

Research on Standardized Procurement Process for Digital Resources in Information Repository Construction and ERMS System Development (Postprint)

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Date: 2023-04-01T16:15:55+00:00

Abstract

[Purpose/Significance] ERMS systems must reflect the proceduralization of procurement and information repository construction while performing “storage” and “management” of digital resources. Researching and formulating standardized procurement processes, exploring scientific and effective digital resource procurement order, and conducting digital resource repository construction during the procurement process help libraries grasp the demands from both upstream and downstream in the digital resource supply chain, improve the quality of digital resource procurement in libraries, and achieve on-demand and precise procurement. [Method/Process] Through research and discussion, metadata, procurement information, supply information, and account information were determined as the content for procurement information repository construction. Based on the repository content, data harvesting nodes were studied, standardized processes for digital resource procurement were formulated, and an ERMS system supporting information repository construction and standardized processes was developed. [Result/Conclusion] This ERMS system demonstrates monitoring of the entire lifecycle of electronic resources, enables integration of library repository data, facilitates multi-dimensional revelation of digital resources, and achieves refined management of digital resources.

Full Text

Research on Standardized Procurement Processes for Digital Resources Based on Information Storage Construction and Development of an ERMS System

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Abstract: [Purpose/Significance] An Electronic Resource Management System (ERMS) should not only facilitate the “storage” and “management” of digital resources but also reflect the construction of procurement processes and information repositories. This study aims to formulate standardized procurement procedures, explore scientific and effective ordering mechanisms for digital resources, and implement digital resource repository construction during the procurement process. This approach helps libraries grasp the demands across the digital resource supply chain, improve procurement quality, and achieve demand-based and precise acquisition. [Method/Process] Through research and discussion, we determined that metadata, procurement information, supply information, and account information constitute the core content for procurement information repository construction. Based on this repository content, we studied data harvesting nodes, formulated a standardized digital resource procurement process, and developed a complementary ERMS system integrated with information repository construction and standardized workflows. [Result/Conclusion] The ERMS system demonstrates lifecycle monitoring of electronic resources, integrates library repository data, enables multi-dimensional disclosure of digital resources, and achieves refined management of digital collections.

Keywords: ERMS; information storage; digital resources; Chongqing University Library

Classification Number: G250.7

DOI: 10.13266/j.issn.0252-3116.2020.12.008

ISO 9000 (2000) defines “process” as a series of interrelated activities that transform inputs into outputs, adding value to inputs and creating more effective outputs for recipients [1]. Digital resource procurement processes aim to achieve precise acquisition as their output. By adopting a systematic approach focused on the entire procurement workflow, libraries can improve division of labor and cooperation, optimize procurement operations, enhance efficiency, and ensure quality. Since libraries first introduced the “process” concept from business management into their operations [2], increasing awareness has emerged regarding the impact of procurement workflows on digital resource acquisition efficiency and ultimately on library information service capabilities.

Xu Wenxian et al. described Hong Kong libraries’ digital resource procurement cycle as comprising selection, trial, evaluation, purchase, implementation, product maintenance, and assessment [3]. Huang Shengguo et al. proposed that consortium-based procurement workflows involve: collecting digital resource information → soliciting member library recommendations → comprehensive review by the purchasing consortium → organizing trials → signing procurement agreements → making payments to providers [4]. Zheng Huaigu et al. argued that user demand and cost-effectiveness are fundamental principles for digital resource procurement, whether conducted individually or through consortia [5]. Under these principles, the basic procurement process includes six steps: demand investigation, procurement plan formulation, data source collection, resource trial, resource evaluation, and ordering/renewal. However, these studies

primarily 梳理 the involved stages and processes, with limited research on standardized details such as required documentation formats at each node, organizational principles for participants, operational discipline, completion methods and timelines, and inter-node coordination. They also inadequately address information repository construction at the procurement source, resulting in insufficiently robust data analysis and inadequate data support for procurement decisions in existing ERMS systems.

2. Necessity of Research on Standardized Digital Resource Procurement Processes with Information Repository Construction

In recent years, with mobile libraries' digitization requirements and increasing emphasis on digital resource development in university libraries, procurement funds for digital resources have risen annually. By introducing rich database varieties and developing specialized databases, libraries' digital collections have become increasingly abundant [15], establishing digital resources as the absolute mainstay of library management and user services. Unlike physical resources such as Chinese and foreign books and periodicals that have complete standardized procurement processes, digital resources—due to their virtual nature, diverse procurement support models, special acceptance methods, and multimedia usage patterns—generally lack unified, standardized procurement workflows in most libraries.

The information repository within the procurement process serves as a comprehensive venue reflecting library resource acquisition activities and a transfer station connecting digital resource lifecycles, playing a crucial role in promoting procurement efficiency. Therefore, research on information repository construction within standardized procurement processes can not only meet supply chain demands but also, through big data derived from repository construction, obtain utilization efficiency across the digital resource supply chain, help establish libraries' role positioning and service functions, and ultimately achieve demand-based and precise procurement amid rapid multimedia technology development, increasing diversified digital resources, and growing personalized user needs [16]. Consequently, formulating standardized procurement processes, exploring scientific and effective ordering mechanisms, and conducting repository construction during procurement—using repository information to support procurement decisions—helps improve digital resource procurement quality and ensures scientific, sustainable resource development.

3. Content of Digital Resource Procurement Information Repository Construction

Digital resource procurement information repository construction comprises four components: metadata repositories storing digital resource attribute data, supply information repositories storing product development and market condi-

tions, procurement information repositories storing purchase details, and account repositories storing payment information. Table 1 details these four repository types.

Table 1. Analysis of Four Types of Procurement Information Repository Content

Repository Type	Content Elements
Metadata Information	Document title, author, affiliation, publication name, publication date, ISSN, etc. [17]
Database Information	Name, URL, language, document type, subject classification, consortium purchase information, access mode, supplier, agent, domestic authorized users
Copyright Registration	Software copyright registration numbers, digital publication numbers, etc., reflecting product copyright
Database Profile	Launch date, primary application fields, target audience, market recognition, functional features
Resource Coverage	Inclusion status, data volume, annual/monthly updates, OA resource proportion, journal inclusion in authoritative index databases, new book status
Reports and Minutes	Trial reports, recommendation reports, evaluation reports, review meeting minutes, resource audit meeting minutes, bidding meeting minutes
Pricing Information	Inquiry receipts, consortium pricing schemes, bidding prices
Procurement Details	Start/end dates, price, procurement platform, procurement content (precise to sub-database) [18], quantity, supplier, agent, consortium organization
Amount and Payment Information	Purchase amount, planned payment installments, planned payment amounts per installment, planned payment dates, actual payment installments, actual payment amounts, actual payment dates, invoice information

3.1 Metadata Repository

The National Science and Technology Terminology Committee defines resource information metadata as “data about data”—background information describing data content, quality, condition, and other characteristics [19]. As a data format revealing digital resource content, attributes, and features, metadata plays a vital role in resource integration, retrieval, discovery, evaluation, and management. Current metadata management primarily focuses on parameters and content provided by digital resource vendors, with insufficient attention to library-driven requirements. Libraries should deeply analyze their own needs regarding metadata content and elements, establish metadata parameters and content standards, and strengthen metadata preservation quality. In preliminary research, Chongqing University Library proposed standardized requirements for metadata elements and quality based on digital resource management objectives and resource types, achieving refined management from “database” to “article” granularity. By 2019, the resource information metadata repository had completed over 212 million metadata records.

3.2 Supply Information Repository

Proactively understanding digital resource supply information, timely comparing product strengths and weaknesses, and exchanging information with other libraries about actual effectiveness are crucial for developing optimal procurement plans. Therefore, libraries must establish supply information repositories to shift from passively accepting vendor recommendations to actively understanding product information, supplementing new resources according to institutional needs, and improving procurement efficiency and service capabilities. Based on procurement and management needs, Chongqing University Library standardized supply information repository content and collected product information through templated formats, establishing over 1,500 digital resource supply information records covering authoritative domestic and international databases and newly developed resources from top publishers and institutions.

3.3 Procurement Information Repository

Digital resource procurement information comprises supporting and execution documents for purchasing activities. Currently, most procurement information is preserved in paper form, becoming increasingly inconvenient to manage and retrieve as procurement varieties and quantities grow and procurement forms diversify. Establishing a digital procurement information repository enables efficient management of all procurement information since initial purchases, providing queryable information for subsequent management and verification. By digitizing all digital resource procurement information since Chongqing University’s first purchase of Tsinghua Tongfang CD-ROM resources on January 15, 2001, the library has established over 1,200 procurement information repository records.

3.4 Account Information Repository

Digital resource account information records purchase amounts, installment payments, remaining payments, and invoice details. Establishing this repository helps managers promptly grasp expected and executed payment status, adjust procurement and payment schedules according to actual fund utilization progress, and enables retrieval of payment information for each specific resource, improving financial and resource management efficiency.

4. Formulation of Digital Resource Procurement Process

Ma Yanbo proposed a digital resource procurement workflow: trial → evaluation → procurement plan → negotiation → purchase → usage tracking and evaluation [20], which essentially represents the general process adopted by most university libraries, with minor adjustments based on institutional tendering requirements and library conditions. Libraries must analyze procurement business in relation to information repository construction nodes, conduct repeated verification to enhance full-process supervision efficiency and repository data support for procurement decisions, and formulate standardized procurement processes. Chongqing University's digital resource workflow comprises: trial → evaluation → procurement plan formulation → procurement plan review → contract formulation → payment → usage → procurement evaluation, as shown in Figure 1 [Figure 1: see original paper].

4.1 Digital Resource Trial

Chongqing University Library requires trials for all planned new resources. The trial process is vendor-initiated: suppliers first register basic information to obtain a vendor account, then submit trial applications by completing standardized supply information forms for library review. Resources approved by librarians proceed to trial, while all submitted applications—regardless of approval—are harvested into the supply information repository.

4.2 Digital Resource Purchase

The procurement phase includes pre-purchase evaluation, review, bidding, negotiation, and post-purchase contract formulation [5]. Professional librarians and users evaluate trial resources based on authority, usability, vendor service capability, and comparative analysis with similar products, completing evaluation reports. Procurement librarians compile approved new and renewal resources into procurement plans for review by a resource leadership group comprising library management and faculty representatives. This group reviews each resource against institutional academic development needs and user demands, submitting recommendations and finalizing procurement content through review meetings.

Based on approved content, procurement librarians execute bidding and negoti-

ations according to the university's tendering management requirements, implement procurement terms and pricing, formulate contracts, and collect/manage contract elements. Evaluation reports, review minutes, bidding/negotiation records, and contracts constitute crucial procurement information, forming a complete procurement information chain when collected at each stage.

4.3 Digital Resource Payment

Although payment belongs to the procurement process, account information complexity and importance warrant separate treatment. Payment terms vary: some require advance payment before access, others pay based on actual usage; some involve annual payments, others one-time settlements; some have fixed amounts, others variable amounts. Chongqing University Library separates the payment stage for accurate account management. Payment information collection during this phase creates a substantial account repository, enabling statistics on total payments, completed payments, outstanding payments, and detailed tracking of each transaction.

4.4 Digital Resource Usage and Evaluation

After trial and purchase, libraries harvest metadata and usage data (downloads, searches) during access provision, enabling granular management down to the "article" level and long-term, dynamic monitoring of coverage, access status, and download counts.

5. ERMS System Design and Development

5.1 ERMS Functional Requirements

Standardized procurement processes and digital resource management practices require a complementary ERMS. Currently, most university libraries rely on manual operations for ordering and management, and while some have purchased or developed management systems, no widely suitable domestic ERMS exists [21]. Comprehensive investigation and verification of functional requirements ensure the developed system truly serves libraries and users.

Management needs research reveals that digital resources' diversity and varied procurement methods (perpetual vs. annual access rights) necessitate systematic procurement process monitoring for lifecycle tracking. As dynamic resources accessed primarily online [22], real-time maintenance is required for network congestion, server failures, and excessive downloading. Manual monitoring cannot ensure normal operation, resulting in low resolution efficiency and poor user experience. Multi-channel user access also creates discrepancies between actual usage and collected data, leading to inadequate performance evaluation and limited support for teaching and research [23].

Based on these requirements, core ERMS functions must include: (1) resource management for ordered, trial, free, self-built, and other resources, establishing

platform-sub-database hierarchies with display controls; (2) resource evaluation for trial resources with recorded opinions; (3) procurement plan management for annual plans combining renewals and new resources; (4) contract management with basic information, resource binding, and payment plan settings; (5) meeting minutes management; (6) payment management; (7) fault and update logs; and (8) statistical analysis for procurement, usage, and payment data.

5.2 ERMS Architecture and Process Design

The ERMS architecture (Figure 2 [Figure 2: see original paper]) comprises a foundational support layer, data support layer, business application layer, and user layer. Business applications include resource management, process management, procurement planning, contract management, payment management, supplier management, user permission management, and statistical management.

The ERMS procurement workflow (Figure 3 [Figure 3: see original paper]) involves: vendor trial database application submission; librarian review and trial organization; trial resource evaluation and procurement review; business negotiations; formal procurement; resource acceptance, release, usage, and maintenance; usage statistical analysis; and renewal evaluation.

5.3 ERMS Module Functions

5.3.1 Digital Resource Management

This module manages all library resources (trial, purchased, free, self-built) through platform-sub-database hierarchies, controlling front-end visibility. Basic information includes resource name, parent platform, procurement type, document type, language, tags, latest supplier, producer, contract dates, amount, description, access URL, subject, profile, details, FAQs, and guidelines. The module comprehensively manages procurement through evaluation, contract formulation, acceptance, and payment processes.

5.3.2 Database Navigation

The navigation module supports traditional database navigation for multi-database and single-database usage. Readers can filter by subject, type, procurement method, language, or alphabetically, viewing basic introductions and access URLs. Sorting options include librarian-defined order, addition date, or access popularity. The system records access counts for statistical reporting.

5.3.3 Procurement Process Management

This module manages the entire digital resource procurement cycle: trial application, trial review, procurement evaluation, procurement review, plan formulation, purchase organization, contract signing, delivery activation, acceptance, and payment. (1) Trial resources can be submitted by vendors or librarians, with vendor applications requiring review before trial. Trial analysis reports

include user trial statistics, resource operation status, and comparative analysis. (2) Recommended resources undergo final review by evaluation groups supporting single or multi-member modes. (3) Annual procurement plans incorporate renewal and new resources, with new resources requiring evaluation before inclusion. (4) Contract management tracks contract information, changes, and execution. (5) Payment management records payment plans and vouchers, providing monthly expenditure statistics, outstanding payment tracking, and annual procurement expenditure trends for budget planning.

5.3.4 User Management

This module supports multiple user management methods: administrator registration or import/synchronization from other platforms. Roles can be defined according to procurement workflows, with administrators granting or revoking permissions. For privacy protection regarding contract prices and payment information, the system limits administrator session duration, requiring re-login after inactivity.

5.3.5 Supplier Management

This module maintains supplier directories with basic information (name, region, contact details, business history). Authorized suppliers can register platform/sub-database profiles, inclusion status, trial availability, and access methods for librarian review and feedback.

5.3.6 Procurement Analysis

Resource analysis visually displays collection configuration by subject, language, and type, clarifying key discipline investments. Data analysis reports include access trends, utilization rates, per-capita usage, usage ratios, popular content, subject distribution, reader education level, and departmental distribution, enabling clear understanding of resource usage.

6. Main Features and Limitations of the Information Repository-Based ERMS

Chongqing University Library's self-developed ERMS uniquely monitors electronic resources' entire lifecycle, integrates repository data, enables multi-dimensional resource disclosure, and supports refined management. Key features include:

6.1 Full Lifecycle Monitoring and Management

The ERMS workflow reflects complete lifecycle supervision: trial application, trial review, procurement evaluation, procurement review, plan formulation, contract management, delivery activation, acceptance/payment, maintenance/monitoring, and efficiency analysis. Automated monitoring provides real-time status checks, abnormal state alerts, and maintenance logs for daily updates and incidents.

6.2 Big Data Integration of Repository Data

Supply data provides encyclopedic information for most databases, establishing resource-supplier connections. Procurement data records acquisition details and behavioral support data, creating procurement archives. Account data tracks expenditures, provides fund alerts, and intelligently calculates database costs. Metadata enables granular resource feature management. These four data types integrate through ERMS to form big data collections supporting scientific decision-making.

6.3 Multi-Dimensional Resource Disclosure

ERMS supports database navigation, journal navigation, and article-level navigation through data analysis and clustering, enabling multi-dimensional classification displays and integration with off-campus remote access systems to match reader usage data from multiple angles, improving both user convenience and resource utilization efficiency.

6.4 Areas for Improvement

After more than a year of operation, the system has enhanced procurement transparency and continuity while reducing librarian subjectivity. However, limitations remain: (1) While evaluation considers inclusion status, journal rankings, and trial statistics, separate evaluation indicator systems for different database types are lacking; (2) The platform lacks integration with consortium platforms like the Digital Resource Acquisition Alliance of Chinese Academic Libraries (DRAA), requiring duplicate work between consortium trials and local system management.

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Author Contributions:

Wang Ying: Designed the research framework and wrote the paper;

Yang Xinya: Revised portions of the content.

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

Source: ChinaXiv — Machine translation. Verify with original.