Research on Sharing Mode of Digital Archives Resources in Colleges and Universities based on Blockchain Technology

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Abstract

Currently, the sharing of digital archives resources in colleges and universities is faced with both objective and subjective factors. In view of the difficulties in the sharing of digital archives resources in colleges and universities, and combined with cases at home and abroad, this paper analyzes the feasibility of applying blockchain technology to the sharing of digital archives in colleges and universities. Additionally, the sharing mode of digital archives resources in colleges and universities is constructed using blockchain technologies, such as distributed storage, consensus mechanism, stamped encryption, double-chain binding, smart contract, etc.

Keywords

Blockchain technology; Digital archives resources in colleges and universities; Sharing Mode; Information resource fusion.

1. Introduction

In December 2016, the Thirteenth Five-Year National Informatization Plan issued by the State Council formally included "blockchain technology" in the national plan for the first time, causing widespread concern in various industries. On January 10, 2019, the State Internet Information Office issued the Regulations on the Management of Blockchain Information Services, which standardizes the application of blockchain technology in the field of information services. On October 24, 2019, "the present situation and trend of the Development of blockchain Technology" became the theme of the 18th collective study of the political Bureau of the CPC Central Committee. Xi Jinping stressed the need to accelerate the development of blockchain technology and industrial innovation, and give full play to the role of blockchain in promoting data sharing.

Archives resources in colleges and universities are the original records formed in the process of running a school, and digital archives resources in colleges and universities are the existing form of digitization of archives resources. The sharing of digital archives resources in colleges and universities has important practical value, providing more efficient utilization and services for teaching and scientific research in colleges and universities, offering more scientific reference and basis for leaders' management and decision-making, accelerating the accumulation, dissemination and innovation of university culture, and enhancing the influence and reputation of colleges and universities in society. [1] The construction of archives informatization has been promoted for many years, and digital archives resources are showing a trend of rapid growth, but the sharing of digital archives resources in colleges and universities is still faced with multiple difficulties. Based on the characteristics of blockchain, such as difficult to tamper, non-fiction, whole-process backtracking, stamped encryption, consensus mechanism, etc.

In this paper, we apply blockchain technology to the sharing of digital archives resources in colleges and universities, and establishes a sharing mode of digital archives resources in colleges and universities based on blockchain technology, hoping to provide reference for colleges and universities to promote the sharing of digital archives resources.

2. Status Quo of Difficulties in Sharing Digital archives resources in colleges and universities

At the end of the 20th century, under the tide of national archives information construction, colleges and universities began to start archives information construction. In 2008, Shanghai Jiaotong University established the first digital archives of domestic universities, and then a number of universities such as Chongqing University and Tongji University built digital archives one after another. In the process of archives information construction in colleges and universities, a large amount of digital archives resources have been rapidly accumulated. In the face of these precious digital archives resources, university archives departments have carried out different types of digital archives services, such as retrieval, consulting, browsing, pushing and so on, from different angles, different levels and under certain authority constraints. Although the digital archives service in colleges and universities has been carried out for many years, the sharing of digital archives in colleges and universities is still unable to be realized, resulting in a large number of digital archives resources utilization is not high, the value has not been fully excavated. At present, there are two main reasons for the difficulties in sharing digital archives in colleges and universities.

2.1. Objective Factors of "Unable to Share"

The objective factors of "unable to share" are mainly reflected in the restriction of objective factors such as archives management system, digitization of collection archives resources, network security protection and so on, which makes it difficult to share digital archives resources in colleges and universities.

Firstly, the popularization rate and system functions of university archives management system hinder the sharing of digital archives resources. Taking the colleges and universities directly under the Ministry of Education as an example, the archives management system is basically popularized in the archives departments of colleges and universities directly under the Ministry of Education, but the functions of the system are uneven. To make matters worse, a small number of university archives departments still use stand-alone management system or C/S architecture management system, which objectively affects the promotion of the sharing of digital archives resources on campus.

Secondly, the proportion of digitalization of archives resources in colleges and universities is not high. The digitization of stock archives accounts for a large proportion of the information work of archives in colleges and universities. some colleges and universities only digitize files with high utilization rates such as students' transcripts and admission rosters, and the digitization rate is less than 50%. Without enough digital archives resources as the support, resource sharing is also difficult to carry out.

Thirdly, the degree of information construction in colleges and universities also affects the sharing of digital archives resources to a certain extent, especially the construction of network security. Campus network has been popularized, but colleges and universities with insufficient network security and weak computer server capacity and security are subject to more restrictions on the sharing of archives resources.

2.2. Subjective Factors of "Unwillingness to Share"

The subjective factors of "unwillingness to share" mainly refer to the lack of trust among various departments of colleges and universities, the problem of information security when

sharing, the problem of reasonable restraint and so on. Compared with the core functions of talent training, teaching and scientific research and social service in colleges and universities, archival work is a behind-the-scenes service work, which is located at the end of all the work in colleges and universities. Part-time archivists in various departments usually hold multiple positions, resulting in the widespread problem of incomplete or difficult collection of archives. Because archives resources are not easy to come by, some archival departments in colleges and universities are unwilling to share them, worrying about the copyright protection and authority control of digital archives after sharing.

Maintaining the information security of digital archives is the most basic guarantee to carry out all kinds of archives management. The main risks in the security management of digital archives in colleges and universities include: (1) The risk of content distortion. The distortion of digital archives content information means that after the structure, content and background information of digital archives are transmitted and utilized by various carriers, the content of digital archives information changes and no longer retains its original appearance;(2) The risk of information leakage. In addition to the information that has been made public, the information resources of digital archives also include a large number of confidential digital files and digital files containing information and privacy of teachers and students. Therefore, network threats and attacks, the backwardness of digital file information encryption technology, and unreasonable authority distribution in the archives management system all evolve the risk points of information leakage.

In addition, the coordination of the relationship between departments when sharing and how to reasonably restrain other departments and departments in the sharing of digital archives resources are also regarded as one of the supervisor factors of "unwillingness to share".

3. Analysis on the Feasibility of Applying Blockchain Technology to the Sharing of digital archives resources in colleges and universities

According to the definition in the 2018 White Paper on Blockchain Industry issued by the Ministry of Industry and Information Technology: blockchain in a broad sense represents a technology. It is a new distributed infrastructure and computing paradigm that uses blockchain ed data structure to verify and store data, uses distributed node consensus algorithm to generate and update data, uses cryptography to ensure the security of data transmission and access, and uses smart contract composed of automated script code to program and manipulate data. Blockchain has the characteristics of decentralization, openness, independence, security, anonymity and so on. Its core technologies include distributed account book, asymmetric encryption, consensus mechanism, smart contract, etc. [2] In view of the difficulties in sharing digital archives resources in colleges and universities, and combined with cases at home and abroad, the feasibility of the application of blockchain technology in digital archives sharing in colleges and universities is analyzed.

3.1. Foreign Case Analysis

With the discussion of foreign academic circles on the application of blockchain technology in the field of archives, foreign archival institutions began to practice and explore the application of blockchain technology. In June 2017, the National Archives (TNA), in conjunction with the University of Surrey and the Open data Institute, launched an 18-month blockchain research project ARCHANGEL: Trusted Digital Archives. Using the blockchain technology, the project designs and implements a shared service model based on the long-term preservation of digital archives on the basis of trust. The main contents of the project are: building a blockchain platform, building a digital file integrity verification framework, feedback public sharing needs, etc. In February 2019, National Archives and Records Administration (NARA) issued the White

Paper on blockchain, which analyzed the challenges brought by blockchain files to NARA management, and held that archives can be used as nodes to participate in the blockchain and improve the constraints of objective conditions such as information facilities in the sharing of digital archives resources. [3] Through the analysis of the maturity curve of blockchain technology, Hype Cycle for Blockchain Technologies, 2019 newly released by Gartner, the most authoritative IT research and consulting firm in the world, points out that the application of blockchain technology in various industries is becoming more and more popular. These foreign application cases show that the blockchain technology is conducive to the security and integrity of digital archives resources, and provides a reference for university archives departments to overcome the constraints of objective factors in the sharing of digital archives resources.

3.2. China Case Analysis

In 2017, domestic archival scholars began to pay attention to the application of blockchain technology in the field of archives in colleges and universities. After full theoretical discussion, in 2019, the archives of Hefei Institute of material Science of the Chinese Academy of Sciences and the archives departments of several research institutes under the Chinese Academy of Sciences applied blockchain to build an alliance chain, and realized the whole process of sharing application, authority examination, access to archives objects, sharing and utilization of the research institute's infrastructure archives and large scientific projects through smart contract technology combined with public chain, IPFS, hybrid encryption, etc. [3] China's Chongqing applies the blockchain technology to the government information sharing mechanism, blockchain technology effectively solves the problems and challenges of government data sharing, making use of the characteristics of blockchain technology, such as information security, data traceability, trusted consensus and so on, to break through the barriers between departments and establish a trust mechanism for government information sharing between departments, so as to provide management for the public to the maximum extent, and thereby improving the efficiency of government information utilization. [4] In addition, blockchain technology is also applied to the sharing of digital archives resources in colleges and universities. For example, the Joint Network and Educational Technology Center of the Archives of Northwest University of Agriculture and Forestry tries to apply blockchain technology and artificial intelligence technology to build an unattended intelligent archives co-search Distributed Autonomous Organization (DAO for short), so as to achieve self-help access to digital archives resources and improve the efficiency of digital archives resources sharing services. [5] Besides, there is a scheme of blockchain credit management platform for college student files, which uses distributed node consensus algorithm to establish a "functional credit" mechanism to solve the problem of privacy leakage in university digital archives resources,[6] this effectively solves the subjective factors that hinder the sharing of digital archives resources in colleges and universities.

4. Construction of Sharing Mode of Digital Archives in Colleges and Universities Based on Blockchain Technology

With the support of blockchain technology and with the help of the campus network that has been basically built in colleges and universities, the university digital archives sharing mode is constructed, which is composed of archives departments, functional departments, departments, teachers and students, alumni and other subjects. The archives department plays a leading and main role in this sharing mode, except for the secret-related digital archives resources that are not suitable for sharing. the degree of archives information construction determines the format type, quantity and quality of archives resources provided to functional departments, colleges and departments, teachers and students and alumni. For example, the archives management system of Beijing Jiaotong University includes archives website, comprehensive archives

management system, personnel archives management system, photo archives management system, student admission score management system and database disaster preparedness management system. In the sharing mode, it can provide more complete digital file resources.

At the same time, archives department plays multiple roles in the multi-agent interconnection chain of the sharing mode of digital archives resources in colleges and universities based on blockchain technology, not only as the policy maker of digital archives resources sharing, but also as the provider of digital archives resources sharing service, the coordinator of sharing contradictions and the supervisor of sharing behavior. The archives department undertakes the collection, storage, management and sharing services of digital archives resources needed for sharing. the other subjects in the chain are departments and functional departments, teachers and students and alumni, and the nodes reach a consensus through negotiation. and abide by the agreement to jointly maintain the consensus. Under the consensus mechanism, the smart contract is formed according to the actual needs and authority of multi-parties, and the smart contract runs automatically on the blockchain, realizing the direct docking between the subjects, and the exchange and sharing of digital archives resources. As shown in Figure 1.
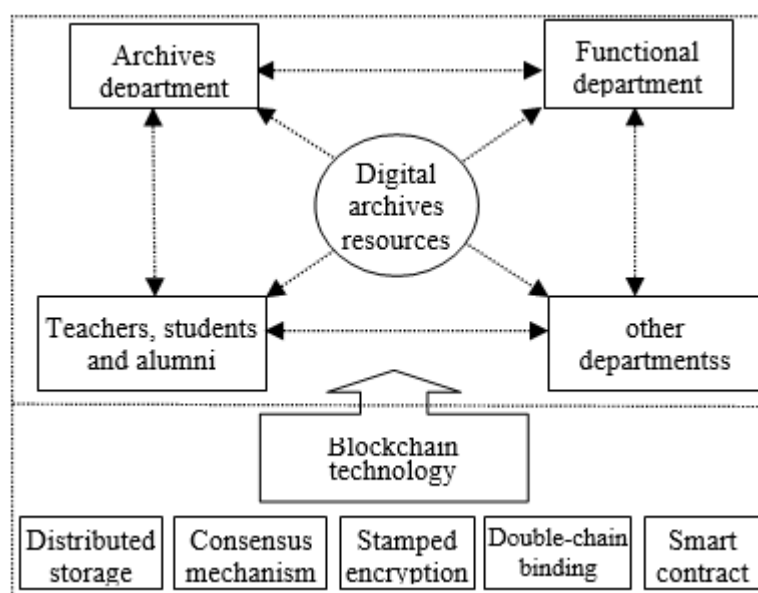
Figure 1. Sharing Mode of Digital archives resources in colleges and universities based on Blockchain Technology

Distributed storage, consensus mechanism, stamped encryption, double-chain binding and smart contract have become the main blockchain technologies to support the sharing of digital archives resources in colleges and universities. the specific analysis of its application is as follows:

Firstly, distributed storage. Digital archives resources in colleges and universities use blockchain technology, in the same algorithm by setting a variety of nodes to store, set different access rights on nodes, these nodes can quickly share digital file resources. The digital archive resources shared by any node will be displayed on the network of the blockchain and recorded by the node. These nodes that complete the record cannot be tampered with. The distributed storage of digital archives resources in colleges and universities not only ensures the authenticity and effectiveness of the accounts, but also makes the resource sharing information of the blockchain open and transparent.

Second, the consensus mechanism. It helps to enhance the sense of trust of various departments in the sharing of digital archives resources. In the case of disagreement or conflict among faculties, departments, teachers, students and alumni in the process of sharing, there is a

consensus reached by several participating nodes in the blockchain, that is, the consensus mechanism is used to address this problem.

Third, stamp encryption. It plays a role in avoiding the security risk in sharing digital archives resources in colleges and universities. "Under the control of appropriate security architecture and infrastructure management, blockchain technology can be used to solve current and recent problems related to information integrity." [7] The timestamp of blockchain makes the sharing and utilization of digital archives resources traceable, and the encryption technology of blockchain protects the privacy-related contents of digital archives resources in colleges and universities.

Fourth, double-chain binding. It is a combination of alliance chain and private chain. Aiming at the cross-departmental and cross-faculty digital archives resources in colleges and universities, the sharing alliance chain is the best choice. For example, the "Southeast University Archives Information Management system" platform integrates multiple single application systems into an integrated management system, completes collaborative work with multiple departments and two-way data exchange, and realizes data sharing between departments. Private chain aims at the sharing of digital archives resources of individual groups such as teachers and students, alumni, etc.

Fifth, smart contract. It will improve the performance of digital file resource sharing. "A smart contract is a series of if/else statements that are programmed and saved on a blockchain. Relying on smart contract, the sharing service of digital archives resources will greatly reduce manual intervention and manual operations, thus simplifying the utilization process and procedures. [8] this not only reduces the pressure on the daily use of university archivists, but also gives full play to the value of digital archives resources in colleges and universities.

5. Conclusions

The rapid development of blockchain technology provides an opportunity for colleges and universities to realize the sharing of digital archives resources. The establishment of the sharing mode of digital archives resources in colleges and universities based on blockchain technology is to promote the sharing of digital archives resources among various departments, departments, teachers and students and alumni within the campus, allowing the digital archive resource library built by the archives departments of colleges and universities to give full play to the value of consulting, vouchers, and reference.

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