

Accelerating Smart Library Development and Smart Service Capacity Building: A Review of the Second Academic Symposium on Smart Libraries and Smart Services

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Abstract

Purpose/Significance: This paper systematically summarizes and distills the expert viewpoints from “The 2nd Smart Library and Smart Services Academic Symposium,” promoting smart library construction and enhancing smart services capabilities, and pointing out the direction for the development of smart libraries. **Method/Process:** It interprets the content of reports from 10 experts, analyzes their perceptions and main viewpoints on smart libraries and smart services, and distills the essence and trends of smart libraries and smart services. **Results/Conclusion:** Smart libraries and smart services constitute a continuously developing process, requiring further clarification of the construction requirements and pathways for smart libraries, and a proper grasp of their development trends.

Full Text

Accelerating Smart Library Construction and Smart Service Capacity Building—A Review of the “Second Smart Library and Smart Services Academic Symposium”

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Abstract

[Purpose/Significance] This paper systematically summarizes and distills the expert perspectives presented at the “Second Smart Library and Smart Services

Academic Symposium” to advance smart library construction and enhance smart service capabilities, thereby charting a clear direction for smart library development. [Method/Process] We analyzed the presentations of ten experts, examining their understanding of smart libraries and smart services while extracting key concepts and emerging trends. [Results/Conclusion] Smart libraries and smart services represent an ongoing evolutionary process that requires further clarification of construction requirements and pathways, along with a firm grasp of future development trends.

Keywords: smart library, smart services, digital resources, intelligent technology

Following the first “Smart Library and Smart Services” symposium held in Hangzhou in 2017, the *Library and Information Service* magazine and Beijing Edusoft Education Technology Co., Ltd. jointly organized the “Second Smart Library and Smart Services Academic Symposium” online on October 27, 2022. The conference invited experts and scholars engaged in smart library research and practice to share their practical progress and academic achievements in this field, attracting over 200 participants from across the country.

Smart libraries represent a crucial development model and trend for libraries. During the 14th Five-Year Plan period and beyond, libraries, archives, and information institutions at all levels must anchor their development in smart library construction, transitioning from traditional and digital libraries to intelligent and smart libraries, while simultaneously evolving from conventional library services to smart services. At the core of smart libraries lies smart services—intelligent knowledge services delivered to users with the support of intelligent technologies. The caliber of smart services will ultimately determine the developmental capacity of smart libraries. Consequently, how to provide users with high value-added smart services within the smart library architecture constitutes a critical issue that libraries must currently research and plan.

Professor Chu Jingli, Director of the Department of Library, Information and Archives Management at the University of Chinese Academy of Sciences and Editor-in-Chief of *Library and Information Service*, delivered a report titled “Smart Libraries: From Understanding to Practice.” Research Librarian Yang Xinya, Director of Chongqing University Library, presented on “The Data Architecture of Smart Libraries.” Professor Shao Bo, Deputy Director of Nanjing University Library, spoke on “Smart Library Construction Progress and R&D Direction Selection—A Case Study of Nanjing University.” Researcher Zhang Zhixiong, Deputy Director of the National Science Library, Chinese Academy of Sciences, addressed “Research on the Technical Framework of Smart Libraries.” Associate Research Librarian Huang Di from Shanghai Jiao Tong University Library discussed “Academic Resource Maps: From Data-Driven to Data Fusion.” Liu Xiaodong, Product Director of Beijing Edusoft Education Technology Co., Ltd., presented on “The MRMS Multimedia Resource Management System and Smart Library Practice.” Wei Ming, Product Director of Chongqing VIP Intelligence Data Technology Co., Ltd., spoke about “Data Governance Solutions

for Smart Libraries.” Researcher Xia Cuijuan from Shanghai Library addressed “Smart Services for Multimodal Cultural Heritage Resources: From Accessibility to Experiential Engagement.” Research Librarian Wu Xu, Director of Beijing University of Posts and Telecommunications Library, discussed “Intellectual Property Information Services in University Libraries Driven by Smart Transformation.” Li Ning, Head of the Technology Department at Southwest Jiaotong University Library, presented on “Exploration and Practice of Smart Library Service Platforms—A Case Study of Southwest Jiaotong University Library.”

2. The Relationship Between Smart Library Concepts and Intelligent Technology

Professor Chu Jingli conceptualized smart libraries as an advanced library form dedicated to achieving intelligent knowledge services through human-machine interaction coupling. This evolutionary path progresses from physical paper-based libraries to digital mobile libraries and ultimately to intelligent smart libraries, driven by dual forces of user demand and intelligent technology, with knowledge service as the fundamental goal. The essential connotation involves librarians and users leveraging technology to achieve superior service outcomes. Professor Li Yuhai proposed that smart libraries integrate the Internet of Things, big data, blockchain, and intelligent computing devices and technologies, combining professional library management with intelligent perception and computation to effectively, accurately, and rapidly provide users with needed literature, information, data, and other resources, along with deeply processed knowledge services, intelligent shared spaces, and distinctive cultural spaces—constituting an organically integrated virtual-physical library. Director Yang Xinya viewed smart libraries as a library form based on comprehensive resource digitization and information management, utilizing big data, artificial intelligence, and blockchain to achieve personalized, humanized, and proactive service systems for users (both readers and librarians). Researcher Xia Cuijuan deconstructed the term “smart” in smart libraries, emphasizing its manifestation in space, resources, and services, with particular focus on resources characterized by multimodality, rich semantics, and assetization.

Smart library construction fundamentally relies on intelligent technology support. Researcher Zhang Zhixiong categorized intelligent technologies into six major clusters: environmental perception, self-reflection, intelligent analysis, trend prediction, intelligent decision-making, and precise intervention. He constructed a core technical architecture for smart libraries comprising infrastructure, smart resources, smart spaces, smart services, and smart management layers, arguing that smart libraries can leverage various intelligent technologies to deliver high-end smart services, promote efficient and convenient resource construction, drive scenario-based and intelligent smart services, and facilitate precise and personalized library management.

3. Smart Library Construction Requirements

During smart library construction, we must properly address the opportunities and challenges presented by artificial intelligence technology, clarify construction objectives and basic requirements, strengthen knowledge and smart services, ensure continuous technological support, and tackle key issues requiring resolution. Throughout this process, the value of librarians becomes increasingly evident. Smart libraries, empowered by AI technology, should comprehensively enhance electronic resource management, streamline the entire workflow of data organization, cataloging, and curation, and provide diverse smart service scenarios and capabilities—representing the developmental direction for smart library construction and R&D. Smart libraries constitute a comprehensive transcendence of digital libraries and a new blue ocean for library development, requiring continuous practical exploration. Construction should prioritize demand and service-driven smart service enhancement, capability and effectiveness-oriented goals, human-centered design concepts, big data technology-supported platforms, and organic integration with higher-level smart platforms, while strengthening collaboration between libraries and technology enterprises.

4. Smart Library Construction Standards

Professor Li Yuhai elaborated on the importance of smart library construction standards, proposing a standard framework model based on exploration of standard sources. Drawing from previous standard development experience, the general path for industry construction standards aligns with the Nolan Model, representing a long-term iterative process. The primary principles involve compatibility and interoperability, multidimensional coverage, scalability, and forward-looking vision. Standard development 线索源 (clue sources) and 需求源 (requirement sources) should consider related institutions, roles, and ontological attributes, extensively incorporating needs from government departments, libraries at all levels, R&D personnel, and user groups to comprehensively formulate a smart library standard system framework covering spaces and resources. From a macro perspective, standardization work facilitates smart library development; from a role perspective, it clarifies R&D directions; from a behavioral perspective, it strengthens cooperation among participants; from an efficiency perspective, it reduces construction costs; and from a competitive perspective, it enhances industry discourse power.

Currently, China's smart library construction is burgeoning with numerous issues requiring urgent resolution, while relevant standard systems remain unformed. The construction and development of smart library standards require joint research and discussion among library professionals nationwide.

5. Smart Library Infrastructure Construction

Infrastructure serves as the pillar of smart library construction, encompassing information and communication infrastructure, information platform construc-

tion, and public space intelligentization. Researcher Xia Cuijuan systematically analyzed smart service scenarios—including digital humanities research, digital memory exhibitions, cultural-tourism integration services, and open data competitions—from three dimensions: accessibility, verifiability, and experiential engagement, advocating for infrastructure that supports the integration, generation, and development of digital-intelligence evidence. Director Li Ning, building on analysis of existing digital library service problems, explored the foundational conditions and strategic thinking for smart library service platform construction. Using Southwest Jiaotong University Library's platform as an example, he introduced a deployment model driven by data, based on data construction, aimed at data services, and balancing efficiency with security. He concluded with future development planning, noting that smart library construction represents long-term work requiring measured, phased, and orderly progress under limited funding and personnel, prioritizing core data system and basic architecture development while striving for comprehensive, high-quality data.

6. Smart Library Data Resource Construction

Smart libraries represent a reconstruction process of libraries through “information technology, digital thinking, and smart objectives,” with data serving as the foundation. Director Wei Ming introduced VIP's smart library data governance framework across five layers—resources, management, data, services, and users—aiming to build data centers and establish data systems for smart libraries. He elaborated on data governance solutions and application cases from perspectives including data warehouses, data harvesting, data standards, data quality monitoring, and data marts. For instance, algorithm-empowered data and comprehensive data quality monitoring systems can provide decision-support analytical tools for literature resource construction and user service optimization. Data intelligence constitutes the first gateway to smart libraries, which require richer and more granular data. Director Yang Xinya proposed prioritizing enhanced capabilities in centralized data management, datafication of literature resources, application of behavioral data for smart service perception, collaborative knowledge base construction, and analysis of zero data, transforming data into useful information to elevate library capabilities through informatization.

Focusing on data resource construction in the academic domain, Associate Research Librarian Huang Di explored academic resource maps as a beneficial smart library initiative, introducing their origins and characteristics. He detailed academic resource integration across four dimensions: journal data fusion, book data fusion, conference proceedings fusion, and disciplinary resource fusion, concluding that academic resource maps ultimately aim to integrate and precisely locate literature resources, tools, and data to support the entire research workflow.

7. Smart Service Platform Construction

Library service platform construction requires coordinated planning and rational deployment as a key work priority, with platforms supporting everything from digital resource integration and application to user reception and feedback. Director Liu Xiaodong noted that new digital resource construction must address platform stability, content review security, long-term resource preservation, and unified cataloging standards. In response, Edusoft developed the MRMS multimedia resource management system, leveraging years of database construction experience to build dozens of multimedia digital resource collections and establish a complete workflow encompassing digital resource collection, processing, and management. To actively address smart library construction challenges, the company built a service platform capable of preserving native and innovative digital resources, institutional special collections, and integrated full-media digital resources, supporting smart libraries through new digital resource construction, special collection management systems, personalized service platforms, and knowledge mining and graph technologies.

In digital spaces, work authentication and rights protection constitute issues that cannot be ignored. Director Wu Xu analyzed existing problems in digital copyright development, detailing intellectual property service practices at Beijing University of Posts and Telecommunications under data factor empowerment. Using an intelligent authorization system as an example, he demonstrated blockchain applications in work deposit, copyright registration, and rights confirmation review. He introduced the construction of a collaborative innovation system for university library intellectual property information public services, outlined a national key R&D project on digital product intellectual property protection and its blockchain-based rights management platform features and advantages, and proposed establishing a sound university copyright protection system and a “copyright + AI” and “copyright + blockchain” protection mechanism.

Director Li Ning, analyzing digital library service environments and conditions, identified areas for reflection in data management and service application, such as fragmented data lacking integration and linkage, various data types scattered across cloud and local environments, and unified service architectures that complicate coordinated management. He noted that new-generation library service platforms feature integrated paper-electronic-digital asset management, big data warehousing, deeply nested academic discovery, microservices architecture, open platforms, and data sharing. Through smart library service platform construction, libraries gain more tools to optimize resource and business systems, thereby providing higher-quality, more efficient, and smarter services to users.

Since 2019, the industry has discussed upgrading to next-generation library platforms, primarily focusing on librarians, readers, directors, and inter-library cooperation. Professor Shao Bo analyzed the evolution from library service platforms (LSP) to knowledge service platforms (KSP), using Nanjing University's

next-generation library service platform (NLSP) to deeply 解析 (analyze) development priorities, including smart library business processes, three-dimensional knowledge resource integration, knowledge service ecosystem upgrading, and three supporting guarantee systems: evaluation, standards and norms, and research and talent cultivation.

8. Smart Library Development Trends

Digital-intelligence empowerment has become a consensus for library development and smart library construction. Drawing on Nanjing University Library's extensive practical experience, Professor Shao Bo noted that reconstructing the literature and information resource guarantee system remains a key issue in smart library construction. Smart libraries should comprehensively enhance electronic resource management based on robotics R&D and knowledge service platform construction, providing more smart service scenarios and capabilities. Future development trends include building smart library standards and norms systems, accelerating technology integration, strengthening practical application integration, focusing on information security, and improving service effectiveness.

This conference comprehensively presented China's smart library research and practice progress, identified key issues in smart libraries and smart services, and provided valuable references for research and construction. Through academic exchanges and intellectual collisions among experts and participants on smart libraries and smart services, the symposium promoted effective integration of theoretical and practical perspectives, facilitated the application of smart data, smart services, and intelligent technologies in smart library construction, and will undoubtedly further advance China's smart library development and smart service innovation.

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

Source: ChinaXiv – Machine translation. Verify with original.