

# Research on Innovation in AI-Driven Research Services for University Libraries

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**Abstract**—Against the dual backdrop of educational digital transformation and the deep integration of artificial intelligence technology, university libraries, as the core hub of academic information infrastructure and knowledge services, are undergoing a transition from "resource repositories" to "intelligent knowledge service centers." Based on the dual-wheel drive concept and drawing on practical cases from university libraries both domestically and internationally, this paper systematically analyzes the transformative value of AI technology in research services, reveals core issues such as resource integration barriers and supply-demand mismatches in current service models, constructs a four-dimensional innovative service model encompassing resource, technology, service, and ecosystem layers, and proposes implementation pathways and safeguard strategies. This study provides theoretical references and practical guidance for enhancing university libraries' research support capabilities and fostering the cultivation of new high-quality productivity.

**Keywords**— Artificial Intelligence, University Library, Research Service Model, Knowledge Service, Service Model Innovation.

## I. INTRODUCTION

With breakthrough advancements in generative AI, knowledge graphs, natural language processing, and other technologies, the research paradigm in higher education is undergoing digital and intelligent transformation. Researchers increasingly demand precise, personalized, and end-to-end knowledge services. The Steering Committee for Library and Information Work in Higher Education Institutions under the Ministry of Education emphasizes that libraries, as the core hub of knowledge services, must leverage technological innovation as a driving force to build an open and collaborative intelligent service system, injecting new momentum into the construction of an education powerhouse [1-6]. Currently, over 500 university libraries across China have initiated intelligent transformation practices. For instance, the Shanghai Jiao Tong University Library collaborated with Chaoxing Group to develop AI agents and proprietary knowledge bases, while Tianjin Agricultural University launched an AI librarian named "Sixiaoyuan" with agricultural expertise. By deeply integrating AI technology with research services, these initiatives shift service models from passive responses to proactive empowerment, providing a practical foundation for innovation in research service paradigms.

On the international level, libraries in European and American universities have been exploring AI applications for some time. Harvard University Library has developed a machine learning-based document recommendation system, while the University of Cambridge has created an intelligent research data analysis platform, focusing on the contextual

integration of technology and services. A university library in Canada collaborated with Sigtica to leverage Baidu PaddlePaddle's OCR and Wenxin large model to process 70,000 legal contracts spanning 60 years in Ontario, building a legal research portal. This enables researchers to perform cross-document clause retrieval and trend analysis in seconds, revolutionizing traditional legal research models.

Domestic research has experienced explosive growth in recent years. The Shanghai Jiao Tong University Library has launched a legal AI knowledge base and an AI librarian named "Jiao Xiaoshu," with the former leveraging the DeepSeek large model to establish a trusted knowledge barrier and the latter enabling instant searches of millions of collections and cutting-edge trend analysis. Tianjin Agricultural University has introduced the third-generation AI librarian "Sixiaoyuan," which integrates agricultural specialty collection data to support precise literature retrieval and policy analysis for disciplines such as crop breeding and veterinary medicine. The Shenzhen Technology University Library has introduced the Scopus AI academic database, whose built-in agents can consolidate patent, literature, and experimental data to help researchers uncover "hidden connections" within disciplines. Meanwhile, the University of Science and Technology Beijing Library has systematically taught doctoral students the application techniques of AI tools in literature review and thesis writing through "embedded classroom" instruction. Existing research primarily focuses on the application of single technologies, lacking systematic studies on service model reconstruction, particularly in the areas of "AI+HI" collaborative mechanisms and ecosystem development, where further refinement is needed.

## II. THE EXISTING PROBLEMS OF AI DRIVEN SCIENTIFIC RESEARCH SERVICES IN UNIVERSITY LIBRARIES

### A. Resource level: Integration barriers and credibility crisis

#### (1) Insufficient cross domain integration

Fragmentation of disciplinary resources and inconsistent formats result in low quality training data for AI models, and a lack of standardized mechanisms for cross institutional data sharing. Although Tianjin Agricultural University's "Sixiaoyuan" integrates multiple platform resources, there are still obstacles to the cross sharing of agricultural research data with other disciplines, and similar problems are common in most university libraries.

#### (2) Insufficient credibility of knowledge

The general large-scale model has the problem of illusion, and the accuracy of academic resources is difficult to guarantee.

The practice of Shanghai Jiaotong University building authenticity barriers through proprietary knowledge base construction has not yet been widely adopted, and some universities directly use generic models to provide services, resulting in a lack of academic authority in their responses.

(3) The development of special collections lags behind

The digitalization level of precious literature is low, and there is a lack of intelligent analysis tools. Although the development cases of special collections in Canadian universities have demonstrative value, most domestic libraries have not yet formed a similar "old literature AI activation" model, and the scientific research value of special collection research has not been fully released.

*B. At the technical level, there is insufficient application shallowness and adaptability*

(1) The scene fusion is not deep enough

It mostly stays in basic scenarios such as consultation response and book recommendation, and has less application in deep scenarios such as literature review generation and scientific research data mining. A survey conducted by the Library of Beijing University of Science and Technology shows that although most doctoral students have been exposed to AI tools, their application in core research areas is still insufficient, reflecting a disconnect between services and core research needs.

(2) Lack of technological adaptation

Some museums blindly introduce general AI models without customized training based on disciplinary characteristics. The success of "Sixiaoyuan" at Tianjin Agricultural University is attributed to specialized training in agricultural data, while some comprehensive universities have applied universal models, resulting in insufficient analysis accuracy of scientific research data in science and engineering fields.

(3) Security risks are highlighted

The risks of AI model bias and scientific research data leakage coexist. Although 'Sixiaoyuan' ensures security through local encrypted storage, most libraries have not yet established a comprehensive AI service security audit mechanism, and there are loopholes in data lifecycle management.

*C. Service level: Supply and demand mismatch and mode solidification*

(1) Delayed demand perception

Traditional services rely on users actively seeking help and lack precise perception mechanisms based on behavioral data. Cheng Jinhua, the director of Shanghai Jiaotong University Library, pointed out that some libraries' AI services have failed to accurately capture the implicit needs of researchers, and the phenomenon of supply-demand mismatch is still prominent.

(2) Service paradigm solidification

Still focusing on resource provision, it has not transformed into a "smart delivery" style customized service. The personalized push model based on user behavior data has not yet become mainstream at Shenzhen University, and most of the AI recommendations in the library are still at the level of generalization.

(3) Lack of evaluation system

Lack of multidimensional evaluation indicators covering resource performance, user interaction, and librarian growth makes it difficult to quantify the research contribution of AI services. Although Scopus AI can improve research efficiency, there is a lack of evaluation methods for its specific contributions in terms of output and patent conversion.

*D. Ecological level: Lack of collaboration and capability gaps*

(1) Insufficient cross subject collaboration

The collaborative mechanism of government, industry, academia, research and application has not yet been formed, and the construction of open knowledge alliances lags behind. Although the cooperation between Shanghai Jiao Tong University and Chaoxing Group is representative, the number of similar deep collaboration cases is limited, and there are obvious barriers to resource and technology sharing.

(2) Insufficient ability of librarians

Traditional librarians lack AI technology literacy, and the role of "technology intermediaries" is ambiguous. The library of Beijing University of Science and Technology needs to provide specialized training to teachers and students on the skills of using AI tools, reflecting the lack of technical ability among librarians themselves.

(3) The digital divide exists

Some teachers and students lack awareness and ability to use AI services, resulting in uneven coverage of technological dividends. Although Tianjin Agricultural University has launched "Sixiaoyuan", the utilization rate of elderly teachers and grassroots researchers still needs to be improved.

III. INNOVATIVE CONSTRUCTION OF AI DRIVEN RESEARCH SERVICE MODEL IN UNIVERSITY LIBRARIES

*A. Overall framework: "Four dimensional integrated" intelligent service model*

Based on the "AI+HI" dual wheel drive concept, an innovative model covering the resource layer, technology layer, service layer, and ecosystem layer is constructed, and each dimension forms a dynamic closed loop through data flow and feedback. The resource layer is the foundation, the technology layer is the engine, the service layer is the core, and the ecosystem layer is the guarantee, jointly supporting the transition from a "knowledge warehouse" to an "academic brain".

*B. Innovative design in core dimensions*

1. Resource layer: Building a trustworthy and integrated knowledge resource system

(1) Intelligent cataloging and metadata generation

Adopting metadata warehousing management technology, integrating various types of resources such as paper and electronic literature, special collections, and scientific research data, and establishing a cross institutional "resource blockchain". AI uses natural language processing and deep learning techniques to automatically extract information such as literature topics, keywords, and abstracts, greatly improving cataloging efficiency and accuracy.

(2) Construction of proprietary knowledge base

Integrate with trusted big models such as DeepSeek and build proprietary knowledge bases based on disciplines. By integrating with professional models, the authenticity of academic content is ensured, and this model can be replicated in other disciplines such as medicine and engineering.

(3) Special Tibet Intelligent Development

Implementing the "AI Activation of Old Literature" project, utilizing image recognition and natural language processing techniques to explore knowledge associations in special collections of literature. Based on text recognition, structured analysis using large models can maximize the scientific research value of special collection resources.

(4) Fine grained processing of resources and knowledge graph

Support multimodal data fusion, achieve fine-grained processing and semantic correlation of resources, and construct a literature resource system with wide coverage and higher efficiency.

(5) Digitization and Content Management

AI driven technologies such as OCR, handwriting recognition, and video content analysis accelerate the digitization and intelligent management of paper and multimedia resources, enriching the content of digital collections.

2. Technical layer: Build a collaborative and customized technical support platform

(1) Basic Technology Platform

Integrate NLP, knowledge graph, computer vision and other technologies to build a school level AI platform. The AI technology support system provided by Chaoxing Group for multiple schools has lowered the technical application threshold through the "plug and play" open-source paradigm, and can serve as a reference model for the construction of the middle platform.

(2) AI literacy and talent cultivation

The library strengthens the introduction and training of AI professionals, enhances the AI literacy of librarians and users, and conducts training on data ethics and privacy protection.

(3) Subject Intelligence Module

Customize technical tools to meet the needs of different disciplines. Science and engineering can refer to Scopus AI's data analysis module to achieve association mining between patents and experimental data; Humanities and social sciences can draw on the intelligent system of legal documents to develop text deconstruction and trend analysis functions.

(4) Security guarantee system

Establish data collection storage usage lifecycle security management. Establishing a sound data security management system, using encryption technology, institutional constraints, and user empowerment to ensure data security, can effectively prevent data leakage and sensitive information dissemination risks.

(5) Technological iteration and service collaboration

The library strengthens its collaborative cooperation with the government, enterprises, and communities, promotes new organizational models such as smart services and innovative service working groups, and achieves the miniaturization and intelligence of business processes.

3. Service layer: Creating a full chain, personalized research service matrix

(1) Intelligent consulting services

The library has deployed AI chatbots to provide 24-hour online service, which can automatically answer common questions, collect user information, and support self-service business processing, greatly improving service efficiency and user satisfaction.

(2) Empowering the entire scientific research process

Provide cutting-edge trend analysis during the topic selection stage, such as Scopus AI's cross domain hotspot recognition; Provide literature review generation and data mining during the research phase, such as clause analysis for legal document systems; Provide patent navigation during the achievement stage, such as the achievement transformation docking service of Shenzhen University of Technology.

(3) Personalized recommendation and precise knowledge push

Based on user behavior data, AI systems can accurately push relevant academic resources and customized information, achieving personalized and intelligent knowledge services. Practice has shown that personalized recommendations based on disciplinary background and research direction can significantly improve literature utilization, and this model needs to be embedded in AI librarians and database systems.

(4) Discipline Knowledge Graph and Intelligent Retrieval

AI technology supports the construction of disciplinary knowledge graphs, helping users efficiently navigate complex information and achieve fine-grained data mining and multi-dimensional knowledge association.

4. Ecological layer: Building an open and collaborative development ecosystem

(1) Cross subject collaborative network

Initiate an Open Knowledge Alliance to collaborate with universities, enterprises, and research institutions to share resources and technologies. For example, the cooperation between Shanghai Jiaotong University and Superstar Group, as well as the international projects supported by Baidu PaddlePaddle's ecology, have proved that collaborative networks can accelerate technology implementation and service innovation.

(2) Reshaping the capabilities of librarians

Building an "AI+Business" team and conducting technical training and interdisciplinary training. For example, the "classroom embedded" teaching practice in the library of Beijing University of Science and Technology is not only a way to serve teachers and students, but also a way for librarians to improve their AI literacy. A regular training mechanism should be established.

(3) Cultivation of User Literacy

Improve the AI service usage ability of researchers through practical training. For example, the AI tool series training at Shenzhen University of Technology Library and the "Sixiaoyuan" user manual at Tianjin Agricultural College can help users at different levels master AI service skills and bridge the digital divide.

IV. COUNTERMEASURES AND GUARANTEE STRATEGIES FOR INNOVATIVE MODELS

A. Countermeasures for innovative models

(1) Collaborative development, co construction and sharing  
Advocate cooperation among university library alliances, jointly develop AI service platforms, share costs, and share data and computing resources.

(2) Talent empowerment and structural transformation  
Implement the "AI Empowerment Program for Library Staff" and enhance the technical literacy of existing library staff through systematic training; At the same time, new roles such as data scientists and AI engineers will be introduced to optimize the team structure.

(3) Ethics first, standardized governance  
Develop strict 'Code of Ethics for AI Application Data in Libraries', clarify data usage boundaries, establish algorithm audit mechanisms, and ensure fairness, transparency, and interpretability of AI services.

(4) Take small steps and run quickly, iterate and verify  
Adopting the strategy of "pilot first", select one or two service points with urgent needs and obvious effects (such as intelligent Q&A) for small-scale pilot, and gradually promote them after success to reduce trial and error costs.

B. Security Strategy

(1) Institutional safeguards  
Develop AI service management measures, data security standards, and detailed rules for intellectual property protection. Clarify the "AI+HI" collaborative service process and division of responsibilities, such as the school library collaboration mechanism established by Shanghai Jiao Tong University in the construction of AI knowledge base, to provide institutional basis for service innovation.

(2) Resource guarantee  
Establish special funds for technology procurement and research and development, and establish a cross departmental resource coordination mechanism. Ensure continuous investment in the construction of proprietary knowledge bases and the operation and maintenance of technology platforms, referring to the resource allocation model introduced by Scopus AI at Shenzhen University of Technology, and balancing the proportion of procurement and independent research and development.

(3) Talent guarantee  
Implement the 'Librarian Capability Enhancement Plan' and conduct cross disciplinary training on AI technology and subject knowledge. Introduce AI technology talents and subject service experts, build a composite service team, such as the AI tool teaching team established by the Library of Beijing University of Science and Technology, to enhance service support capabilities.

(4) Evaluate the guarantee  
Establish a four-dimensional evaluation index system, covering resource performance (such as knowledge unit conversion rate), technical efficiency (such as service response time), user interaction (such as demand satisfaction rate), and librarian growth (such as technical application ability).

Regularly conducting evaluations and iterative optimizations can draw on Scopus AI's transparent evaluation method to ensure continuous improvement in service quality.

V. CONCLUSION

AI technology is driving a revolutionary change in scientific research services in university libraries, with its core values reflected in resource value reconstruction, service efficiency improvement, scientific research process empowerment, and ecological synergy construction. The legal knowledge base of Shanghai Jiao Tong University, the agricultural AI librarian of Tianjin Agricultural University, and the legal document system of Canadian universities have shown that AI technology has achieved practical results in multiple scenarios. The current service model has prominent problems such as resource integration barriers, shallow technology applications, and supply-demand mismatch. It is necessary to build a "four-dimensional integrated" intelligent service model, create a trustworthy integrated system at the resource layer, build a collaborative customization platform at the technical layer, form a full chain matrix at the service layer, and build an open collaborative network at the ecological layer. With phased implementation paths and multi-dimensional guarantee strategies, systematic innovation of the scientific research service model can be achieved. The dual wheel drive of "AI+HI" is not only the principle of technological application, but also the soul of service innovation. Only by balancing technological efficiency and humanistic care can the core value of the library be demonstrated in the academic ecosystem. Future research can further focus on the construction of AI ethical norms, innovation in cross linguistic knowledge services, and intelligent mining of special collections, providing deeper theoretical and practical support for library service innovation.

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Author's biography with Photo



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