Research on the Digital Construction and Management of Library Document Resources

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Abstract: The transformation of the information environment in the digital age poses new challenges to the construction of library literature resources. The digitization of literature resources has become a core strategic choice for libraries to achieve transformation and development and fulfill their mission of cultural inheritance. In recent years, the National Library of China has been promoting the construction of a long-term preservation standard system for digital resources, and many university libraries have carried out numerous beneficial practices in the digitization of ancient books and special literature. However, problems such as non-uniform standards, long-term preservation risks, weak copyright management, and a lack of compound talents remain prominent. This study explains the concept and strategic value of literature resource digitization from the perspective of information resource management, reveals the intrinsic logical connection between digital construction and resource management, systematically reviews typical domestic and international practice models, deconstructs the core links and key technologies of resource management, and designs optimization strategies from four dimensions: standardization leadership, characteristic development, full-cycle management, and sharing promotion. The aim is to provide theoretical basis and practical guidance for the digitization construction and management of library literature resources.

Keywords: Digitalization of literature resources; Management of digital resources; Long-term preservation Standards and norms

1. Introduction

The digitalization of library resources is a core strategic choice for libraries to respond to the challenges of the digital age and achieve transformational development. From the perspective of theoretical evolution, the digitalization of library resources has undergone a value leap from "carrier preservation" to "knowledge discovery" [1,2]. Currently, the academic community has conducted multi-dimensional research on the digitalization of library resources. The bibliometric analysis based on CiteSpace shows that the integration of digital resources, the application of big data, and the management of smart libraries constitute the current hot research areas; issues such as copyright risk management for the sharing of library information resources in the digital environment and the standard construction for the long-term preservation of digital resources have attracted widespread attention. However, existing research mostly focuses on the application of single-dimensional technologies or problem descriptions, and there is still a lack of systematic integration of research on standardization leadership, characteristic development, full-cycle management, and shared

promotion, which is difficult to meet the overall needs of the coordinated development of digital construction and resource management [3].

Based on this, this study, titled "Research on the Digital Construction and Management of Library Resources", follows the logical sequence of "theoretical basis - practical review - optimization strategies" to conduct a systematic study. Starting from the definition of concepts, this paper explains the strategic value of digital construction, reveals the logical connection between digital construction and resource management, and further systematically reviews typical domestic and international practice models, deconstructs the core links and key technologies of resource management, and diagnoses the main existing problems; then, it systematically designs optimization strategies from four dimensions: standardization leadership, characteristic development, full-cycle management, and shared promotion, aiming to provide theoretical basis and practical guidance for the digital construction and management of library resources.

2. Theoretical Foundation and Strategic Value of Digitalization of Library Document Resources

2.1 Definition and Theoretical Connotation of Digitalization of Document Resources

From the perspective of information resource management, the digitalization of document resources refers to the process of converting traditional carrier-form document resources into digital formats recognizable and processable by computers through technical means such as scanning, shooting, and inputting, and organizing, indexing, and storing them. This concept encompasses three levels: the resource transformation level focuses on the digital conversion of carrier forms, addressing the technical issue of "paper to digital"; the knowledge organization level focuses on metadata indexing and semantic revelation, addressing the issue of "digital discoverability"; the service application level focuses on the retrieval and utilization of digital resources, addressing the issue of "good service" [4]. From the perspective of theoretical evolution, the digitalization of document resources has undergone a value leap from "carrier preservation" to "knowledge discovery" - in the early stage, digitalization focused on the protection and alternative utilization of physical entities, reducing the wear and tear of precious original documents through digital copies. This chapter further distinguishes the three progressive concepts of digitalization, dataization, and wisdomization - digitalization solves the problem of "existence", being the basic prerequisite for resource availability; dataization solves the problem of "computability", being the technical key to knowledge discovery; wisdomization solves the problem of "serviceability", being the ultimate goal of value realization. The three concepts progress step by step, jointly constituting the complete chain of the digital transformation of document resources.

2.2 Strategic Value of Digitalization Construction of Library Document Resources

Systematically expounded from the dimensions of cultural inheritance, knowledge service, and competitiveness enhancement, the digitalization construction of library document resources has irreplaceable strategic value. In the dimension of cultural inheritance, digitalization is the fundamental guarantee for the "sustainable inheritance" of precious resources such as ancient books, manuscripts, and local documents. The "Ancient Books Sorting and Digitalization" project initiated by the library of China Agricultural University has completed high-precision scanning and metadata indexing of 252 types and 1,023 volumes of agricultural ancient books, and built an agricultural ancient books database integrating "one-box search", "simulation reading", and "associated recommendation", effectively reducing the wear and tear of original documents and rejuvenating the

ancient agricultural books that have endured the vicissitudes of time. Digitalization enables cultural genes to be permanently preserved without the vulnerability of the carrier, achieving the unity of "preservation" and "protection". In the dimension of knowledge service, digitalization transforms document resources from "storage" to "utilization", breaking through time and space limitations to achieve 7*24-hour convenient access. Digitalization converges scattered resources into a systematic knowledge system, allowing "hidden" characteristic documents to reach a broader user group. In the dimension of competitiveness enhancement, digital transformation is a strategic choice for libraries to respond to the changes in the information environment and maintain their core competitiveness. Against the backdrop of the massive growth of Internet information and the diversification of user needs, libraries can only establish an irreplaceable value position in the ubiquitous information environment by converting their collection resources into computable and analyzable knowledge assets through digitalization. Digitalization construction enables libraries to transform from traditional document collection institutions into knowledge service centers, playing a more important supporting role in higher education, scientific research, and cultural inheritance [5].

2.3 Logical Relationship between Digitalization Construction and Resource Management

From the perspective of the life cycle, there is a profound intrinsic logical relationship between the digitalization construction of document resources and subsequent resource management. Digitalization construction is not the end but the starting point of resource management. From the perspective of the life cycle, digitalization construction covers three front-end links: resource selection, digital processing, and metadata creation; resource management involves four mid-end links: long-term preservation, access control, knowledge organization, and update maintenance; ultimately pointing to three back-end links: knowledge retrieval, intelligent service, and user utilization. The quality of front-end construction directly determines the effectiveness of back-end management. The format selection at the front end affects the preservability at the back end, the quality of metadata at the front end restricts the discoverability at the back end, and the collection norms at the front end decide the usability at the back end. The standard construction carried out by the National Version Library of China around the long-term preservation of digital resources is of exemplary significance [6]. Its eight standard norms cover the entire process requirements including data format, data packaging, data dictionary, collection and update, access control, secure transmission, software environment, and hardware environment, ensuring the authenticity, integrity, and usability of digital resources during the long-term preservation process. This standard system profoundly reveals the coupling relationship between digital construction and resource management: the data format requirements stipulate the archiving interface and format standards, laying the foundation for long-term preservation; the data packaging requirements clarify the metadata representation methods and packaging formats, providing guarantees for resource exchange; the collection and update requirements stipulate the data preparation, quality control, and update frequency, establishing norms for the dynamic maintenance of resources. Constructing an integrated theoretical framework of "construction - management - service" helps break the practical predicament of the separation between front-end construction and back-end management, ensuring that digital work always aims at long-term preservation and effective utilization.

3. Practical Review of the Digitalization and Management of Library Document Resources

3.1 Investigation of Typical Models of Digitalization of Document Resources at Home and Abroad

A systematic investigation of the typical practice models of digitalization of document resources in libraries at home and abroad reveals that each institution has formed its own development path based on its own positioning. As a national-level institution for the preservation of version resources, the National Library of China is promoting the construction of a long-term preservation standard system for digital resources, systematically formulating eight standards and norms including data format, data packaging, data dictionary, collection and update, access control, secure transmission, software environment, and hardware environment, around five types of digital resources: text, image, audio, video, and program data. This lays the institutional foundation for the construction of the National Version Data Center. The advancement of this national-level project marks the transition of China's digitalization of document resources from fragmented exploration to a standardized and systematic stage, providing an important institutional reference for libraries at all levels and of all types [7].

At the international level, the group standard T/CCUA 040—2024 "Core Metadata for Long-Term Preservation of Version Archiving Website Resources" has established a metadata model architecture and entity relationship for the long-term preservation of website resources, applicable to the construction and maintenance of metadata for long-term preservation of website resources by various libraries and related institutions [8]. The formulation of this standard reflects the common pursuit of the international community for the standardization and normalization of long-term preservation of digital resources and also provides a technical basis for Chinese libraries to participate in international exchanges and cooperation.

3.2 Core Links and Key Technologies in Digital Resource Management

From the perspective of management processes, digital resource management can be divided into five core links: resource storage, metadata management, long-term preservation, access control, and update and maintenance. These links are interlinked and together form a complete management chain. In the resource storage link, it is necessary to select appropriate digital formats and storage media to ensure the long-term readability of resources. Text resources should adopt long-term preservation formats such as PDF/A, image resources need to choose lossless compression formats, and audio and video resources should follow industry standard format specifications. In the metadata management link, a standardized metadata system should be established to support resource discovery and knowledge organization. The data dictionary standard formulated by the National Library of China stipulates the metadata norms, description rules, data types, and constraint conditions of digital resources, providing a guarantee for the unified description and interoperability of resources.

In the long-term preservation link, strategies such as data packaging, format migration, and regular detection should be adopted to address the risk of technological obsolescence. Data packaging requires the specification of principles for data packaging of digital resources, methods for representing metadata, packaging formats, naming rules, and verification mechanisms to ensure the integrity and exchangeability of resource packages. At the hardware level, the life cycle management of storage hardware should be stipulated, including media detection, equipment retirement processes, and environmental control requirements; at the software level, it is necessary to ensure that digital resource files are fully manageable and traceable from formation to archiving. In the access control link, the relationship between resource openness and copyright protection should be balanced, and requirements for access control strategies, user identity authentication, emergency response

procedures for anomalies, and retention of access logs should be clearly defined. In the update and maintenance link, a dynamic collection and update mechanism should be established, stipulating requirements for data collection preparation, collection plans, mapping plans, quality control, update frequency, content review, and backup, to ensure the continuous update and dynamic maintenance of resources.

From the perspective of technical support, the current technical architecture of digital resource management presents three major characteristics: first, standardization-driven, the eight standards and norms formulated by the National Library of China stipulate the archiving interfaces and format requirements for different types of resources, providing technical norms for the long-term preservation of resources; second, intelligent empowerment, the library of Hubei Minzu University has introduced AI smart librarians to simulate the dynamic demonstrations of inheritors, promoting the dynamic dissemination and immersive experience of culture; Third, platform integration. The library of China Agricultural University has built an agricultural ancient books database integrating multiple functions, achieving the platform-based integration of search, reading, and recommendation functions.

3.3 Diagnosis of the Main Problems in Current Digitalization Construction and Management

Systematically diagnosing the prominent problems existing in the digitalization construction and management of library literature resources reveals a complex picture of multiple challenges intertwined. From the perspective of resource construction, the digital transformation faces practical difficulties such as rapid technological updates, large capital investment, and inconsistent standards. Some libraries lack systematic planning for digitalization, with fragmented selection of resource types and inconsistent metadata standards, which poses hidden dangers for subsequent resource sharing and long-term preservation. Literature metric research based on CiteSpace shows that current research hotspots focus on digital resource integration, big data application, and smart library management, but there is still a gap between theoretical research and practical application.

From the perspective of long-term preservation, ensuring the authenticity, integrity, and usability of digital resources remains a challenge. The risk of data becoming unreadable due to outdated formats, aging carriers, and technological iterations always exists, especially for resources digitized in the early stages, which face severe challenges in long-term accessibility. From the perspective of copyright management, the risk of infringement in the sharing of library information resources in the digital environment has significantly increased. Research shows that the copyright protection mechanism in the co-construction and sharing of digital resources needs to be improved. Libraries face infringement risks in all aspects of digital resource construction and services, and the copyright management of interlibrary loan systems has become a prominent issue. It is necessary to strengthen risk prevention and control from the aspects of systems, technology, and copyright awareness.

From the perspective of resource utilization, the phenomenon of "emphasizing construction over service" and "emphasizing quantity over quality" still exists. Some libraries equate digitalization with "scanning and archiving", with insufficient investment in subsequent knowledge organization and user services, resulting in low utilization of digital resources and failing to truly achieve the construction goal of "bringing literature to life". From the perspective of talent teams, there is a relative shortage of compound talents with both library science professional qualities and digital technology application capabilities, which restricts the sustainable development of digitalization

construction and management. These problems are interwoven and mutually causal, constituting deep-seated obstacles to the high-quality development of library literature resource digitalization construction and management.

4. Optimization Strategies for the Digitalization Construction and Management of Library Literature Resources

4.1 Establish a Standardized System for Digital Resources

Led by standardization construction, establishing a standardized system covering the entire digitalization process is a fundamental project to ensure the long-term usability and wide sharing of digital resources. At the data format level, for the five types of resources including text, images, audio, video, and program data, requirements for file and metadata archiving interfaces, archiving formats, etc., should be stipulated to ensure the long-term readability of digital resources. Text resources should adopt long-term preservation formats such as PDF/A, image resources should choose lossless compression formats like TIFF, and audio and video resources should follow industry standard format norms to avoid the risk of format obsolescence from the source. At the data packaging level, principles for data packaging, methods for metadata representation, packaging formats, naming rules, and verification mechanisms should be stipulated to ensure the integrity and interchangeability of resource packages. At the metadata standard level, referring to the standard framework of T/CCUA 040—2024 "Core Metadata for Long-Term Preservation of Versioned Archival Websites", the core metadata model architecture and entity relationships should be established, and elements such as semantic unit attributes, object entity semantic units, and event entity semantic units should be stipulated to provide a technical foundation for the unified description and interoperability of resources. At the data collection and update level, requirements for data collection preparation, collection plans, mapping plans, collection methods, quality control, update frequency, content review, and backup are stipulated to ensure the continuous update and dynamic maintenance of resources. The requirements proposed by the National Library of China for data collection preparation, data mapping plans, and data quality control provide normative guidance for the collection process. At the access control level, requirements for access control policies, user identity authentication, emergency response procedures for anomalies, and retention of access logs are clearly defined to balance open utilization and security. At the software and hardware environment level, requirements for the lifecycle management of storage hardware, including media detection, equipment retirement processes, and environmental control requirements, are specified; the software level must ensure that digital resource files are fully manageable and traceable from creation to archiving. Through the construction of a full-process standard and normative system, the digital construction and management of libraries have clear guidelines and a solid institutional foundation for the long-term preservation and shared utilization of resources.

4.2 Establish a "Resource-Oriented, Feature-Prioritized" Construction Position

Promoting the transformation of library literature resource digitization from "universal construction" to "feature-oriented development" and establishing a "resource-oriented, feature-prioritized" construction position is the core strategy to enhance the irreplaceability of digital resources. The practice of the "Tujia Medicine" feature database of Hubei Minzu University Library and the agricultural ancient books database of China Agricultural University Library has proven that a feature-oriented path based on the library's collection characteristics, serving the university's

disciplines, and highlighting regional culture can enable digital resources to form a competitive advantage in a ubiquitous information environment. At the resource selection level, a systematic feature resource assessment mechanism should be established, comprehensively evaluating from dimensions such as historical value, academic value, uniqueness, and demand, and prioritizing the selection of the most representative feature resources for digitization to avoid a "scattergun" approach.

At the resource integration level, the practice of China Agricultural University Library is worth learning from - not only completing the digitization scanning of ancient books but also building an agricultural ancient books database integrating multiple functions such as "one-box search", "simulated reading", and "associated recommendation", turning scattered resources into a systematic knowledge system. At the technology application level, the approach of the "Tujia Medicine" database in introducing AI smart librarians to simulate the dynamic demonstration of inheritors can be borrowed, using 3D modeling, VR/AR technology to create digital humanities virtual exhibition halls, promoting the dynamic dissemination and immersive experience of feature culture. China Agricultural University Library has used 3D modeling and VR/AR technology to create the "Agriculture as the Foundation of the World, the People's Livelihood" digital humanities virtual exhibition hall, selecting 40 representative ancient books for immersive display, allowing readers to experience the charm of ancient books as if they were there. Through feature-oriented development, library digital resources can form a competitive advantage of "what others don't have, we do; what others have, we do better", establishing an irreplaceable value perception in the minds of users.

4.3 Establish a "Collection - Preservation - Service" Closed-loop Operation Mechanism

Guided by the concept of full lifecycle management, establishing a "collection - preservation - service" three-in-one closed-loop operation mechanism is the institutional guarantee to ensure that digital resources are "collected, stored, found, and used well". At the collection stage, a standardized digital resource collection process should be established, clearly defining resource selection criteria, collection technical standards, and metadata creation requirements to ensure the quality at the source. Resource selection should comprehensively evaluate historical value, academic value, and user demand, avoiding blind following; collection technology should comply with format standards to ensure the quality of digital copies; metadata creation should follow unified standards to lay the foundation for subsequent discovery and utilization.

At the preservation stage, a multi-level long-term preservation system should be constructed, comprehensively applying technical strategies such as format migration, simulation, encapsulation, and regular detection to address the risk of technological obsolescence. In line with the standard requirements of the National Version Library of China, at the hardware level, it is necessary to stipulate the life cycle management of storage hardware, including medium detection, equipment retirement procedures, and environmental control requirements. At the software level, it is essential to ensure that digital resource files are fully manageable and traceable from their formation to archiving. Regular data integrity checks and readability tests should be conducted to promptly identify and rectify data issues. In the service aspect, a convenient and efficient resource discovery and acquisition mechanism should be established.

At the closed-loop feedback level, a dynamic adjustment mechanism of "service - evaluation - optimization" should be established. Through the analysis of user behavior data and the assessment

of usage effects, the resource collection strategy and service quality should be continuously optimized. Research shows that the risk of copyright infringement in the digital environment for library information resource sharing has significantly increased. It is necessary to incorporate copyright management throughout the entire cycle and strengthen risk prevention and control from the aspects of systems, systems, and copyright literacy. Through the closed-loop operation of full-cycle management, it is ensured that each link from the collection to the preservation and from the preservation to the service of digital resources has norms to follow, standards to rely on, and feedback to adjust, forming a virtuous cycle of continuous optimization.

4.4 Promotion of Sharing: Building a Multi-party Collaborative Resource Co-construction and Sharing Ecosystem

Breaking through the resource limitations of a single institution and building a multi-party collaborative and win-win digital resource co-construction and sharing ecosystem is a strategic choice to maximize the value of resources. From the institutional level, it is necessary to improve the copyright risk management mechanism for digital resource sharing. Research shows that the risk of copyright infringement in the digital environment for library information resource sharing has significantly increased. It is necessary to strengthen risk prevention and control from the aspects of systems, systems, and copyright literacy. Libraries should formulate clear digital resource sharing agreements, standardize the rights and responsibilities of all parties, and establish a mechanism for pre-emptive prevention, in-process control, and post-event resolution of copyright infringement risks. In the construction of inter-library loan systems, special attention should be paid to the design of copyright management plans to ensure that resource sharing operates within a legal and compliant framework. From the technical level, efforts should be made to promote the construction of cross-institutional resource sharing platforms, achieving functions such as metadata interoperability, unified resource search, and single sign-on for users. Referring to the standard construction experience of the National Version Library of China, a unified metadata standard is the technical foundation for resource sharing, and the formulation of standards such as T/CCUA 040—2024 provides a technical prerequisite for resource sharing. From the cooperation model level, multiple paths such as inter-library cooperation, library-enterprise cooperation, and library-school cooperation should be explored. From the talent support level, the copyright literacy of librarians should be strengthened to enable them to identify infringement risks and use resources in a standardized manner. At the same time, a regular cooperation mechanism should be established between libraries and information technology departments, as well as teaching and research departments, to form cross-disciplinary innovation teams.

5. Conclusion

This study systematically constructs a strategic framework for the digitalization and management of library literature resources. The research reveals that digitalization construction and resource management form an organic whole, and the concept of the entire life cycle should be consistently applied throughout. The core of the optimization strategy lies in achieving "four transformations": from decentralized construction to standardization leadership, drawing on the standard construction experience of the National Library of China to establish a full-process normative system; from universal construction to characteristic development, establishing a construction orientation of "resource-oriented and characteristic priority"; from fragmented links to

full-cycle management, establishing a closed-loop operation mechanism of "collection - preservation - service"; from independent efforts to shared advancement, building a multi-party collaborative resource co-construction and sharing ecosystem. Future research can further explore the application potential of artificial intelligence technology in the in-depth mining of literature, as well as the technical iteration and format migration strategies for the long-term preservation of digital resources, contributing continuously deepened theoretical wisdom to the digital transformation of libraries.

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