + blockchain, insurance + blockchain, securities + blockchain, commodity traceability + blockchain, medical + blockchain, etc. Using the blockchain as the underlying infrastructure to build a trusted value transmission network plays a huge role in all aspects of society.

References

1. Hou B, Zhang L (2021) Research on the application of blockchain technology in auditing. *Foreign Econ Relat Trade* 03:80–83
2. Mu C, Di G, Lv Y, Qian Y, Qing, S (2020) Development and management of blockchain technology. *China Financ* 04:28–29
3. Jiayan L (2020) Research on the development and application of “blockchain+” education. *J Phys Conf Ser* 1607(1):012089
4. Bai Y, Chen J, OuYang B, Liang S (2019) Blockchain-based application system for scientific research projects. *Sci Technol Innov* 03:85–86
5. Xiong D (2019) The real application prospect and analysis of blockchain of government information. *Zhongguancun* 11:86–89

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter’s Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter’s Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

