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# Sharing and Co-Construction of Library Alliance Driven by Big Data and Blockchain

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**Abstract.** Big data technology drives the library alliance and shifts focus from the construction of cooperation mechanism to the construction of technology level. It integrates library big data by building a national shared service platform covering concepts, resources, technology, readers, mechanisms and then fully share the literature resources within the library alliance with the help of blockchains and alliance chains technology to explore the future development and direction of the library.

**Keywords.** Library, library alliance, big data, blockchain, co-construction, sharing

## 1. Introduction

Before the advent of computers, libraries were the only sources of literature review and data collection for the researchers. Subsequently, the computer applications enabled easily to compile machine readable catalog (MARC) data in order to retreat library's massive literature information resources. The use of Internet further exploded the network information and the position of libraries as an information center affected significantly. The emergence of the search engines had rapidly replaced libraries as the first choice of the people to obtain information and libraries were gradually marginalized. With the development of big data and blockchain technology, massive data and advanced algorithms enables scholars to search relevant information. There are two laws in this series of changes. First being the changes in the way the people obtain information have changed with the progress of science and technology, that is, "productivity determines superstructure". Second, the speed by which people access information is constantly accelerating, and the access speed has become a key factor in the survival of the fittest. In the face of the society's ever-increasing demand for accessing information, no single library can meet their expectations, but even libraries all over the country or the world would be inadequate. The World Library will be the ultimate ideal form that will emerge in near future.

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## 2. Current situation of domestic library alliances

Library alliance refers to a library consortium in which several libraries sign a cooperation agreement for the purpose of co-construction and sharing of literature information resources [1]. Geographically, the forms of the library alliances can be divided into national alliances and regional alliances according to the scope covered. It can also be divided into the same system alliances or cross system alliances according to the types of the libraries. The specific forms include national same system alliances, national cross system alliances, regional same system alliances, and regional cross system alliances [2].

China's library alliance is dominated by the university libraries and the public libraries, such as China's Higher Education Document Security System, Hunan University Digital Library, etc. [3]. Regional library alliances led by the public libraries have also spread all over the country, such as the Guangdong Hong Kong Macao Greater Bay Area Public Library Alliance [4], the six central provinces (Hunan, Hubei, Jiangxi, Anhui, Shanxi and Henan) Public Library Alliance. [5] In addition to the alliance between the university libraries and the public libraries, there are many other types of library alliances, such as the National Library Reference Consulting Alliance [6], the Library Emergency Management Strategic Alliance [7], etc.

From the various types of library alliances mushrooming at home and abroad, all libraries can reach a consensus on the necessity of establishing alliances and join as many library alliances as possible. But why does each province still have its own university library alliance even when they join the national university library alliance like CALIS? Why some libraries which have joined the provincial library alliance also want to join the municipal library alliance? In fact, most of the libraries have joined more than one alliance since each alliance is mainly established to solve a certain kind of problem. However, there are many problems that need to be addressed by establishing the alliances, so they need to join one or the another alliance. Theoretically, the more the participation in the alliances, the greater the benefits libraries reap through joint construction and sharing, but the difficulty lies in cooperating each other. How to build up a library alliance that allows more libraries to join easily and further accelerate the accession of information resources among the member managers? Both the form of library and the form of library alliance are constrained by science and technology over the times. What kind of technical support is necessary for effective library alliance? Presently, two new emerging technologies viz., big data and blockchain can provide new support to library alliances and has tremendous scope to take a step forward.

## 3. Co-construction of library alliance service platform driven by big data

### *3.1 Big Data and Library*

Big Data refers to a data set that cannot be managed and processed by conventional software tools. Library has a long history of dealing data. In fact, MARC data, which was first produced in the United States in 1961, can be regarded as a kind of big data in the early days. The birth of MARC data has significantly improved the efficiency of library in searching literature resources and laid a foundation for the libraries to move towards integration and automation. In addition to MARC data, each library has accumulated enormous data, reader data, and circulation data in the business

management system and are intangible assets of the libraries. Libraries have accumulated massive big data without its full use. This is because these data are scattered in every library and in the absence of any advanced algorithm for processing the data become unusable. Therefore, there is an urgent need to build a new generation of service platform that can collect the big data of all the libraries.

### *3.2 Feasibility of building a new generation of library service platform*

Let's take a look at the statistics of "Double 11" in 2020: from November 1 to 11, 2020, the peak number of orders by Tmall reached 583000 transactions/second. In 2019, there were 3196 public libraries in China, with a total circulation of 90.135 million people, 613.73 million books and literatures to borrow, and 266.09 million people had borrowed books from the libraries [8]. This clearly reflects that only computers can process big data, which is technically feasible for all the libraries across the country to share a common platform for data processing.

The traditional library management system is mainly designed according to the business process of paper books. It is difficult to deal with the diverse library collection resources under the background of the big data that can solve the unified management of all library collection resources. Further, it restricts the process of resource sharing among the libraries and cannot manage the reader's behavior data. In order to meet the needs of business management under the background of big data and to bring a fair level big data technology cooperation, many library alliances are developing new generation library sharing service platforms, which are convenient for the alliance members to carry out big data development and in-depth cooperation on the same platform.

### *3.3 Construction of library alliance service platform*

The service platform of the National Library Alliance can be jointly developed by several institutions. When such platform is available, each library alliance will be integrated, and all the libraries will gradually be absorbed through the convenient joining mechanism to form the service platform of the National Library Alliance.

The construction of the National Library Alliance service platform should organically combine the five elements namely, concept, resources, technology, readers, and mechanism to achieve "innovation from the inside out" [9], so that the platform not only has massive data, but also a management system with multiple advantages such as strong resource integration, new knowledge services, wide coverage, convenient operation, and more user-friendly. The platform should at least include the portal service sub-platform, the shared bibliography retrieval sub-platform, the user monitoring and analysis sub-platform, the information service sub-platform, etc., and each sub-platform has to be connected in series to form a network to provide "one-stop" and "nanny" services (Figure 1).

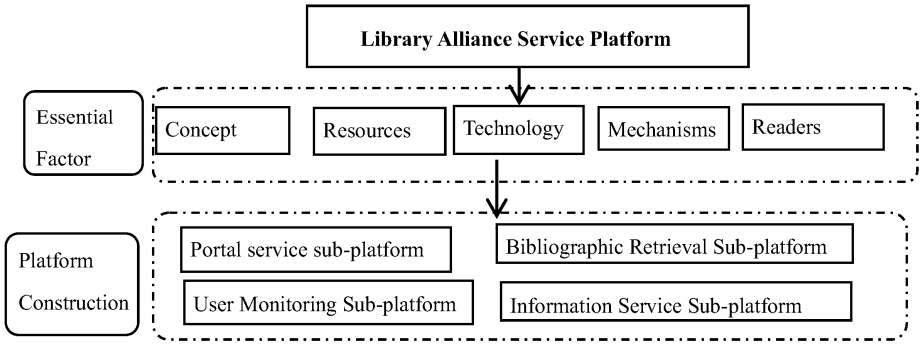


**Figure 1.** Framework of Library Alliance Service Platform

Although the national shared service platform, which is mandatory for all the libraries, will be created to solve the latest and cutting-edge problems, of which the routine business processing of libraries key module is the early stage development. In fact, a shared bibliographic retrieval platform should first be built based on the data of several major libraries such as the National Library of China, the China Version Library, and the Peking University Library. Each book has only one bibliographic data. Each member library that owns books can add collection information under this bibliography. The collection information can be a private or shared which ensures that the new member libraries can carry out routine business as long as they import their own bibliographic data. After purchasing new books, member libraries can directly store them without cataloging as long as they check duplicates in the general bibliography. This can save a lot of data storage space, cataloging costs and facilitate the centralized data management.

In addition to bibliographic data, the reader data is also the basis for regular library business, and the construction of a nationwide unified user monitoring and analysis platform is also one of the basic works of the National Alliance service platform. As such, it is not difficult to build the reader database. The success of MARC data lies on its specified unified format and allotment of national unified number to each reader. Some information is used as public data whereas, the rest is used as private data with different permissions to different reader data. Different libraries open variety of resources to readers according to their own terms and conditions. Whereas, when one platform is used for circulation of data such as borrowing, repayment, renewal, expiration, and fines, the data is analyzed and managed uniformly, the user tracking activity and interaction data of each library can be synchronized. The artificial intelligence can easily handle enormous volume and complexity of the document information resources especially, for the National Library Alliance service platform. The only solution is to carry out online original text delivery, interlibrary consultation and other services, and build a collaborative service platform for exchange of document information resources. Various strategies like introduction of professional consulting institutions, the establishment of a reference consulting team based on scientific research, university subject librarians and reference consultants of the member libraries of the community, the provision of professional and real-time consulting services for users, and strengthening and expansion of the construction of the collaborative service platform for literature and information resources are in vogue [10].

The construction of the national shared service platform needs to pay attention to the following issues: First, the platform construction is undertaken by the state and is free for all small or large libraries in the country. Second, the platform and data are put into the cloud, which is conducive to the big data processing. Third, attention needs to be provided to data security, storage and backup with different permissions for different member libraries, and protect the data privacy of each library; last but not the least, the platform needs modular development so that different member libraries can choose their own modules according to their specific needs.

The construction of the service platform of the National Library Alliance can save the cost of purchasing, maintenance and upgradation as well as the cost of purchasing the server and storage equipment of each member library. The big data analysis and statistics module can be used to query the borrowing and circulation data, resource guarantee rate and utilization rate of each member library in real time, and even analyze the resource guarantee rate of the member library in the same city, guide the member libraries to coordinate procurement, and improve the efficiency of fund utilization. It can also meet the diversity and personalized needs of the users, ensure social information fairness and bridge the digital divide. Furthermore, new functional modules, such as the module to guide the reading promotion of each library can be developed so that each library can get suitable, scientific and reasonable reading promotion program and develop a module to accurately push the books by finding readers for books and vice versa.

## 4. Library alliance service platform sharing in the context of blockchain

If free sharing service platform is the reason to attract all the libraries to join the National Library Alliance, then borrowing books from any library in the country is the greatest temptation to attract the readers. The emergence of blockchain technology provides a new imagination space for the library alliance to realize electronic document sharing under the premise of protecting the intellectual property rights.

### *4.1 Protection of electronic documents in the existing copyright law*

With the popularization of smart phones, although paid reading has gradually been accepted by some people, libraries are still the intermediate platform to ensure people's reading and eliminate the data gap. There are many advantages in the dissemination of electronic documents. The number of electronic documents purchased by each library is increasing however, the public service of the library and the copyright protection of electronic documents are the preconditions. The openness of the network makes the electronic documents extremely easy to be copied indefinitely however, the copyright protection is a major obstacle restricting the library's electronic document borrowing service. But, China's Copyright Law and the Regulations on the Protection of the Right of Information Network Communication has exempted the libraries to provide free digital works to the public in their own premises [11]. The copyright law has to be adjusted with time, to balance the intellectual property protection, convenient dissemination of knowledge, expand the scope of use of the library's copyright exception system under the digital reading environment and encourage interlibrary borrowing and document transmission [12].

### *4.2 New opportunities provided by blockchain technology for electronic document sharing*

Blockchain originated from Bitcoin and can be easily applied to library copyright protection. With the gradual expansion of blockchain technology from digital currency to other areas of society, the library community has also carried out in-depth research on the application of blockchain technology and divided into public chain, alliance chain and private chain according to the sharing scope and purpose. The most suitable one for the library alliance is the alliance chain [13]. Compared with the traditional means of copyright and copyright protection, the alliance chain not only has the characteristics of decentralization of the public chain to ensure that data cannot be illegally modified by the organization, but also retains the privacy of the private chain, so that the data storage efficiency is significantly improved. These characteristics provide feasibility in dealing the copyright protection of electronic documents in digital libraries. While publishing electronic documents, publishers generate unique alliance chain for each electronic document after encryption, and then generate a corresponding number of sub chains according to the number of electronic documents issued. It is safe and reliable to manage copyright through alliance chain, since it is difficult to tamper. Publishers can sell the sub chain of the alliance chain to the library distributor or directly to the library. Purchasing a sub chain is equivalent to purchasing an electronic document. The data on the sub chain can be set to the reader online reading mode or download reading mode according to the management needs, and the reader's query however, the downloads and other operations will leave traces on the chain [14]. The sub chain is equivalent to a powerful book borrowing card, which can objectively and truly record the borrowing amount, download amount, appointment information, etc. of each electronic document.

### *4.3 Construction of reading sharing module of the National Library Alliance service platform*

The biggest advantage of the application of the alliance chain technology to the library alliance is that it can limit the random copying of electronic documents and managed completely as paper documents. When electronic documents have the non-random duplication of paper-based documents, they should have the same circulation authority as paper-based documents from a legal perspective. As library books are borrowed for home reading, the library alliances can lend and return paper-based documents similarly, electronic documents can also be issued to the readers and returned.

The National Alliance Service Platform needs to develop a national shared e-book reading module (hereinafter referred to as the "reading module"). Readers who borrow a sub chain from the library have the right to read the book. They can only read the book directly on the reading module, but cannot download or copy it to protect intellectual property rights. For books within the copyright protection period, the reading module can give each library a corresponding number of sub chains based on the number of paper books owned by each library through the alliance chain technology. The current law in China does not specify how many electronic versions can be owned by a library for the digital collection of paper books, but at least one should be owned. The sub chains owned by each library are one-to-one corresponding to the paper books. The books can even be borrowed in the library premises of the entire library consortium (the agreement of joining the consortium can stipulate the

interlibrary borrowing terms of electronic books). The copyright law neither explicitly supports interlibrary borrowing nor prohibits it. In reality, the interlibrary document transmission is quite common. The construction of reading modules is highly shared and avoid repeated construction of each library. The big data generated in the borrowing process is stored in the alliance chains and sub chains, which is also convenient for future analysis and processing.

How to ensure that the number of sub chains of each alliance chain on the reading module is enough for the readers to read? First, the system is set to allow readers to borrow when they open the documents, and return when they close the documents. The maximum borrowing period is not more than 24 hours, so that the book borrowing efficiency is maximized. When the borrowing period of each library is 30 days the book borrowing efficiency increases by 30 times so, the individual library savings are obvious. Second, the documents are timely returned and the borrowing volume generally decreases with the passage of time. Therefore, depending on the number of sub chains converted from the paper books owned by each library, most of the national reading needs get fulfilled. Especially, for new bestseller books, the number of sub chains need to be increased. For e-books on the reading module, the system can calculate the recommended purchase index of books according to the readers demand and the scores of the readers. Each member library will purchase books according to its own purchase budget and combine with the recommended purchase index to supplement the number of sub chains of the platform. Third, libraries with large borrowing volume and insufficient existing sub-chains can appropriately increase the purchase quantity or mobilize social forces to donate.

## 5. Conclusion

Big data has provided new impetus in the construction of the National Library Alliance service platform and ensured close cooperation in library alliance and high sharing of resources and data. The more data the platform has, the better the advantages of the algorithm can be brought into full play. Relying on the support of the National Library Alliance service platform, better library services can be offered not only within the country but even at the global level. Big data and blockchain technology drive library changes and in turn promote technological progress. Through this series of virtuous cycles, we can create a win-win situation of technology, library reform and transformation.

## References

[1] Zhao Naixuan, Jin Jieqin, Feng Qin. Empirical Study on the Construction and Development of China's Cross system Regional Library Alliance [M]. Nanjing: Nanjing University Press, 2018.
[2] Liu Kuibo. Research on Co construction and Sharing of Characteristic Databases of Regional University Library Alliances [J]. Information Exploration, 2018 (11): 112-116.
[3] Wang Yi, Shao Bo. Development Status of Domestic University Digital Library Alliance: Lack of Connotation and Restructuring [J]. Library Science Research, 2020 (4): 87-93.
[4] Teng Xue, Deng Min, Yan Ping. Research on Library Collaboration Alliance Mechanism in the Context of Guangdong Hong Kong Macao Greater Bay Area [J]. Library Research and Work, 2020 (9): 39-42.
[5] Hunan Hubei Jiangxi Anhui Public Library Alliance. Introduction to the Public Library Alliance of the Six Central Provinces (Hunan Hubei Jiangxi Anhui Shanxi Henan) [EB/OL]. (2020-9-27) [2022-11-18] http://www1.library.hb.cn/gaikuang.html.

[6] Xie Chaohui. Analysis on User Demand Characteristics and Service Status of National Library Reference Consulting Alliance [J]. Library Forum, 2015 (2): 48-54.
[7] Guo Xiao. The Operating Characteristics and Enlightenment of Foreign Library Emergency Management Strategic Alliance -- Also on the Construction of China's Library Emergency Management Alliance [J]. Library Work and Research, 2020 (7): 58-63.
[8] Website of the Ministry of Culture and Tourism. Statistical Bulletin of the Ministry of Culture and Tourism of the People's Republic of China on Culture and Tourism Development in 2019 [EB/OL]. (2020-06-22) [2022-11-18] http://www.gov.cn/xinwen/2020-06/22/content_5520984.htm.
[9] Gan Lu. On Library Immunity [J]. Journal of University Library, 2016 (6): 100-104
[10] Li Qiurong. Challenge and Reconstruction of Library Copyright Exception System in the Age of Big Data [J]. Library Work and Research, 2019 (7): 10-14, 49.
[11] Xu Lihua, Nie Feixia. Construction of information resource security sharing model based on digital library alliance chain [J]. Library and Information Work, 2020 (3): 53-58.
[12] Li Jinyang. The Combination of Library and Alliance Chain: Concept, Demand and Prospect [J]. New Century Library, 2020 (8): 5-10.
[13] Xu Lihua, Nie Feixia. Construction of information resource security sharing model based on digital library alliance chain [J]. Library and Information Work, 2020 (3): 53-58.
[14] Li Jinyang. Combination of library and alliance chain: concept, demand and prospect [J]. New Century Library, 2020 (8): 5-10.