Data-Enabled Personalized Knowledge Service Ecosystem for University Libraries: Development and Practice

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Abstract

Abstract

Purpose/Significance In the context of the current information age, knowledge demands exhibit pronounced trends of dynamism, diversity, and personalization. Against this backdrop, university library users' demand for personalized knowledge services is increasingly growing, necessitating corresponding adjustments and optimization of library service models to satisfy users' personalized requirements throughout the knowledge acquisition process. Big data, artificial intelligence, and other related technologies provide the necessary technical support for personalized knowledge services in university libraries. Personalized knowledge services characterized by data empowerment have become a critical factor driving service innovation and quality enhancement in university libraries, representing an inevitable trend in contemporary library development.

Method/Process This paper adopts data empowerment as the central theme, integrates relevant theories of knowledge ecosystems, and from a system element analysis perspective, constructs a multi-data-empowered knowledge service ecosystem framework for university libraries, while elaborating in depth on its operational logic and implementation pathways. Concurrently, it analyzes the specific practices of Shenzhen University Library as a case study, aiming to enrich and expand the practical scenarios and pathways for knowledge services in university libraries.

Results/Conclusion Through data empowerment, it achieves precise perception of user needs, effective construction and excavation of knowledge resources, design and optimization of service platforms, expansion and deepening of service modalities, and efficient mechanisms for service evaluation and feedback, thereby forming a personalized knowledge service ecosystem. The multi-data-empowered knowledge service ecosystem for university libraries not only intro-

duces innovative service models and service ecology to university libraries but also, on the foundation of comprehensive data and intelligence, assists university libraries in innovating personalized knowledge service systems, providing valuable reference and practical guidance for the future development of library services.

Full Text

Research on the Construction and Practical Exploration of Data-Enabled Personalized Knowledge Service Ecosystem in University Libraries

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Abstract

[**Purpose/Significance**] In the current information age, knowledge demands exhibit pronounced characteristics of dynamism, diversity, and personalization. Against this backdrop, university library users' need for personalized knowledge services is growing exponentially, requiring corresponding adjustments and optimization of library service models to meet individualized needs throughout the knowledge acquisition process. Big data, artificial intelligence, and other emerging technologies provide essential technical support for personalized knowledge services in university libraries. Data-enabled personalized knowledge services have become a critical driver for service innovation and quality enhancement in university libraries, representing an inevitable trend in contemporary library development.

[**Method/Process**] This paper takes data empowerment as its central theme, integrates theories of knowledge ecosystems, and constructs a multi-data-enabled knowledge service ecosystem for university libraries from a system element analysis perspective. It elaborates on the operational logic and implementation pathways of this ecosystem, using the specific practices of Shenzhen University Library as a case study to enrich and expand practical scenarios and approaches for knowledge services in university libraries.

[**Result/Conclusion**] Through data empowerment, the ecosystem achieves precise perception of user needs, effective construction and mining of knowledge resources, intelligent design and optimization of service platforms, expansion and deepening of service modalities, and an efficient service evaluation and feedback mechanism, thereby forming a comprehensive personalized knowledge service ecosystem. This multi-data-enabled knowledge service ecosystem not only introduces innovative service models and ecological frameworks to university libraries but also, built upon a foundation of full-spectrum data and intelligence, empowers libraries to innovate their personalized knowledge service systems,

providing valuable reference and practical guidance for the future development of library services.

Keywords: university libraries; big data; data-enabled; personalized knowledge services; knowledge ecosystem

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1 Introduction

The disciplinary diversity and interdisciplinary nature of university library user communities have significantly transformed users' knowledge structures and demands. Modern users expect far more than traditional document retrieval and circulation services; they increasingly seek personalized and precision-oriented knowledge services. The rapid development of internet, big data, and artificial intelligence technologies has positioned data as a revolutionary production factor, offering innovative perspectives and implementation methods for library personalized knowledge services. Through efficient collection and processing of large-scale user data, libraries can accurately grasp user needs, understand information search behaviors, and train AI tools to deliver efficient services. By leveraging advanced technologies to effectively organize and mine resource data, libraries can provide more personalized and precise knowledge services. Through analysis and deep utilization of service statistics, libraries can effectively evaluate service quality and optimize both services and platforms. With the advent of the AI-Generated Content (AIGC) era, the democratization of algorithms and computing power has made data ownership, governance, and deep insight critical factors for library service innovation.

Thus, data has become the core element and innovation driver of library personalized knowledge services. However, in the process of data utilization, most university libraries face numerous challenges, including fragmented management and application of user personalized data and service statistics; monolithic approaches to organizing and mining resource data; and insufficient integration of data acquisition, analysis, and utilization processes with advanced technological tools. These issues affect the precision of user need identification, the granularity of resource organization, and the depth of aggregation, thereby severely limiting the implementation effectiveness and innovation potential of personalized knowledge services. Based on these challenges, this paper employs the ternary model of knowledge ecosystems as its theoretical foundation to systematically analyze the multidimensional roles of data in personalized knowledge services, explore the operational logic of data-enabled personalized knowledge

service ecosystems, and provide reference for university libraries to optimize and innovate personalized knowledge services in the new era through practical analysis.

2 Literature Review

Knowledge service is a concept that exists across numerous professions and disciplines. In the domestic library and information science field, knowledge service was first proposed in 1983 when Mr. Zhuang Ziyi explicitly defined the core of library work as "knowledge service." Since then, knowledge service has attracted widespread academic attention and gradually developed into an important research direction in library and information science. Zhang Xiaolin subsequently proposed the concept of knowledge service as services based on the search, organization, analysis, and reorganization of information and knowledge, integrated into users' problem-solving processes according to their problems and contexts, to effectively support knowledge application and innovation.

2.1 Research on Personalized Knowledge Services

Scholars have conducted in-depth research on personalized knowledge services, which can be categorized into four main dimensions. First, technical-level research has explored various technologies including Portal technology, RSS technology, cloud computing, semantic web, intelligent aggregation technology, heterogeneous network embedding methods, and knowledge graphs for application in personalized knowledge services. Second, research targeting specific user groups has focused on particular populations such as hearing-impaired students, teachers, and users from different professional backgrounds. Third, studies on innovative service modalities have examined various approaches including "knowledge butler" services, knowledge service platform construction, new media channels, and personalized service strategies based on knowledge discovery, knowledge mapping, knowledge management, and context awareness, along with investigations into user needs, behaviors, market cultivation, and brand effects of personalized knowledge services. Fourth, research on personalized knowledge service model construction has explored models based on user needs, user profiles, artificial intelligence technology, user behavior data, research tracking, knowledge management, knowledge discovery, social networks, and mobile terminals. These studies provide theoretical foundations and practical guidance for constructing personalized knowledge service systems adapted to different user groups and application scenarios.

2.2 Research on Data-Enabled Knowledge Services

With the vigorous development of big data technology, knowledge service has evolved into an interdisciplinary field involving computer applications, data mining, artificial intelligence, statistical analysis, numerical algorithms, and other disciplines. Research on data-enabled knowledge services primarily focuses on

three aspects. First, at the technical level, studies include user profile technology, collaborative filtering algorithms, research introducing compressed sensing and blockchain technology to enhance knowledge graph data transmission and security, and data mining model construction. Second, exploration of new data-based service methods includes AI-assisted intelligent collection of user basic information and behavioral data, AI technology for optimizing acquisition workflows, automated tools like scanning robots for promoting digitization of paper resources, knowledge graphs for multi-dimensional resource revelation and presentation, AI automatic metadata retrieval and information organization standards creation, data-intensive service platform design, value-added services based on subject mapping, research on using ChatGPT to optimize library intelligent knowledge services, studies on subject knowledge services based on "small data," deep reflection and optimization of existing personalized knowledge service strategies from a zero-data perspective, and introduction of personalized data service value-added products for faculties and students at Peking University. Third, research on data-based service systems includes studies on constructing implementation paths for university library maker space knowledge services based on user profiles, application of "big data + micro-services" models in university library knowledge services, construction of frameworks for university library data resource value-added services, research on library personalized service solutions based on user behavior modeling and big data mining, and studies on ubiquitous library personalized knowledge service models based on cloud computing technology.

Through literature review, we find that although current research has explored library personalized knowledge services from multiple data-based perspectives, no study has systematically examined data's enabling role across the entire personalized knowledge service process—from user need perception and knowledge resource construction to platform design optimization, service modality expansion, and efficient evaluation feedback—from a knowledge ecology perspective. Ecological theory provides a comprehensive framework for analyzing interactions within complex systems, helping to understand the interdependence and synergistic effects among elements in personalized knowledge services. Moreover, ecological theory emphasizes dynamic balance and adaptability within systems, enabling libraries to flexibly adjust service strategies amid rapid technological changes to accommodate evolving user needs. The openness and interconnectivity characteristics of ecological theory also encourage libraries to consider cross-disciplinary and cross-domain resource integration and knowledge sharing when constructing knowledge service systems. This paper adopts this theoretical perspective to systematically explore how effective data management, organization, and analytical application can drive the entire process of library personalized knowledge services.

3 Construction of Data-Enabled Personalized Knowledge Service Ecosystem in University Libraries

In the 1990s, George Pór, founder of the Community Intelligence Laboratory in the United States, first introduced ecological principles into knowledge management, proposing the concept of knowledge ecosystems. As a crucial hub for knowledge dissemination and sharing in universities, libraries can significantly enhance knowledge utilization efficiency and value through an ecological perspective that promotes knowledge integration and coordination. Based on George Pór's general model of knowledge ecosystems—the ternary network model—this study constructs a theoretical framework for library personalized knowledge services. The model comprises three elements: people network, technology network, and knowledge network, which intertwine to form cross-connections that facilitate knowledge value generation. This model aligns closely with the objectives of library personalized knowledge services, namely achieving deep development and effective utilization of knowledge value through interaction and support among system elements and activity subjects.

[Figure 1: see original paper]

3.2 Construction and Element Analysis of Personalized Knowledge Service Ecosystem

Based on the knowledge ecology ternary network model, this paper constructs a personalized knowledge service ecosystem (see [Figure 2: see original paper]), where through the interaction of the three elements—people network, knowledge network, and technology network—libraries can precisely analyze and grasp users' explicit and implicit needs using technological means. This enables multilevel, networked reorganization of knowledge resources in the knowledge network, formulation of personalized service strategies aligned with user needs, and expansion and deepening of service modalities through various knowledge service platforms to provide customized knowledge services.

[Figure 2: see original paper]

In constructing the personalized knowledge service ecosystem, each element of the ternary network model plays a critical role.

3.2.1 People Network The people network consists of participants in library knowledge services, divided from a supply-demand perspective into users and librarians. As knowledge recipients, users are the core service objects, encompassing individual users and user groups that can be further categorized into management personnel, researchers, teachers, and students. In the big data context, users' knowledge needs exhibit personalized, contextualized, diversified, and dynamic characteristics, driving libraries to provide customized services. As service providers, librarians utilize data analysis tools to precisely capture user needs, achieve effective integration and supply of knowledge resources, and ensure orderly knowledge flow, forming the foundation for personalized services.

3.2.2 Knowledge Network The knowledge network constitutes the prerequisite and foundation for library services, demonstrating a trend toward three-dimensional and diversified development. It can be divided into academic resources, teaching resources, and research resources. Academic resources include paper and electronic books, journals, special collections, and other types of literature. Teaching resources encompass courseware, videos, test questions, and other instructional materials. Research resources include research literature data and research process data.

3.2.3 Technology Network The technology network encompasses various technologies related to data collection, storage, mining, organization, analysis, and machine learning, such as AI-assisted intelligent collection technology, intelligent storage technologies like scanning robots, data organization technologies like knowledge graphs, as well as user profile technology, intelligent search technology, and artificial intelligence technology.

Through the interaction of these three elements, libraries can construct a dynamic, interconnected personalized knowledge service system that meets users' evolving knowledge needs and drives library service innovation and development.

3.3 Operational Logic and Implementation Pathways

3.3.1 Operational Logic In the library domain, knowledge service-related data primarily falls into three categories: resource data, user personalized data, and service statistics data (see). Under the support of data technologies, these three data types play crucial roles in constructing and operating the personalized knowledge service ecosystem. Through five implementation pathways—data-enabled user need perception and analysis, knowledge resource mining and organization, service platform design and optimization, service modality expansion and deepening, and efficient service evaluation and feedback—data empowerment facilitates knowledge interaction among the three elements and knowledge integration within each element. This process not only optimizes personalized service strategies but also improves personalized service methods, effectively enhancing the overall level of personalized knowledge services.

[Figure 3: see original paper]

3.3.2 Implementation Pathways (1) Data-Enabled User Need Perception and Analysis

The core of personalized knowledge services lies in emphasizing user-centricity, with transformative significance in revealing and satisfying users' implicit needs to maximize demand fulfillment. At the group level, by categorizing university library users into management personnel, researchers, teachers, and students, and employing big data technology for in-depth data collection and analysis, libraries can identify similarities and differences among user groups. Based on this, user needs can be summarized into four categories: decision support,

research assistance, teaching application, and learning facilitation, enabling customized knowledge service solutions for each user group.

At the individual level, with the widespread application of intelligent sensing devices and smart terminals, combined with big data mining, intelligent information processing, and artificial intelligence technologies, libraries can collect and analyze vast amounts of personalized user data. For instance, human-computer interaction systems can record and feedback needs during user interactions; context-aware and intelligent sensing devices like wearable devices and sensors expand data collection channels to include reader locations, movement trajectories, and dwell time; and intelligent search technologies such as visual search and semantic search help deeply understand users' information retrieval habits.

By integrating various types of personalized user data, libraries can accurately perceive users' explicit and implicit needs, design and provide targeted knowledge products and services, and achieve precision and efficiency in personalized knowledge services.

(2) Data-Enabled Knowledge Resource Construction and Organization

With the development of data technology, libraries can gradually achieve diversification of forms and efficiency improvements in resource construction and organization. In resource construction, libraries can employ automated tools like scanning robots for digitizing paper resources. For example, Cambridge University Library, Harvard University Library, and Microsoft Online Library use the Kabis scanning robot, which utilizes vacuum adsorption technology and simulated human page-turning actions to achieve high-speed, non-destructive scanning processes at speeds up to 3,300 pages per hour. Additionally, AI software can automatically collect and update open resources to build specialized databases, further enriching libraries' digital resources.

In resource organization, libraries can transcend traditional subject-based and Chinese Library Classification systems by leveraging big data, semantic web, content mining analysis, and artificial intelligence technologies for fine-grained processing, deep aggregation, and sequential organization of resources. Through visualization technologies and knowledge graphs, libraries can reveal and present knowledge content from multiple dimensions, enabling users to quickly locate information resources, discover new knowledge, and deeply understand relationships among knowledge elements. For example, AI automatic extraction technology can automatically identify entities and relationships to achieve intelligent knowledge graph construction.

(3) Data-Enabled Service Platform Design and Optimization

The application of big data technology provides strong support for the intelligent upgrading of library knowledge service platforms. For instance, Zhejiang University Library's My Library system achieves personalized information push services by deeply analyzing user behavior patterns and preferences, thereby en-

hancing user experience personalization and interactivity. Additionally, the National Science Library's "My Digital Library" system provides customized knowledge service products by comprehensively analyzing users' knowledge needs, information needs, and problem contexts. The system's intelligent upgrade is reflected not only in personalized services but also in user consultation response mechanisms. For example, when users raise inquiries, the system can automatically recommend relevant references and materials using advanced information retrieval and recommendation algorithms, significantly improving information acquisition efficiency and accuracy. Data-enabled service platform design and optimization encompasses user behavior analysis, intelligent recommendation system construction, service response speed improvement, knowledge discovery and linking enhancement, interactive service design improvement, security and privacy protection, and continuous service evaluation and feedback mechanisms. These measures collectively aim to improve user experience, ensure data security, enhance service timeliness, accuracy, and user satisfaction, thereby achieving efficient knowledge service delivery and library service model innovation.

(4) Data-Enabled Service Modality Expansion and Deepening

In the big data environment, technological development provides strong support for the expansion and innovation of university library knowledge service modalities, driving a transformation from traditional commonality-based, passive services to personalized, proactive services. This transformation is manifested in the upgrading of various services based on data mining, organization, analysis technologies, and artificial intelligence.

1. Data-Enabled Correlative Knowledge Retrieval Services

This service is based on deeply integrated knowledge resources, utilizing big data technology for intelligent expansion of search terms and optimization of result presentation. By constructing knowledge correlation networks such as citation networks, author association networks, and similar literature networks, the service reveals deep-level correlations among resources, promotes knowledge discovery during retrieval processes, and helps users better understand knowledge development trajectories. For example, Tsinghua University Library collaborates with Baidu to provide intelligent retrieval services using AI technology. The system can intelligently identify search terms, automatically search relevant literature, and provide recommendation services, significantly improving retrieval efficiency and accuracy.

2. Data-Enabled Precision Knowledge Navigation Services

Traditional library navigation services are typically based on simple attribute classifications such as alphabetical order, language, and discipline categories. Big data technology enables more precise matching of deep-level attributes and semantic associations among resources with automatic updating and crawling, providing new perspectives for precision knowledge navigation. For example, Jinan University Library launched an intelligently updated college digital library that dynamically integrates college-related database resources, services, train-

ing lectures, and academic developments, providing users with more precise navigation experiences.

3. Data-Enabled Intelligent Knowledge Consultation Services

Current university library consultation service models mainly include three categories: on-site services through face-to-face communication between librarians and users; online reference consultation services through social platforms like QQ, WeChat, and email; and AI automatic Q&A platforms based on artificial intelligence technology. By machine learning from historical questions and responses, AI Q&A accuracy can be improved, reducing librarians' workload. Examples include Tsinghua University's "Qingxiaotu," Fudan University Library's "Danxiaotu," and the "ChatLibrary AI" intelligent service platforms launched by Yunnan University Library and Chongqing Jiaotong University Library, all providing diversified reference consultation services.

4. Data-Enabled Personalized Knowledge Recommendation Services

Proactively providing comprehensive, relevant, and personalized knowledge recommendation services based on users' explicit and implicit needs represents a distinct manifestation of data-enabled library knowledge service transformation. Currently, some university libraries have begun experimenting with recommendation algorithms to provide personalized knowledge recommendation services based on users' historical data and feedback. For example, Zhejiang University Library, the National Science Library, and Cornell University's My Library system can provide personalized information push services based on readers' reading history and interests. Washington University in St. Louis's Learning Center collects students' tutoring needs, selects appropriate mentors, and pushes customized learning materials and strategies to promote students' learning ability enhancement. In the future, libraries can provide targeted knowledge recommendation services to different groups, such as pushing paper writing and research submission information to researchers; providing ideological and political education, innovation and entrepreneurship, and psychological counseling resources to student affairs teams; offering teaching resources and AI-assisted tools to faculty; and pushing information literacy training resources and industry information to students.

5. Data-Enabled Other Deep-Level Services

These include knowledge management services, data analysis services, and literacy training services. Knowledge management services involve many university libraries launching research management platforms dedicated to collecting, organizing, and developing research data for long-term preservation and sharing. Some libraries also build special collections based on typical data resources, such as various special collection databases at Peking University Library and case databases built by Beijing Institute of Technology based on academic growth materials of senior scientists.

Data analysis services refer to services that conduct deep-level analysis of data

resources using data analysis tools to provide customized products, including research output statistical analysis, discipline analysis reports, and bibliometric analysis. Some university libraries, such as Beijing Institute of Technology Library, have established specialized intelligence analysis and data analysis teams using methods and tools like PEST analysis, SWOT analysis, TDA, and SPSS to meet consultants' needs.

Literacy training services involve university libraries conducting various literacy training programs to enhance users' information literacy, data literacy, and AI literacy. Based on user feedback data and service statistics, libraries can understand training needs of different groups and provide targeted specialized training in multiple formats.

(5) Data-Enabled Efficient Service Evaluation and Feedback

Service evaluation is crucial for accurately grasping service implementation effects, identifying problems, making targeted improvements, and continuously enhancing knowledge service quality. Traditionally, libraries have mostly relied on user interviews and questionnaires to collect feedback—methods that are not only time-consuming and labor-intensive but may also fail to fully capture users' genuine feelings and evaluations. With big data technology assistance, libraries have more methods to collect user evaluation data. For example, by analyzing behavioral indicators such as dwell time, click-through rates, repost volumes, and comment counts on knowledge service products, libraries can grasp users' preferences and satisfaction levels with various services. Through statistical analysis and identity feature analysis of users participating in knowledge service activities, libraries can identify participation preferences of different user groups to design more personalized service activities. Through resource usage data, libraries can evaluate the effectiveness of various resources and optimize resource allocation and construction plans accordingly. These data-based evaluation methods not only improve evaluation accuracy and timeliness but also provide strong data support for service improvement and innovation.

4 Data-Enabled Personalized Knowledge Service Practices in Shenzhen University Library

4.1 Data-Enabled User Need Perception and Analysis

Selective Dissemination of Information (SDI) service is one of the main personalized and customized knowledge services provided by Shenzhen University Library for university departments and researchers. Through data analysis and organization of nearly 400 SDI service requests over the past two years, needs were categorized into three major types: "data support," "research support," and "decision support" (see [Figure 4: see original paper]). Data support services mainly involve statistics on paper data, patent data, ESI discipline data, university-enterprise cooperation data, and international cooperation data for different faculties and research teams, primarily serving functional departments

and research secretaries. Research support services include resource recommendations, core journal directory downloads, key laboratory patent reports, and patent novelty searches, mainly targeting individual users and research teams. Decision support services assist leadership decision-making by writing talent analysis reports, discipline analysis reports, university-wide patent analysis reports, and university-wide technology transfer case analysis reports.

Through statistical analysis of SDI service demands, the library has clarified personalized data needs of different user groups. This process not only provides a basis for optimizing personalized knowledge service strategies but also lays a solid foundation for designing functional modules of the "Shenzhen University Academic Portal." Through this data-driven analytical approach, the library can more accurately meet user needs, improve service quality, and drive innovation in knowledge services.

[Figure 4: see original paper]

4.2 Data-Enabled Knowledge Resource Mining and Organization

To promote centralized display and efficient management of research achievements, Shenzhen University has undertaken the construction of the "Shenzhen University Academic Portal," aiming to achieve one-stop aggregation and single-platform management of university research outputs. During portal construction, advanced technologies including data warehousing, data cleaning, data harvesting, and data migration were employed to thoroughly clean and systematically organize research data. The project completed multi-dimensional information matching from literature to authors, faculties, disciplines, and themes, constructing a standardized institutional knowledge dictionary and scholar achievement database (see [Figure 5: see original paper]). This process not only optimized data organizational structure but also improved data accessibility and usability, providing strong data support for decision-making and statistical analysis by university management and researchers.

[Figure 5: see original paper]

4.3 Data-Enabled Intelligent Platform Design and Optimization

4.3.1 Function Design and Optimization of "Shenzhen University Academic Portal" Through in-depth analysis of "data support" related data from SDI services over the past two years, Shenzhen University Library clarified user needs regarding data export, data source supplementation and governance, institutional and author identity attribution governance, and deep analysis of achievement data. Specific needs include export of citation retrieval templates, unmatched data export, visualization analysis result export, research evaluation data export, as well as needs for collection display, filtering, and statistical services for leading journals, key journals, Nature Index journals, and SCOPUS achievements. Additionally, there are needs for deep analysis of research themes, publication cooperation networks, and multi-disciplinary classification systems.

These analysis results provide clear direction for academic portal function optimization, ensuring the portal can better meet user needs in data support and research evaluation.

4.3.2 Function Design and Optimization of "Information Literacy Learning Platform" Given the continuous growth in reference consultation volume, Shenzhen University Library established a QQ consultation group with over 4,000 members, essentially achieving 24/7 real-time responses to user questions and receiving positive feedback from faculty and students. Through statistical analysis of consultation data, the library discovered numerous repetitive or common questions (see [Figure 6: see original paper]). Additionally, service needs varied among users of different identities: undergraduates focused more on basic library functions, master's and doctoral students preferred in-depth database usage skills training and research techniques, while faculty paid more attention to professional database usage methods, teaching resources, and research skills. To provide one-stop solutions for diverse user needs, Shenzhen University Library constructed the "Information Literacy Learning Platform," which provides solution guidance and categorized integration in micro-video and micro-graphic formats. This allows users to directly search for answers on the platform when encountering problems and enables librarians to reference platform resources during consultations or training (see [Figure 7: see original paper]). This platform construction not only reduces consultation pressure and improves work efficiency but also ensures standardized responses and provides users with a one-stop platform for autonomous information literacy enhancement.

[Figure 6: see original paper] [Figure 7: see original paper]

4.4 Data-Enabled Service Modality Expansion

Utilizing big data technology and based on data mining and analysis, Shenzhen University Library has constructed the "University Intellectual Property Innovation Service Big Data Platform." This platform provides solid technical support for service modality expansion and diversified knowledge product development. Application examples include regularly published "Shenzhen University Intellectual Property Information Briefing" and "Intellectual Property and Technology Transfer Information Briefing," as well as in-depth patent analysis reports such as "University Patent Analysis Research Report" and "White Paper on Patent Analysis of Shenzhen Universities," providing users with timely and comprehensive updates on domestic and international intellectual property developments. Additionally, relying on the platform's big data project management functions, users can customize data sets according to their needs and conduct personalized data processing to form customized data products and services.

4.5 Data-Enabled Service Evaluation and Feedback

Shenzhen University Library collects and analyzes user feedback data through multiple channels to achieve continuous service optimization and improvement. For example, by analyzing user click rates on the "Information Literacy Learning Platform," the library gains insights into user interests and needs to guide platform content iteration and updates. By analyzing click-through and forwarding rates of WeChat articles, the library optimizes article topics to improve information dissemination effectiveness. By collecting and analyzing user trial feedback and test data from the first phase of the "Shenzhen University Academic Portal," the library has made targeted improvements to portal functions to enhance user experience. This data-driven evaluation and feedback mechanism not only improves service responsiveness and adaptability but also ensures data support and scientific rigor in service improvement decision-making.

5 Conclusion

With the development of digital and intelligent technologies, diversification of user needs, and rapid evolution of the knowledge ecology environment, university library knowledge services must actively transform their service philosophy. Starting from user needs, libraries should provide personalized and precise knowledge services, achieving a transformation from "passive service" to "proactive service," "personalized service," and "intelligent service." Data-enabled personalized knowledge services bring innovative service models and ecosystems to libraries, enabling precise matching between massive, diverse data and users' personalized knowledge needs, and more effectively facilitating users' knowledge acquisition and application. In the future, with deeper development of digital-intelligence fusion technology, knowledge service manifestations will become more diversified. University libraries should seize the opportunity of service transformation, fully leverage data empowerment advantages, emphasize and strengthen the collection of diverse data, and achieve efficient management and application of data resources. Libraries need to continuously explore new methods and approaches for data-enabled personalized knowledge services to improve users' knowledge acquisition efficiency and experience, drive knowledge service innovation and upgrading, meet users' demands for high-quality knowledge services in rapidly changing knowledge environments, and provide strong support for building a knowledge-based society.

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Peng Zhaoxia: Literature review, paper writing and revision
Liu Qianxiu: Paper framework and conceptual design, paper revision
Zhong Qinghong: Paper revision

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