

Postprint: Research on the Current Status and Practice of Library Multimedia Resource Management System (MRMS)

Authors: Yang Xinya, Liu Shangwu, Luo Li, Wei Qunyi, Wang Xianghui, Fu Ran, XU Tiancai, Shen Min, Wang Yanli

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Abstract

[Purpose/Significance] Multimedia resources constitute an important component of library collection development, yet they have long lacked effective management methods. To address current challenges in the collection, organization, and service of multimedia resources, and to further tap into their potential value, it is imperative to enhance libraries' information management capabilities for multimedia resources and construct a multimedia service platform that meets user needs and encourages user participation.

[Method/Process] Employing literature research and empirical study methods, this paper analyzes deficiencies in current multimedia resource development in libraries both domestically and internationally. Based on the needs of libraries and users, it proposes that libraries must construct a Multimedia Resource Management System (MRMS). Through practical implementation, the system architecture and functions of MRMS are presented.

[Results/Conclusion] Using the "+Collection" system of Chongqing University Library as an experimental platform, this study verifies that MRMS not only supports libraries in integrating their self-owned multimedia resources and digital special collection resources, achieving comprehensive digital management and utilization of multimedia resources, but also provides users with multiple access methods through online PC terminals, APPs, and mini-programs. The system advocates for users to upload multimedia resources themselves, while combining the online service platform with an offline audio library. Through diversified service channels and innovative service methods, it enhances the utilization rate of multimedia resources.

Full Text

Research on the Status and Practice of Library Multimedia Resource Management System MRMS

Yang Xinya^{1,2}, Liu Shangwu³, Luo Li⁴, Wei Qunyi², Wang Xianghui³, Fu Ran³, Xu Tiancai^{1,2}, Shen Min¹, Wang Yanli¹

¹Chongqing University Library, Chongqing 400044

²Institute for Advanced Studies in Humanities and Social Sciences, Chongqing University, Chongqing 400044

³Beijing EDU & SUN Education Technology Co., Ltd., Beijing 100085

⁴Chongqing Medical University Library, Chongqing 400033

Abstract:

[Purpose/Significance] Multimedia resources constitute an important component of library collection development, yet they have long lacked effective management approaches. To address current challenges in collecting, organizing, and serving multimedia resources, and to further unlock their potential value, libraries urgently need to enhance their information management capabilities for multimedia resources and build a reader-participatory multimedia service platform that meets user demands. **[Method/Process]** Through literature review and empirical research, this paper analyzes existing deficiencies in multimedia resource development in libraries both domestically and internationally. Starting from the needs of libraries and readers, it proposes that libraries must construct a Multimedia Resource Management System (MRMS) and presents the system architecture and functionalities through practical implementation. **[Result/Conclusion]** Using the “+Collection” system of Chongqing University Library as an experimental platform, this study verifies that MRMS not only supports libraries in integrating their own multimedia resources and digital special collections, achieving comprehensive digital management and utilization of multimedia resources, but also provides readers with multiple access methods through online PC terminals, mobile apps, and mini-programs. The system advocates for readers to upload their own multimedia resources while combining online services with offline sound libraries, thereby improving multimedia resource utilization through diversified service channels and innovative approaches.

Keywords: multimedia resources; MRMS; smart library; digital special collection; knowledge management

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With the changing information environment in libraries during the new era, various networked services, novel information discovery tools, information organization methods, and diverse communication tools have gradually transformed user behavior, exerting a subtle influence on library management and service en-

vironments. As vital information and intelligence centers, libraries' traditional roles in information collection, organization, dissemination, and preservation can no longer fully adapt to the current information collection environment, nor can they satisfy readers' diverse and complex needs. Multimedia resources—including video, audio, and image materials—represent a crucial component of library collection development. Particularly unique multimedia resources that reflect local or institutional history and culture are invaluable assets that libraries should prioritize collecting. These multimedia special collections often embody profound cultural significance. Their collection, preservation, and utilization align perfectly with libraries' cultural functions, as they not only enhance cultural atmosphere and create distinctive, humanistic environments but also preserve the historical and cultural value inherent in these materials.

However, most libraries currently possess relatively weak capabilities in collecting, organizing, and serving multimedia resources, causing the value of these resources to be overlooked. This study proposes that libraries must build a Multimedia Resource Management System (MRMS) to establish a standardized, comprehensive, and easily maintainable multimedia management and service platform. On the basis of standardization and workflow processes, MRMS would integrate all multimedia resources within library collections, especially multimedia special collections. This study also innovatively recommends that libraries encourage readers to upload their own multimedia resources to enrich collections, thereby compensating for shortcomings in multimedia resource collection, management, and services.

2. Current Status of Multimedia Resource Management and Services in Libraries

2.1 International Library Practices in Multimedia Resource Management and Services

Research reveals that international scholarship on library multimedia resource development focuses primarily on system construction, platform development, resource identification, and retrieval utilization. For instance, G. Amato et al. proposed building a multimedia content management system called MILOS and developed the PhotoBook online album application system to support photo management, sharing, and search [?]. O. A. Hamid et al. researched a semantic-based automatic annotation system for multimedia data to ensure accurate description of stored and retrieved resources [?]. Other scholars have utilized web usage logs and limited keywords related to multimedia objects to solve automatic indexing problems [?]. J. Nandzik et al. studied systematic preservation, utilization, and management of multimedia resources while providing tools for resource digitization [?]. Some researchers have investigated content-based document image retrieval to improve efficiency and precision, particularly for self-built image collections [?].

In practical applications, some international libraries have developed self-built

multimedia resource service platforms. The University of Oxford's Digital Bodleian platform comprehensively collects digitized modern manuscripts, maps, music, Oxford University resources, prints, portraits, and western manuscripts, offering a one-stop search interface along with personalized services such as private notes, custom tags, public comments, collection addition, and sharing functions. The University of Cambridge's Cambridge Digital Library platform provides front-and-back image displays, 3D image presentations, and virtual exhibition halls with digital introductions of current exhibitions. The platform allows resource sharing links to social media platforms like WeChat, Twitter, and Facebook, and provides embed codes for personal webpages or blogs to meet multi-level user needs. Evidently, international libraries have rich theoretical research on multimedia resource development, and a few have the capacity to integrate diverse multimedia resources with comprehensive services. However, most libraries primarily provide single-type image resource services, and practical applications remain personalized custom developments lacking unified standards and normalized platforms capable of integrating different types of collection-based multimedia resources.

2.2 Domestic Libraries' General Neglect of Multimedia Resource Development and Services

With the widespread adoption of computers and improved network environments, vivid and intuitive multimedia resources have attracted increasing attention. Thanks to their massive information storage capacity, convenience, and superior audio-visual effects, multimedia resources have become important components of contemporary digital library collections, drawing attention from some scholars. Research has primarily concentrated on theoretical aspects such as multimedia resource information organization [?], metadata standards [?], resource types and digitization processing, platform characteristics, and personalized services [?], with limited and fragmented research outcomes. Some libraries have developed multimedia resource platforms through cooperation or self-building, but most feature single-functionality, insufficient service intensity, and non-distinctive resources that fail to attract users. Notable exceptions include Tsinghua University Library's multimedia resource management platform, which provides vocal music, film, tapes, training courseware, videos, and images categorized under themes such as audio literature, music appreciation, film appreciation, online courses, and librarian resources, offering diverse services including resource retrieval, browsing, overview, advanced search, resource descriptions, special recommendations, rankings, news announcements, and recent additions that are well-received by faculty and students. Shanghai Jiao Tong University Library's "Art Enters Campus" series combines scholar lectures and classic screenings, allowing readers to appreciate thematic multimedia collection resources with on-site interaction, while actively encouraging reader participation in multimedia resource creation, collection, screening, and classification [?].

Research shows that domestic theoretical and case studies on multimedia resource development have become outdated and cannot fully meet current library management needs. In recent years, as academically valuable multimedia resources have grown increasingly abundant, their impact and role in teaching and research have gradually expanded. Yet most libraries still generally neglect multimedia resource development and service issues, with diminishing voices in collection development processes despite the growing importance of multimedia resources. This indicates that most libraries have not yet recognized the significance of multimedia resources in collection development, research support, and cultural construction. Consequently, problems persist in domestic libraries' multimedia resource development, management, and services.

2.3 Existing Problems and Cause Analysis

2.3.1 Lack of Dedicated Multimedia Resource Management Systems in Libraries

Research on multimedia resource construction, management, and utilization concentrates heavily on theoretical aspects, showing a phenomenon of emphasizing theory over practice. While some university libraries have implemented multimedia management and services through self-built platforms, results are generally unsatisfactory. These self-built platforms are almost blank in terms of cross-institutional resource sharing and neglect users' subjective initiative in resource construction, essentially ignoring readers' needs to upload and share collection resources. These issues require building dedicated multimedia resource management systems for resolution, yet such effective systems are currently lacking.

2.3.2 Multimedia Resources Require Reconstructed Management and Service Standards and Processes

Current library management of paper books, journals, and electronic resources follows standardized processes of acquisition, classification, cataloging, inventory, and circulation, with standardized classification systems like the Chinese Library Classification or Dewey Decimal Classification. However, multimedia resources differ from traditional literature resources in their complexity and belong to the category of non-book materials, making processing difficult. The profession must reconstruct management and service standards and processes for multimedia resources to enable simple, standardized, and workflow-based handling of increasingly abundant resources.

2.3.3 Complexity of Multimedia Resources Creates Library Dependence on Database Vendors

First, multimedia resources comprise collections of text, images, audio, video, and other media materials for network-based retrieval and use, with carriers including floppy disks, CDs, hard drives, and network storage, requiring libraries to possess certain management capabilities for accurate and comprehensive collection and management. Second, network environment optimization and widespread availability of computers, tablets, and smartphones pro-

vide superior conditions for creating, disseminating, and utilizing multimedia resources in the self-media era, accelerating resource updates and dissemination while exponentially increasing volume. Third, multimedia resources stored and transmitted in various formats such as text, graphics, images, animation, and sound utilize multiple storage media—from legacy floppy disks, videotapes, and cassette tapes to CDs, DVDs, and current hard drives, flash memory, USB drives, and cloud storage—with file formats including dozens of types such as jpg, jpeg, png, mp4, mpeg, mov, wmv, avi, flv, wav, mp3, and wma, encompassing books, journals, music, films, and instructional videos. This complexity demands high-level information technology capabilities for digital preservation, management, and utilization. When converting resources for preservation, such as audio-visual materials, content from various carriers must be transformed into digital formats for better management and utilization.

2.3.4 Single-Function Existing Platforms and Simple Service Methods

Current multimedia resource management platforms both domestically and internationally generally suffer from single functionality, slow resource updates, and simple, traditional service methods. Some platforms fail to implement specialized retrieval functions for multimedia resources, primarily displaying images and videos as slideshows with insufficient user openness. Therefore, creating comprehensive, innovative library multimedia resource platforms is urgently needed.

3. Library MRMS System and Requirements Research

3.1 MRMS Overview

The Multimedia Resource Management System (MRMS) is a full-process information management system for library multimedia resource collection, management, online services, and long-term preservation, built on the concepts of co-creation, co-preservation, and sharing, and employing streaming media, artificial intelligence, and big data technologies. MRMS addresses the challenges of managing unique digital special collections and the urgent need to promote multimedia resource utilization. It supports libraries in integrating their own multimedia resources and commercial databases, maximizing digital management of multimedia collections while providing readers with multiple access methods through online PC terminals, apps, and mini-programs. The system advocates for reader-uploaded multimedia resources and combines online platforms with offline sound libraries to improve utilization through diversified service channels and novel approaches.

3.2 MRMS Construction Approaches and Methods

3.2.1 Integrating the Multimedia Resource Industry Chain

Current library multimedia resources fall into three main categories by source: (1) libraries' own digitized information resources such as electronic documents, local literature, historical images, and cultural activities; (2) commercially pur-

chased resources such as book-accompanying CDs, audio-visual materials, educational courses, and various databases; and (3) networked shared resources such as interlibrary loans, web searches, or linked open resources. Libraries must integrate these resources for unified management and utilization, considering the entire industry chain from a macro perspective. Key approaches include: (1) Starting from resource sources—the upstream publishers—to establish high-quality, comprehensive procurement networks with standardized purchasing platforms and behaviors, ensuring immediate access to first-hand legitimate multimedia resources. (2) Considering priority dissemination pathways: with terminal users as readers and libraries as the connecting link, building multi-terminal management and service platforms for widespread information dissemination and utilization, especially important in the 5G era of immersive live-streaming and short-video cultures. (3) Implementing effective user engagement: users/readers are key to forming a virtuous cycle, requiring big data technologies to actively understand reader needs, establish demand models, and feedback into resource procurement to create a sustainable multimedia resource management and service ecosystem.

3.2.2 Establishing Collection, Organization, and Service Processes

As the core system for orderly resource management and service provision, MRMS requires a comprehensive workflow system. First, libraries must define multimedia resource collection scopes, gathering resources by role, permission, and category, including: (1) images focusing on regional or institutional development, teaching and research, and cultural life; (2) videos including documentaries, academic lectures, historical materials, promotional videos, cultural activities, original micro-films, and stage plays; and (3) audio content including lecture recordings, audiobooks, and original music. Second, resources should be organized and preserved by thematic levels, using primary categories such as infrastructure, party and government development, teaching and research, cultural life, and social activities, with secondary categories as needed to ensure comprehensive coverage while following unified multi-level review mechanisms, cataloging standards, resource indexing, and storage management processes. Third, multimedia resource services should provide both standard collection display and conventional retrieval systems, and diversified spaces combining online thematic exhibitions and cultural programs with offline spatial reconstructions to enhance resource acquisition experiences.

3.2.3 Perfecting Multimedia Resource Standards Systems

Multimedia resources and associated metadata are inherently heterogeneous, resulting in different data structures, standards, and quality across sources. Therefore, systematic management and utilization require continuously improving supporting standards systems to normalize procurement indicators, processing parameters, cataloging requirements, and alliance sharing. In MRMS cataloging standards, an independent information resource with a unique name or identifier serves as the cataloging unit (e.g., a video, audio file, or image/set of images). For multi-content resources, libraries may choose comprehensive or separate cataloging. Each resource's metadata should include basic indexing items such as

title, description, time, location, people, copyright holder, keywords, and classification, with additional specific indexing for different file types (e.g., image dimensions, genre, shooting location; video shooting method, picture quality, compression format). Artificial intelligence can automatically add metadata such as frame dimensions, aspect ratio, and duration to efficiently establish a systematic, holistic, and distinctive set of standards for acquisition, processing, cataloging, and management.

3.2.4 Encouraging User Participation

The 5G era and increasingly sophisticated mobile terminals have made people eager to create, share, and utilize massive amounts of multimedia data. Libraries should capitalize on this advantage by encouraging user participation in resource co-construction. Different users play various social roles—intangible cultural heritage inheritors, historical event witnesses, academic creators, institutional history chroniclers, or arts enthusiasts—enabling them to create multimedia resources related to teaching and research, campus life, personal reflections, and cultural activities. User participation helps users revisit authentic experiences and preserve precious memories while continuously enriching library collections and enhancing special collection strength. Additionally, encouraging user participation opens new collection development models, attracting users to co-build multimedia resources through familiar and interesting approaches. For example, MRMS can provide time-capsule-style mood journals to increase user stickiness, organize exhibition competitions to boost engagement, and leverage educational collection resources to increase platform value.

3.2.5 Advocating Inter-Library Cooperation and Sharing

Networked environments should actively promote cross-platform multimedia resource sharing and establish cooperative sharing alliances among libraries. Standardized and unified service standards can achieve multimedia resource clustering while continuously expanding each library's resource scope and increasing reserves. Alliance libraries can establish cooperation and sharing principles, forming win-win unified entities within certain regions or resource types to process, integrate, and share rare multimedia resources with unique characteristics reflecting historical culture. This not only rapidly enriches alliance collections but also expands resource sharing and utilization while avoiding massive duplication and waste of manpower, materials, and financial resources.

4. MRMS Architecture Design for Libraries

4.1 MRMS Overall Architecture

The Multimedia Resource Management System comprises multiple subsystems forming a sustainable ecosystem centered on the multimedia resource ecological chain, from resource acquisition to service application, adhering to principles of completeness, interaction, independent development, and collaborative innovation. Based on this concept, this study designed the overall system architecture [Figure 1: see original paper]. Considering multimedia resource complexity, the

system is divided into six layers: construction and integration layer, underlying middleware, basic capability layer, core service layer, business process layer, and interactive access layer. These form seven business domains by function, implementing various media data processing, long-term preservation, services and interaction, management, and operations and maintenance. Through this system's development and application, libraries can ultimately achieve multimedia resource acquisition, processing and management, sharing, special collection development, and application dissemination.

4.2 Core Functions and Value of MRMS

4.2.1 Three Core Functions of MRMS

- (1) Establishing a multimedia resource procurement system: Through authoritative peer review and recommended resource providers, selecting high-quality, legitimate multimedia resources from various authoritative institutions for unified procurement to break down procurement barriers and improve efficiency and quality.
- (2) Creating standardized processing systems and operational workflows for library multimedia resources: Supporting standardized multimedia processing of physical collections to convert large stockpiles of legacy resources through unified standards for transcoding, restoration, deep processing, and cataloging application, saving collection space, reducing service costs, improving archiving efficiency, and reconstructing multimedia resource services.
- (3) Providing library multimedia resource publishing and discovery systems: Establishing dynamic resource networks for public, university, and research libraries to exchange and share resources with diversified participation methods and reading experiences. Multimedia collections should be equipped with management service platforms for terminal display to fulfill library service functions and sustain libraries' positive roles in literature collection, knowledge dissemination, public education, and cultural exchange.

4.2.2 Practical Application Value of MRMS

- (1) **Building an Integrated Multimedia Resource Management and Sharing Platform:** MRMS enables centralized management of image, audio, and video resources according to library management needs and user intentions, allowing libraries to clearly understand multimedia resource quantities, click rates, utilization rates, and popularity. Users can conduct unified retrieval, utilization, and sharing through diversified online service platforms, presenting a new and colorful multimedia resource sharing and exchange platform that compensates for deficiencies in centralized multimedia resource management and greatly promotes libraries' expanded resource service scope, improved reader service capabilities, and enhanced collection strength.
- (2) **Building an Open and Shared Research Collection Platform to Enhance Academic Atmosphere:** In the new era of library service innovation, libraries' role transformation and innovation have become vital for maintaining their vitality as academic exchange institutions. This

transformation requires libraries to manage diverse media content, especially research multimedia data such as manuscripts, reports, academic conference videos, images, and PowerPoint presentations. MRMS effectively supports researchers and faculty-student online interaction, improving research dissemination and utilization while providing libraries with platforms for collecting, integrating, and managing research collections to form open and shared online academic exchange communities that strengthen research atmosphere.

- (3) **Facilitating Digital Special Collection Development and Expanding Unique Holdings:** Special collections are important indicators reflecting libraries' and their regions' or institutions' historical traces, cultural traditions, and characteristics. Compared with uniform electronic resources, preserving and managing unique institutional resources highlights distinct value and significance. However, many libraries' old photos, videos, and other multimedia special collections have become difficult to access due to aging carriers. MRMS enables digital management and long-term preservation of special collections through standardized cataloging and indexing, extending digital special collection services from offline to online, thereby improving both resource management capabilities and service capacity.

5. Practical Application: Chongqing University Library “+Collection”

5.1 Development Background of the “+Collection” Service Platform

Chongqing University Library had previously attempted to build self-developed multimedia databases for effective resource management and utilization but achieved unsatisfactory results due to technical and experiential limitations. Urgently needing a fully functional multimedia resource management platform, the library adopted an industry-academia-research cooperation model in early 2019, partnering with Beijing EDU & SUN Education Technology Co., Ltd. to develop MRMS. Through complementary advantages in personnel, technology, and funding, the collaboration processed and integrated the library's large stockpiles of underutilized multimedia resources while supporting reader participation in special collection development. This improved the library's multimedia resource management and service capabilities, promoted research application in the library industry, and achieved mutual development and win-win outcomes. In this development plan, the MRMS system was named the “+Collection” service platform.

5.2 Construction of a Comprehensive Multimedia Resource Service System

5.2.1 Digital Services for Multimedia Collections

The “+Collection” platform digitizes and reprocesses large stockpiles of

fragile, low-utilization multimedia carriers such as old paper publications, book-accompanying CDs, cassette tapes, and videotapes through scanning and transcoding. Following standardized multimedia resource cataloging formats for long-term preservation, the platform provides online retrieval and utilization services, enabling libraries to dynamically monitor resource usage, reduce zero-data phenomena in resource utilization [?], and save collection space and hardware investment.

5.2.2 Online Multimedia Resource Procurement

Given multimedia resources' multiple sources and copyright complexity, the "+Collection" platform implements one-stop multimedia resource procurement services to avoid illegal use and copyright disputes while enabling timely, targeted acquisition that shortens the time lag between publication and collection. Procured resources undergo cataloging, description, storage, digitization, and collection, improving preservation and management efficiency while enhancing update timeliness to ensure readers can retrieve needed multimedia resources within the shortest time possible.

5.2.3 Comprehensive Online Service System via "PC + APP + Mini-Program"

Recognizing readers' diverse network access patterns for digital resources, the "+Collection" multimedia resource service platform provides three online access methods: WeChat mini-program [Figure 2: see original paper], PC terminal [Figure 3: see original paper], and mobile APP. Readers can conveniently utilize platform resources and upload their own images, audio, and video materials through these channels. The platform offers personalized services where logged-in readers can favorite, follow, and upload resources, with differentiated interfaces for different management roles. Library administrators can use the back-end management interface to review, screen, and statistics-track user-uploaded and shared resources.

5.2.4 Offline "Sound Library"

Beyond online management and service platforms, the library and company jointly built a physical "Sound Library" that officially opened in November 2019. The Sound Library integrates all audio resources, allowing readers to listen using in-library audio-visual equipment. The combination of online and offline sound libraries provides unique audio-visual experiences for faculty and students and will gradually expand to include cultural activities and course instruction functions. The full-process "+Collection" system enriches digital special collections and provides crucial support for the long-term preservation of Chongqing University's memory and the creation of a distinctive audio resource system.

5.3 Multimedia Resource Promotion

The "+Collection" platform's multimedia resource promotion currently employs three main methods: First, **student team participation**: Inviting student

teams to participate in resource construction and promotion transforms readers into special collection builders, enriching library resources while strengthening library-reader relationships. Second, **subject teaching and research**: The platform collects and manages daily teaching and research multimedia resources such as PowerPoint courseware, instructional audio-video materials, and research dynamic diagrams, presenting them to readers through online courses, exhibitions, and thematic displays that enhance teaching vitality, improve service experiences, strengthen user-resource stickiness, and better promote multimedia resource utilization among faculty and students. Third, **online cultural exhibitions**: The platform periodically exhibits and broadcasts old photos, certificates, badges, and precious audio-video resources reflecting history, strengthening multimedia resource promotion and utilization.

As of March 2020, Chongqing University Library's MRMS has demonstrated significant operational effectiveness, with robust multimedia resource utilization reaching 6,259 resources and 22,832 cumulative visits, fully achieving the development objectives.

6. Conclusion and Outlook

In summary, through practical application and in-depth analysis, the Multimedia Resource Management System (MRMS) leverages information technology to construct an innovative ecosystem spanning multimedia resource publishing, processing, cataloging, storage, management, sharing, and application. Standardization runs through the entire workflow, while deepening cooperation, expanding sharing, and collaborative development concepts utilize networks and artificial intelligence to address current pain points in multimedia resource management and special collection development. The system meets libraries' needs for extensive, high-quality, convenient, and vivid information access, enriches resource development, empowers resource value, expands collection types, and upgrades special collection strength, creating diverse possibilities for industrial integration across every link of the multimedia resource industry chain. However, the complexity of multimedia resource sources, content, and metadata means that library multimedia resource development remains a long-term endeavor requiring continuous exploration and collaborative construction to achieve cross-library sharing and jointly overcome challenges in metadata standard construction, intelligent resource evaluation and review, and innovative resource services.

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Author Contributions

Yang Xinya: Designed the overall research framework and wrote the paper;
Liu Shangwu: Responsible for application system development;
Luo Li: Conducted research and wrote the paper;
Wei Qunyi: Revised portions of the paper;
Wang Xianghui: Responsible for application system technical architecture and platform construction;
Fu Ran: Responsible for application system interaction design;
Xu Tiancai: Conducted research and revised portions of the paper;
Shen Min: Responsible for experimental data construction and proofreading;
Wang Yanli: Responsible for experimental data construction and proofreading.

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(see: <http://www.lis.ac.cn/CN/column/item202.shtml>). Subsequently, the journal also led the formulation and release of the “Joint Action Plan for Library and Information Science Journals in China to Resist Academic Misconduct” (hereinafter referred to as the “Joint Action Plan”) (see: <http://www.lis.ac.cn/CN/column/item247.shtml>). To implement and realize this philosophy, the journal hereby solemnly declares that, effective immediately, all submitting authors must commit that their submissions comply with the aforementioned “Statement” and “Joint Action Plan,” consciously uphold academic ethics, and resolutely resist academic misconduct. *Library and Information Service* maintains zero tolerance for all forms of academic misconduct including plagiarism and appropriation, and will implement corresponding disciplinary measures.

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