

Research on Data Quality Control in Electronic Resource Management: A Case Study of Tsinghua University Library's Practice Based on the ALMA System

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Abstract

Purpose/Significance: This paper introduces the experience of Tsinghua University Library in utilizing the ALMA system for electronic resource management and quality control, which can serve as a reference for peer libraries in the application practice of next-generation library service platforms and in methods for electronic resource data quality control.

Methods/Process: The necessity of electronic resource data quality control is established through literature review; a questionnaire survey is employed to investigate the management models and challenges faced by peer libraries in electronic resource management, thereby extracting common issues. Based on the data model, workflow, and management paradigm for electronic resource management within the ALMA system, corresponding data quality control methods are proposed from the perspectives of electronic resource databases and individual title levels, bibliographic record levels, discovery system levels, and central discovery index levels, providing practical guidance for data quality control throughout the electronic resource management process.

Results/Conclusion: Electronic resource management constitutes a complex, multi-platform systematic engineering endeavor; libraries should formulate multi-level, comprehensive data quality control schemes to enhance the standards of electronic resource management and service delivery.

Full Text

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Abstract

[Purpose/Significance] This paper introduces Tsinghua University Library's experience in electronic resource management and quality control using the ALMA system, providing a reference for peer libraries in implementing next-generation library service platforms and developing electronic resource data quality control methods. **[Method/Process]** We employed literature review to establish the necessity of electronic resource data quality control and conducted questionnaire surveys to investigate the management models and challenges faced by peer libraries, identifying common issues. Based on ALMA's data model, workflow, and management mode for electronic resources, we propose corresponding data quality control methods at four levels: electronic resource collections and portfolios, bibliographic records, discovery systems, and central discovery indexes, offering practical guidance for data quality control in electronic resource management. **[Result/Conclusion]** Electronic resource management is a complex, multi-platform systematic project. Libraries should develop multi-level, comprehensive data quality control schemes to enhance electronic resource management and service levels.

Keywords: library, electronic resources, data, quality control

Classification Number: G250

1.1 Data Quality Control Standards for Electronic Resources

Resource discovery and access directly reflect the effectiveness of data quality control in electronic resource management and constitute important indicators in library service evaluation standards. Multiple international and domestic standards, including NISO Z39.7-2002 (U.S. Library Statistics Standard), ISO 11620:2008 (Information and Documentation—International Library Performance Indicators), ISO 16439:2014 (Information and Documentation—Methods and Procedures for Assessing the Impact of Libraries), and GB/T 29182-2012 (Library Performance Indicators), all incorporate resource discovery and access metrics [1]. Domestic research also considers resource accessibility as an indicator for evaluating library management and service capabilities [2]. The Library of Congress's *Digital Collections Strategy Overview 2022-2026* proposes improving resource availability and accessibility, enhancing content discoverability, and building integrated discovery systems for digital collections [3]. While

next-generation library service platforms enable full-process management of electronic resources, they also impose higher demands on business management and data quality. System migration triggers departmental and business reorganization and redefines the responsibilities of electronic resources librarians, shifting the challenges of electronic resource management from acquisition workflows to resource discovery and access services.

Research on electronic resource management in North America began relatively early, with the Digital Library Federation (DLF) publishing an electronic resource management report in 2004 [4]. Subsequently, academic libraries in Europe and North America collaborated closely with the publishing industry to establish a series of technical specifications facilitating electronic resource management, discovery, and dissemination, which were rapidly implemented in libraries alongside corresponding workflows and standards [5]. ALMA is a full-media resource management platform developed based on these workflows and specifications. Therefore, studying and analyzing data quality control in ALMA's electronic resource management processes can significantly help libraries learn from advanced peer practices, improve data sharing and exchange between international publishers and libraries, and enhance resource discovery and access capabilities.

The characteristics of electronic resources—high funding allocation, large volume, diverse types, multiple sources, and wide distribution—make them a challenge for library resource management. However, domestic libraries generally lack experience in managing electronic resources based on next-generation service platforms, and there are imbalances and mismatches between resource volume and service capacity. Electronic resource data quality is constrained by multiple factors, including data services from database vendors, the professional skills of electronic resources librarians, and system functionality support. Consequently, data quality control methods and standards have become a shared and urgent issue for both libraries and the publishing industry. Libraries must establish data quality control schemes for electronic resource management processes to improve their management and service capabilities.

1.2 Research and Practice Status

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We conducted a literature review on electronic resource data quality control. On November 28-29, 2022, we searched the Web of Science Core Collection using the query $TS=(librar) \text{ AND } TS=(electronic \ resource) \text{ AND } TS=(data \ quality)$, yielding 212 results. After removing irrelevant literature, we identified 23 articles related to electronic resource data quality control. A similar search

on CNKI using the keywords “library,” “electronic resources,” and “data quality” produced 12 results. Reviewing these articles’ titles and abstracts revealed that foreign libraries, having adopted next-generation service platforms earlier, focused on evaluating electronic resource data quality, collection management models, bibliographic data quality, and journal quality standards, recognizing that electronic resource data quality and its disclosure significantly impact discovery services [6-8], necessitating quality control. Domestic literature is relatively scarce, concentrating on ALMA system implementation [9-10], platform comparative studies [11-12], electronic resource management [13-14], cataloging data for electronic resources [15-17], and usage statistics [18]. Regarding data quality control in electronic resource management, only reports on electronic resource access failures are available [19-20].

We also administered questionnaires to 12 libraries via email, WeChat, and QQ. These libraries included six ALMA users and six non-ALMA users. The six non-ALMA users (Peking University Library, Beihang University Library, Jilin University Library, Central South University Library, Xi’an Jiaotong University Library, and Zhejiang University Library) are all “Double First-Class” universities in China with extensive electronic resource management experience. The six ALMA users (Beijing Normal University Library, Chinese University of Hong Kong (Shenzhen) Library, Macau University of Science and Technology Library, Southern University of Science and Technology Library, Institute of High Energy Physics (Chinese Academy of Sciences) Library, and Northeast Normal University Library) are geographically distributed and have different system implementation timelines, providing representative diversity. The questionnaire covered management systems used, types of electronic resources cataloged, cataloging standards, electronic resource volume, proportion of bibliographic data provided by vendors, data acquisition channels, departmental organization and division of labor for electronic resources disclosure, challenges encountered, user feedback, and discovery-related issues. Due to limited implementation in some libraries, questionnaire responses were incomplete. Analysis of the survey results yielded the following conclusions: (1) Sample libraries used management systems including ALMA, Huiwen, and ALEPH, with discovery systems including PRIMO, SUMMON, and Chaoxing Discovery. (2) Seven libraries catalog electronic resources, while others (e.g., those using Huiwen) either lack system support for electronic resource cataloging or have no dedicated librarians for this task. Overall, libraries have limited human resources for electronic resource disclosure or lack corresponding positions. (3) Cataloging scope focuses primarily on e-books, e-journals, and dissertations, mainly purchased resources, without extending to other resource types. (4) Although relevant standards exist (GB/T 3792-2021 Information and Documentation—Resource Description), domestic libraries have not adopted unified standards. (5) Electronic resources cataloging librarians typically work in the same cataloging group as print catalogers, partly due to limited staffing. (6) Challenges in electronic resource disclosure and quality control include incomplete data acceptance mechanisms, some vendors not providing bibliographic data, poor metadata quality, difficulties in Chinese re-

source discovery, and users' inability to find required articles or access full-text in discovery platforms.

We selected Tsinghua University Library as a case study for two main reasons: (1) The library began electronic resource procurement early and has accumulated a substantial collection over the years, currently comprising 938 databases, 8.45 million e-books, 174,000 e-journals, and various other electronic resources distributed across over 200 heterogeneous platforms worldwide. (2) Tsinghua University Library was among the first in China to adopt ALMA for electronic resource management, accumulating rich experience. Before migrating to ALMA, databases, e-journals, and e-books were managed separately by Metalib, SFX, and OPAC, with access based on database navigation, journal navigation, and catalog retrieval. After migrating to ALMA and PRIMO, unified management and discovery of these resources were achieved. The discovery platform's searchable resources include not only journal- and book-level data managed by librarians in the backend but also over 4 billion metadata records covering journal articles, book chapters, and research datasets from the cloud-based Central Discovery Index (CDI), as well as PRIMO local resources. Consequently, the number of data management levels increased, complicating data quality control. Thus, Tsinghua University Library's large electronic resource volume and early adoption of ALMA in China have yielded valuable data quality control experience that can serve as a reference for peer libraries.

2 Data Model and Workflow for Electronic Resource Management in the ALMA System

The ALMA system enables full-process management of electronic resources from acquisition to discovery, while PRIMO provides users with one-stop retrieval and discovery. In ALMA, all resources follow a unified three-tier data model (Figure 1 [Figure 1: see original paper]) to facilitate integrated management. For the same knowledge entity, such as the e-journal *The Library*, ALMA typically contains one bibliographic record (Metadata Management System, MMS) with two portfolios corresponding to different accessible date ranges (portfolio coverage). Simultaneously, the two electronic collections containing this knowledge entity also have corresponding bibliographic data.

Resources cataloged in ALMA appear in multiple user scenarios, including the discovery platform (PRIMO interface), database navigation, and electronic resource navigation. ALMA functions as a link resolver, enabling citation-to-full-text linking with cloud-based resource metadata repositories. As a crucial PRIMO data module, the Central Discovery Index (CDI) searches, discovers, and provides full-text access to electronic collections based on ALMA's link resolver configuration. ALMA periodically publishes the library's holdings file (HF) to CDI. For journals, ISSN and accessible date range information are used to match source journals, volumes, and issues in CDI, with full-text availability displayed in the discovery platform. Therefore, when users search for an article in the discovery platform, the process from triggering the search to locating the

database and successfully accessing full-text involves multi-level data matching and mapping. Table 1 explains relevant terminology, and Figure 2 [Figure 2: see original paper] illustrates the data publishing workflow from ALMA to PRIMO.

Table 1 Basic Concepts of Electronic Resources in the ALMA System

Term	Description/Example
Holdings (inventory)	Link parameters and accessible date ranges for an e-journal and its collection
Electronic Collection	Resource package corresponding to a database, e.g., Oxford University Press Journals
Portfolio	Accessible range and link parameters for an e-journal
Service	Services for electronic collections include full-text types and access parameters
Bibliographic Record (MMS)	Bibliographic record for e-journal <i>The Library</i>
Central Discovery Index (CDI)	CDI collection: Oxford Journals 2020 Social Sciences
Holdings File (HF)	Holdings file published from ALMA to CDI, containing resource identifiers and volume/issue information
CDI Institutional Profile	CDI profile for an electronic collection
Link Resolver	ALMA as link resolver receives and parses OpenURL information, constructs digital objects, matches metadata in bibliographic records, and generates service links
Community Zone (CZ)	Electronic collections, portfolios, and bibliographic information for a database provided by ALMA's knowledge base

Note: Some terminology descriptions or examples are derived from Figure 1.

Note: Revised based on diagrams from the 2019 CCEU Annual Conference China Discovery Solution Progress Report (Li Zhen, Kang Lifan).

Figure 2 Data Publishing Workflow from ALMA to PRIMO

3 Management Mode of Electronic Resources in the ALMA System

Currently, most electronic resource data disclosure and maintenance relies on the Community Zone knowledge base. When the knowledge base lacks required resources, has incomplete coverage, or contains poor-quality data, librarians must evaluate external data quality, verify or improve data using batch processing

software, and then complete electronic resource activation by importing bibliographic data or extracting records from external sources (Figure 3 [Figure 3: see original paper]). The specific data management approach depends primarily on the quality of data to be disclosed, including whether metadata comprehensively covers the resource scope, completeness of fields, and cataloging rules. Based on experience, foreign publishers provide higher-quality data than aggregators; database vendors cooperating with import/export companies and data firms can provide higher-quality metadata; while some Chinese e-book platform vendors, particularly for ancient books and audio-visual resources, lack capacity and service awareness in providing bibliographic data.

For instance, some publishers conduct bibliographic data quality surveys for libraries, covering resource management system selection, bibliographic data acquisition and processing methods and tools, and the relationship between metadata and resource discovery [21]. E-textbooks jointly purchased through foreign textbook centers and e-books ordered through the Yiyuetong platform often provide high-quality bibliographic data because import/export companies have dedicated catalogers who can improve bibliographic data according to library requirements. Chinese e-book platforms, especially for ancient books and audio-visual resources, typically only provide metadata in Excel format, requiring librarians to compile bibliographic data themselves. Figure 4 [Figure 4: see original paper] shows sample bibliographic data completed through batch cataloging using tools like Excel and Marcedit.

Figure 3 Electronic Resource Management Approaches in ALMA

Figure 4 Sample MARC Data from Batch Cataloging Using Excel and Marcedit

4 Data Quality Control Schemes at Various Data Levels

Based on the aforementioned data model and workflow for electronic resource management in ALMA, as well as the management approaches described, electronic resources librarians must understand not only the data publishing workflow from ALMA to PRIMO but also the specific operational methods of electronic resource management. This section proposes corresponding data quality control methods for key data levels involved in the electronic resource management data model and workflow, including electronic resource collections and portfolios, bibliographic records, discovery systems, and central discovery indexes, to improve resource discovery and access. Overall, data quality at the collection, portfolio, and bibliographic levels depends on both database vendors improving data service and sharing awareness and professional librarians enhancing their understanding of data quality's impact on user retrieval while mastering process management and quality control methods. Data quality control at the discovery system and central discovery index levels relies more on vendor data standardization and system functionality improvements.

4.1 Data Quality Control at the Electronic Resource Collection and Portfolio Level

For electronic collections, Community Zone collections may undergo updates such as deletion or merging, which alter activation status and require timely librarian attention. For portfolio-level data quality control, librarians must monitor resource types, access parameters, bibliographic data, and other information to develop appropriate processing solutions. At Tsinghua University Library, to improve proactive data verification and timely maintenance, librarians configure corresponding statistical reports at the analytics end to periodically review knowledge base updates and perform cyclical maintenance accordingly.

Knowledge base data updates improve resource data accuracy and facilitate user retrieval in PRIMO but also increase librarian maintenance workload. Portfolio data updates include accessible date range modifications, resource deletions, and bibliographic data improvements. For example, updated e-book bibliographic data may supplement 505 fields with chapter information, making records more complete.

Beyond monitoring knowledge base changes, we employ multiple approaches in practice: recommending data acceptance as part of acquisition librarians' responsibilities; configuring automatic updates for databases supporting KBART data harvesting like Springer and Taylor & Francis; and using existing print bibliographic records as the foundation for e-book cataloging to improve data quality and facilitate discovery.

4.2 Data Quality Control at the Bibliographic Level

Electronic resources must be cataloged and indexed to provide users with richer access points. Resource discovery platforms enable faceted searching by resource type, author, publication information, etc. Search result precision and recall depend on bibliographic data quality in ALMA. Tsinghua University Library began batch cataloging of electronic resources early and believes domestic libraries generally insufficiently emphasize data quality [15-16], with batch cataloging being an effective means to promote electronic resource access. As database vendors improve data service awareness, more are proactively addressing how bibliographic data quality impacts resource discovery.

For foreign books and journals, some bibliographic data can rely on Community Zone knowledge base data, while others depend on vendor-provided bibliographic data or resource lists. However, Community Zone bibliographic data suffers from inaccurate titles, missing subject or author fields, and inconsistent quality. Multiple ALMA users have recommended that the knowledge base evaluate its provided bibliographic data, informing libraries about cataloging levels, ISBN/ISSN availability, title, author, and subject field completeness to facilitate assessment [22]. For Chinese books, journals, and video resources, situations arise where the Community Zone lacks bibliographic data while vendors provide non-standard, incomplete, garbled, or no bibliographic data, requiring

librarians to revise or completely abandon knowledge base records. Poor data source quality for Chinese e-books is also reflected in non-standard data on their own platforms [23]. Peers have compared user experiences in discovering and accessing streaming media through discovery platforms, evaluated streaming resource bibliographic data, and concluded that metadata quality significantly impacts discovery services [24]. Our practice also reveals that when platform bibliographic data quality is poor, database vendors struggle to provide high-quality bibliographic data. Table 2 presents the basic status of e-book bibliographic data at Tsinghua University Library and the different data processing approaches adopted, ensuring more comprehensive and accurate e-book data disclosure through tailored processing for different databases.

Table 2 Basic Status of E-book Database Bibliographic Data

Typical Database	Record Source/Acquisition Method	Cataloging Standard	Data Processing Approach
Academic Video Online, Elsevier PQDT, World Library CAMARC	Provided by database vendor (proactively offered/librarian requested/provided after library-initiated vendor-data company cooperation)	MARC21 AACR2/RDA	Direct import into ALMA
Science Book Database, Chengyi Art Hanwen Republican Books, Party and Government Library	Excel	MARC21 AACR2/RDA	Convert print bibliographic records to e-book records before import
Superstar E-books	Downloaded from admin platform	MARC21 AACR2/RDA	Librarians batch-process Excel metadata into MARC data XML direct import with data matching and editing based on 035 fields
	Provided by database vendor	MARC21 AACR2/RDA	Import into PRIMO

Verification and batch processing of electronic resource bibliographic data constitute a critical component of data quality control, demanding high competency from librarians. One university library's qualifications for cataloging and meta-

data assistant librarians specify that candidates must possess not only cataloging experience but also ALMA bibliographic data import and batch processing capabilities, ability to apply different metadata standards to various resource types, understanding of discovery platform metadata issues, and comprehension of linked data [25]. In practice, librarians should also master batch processing tools like Marcedit and Excel and ALMA data import configurations. Therefore, librarians should proactively master various data batch processing methods to improve efficiency and data quality.

4.3 Data Quality Control at the Discovery System and Central Discovery Index Level

ALMA bibliographic records are transcribed into corresponding XML files according to normalization rules for user query and display. Although the discovery system (PRIMO) does not modify metadata from ALMA, it can use rules to restrict whether information in metadata can be searched or displayed. PRIMO's data quality control primarily comes from rule configuration, which is highly flexible and allows customized metadata display for different resource types according to user needs. However, since libraries can customize display, search, sorting, deduplication, and faceting during metadata import, these settings ultimately affect how bibliographic records appear and are retrieved at the user end. Therefore, libraries must continuously adjust rule configurations for optimization.

In practice, librarians can set conditions to determine presentation content for different resource types in the discovery system and use deduplication algorithms to edit records in ALMA, allowing PRIMO to match and merge data based on identifiers and other information into more complete logical records that consolidate different formats of the same resource into a single bibliographic record for easier access. However, when consciously influencing record presentation through system rules, we should consider whether users actually need such merging or deduplication convenience. Some libraries restrict the system to stop merging records for different formats of the same resource, instead presenting all records as-is for user selection. Meanwhile, user search habits, influenced by web search engines, involve increasingly broad search terms, requiring systems to infer users' actual intended results. Discovery systems must now balance recall and precision, which cannot be achieved solely through record deduplication and merging but requires improvements to the discovery system's search engine itself—demanding more technical support from vendors that libraries alone cannot implement.

The Central Discovery Index (CDI) metadata comprises over 4 billion records from more than 1,600 publishers, content providers, and institutional repositories, including journal articles, book chapters, and datasets. For data quality control at the CDI level, foreign peers have surveyed user experiences with resource discovery platforms across 36 indicators in five dimensions: content, search functionality, discovery, interactivity, and usability, finding usability

most important and central index data quality carrying the highest weight [26]. We and our peers have published articles on electronic resource access issues and influencing factors in next-generation service platform environments, identifying ALMA knowledge base data quality, metadata quality, and changes in electronic resource information as primary causes of access failures [13,20]. For a given electronic collection, article-level retrieval and access depend not only on portfolio data, bibliographic data, and publishing from ALMA to PRIMO but also on the collection's CDI data configuration. Electronic resources librarians must configure and maintain CDI menus for electronic collections while understanding the coverage scope of article-level resource metadata. They can also decide whether to support article-level resource display in the discovery end based on the collection's CDI data quality. All these require librarians to conduct in-depth testing and analysis of each database's data status and system configurations to formulate appropriate configuration schemes.

5 Recommendations and Measures for Data Quality Control

Beyond the quality control measures described above, libraries can undertake work in six areas: strengthening literature asset and documentation standardization management, fully utilizing system functions for automatic data harvesting and integration, conducting quality control based on statistical analysis, establishing effective communication mechanisms and channels with faculty and students, enhancing librarian capacity building and team collaboration, and strengthening data co-construction and sharing.

5.1 Strengthening Literature Asset and Documentation Standardization Management

Literature asset management is the foundation of library services. Libraries should build a precise literature metadata asset management system to overcome the dilemma of "having resources but no data," becoming true resource owners [27]. We recommend establishing clear requirements for resource lists provided by database vendors and incorporating data comprehensiveness and accuracy requirements into resource acquisition contracts. Additionally, libraries should effectively archive acquisition resource lists and bibliographic data from vendors. Electronic resource management involves many complexities requiring standardized documentation systems. For example, establishing e-journal disclosure workflows and standards suitable for the library, creating collection data maintenance manuals for each database, and properly archiving metadata standards should permeate the entire electronic resource management process.

5.2 Fully Utilizing System Functions for Automatic Data Harvesting and Integration

For databases supporting automatic harvesting, such as Springer, Elsevier, and Wiley, libraries can communicate with vendors to obtain data harvesting parameters for configuration, enabling periodic automatic resource updates. For databases allowing ordered data downloads from platforms, such as Springer, librarians can manually download and import KBART-format files supported by ALMA. Both approaches improve data accuracy while reducing librarian workload. Resource usage data, such as COUNTER reports, should also be configured for automatic harvesting protocols to enable seamless data integration.

5.3 Conducting Quality Control Based on Statistical Analysis

Foreign peers believe ALMA's statistical analysis functions can help libraries identify resource access failures, understand business trends, and analyze user behavior [29]. Although studying these modules is time-consuming for librarians, libraries must train more librarians in report-building skills and establish teams for data management analysis. The ALMA analytics end provides multiple access service statistical functions. For example, reports sorted by title searches can inform collection development priorities. Reports on failed link resolver access can help reduce unserved data. In practice, Tsinghua University Library uses the report "Top ten article title accesses via OpenURL requests without services in the previous year" to track access failure causes and resolve them. In-depth data-level analysis can identify database-level issues. This module not only helps librarians understand user needs and difficulties but also improves their data management capabilities and service awareness.

5.4 Establishing Effective, Multi-Channel Feedback and Communication Mechanisms with Faculty and Students

Librarians can understand faculty and student usage habits and experiences through discussions, surveys, resource usage data analysis, and user behavior analysis, better integrating resource management and service needs. Tsinghua University Library receives feedback on electronic resource access through multiple channels, including a "Problem Feedback" form on the resource discovery platform, an in-house electronic resources WeChat group, and feedback from subject librarians or interlibrary loan services. The "Problem Feedback" section on the library's PRIMO interface (Shuimu Search) receives suggestions on resource recommendations, access, and acquisition, covering platform data errors, metadata mistakes, full-text access failures, off-campus access issues, and usage rights, serving as a bridge between the library and users.

5.5 Strengthening Librarian Capacity Building and Team Collaboration

The transformation of electronic resource management models and systems has triggered business and organizational restructuring, giving rise to new library architectures [30]. Core competency development for electronic resources librarians has also attracted industry attention. In 2017, the Association for Library Collections and Technical Services (ALCTS) of the American Library Association (ALA) released *Core Competencies for Cataloging and Metadata Professional Librarians* [31]. The North American Serials Interest Group (NASIG) Executive Committee approved core competencies for electronic resources librarians in 2013, comprising seven key areas [32]. Research suggests that the overall core competency level of domestic electronic resources librarians is relatively low [33]. The library and information science field should pay greater attention to librarians' professional development in both curriculum design and online training. On one hand, LIS curricula should emphasize connections with practical work. On the other hand, libraries should utilize platforms like ALA eLearning [34] and Library Juice Academy [35] to provide capacity-building opportunities. Libraries should consider effective position allocation and task distribution, strengthen training on electronic resource management knowledge systems, and support skill development. Additionally, electronic resource management requires more team collaboration, necessitating the establishment of corresponding mechanisms and workflows that leverage the strengths of acquisition librarians, disclosure librarians, reference librarians, and technical librarians to effectively coordinate and enhance problem-solving capabilities, enabling librarians to find their roles in integrated electronic resource management models.

5.6 Strengthening Cooperation with System Developers and Resource Sharing Consortia

The next-generation service platform environment drives libraries to integrate into the entire electronic resource management ecosystem, making independent management increasingly difficult. The industry is seeking consortium-based unified management. A survey on library consortia adopting ALMA shows a rising trend in consortia selecting ALMA for unified resource management and services [36]. For example, the National Institute of Informatics in Japan introduced ALMA to support electronic resource management for over 500 libraries in the Japan Alliance of University Library Networks for Electronic Resources [37]. Therefore, libraries should strengthen communication and deep cooperation with system developers to upgrade systems according to localization needs and improve performance and domestic service capabilities. Simultaneously, they should leverage consortium support to enhance cooperation through DRAA, CALIS, CASHL, NSTL, and other institutions, as well as interlibrary data sharing, seeking integrated development and data sharing with next-generation library service platforms. Libraries must strengthen com-

munication and cooperation not only with system vendors and consortia but also with the publishing industry to explore more scientific and efficient electronic resource disclosure methods, forming a joint force for data quality control improvement.

The application of next-generation library service platforms, the characteristics of electronic resources, and the diversification of user demands challenge the entire electronic resource ecosystem, imposing higher requirements on libraries' management and service capabilities. Libraries should adapt proactively and develop multi-level, comprehensive electronic resource data quality control schemes to enhance their management and service levels. This paper surveyed 12 peer libraries on common issues in electronic resource data disclosure and quality control, introduced Tsinghua University Library's multi-level data quality control scheme based on ALMA, and proposed multiple recommendations for improving electronic resource data quality from institutional, technical, training, and cooperation perspectives. We hope these practical experiences can provide reference for peer libraries and draw attention to electronic resource data quality control from all stakeholders in the ecosystem, including publishers and system vendors.

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Author Contributions

Wu Lina: Conceptualized the research topic, conducted literature review, wrote sections on questionnaire survey, electronic resource management mode, and bibliographic-level quality control, and revised the manuscript.

Dou Tianfang: Provided guidance and manuscript revision.

Zhou Hong: Wrote the section on discovery system data quality control.

Liu Yang: Wrote the section on electronic resource collection and portfolio quality control.

Note: Figure translations are in progress. See original paper for figures.

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