Comparative Study on the Development of National Standards for Electronic Resources between China and the United States: Methodology and Status Quo (Postprint)

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Abstract

[Purpose/Significance] Through a comparative study of Chinese and U.S. national standards for electronic resources, this research identifies the developmental advantages and deficiencies of China's existing electronic resource standards and specifications, understands and learns the specific work processes of advanced industrial standards and specifications, and provides references for the construction of China's electronic resource standards and specifications, thereby promoting industrial development. [Methods/Process] By introducing the methodology of the Sino-U.S. University Libraries Joint Project "Comparative Study of Chinese and U.S. National Standards for Electronic Resources" and the national standards for electronic resources of both countries, this paper expounds on the development status of the system architecture, formulation principles, content, standardization organizations, update and maintenance, and internationalization levels of Chinese and U.S. electronic resource standards and specifications, and conducts preliminary analysis. [Results/Conclusion] Summarizing the developmental characteristics of national and industry standards for electronic resources in China and the U.S., this paper proposes that if China's electronic resources industry is to achieve substantial development, it must firmly embrace the concept of parallel development of innovative standards/specifications and industrial development, allowing standards and specifications to become one of the foundations for promoting industrial development, leading the industry's progress, and improving industrial development efficiency.

Full Text

Preamble

Comparative Study on the Development of National Standards for Electronic Resources in China and the United States: Methodology and Current Status

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Abstract

[**Purpose/Significance**] This study conducts a comparative analysis of national standards for electronic resources between China and the United States, identifying strengths and gaps in China's current standardization efforts while examining the operational workflows of advanced industry standards. The findings provide reference points for developing China's electronic resource standards and promote industrial development. [**Method/Process**] Through the methodology of the joint China-U.S. academic library project "Comparative Study on National Standards for Electronic Resources" and an overview of relevant standards in both countries, this paper examines the architecture, development principles, content, standardization organizations, maintenance protocols, and internationalization levels of electronic resource standards. [**Result/Conclusion**] The study summarizes development characteristics of national and industry standards in both countries, concluding that China's electronic resources industry must embrace parallel development of innovative standards and industrial growth. Standards should serve as foundational infrastructure that guides industry development and enhances productivity.

Keywords: electronic resources, standards and recommended practices, China-U.S. comparative analysis, China-U.S. academic library collaborative research
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Electronic resources, in their broadest sense, refer to digital information resources encompassing all content produced and distributed in digital formats—including text, images, audio, and video—stored on media such as hard drives, magnetic tapes, and optical discs, or transmitted via networks. The International Federation of Library Associations and Institutions (IFLA) defines them in its 2012 *Key Issues for e-Resource Collection Development: A Guide for Libraries* as materials accessed via computers, whether through PCs, mainframes, or mobile devices, either remotely via the internet or locally. Common types include e-journals, e-books, full-text (aggregated) databases, indexing and abstracting databases, reference databases (biographies, dictionaries, directories, encyclopedias), numeric and statistical databases, electronic images, and audio/video files [1].

In networked environments, ensuring the discoverability, usability, reusability,

interoperability, and shareability of electronic resources requires unified standards for description, publishing, service provision, management, preservation, and exchange. These standards constitute essential "soft infrastructure" for sustainable resource development in the big data era. For publishers and libraries, where electronic resources dominate user access and digital library collections, standardization has become a critical consideration and foundational guarantee.

Recognizing this need, China's Academic Library & Information System (CALIS) and the Digital Resource Acquisition Alliance of Chinese Academic Libraries (DRAA) partnered with the U.S. Council on East Asian Libraries (CEAL) to launch the "Comparative Study on National Standards for Electronic Resources" project. Involving over 30 librarians from more than 10 prestigious universities across China and North America, the project received support from China's National Social Science Fund. Its objectives include: (1) translating and analyzing U.S. national standards for electronic resources, (2) examining their implementation, and (3) comparing Chinese and American standards to provide references for China's electronic resources industry and library resource development.

The Chinese team, led by CALIS and DRAA, includes Peking University Library, Xi'an Jiaotong University Library, Renmin University Library, Capital Normal University Library, Xiamen University Library, and Shenzhen University Library. The U.S. team, coordinated by CEAL's Task Force on Metadata Standards and Best Practices for East Asian Electronic Resources (CEAL ERM-B), comprises UC San Diego Library, Claremont Colleges Library, UC Berkeley Library, California State University Fresno Library, Columbia University Library, University of Hawaii at Manoa Library, University of Oregon Library, New York Public Library, Yale University East Asia Library, University of Victoria Library, Ohio State University Library, University of Illinois at Urbana-Champaign Library, University of Minnesota Library, University of British Columbia Asian Library, University of Alberta East Asia Library, and the World Bank/IMF Library. Hong Kong University librarians also participate as CEAL ERM-B members.

The research proceeds in four phases [Figure 1: see original paper]. This paper presents findings from the first two phases, introducing the current state and research methodology of national electronic resource standards in both countries.

1. Methodology for Comparative Study of China-U.S. Electronic Resource Standards

1.1 Framework Based on Electronic Resource Lifecycle

Standards are documents developed through standardized processes via consensus, providing rules, guidelines, or characteristics for activities and their results [2]. National standards represent the highest level, typically applied across industries, institutions, and regions, and approved by national standard-

ization authorities. Industry standards rank below national standards but may be elevated to national status through approval, receiving formal designations including codes, sequence numbers, and publication years.

Electronic resource standards align closely with resource lifecycle stages. Based on digital curation lifecycle theory [3], electronic resource development encompasses: acquisition/creation, processing/description, publishing/dissemination, service/discovery, exchange/transfer, management/statistics, and long-term preservation. From an industry perspective, these processes involve information publishing, information services, and information technology sectors.

Our research framework addresses: (1) lifecycle-based standardization content, (2) cross-industry national standards with priority on U.S. NISO standards and Chinese standards from the National Information and Documentation Standardization Technical Committee, National Library Standardization Technical Committee, National Press and Publication Standardization Technical Committee, and National Information Technology Standardization Technical Committee, and (3) relevant industry standards.

1.2 Research Process

Following this framework, the project conducts systematic research on specific standards:

1. Translate NISO standards related to electronic resources, publishing them on CALIS, DRAA, and CEAL websites with NISO authorization.
2. Apply comparative analysis to examine China-U.S. standards, including U.S. standard implementation.
3. Evaluate both systems and recommend select U.S. standards for Chinese industry adoption.

The framework and process are illustrated in [Figure 1: see original paper].

This applied research aims to: (1) deepen understanding of China-U.S. standard implementation through comparative analysis, (2) facilitate Chinese standard development by introducing U.S. models to address gaps and support internationalization, (3) promote scientific industry development by identifying and resolving issues across the resource lifecycle, and (4) strengthen China-U.S. academic library cooperation. For North American libraries, promoting these standards improves discovery and use of East Asian resources, increasing ROI. For Chinese libraries, the research evaluates standard effectiveness and provides developmental references.

2. Current State of U.S. Electronic Resource National Standards

2.1 Robust Standardization Organizational Structure

U.S. electronic resource standards originate from three sources: (1) International Organization for Standardization (ISO) and IFLA international standards, such as the Digital Object Identifier System (ISO 26324:2012) [4]; (2) NISO national standards and recommended practices, which dominate the landscape; and (3) industry standards from ALA, IEEE, W3C, and the Library of Congress, such as MODS [8].

ANSI, legally authorized by the U.S. government, accredits standards developers, with NISO being ANSI-recognized for information industry standards [9]. NISO standards thus apply across libraries, publishing, software development, and information services, with all ecosystem stakeholders participating in development.

NISO has published approximately 38 electronic resource standards, mostly since 2010 [10]. Some are resource-specific (e.g., NISO RP-16-2013 PIE-J: Presentation and Identification of E-Journals), while others adapt from print or general information standards (e.g., NISO RP-17-2013 Institutional Identification). Notably, 11 standards have undergone multiple revisions, demonstrating high update frequency.

2.2 Rapid, Mature Standard Development

Development Pace: NISO's organizational structure enables responsive standardization that keeps pace with industry growth. Proposals typically emerge from libraries, publishers, or software developers. For example, the KBART recommended practice originated with the UK Serials Group in 2007 [11]; the Open Discovery Initiative came from Ex Libris and industry managers in 2011 [12]; and Demand-Driven Acquisition was proposed by librarian Michael Levine-Clarke in 2012 [13]. Multiple working groups operate simultaneously, such as current projects on altmetrics and the Flexible API Framework for E-content in Libraries.

Content Distribution: The 38 standards span the resource lifecycle, with most focusing on processing/description (e.g., PIE-J) and exchange/transfer (e.g., RP-21-2013 IOTA: Improving OpenURLs Through Analytics). Long-term preservation standards remain limited, though PREMIS from the Library of Congress helps fill this gap [15]. Content distribution is shown in [Figure 2: see original paper].

Completion Rate: Of 38 standards, 31 are complete (82% completion).

Currency: NISO standards undergo periodic review every 5-10 years, with some under continuous review. Withdrawn standards are archived for five years before removal.

Impact: Many standards have gained traction in China, including the Dublin Core Metadata Element Set (ANSI/NISO Z39.85-2012), DOI Syntax (ANSI/NISO Z39.84-2005(R2010)), and OpenURL Framework (ANSI/NISO Z39.88-2004(R2010)). Table 2 lists key NISO standards recommended by this project.

3. Current State of Chinese Electronic Resource National Standards

3.1 Multiple Standardization Organizations, Abundant Standards

China's electronic resources industry began in the 1970s, with commercial databases like Wanfang and CNKI emerging in the 1990s. Standardization research started in the 1990s, with major initiatives like the "Digital Library Standards" project launched in 2002 by the National Science and Technology Library, Chinese Academy of Sciences, CALIS, and the National Library.

Unlike the U.S., China lacks a single NISO-equivalent organization. Four bodies develop electronic resource standards:

1. **National Information and Documentation Standardization Technical Committee** (est. 1979): Nearly 100 standards, including those in Table 3.
2. **National Library Standardization Technical Committee** (est. 2008): Focuses on library management and services, with standards listed in Table 4 [20].
3. **National Press and Publication Standardization Technical Committee** (est. 2007): Oversees publishing standards (Table 5).
4. **National Information Technology Standardization Technical Committee** (est. 1983): Over 1,200 IT standards, some resource-related [21].

3.2 Rapid Industry Standard Development, Need for More National Standards

Characteristics:

1. **Practical, demand-driven development:** Industries actively develop and apply standards to meet operational needs.
2. **International alignment:** China tracks and adopts international standards, such as GB/T 25100-2010 (Dublin Core) and GB/T 27702-2011 (Z39.50).
3. **Comprehensive coverage:** Standards address acquisition, processing, publishing, discovery, management, preservation, and exchange.
4. **Lack of cross-industry coordination:** Multiple bodies develop overlapping standards with poor interoperability. For example, three different e-book metadata standards exist (Table 6), with varying semantic structures (single-element vs. element-plus-qualifier). While all map to Dublin

Core, conversion inevitably loses data, reducing interoperability.

5. **Few universal national standards:** Compared to NISO's cross-industry standards, China has few GB-numbered national standards that apply across sectors.
6. **Need for internationalization:** While localizing international standards, China must also internationalize its own to enhance competitiveness and global recognition.

China's digital publishing revenue reached 572.085 billion RMB in 2016 (29.9% growth) [22], underscoring the urgent need for cross-industry, lifecycle-wide national standards.

Conclusion

China and the U.S. share fundamental goals of demand-driven development and international alignment, but differ significantly in organizational structure, content, cross-industry coordination, stakeholder participation, and update frequency. The U.S. system is more mature and stable.

For China's electronic resources industry to thrive, it must adopt parallel development of standards and industry, transforming the "standards lagging behind industry" paradigm. Standards should become foundational infrastructure that guides and regulates industry development, not merely documents past practices. The "Comparative Study on National Standards for Electronic Resources" project addresses this need through systematic comparative research, case studies, and evaluation of standard implementation to provide actionable references for China's standardization efforts and industrial advancement.

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Author Contributions

Xiao Long: Conceptualized the outline, drafted, revised, and finalized the manuscript.
Bie-hwa Ma: Co-authored Section 2, reviewed and proofread the manuscript.
Deng Shi: Co-authored Section 2, reviewed and proofread the manuscript.

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Abstract: [Purpose/significance] This paper aims at conducting a comparative study of national standards of electronic resources in China and the United States, analyzing the strengths and drawbacks in developing national standards in China, studying the mechanism and operational process for developing well-accepted and implemented standards in the United States, and further discussing what experiences China can draw from good practices in the United States to advance the standardization of electronic resources industry. [Method/process] Through the discussion of the methodology of a joint project of academic libraries in China and the United States: China-U.S. Comparison Study on national Electronic Resource Standards and Recommended Practices, and an environmental scan of current national standards of electronic resources in the two countries, this paper discusses standards' governing institutions, organizational structure, principle, contents, review/updating, maintenance, and internationalization, and provides preliminary analysis. [Result/conclusion] In light of the experience and characteristics in the development of national standards of electronic resources in China and the United States, this paper concludes that to ensure a healthy and steady development of the electronic resources industry, China needs to introduce the concept of parallel development of industry standardization and industry further advancement, and change the practice of "the development of standards lags behind of the development of industry". The industry needs to make standards and best practices the real fundamental basis, to lead to a more healthy development and more effective production.

Keywords: electronic resources, standards and recommended practices, China-U.S. comparative analysis, China-U.S. academic library collaborative research

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