The Five Laws of Library Science in the Age of AI: From New Service Concept to New Functional Thinking

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Abstract: This study explores the evolution of new service concepts and functionalities in library science under the Five Laws framework during the AI era. Through systematic literature review and case analysis, it examines how AI technology reshapes library service philosophies and operational models. The research reveals that modern libraries are transitioning from passive to proactive service approaches, adopting personalized recommendations and data-driven delivery systems while strengthening user-centric strategies. Emerging features like intelligent search systems, AI-curated book recommendations, and virtual reading guides have been successfully developed. However, implementation challenges persist in technical infrastructure, staff training, and resource allocation. To address these issues, the study proposes practical solutions including technological support systems, staff competency development programs, and resource optimization strategies, providing theoretical foundations and actionable guidance for libraries navigating the AI era.

1. Introduction

1.1 The general background of the AI era

As a pivotal force in the contemporary technological revolution, artificial intelligence (AI) is penetrating every aspect of social life at an unprecedented pace. In healthcare, AI leverages deep learning algorithms and big data analytics to significantly enhance diagnostic accuracy and personalized treatment plans. In education, intelligent teaching systems provide customized learning paths based on students academic performance and knowledge acquisition. In transportation, autonomous driving technologies and smart traffic management systems have effectively optimized urban traffic flow while reducing congestion (Li Xiaochun, 2024)[1] . These applications not only revolutionize lifestyles but also redefine how information is accessed and disseminated. Against the backdrop of information overload, traditional linear search models are being replaced by intelligent, personalized recommendation systems, with user demand for efficient and precise information services growing steadily (Xu Jitian, 2017)[2].

As pivotal institutions for knowledge dissemination and information services, libraries are profoundly impacted by AI advancements. The widespread adoption of AI technologies has endowed libraries with innovative service tools, driving their evolution from traditional document storage and

lending to intelligent, digitalized operations. For instance, natural language processing-powered search systems enable precise user demand understanding, while machine learning algorithms leverage behavioral data analysis to deliver targeted resource recommendations (Li Xiaochun, 2024)[1]. Furthermore, AI has transformed library spaces from mere reading areas into integrated hubs for learning, communication, and innovation (Xu Jitian, 2017)[2]. These technological innovations in the AI era not only redefine service models but also create vast opportunities for expanding library functions and fostering creative development.

1.2 Significance of the study

Exploring the new service concepts and functionalities of the Five Laws of Library Science in the AI era holds significant importance for advancing the sustainable development of the library industry, meeting readers diverse needs, and refining the theoretical framework of library science. Firstly, from an industry perspective, the integration of AI technology has revitalized traditional libraries, enabling them to better adapt to the evolving demands of information society. By establishing intelligent service platforms and optimizing resource allocation, libraries can enhance service efficiency and quality while maintaining their public service nature, thereby strengthening their competitiveness in the knowledge economy era (Xu Jitian, 2017)[2]. Secondly, in terms of reader satisfaction, AI applications allow libraries to gain deeper insights into user behavior patterns and preferences, enabling personalized and targeted services. This user-centric approach not only boosts reader satisfaction but also stimulates academic enthusiasm, fully leveraging libraries role as core hubs for knowledge dissemination (Wang Qian, 2023)[3].

Furthermore, this study holds significant academic value for advancing library science theory. With the widespread application of AI technology in libraries, traditional library sciences five principles require reinterpretation to meet contemporary demands. For instance, the classic principle "books are for use" can be expanded in the AI era to "knowledge is for intelligent discovery," emphasizing technological means to enhance knowledge accessibility and utilization efficiency (Xu Zhengxing, 2015)[4]. Through in-depth exploration of new service concepts and functionalities, this research not only enriches the theoretical framework of library science but also provides scientific guidance for practical operations, thereby promoting the synergistic development of both theory and practice in library science.

1.3 Research Methods and Contents

This study combines literature review with case analysis to systematically examine theoretical frameworks and practical achievements of the Five Laws of Library Science in the AI era, followed by in-depth discussions. The literature review method focuses on comprehensively collecting and organizing research findings from domestic and international studies on AI applications in library science, including advancements in intelligent search, personalized recommendations, and virtual reading guidance. Through systematic analysis of existing literature, this approach identifies current research priorities and gaps, thereby establishing a solid theoretical foundation for the study (Zheng Xiuxiu, 2020)[5]. The case analysis method selects representative library practice cases, examining their specific implementations in AI technology adoption, service philosophy innovation, and functional expansion. This process summarizes successful experiences and addresses existing challenges, providing empirical support for subsequent research.

The research paper focuses on four key aspects: new service concepts, innovative functionalities, challenges faced, and corresponding strategies. First, it explores how AI technology enables libraries to transition from passive to proactive services while enhancing personalized services and user-centric philosophies. Second, the paper analyzes implementation pathways and technical support for

intelligent search systems, smart book recommendations, and virtual reading guides driven by these new service concepts. Third, it examines challenges in technological, human, and resource allocation during implementation and proposes targeted solutions. Finally, it outlines future directions for the "Five Laws of Library Science" in the AI era, providing reference points for continuous innovation and theoretical refinement in the library industry (Xu Zhengxing, 2015)[4].

2. Literature review

2.1 Traditional connotation of the five laws of library science

The Five Laws of Library Science, proposed by Indian librarian Ranganathan, form the theoretical foundation and core framework guiding library practice. The first law, "Books are for use," emphasizes that libraries should not merely collect books but focus on making collections accessible to readers, thereby maximizing the efficiency of information resources (Wang Qian, 2023)[3]. This concept is particularly crucial in traditional library environments, as the utilization efficiency of books—the primary knowledge carriers—directly determines the quality of library services. The second law, "Every reader has a book," addresses personalized needs by advocating for diverse resource development and tailored service designs to meet different readers reading requirements (Liu Yuexue, 2016)[6]. The third law, "Every book has its readers," expands the social role of libraries by requiring effective resource promotion and organization to ensure every book reaches its target audience (Wang Qian, 2023)[3]. The fourth law, "Save readers time," reflects the pursuit of service efficiency through optimized collection layouts and simplified borrowing procedures, reducing time costs for information acquisition. The fifth law, "Libraries are growing organisms," adopts a dynamic development perspective, emphasizing continuous adaptation to evolving needsTo meet the changing demands of society, sustainable development should be achieved through technological innovation and service upgrading (Liu Yue-xue b, 2016)[7]. These principles collectively form the core value system of traditional library services, which have been widely verified and applied in long-term practice.

2.2 Research progress of libraries in the AI era

With the rapid advancement of artificial intelligence (AI) technology, scholars worldwide have conducted extensive research on AI applications in libraries, focusing primarily on service philosophy transformation, new functional development, and technical implementation pathways. Regarding service philosophy, studies generally indicate that AI has driven libraries to transition from passive service models to proactive service approaches. For instance, big data-driven intelligent recommendation systems can proactively suggest personalized reading materials based on users behavioral patterns and preferences, thereby enhancing service quality and user satisfaction (Jin Jing, 2023)[8]. Additionally, AI has spurred innovations in library service models, with emerging solutions like virtual librarians and smart search systems providing more efficient information access for readers (Gao Chunling, 2013)[9]. However, existing research reveals several limitations. First, some studies overemphasize technical implementation details while neglecting deeper explorations into their transformative impact on library service philosophies. Second, there is a relative lack of systematic empirical analysis regarding the actual effectiveness of AI applications in libraries (Li Jing, 2018)[10]. Finally, research on librarian role transformation and competency enhancement in the AI era remains insufficient, particularly concerning discussions about technological adaptability and career development planning. The current research remains limited (Long Jianglan, 2012)[11]. While existing studies have achieved certain results, further exploration is needed to fully understand the impact of AI technology in libraries.

2.3 The entry point of this study

Through systematic review and comparative analysis of existing literature, it is evident that current research on libraries in the AI era predominantly focuses on single-dimensional analyses—such as technological applications or functional development—while lacking a holistic perspective that integrates new service concepts with innovative functional considerations. This study aims to bridge this gap by combining the traditional connotations of the Five Laws of Library Science with contemporary AI characteristics, exploring how libraries can achieve dual innovation in service philosophy and functional design (Liu Yu, 2020)[12]. Specifically, building upon the Five Laws framework, this research examines how AI technology is reshaping library service philosophies, including the transition from passive to proactive services, deepening personalized services, and strengthening user-centric principles (Li Jing, 2018)[10]. Simultaneously, it investigates how these new service concepts drive the expansion of library functions, such as constructing novel service models like intelligent search, smart book recommendations, and virtual reading guides(Liu Yu, 2020)[13]. Through this unique research perspective, this study not only enriches the theoretical framework of library science but also provides crucial references for practical innovation in the AI era, thereby promoting comprehensive development and transformation within the library industry (Leng Jing, 2016; Ling Dingyang, 2017)[14][15].

3. New service concepts of libraries in the AI era

3.1 From passive service to active service

In traditional library models, services primarily follow a passive approach where patrons must actively seek resources or request assistance before librarians provide corresponding support. However, with the integration of artificial intelligence technologies, libraries are transitioning from passive service models to proactive ones. The core of this transformation lies in accurately capturing and responding to reader needs through data analysis and predictive technologies. For instance, AI can build user behavior models by comprehensively analyzing readers borrowing history, browsing records, and search keywords, thereby predicting potential needs and proactively recommending relevant resources or services (Leng Jing, 2016)[14]. Furthermore, combining natural language processing and machine learning algorithms enables libraries to develop intelligent information recommendation systems that dynamically adjust service content based on real-time user demands, further enhancing service efficiency and quality (Jin Jing, 2023)[8]. This data-driven proactive service model not only significantly improves resource utilization rates but also strengthens readers reliance on library services and their satisfaction with these offerings.

Meanwhile, AI technology has empowered libraries with innovative service solutions. For instance, computer vision systems can track and analyze reader behaviors within library spaces, enabling optimized spatial layouts and resource allocation that better meet actual needs (Jin Jing, 2023)[8]. Furthermore, through voice recognition and intelligent dialogue systems, libraries provide round-the-clock consultation services where users can access information without waiting for human assistance. These technological applications allow libraries to proactively offer personalized support before readers explicitly request it, thereby truly realizing the "reader-centric" service philosophy.It can be seen that the application of AI technology not only changes the service mode of libraries, but also provides new possibilities for libraries to reposition their own value in the information society.

3.2 Personalized service and accurate push

One of the core advantages of AI technology lies in its powerful data processing capabilities and

algorithm optimization, which lays a solid foundation for libraries to achieve personalized services and precise recommendations. By conducting multi-dimensional analysis of readers reading habits, interests, and behavioral patterns, libraries can build detailed user profiles and provide tailored service content accordingly. For instance, recommendation systems based on deep learning algorithms can suggest highly relevant books or academic resources according to readers historical borrowing records and current reading interests, thereby meeting their diverse knowledge needs. Additionally, AI technology can combine time series analysis with collaborative filtering algorithms to further enhance the accuracy of recommendation results, ensuring that each reader receives content that closely aligns with their interests (Liu Yue-xue b, 2016)[7].

Beyond book recommendations, AI technology can be widely applied to precisely target library activities. For instance, by analyzing readers participation history and interest tags, libraries can push cultural events, lectures, or exhibitions tailored to specific user groups, thereby enhancing engagement and impact. Additionally, AI can provide nearby or timely activity suggestions based on readers geographical locations and time preferences, further improving service convenience and practicality. Notably, the realization of such personalized services relies on in-depth data mining and intelligent analysis. How to effectively utilize these data while ensuring user privacy remains a key challenge for libraries in practice (Liu Yue-xue b, 2016)[7].

In conclusion, AI technology has provided libraries with unprecedented personalized service capabilities, enabling them to better meet readers diverse needs. By precisely recommending books, events, and related information, libraries can not only enhance reader satisfaction and loyalty but also maintain their unique competitive edge in an increasingly competitive information environment.

3.3 The user-centered service concept is strengthened

In the AI era, libraries are transitioning from a "resource-centric" to a "user-centric" service philosophy, with technological integration and optimization being pivotal. By leveraging AI, libraries can gain comprehensive insights into user needs and implement deep-seated process improvements, significantly enhancing satisfaction and user experience. For instance, through natural language processing (NLP) and speech recognition technologies, libraries can develop intelligent customer service systems that provide round-the-clock real-time assistance. These AI-powered agents not only efficiently resolve common queries but also utilize semantic understanding to identify users latent needs, delivering proactive and personalized services (Jin Jing, 2023)[8].

Furthermore, AI technology enables libraries to develop more flexible and efficient service systems. For instance, by leveraging data analytics to monitor user behavior in real-time, libraries can dynamically adjust service strategies to promptly address emerging needs or changes (Liu Yu, 2020)[12]. Simultaneously, AI technology optimizes physical space layouts to better align with user habits. Through computer vision tracking of reader flow patterns, libraries can strategically rearrange bookshelves or create additional rest areas, thereby enhancing user convenience and comfort (Jin Jing, 2023)[8]. This demand-driven service optimization not only demonstrates libraries commitment to a "human-centered" philosophy but also earns them greater recognition and support in the digital age.

It is noteworthy that the application of AI technology is not merely about technical innovation, but requires integration with librarians professional ethics and service consciousness to maximize its value. For instance, librarians can conduct in-depth analysis of data reports generated by AI systems to refine their understanding of user needs and translate these insights into concrete service improvements (Liu Yu, 2020)[12]. This service model combining technological advancement with humanistic care not only enhances library service quality but also provides users with warmer, more personalized reading experiences. Therefore, in the AI era, libraries should fully utilize technological means to reinforce the "user-centered" service philosophy, thereby achieving sustainable

development while meeting user needs (Jin Jing, 2023)[8].

4. New functions of libraries driven by new service concepts

4.1 Intelligent retrieval function

In the AI era, libraries have significantly enhanced their intelligent search capabilities, primarily driven by the widespread application of artificial intelligence technologies in natural language processing, semantic understanding, and data analysis. Traditional library search systems typically rely on keyword matching, which, while providing some results, often fails to meet users demands for precision and efficiency. By integrating AI technologies, modern libraries can deliver more intelligent search services. For instance, natural language processing-based systems allow users to query in everyday language without being constrained by specific keywords or grammatical structures. This technological application not only improves user experience but also substantially enhances search accuracy. Furthermore, the introduction of semantic understanding technology enables search systems to deeply analyze user intent and provide context-aware recommendations. When a user searches for "books about artificial intelligence," the system not only returns directly relevant titles but also recommends materials related to machine learning and deep learning through semantic analysis (Jin Jing, 2023)[8]. These technological advancements have transformed library search systems from simple keyword-match tools into intelligent platforms capable of comprehending user needs. The intelligent platform of seeking and providing personalized services can better meet the diversified needs of readers in information acquisition.

Meanwhile, AI technology has further optimized search efficiency through data analytics and automated systems. By monitoring and analyzing user behavior data in real time, libraries can dynamically adjust search strategies to meet the needs of different user groups. For instance, using computer vision technology to track and analyze users search habits, libraries can identify frequently searched topics or fields, thereby optimizing resource allocation and indexing structures (Jin Jing, 2023)[8]. This data-driven approach not only enhances search speed but also strengthens system adaptability, enabling continuous evolution in response to changing user demands. Therefore, intelligent search functionality is not only a significant application of AI technology in the library sector but also a crucial driving force for advancing library services toward smarter and more efficient development.

4.2 Intelligent recommendation of bibliography

AI-powered recommendation systems have become a cornerstone of modern libraries digital offerings. By analyzing readers preferences, browsing histories, and book correlations, these systems deliver personalized recommendations. This functionality relies heavily on machine learning technologies, particularly collaborative filtering and content-based recommendation algorithms. Collaborative filtering works by analyzing users historical data (e.g., borrowing records and browsing history) to identify groups with shared interests, then suggests books that other like-minded readers have enjoyed. For example, if a reader frequently checks out science fiction novels, the system might recommend new releases or classics based on similar reading patterns. Content-based recommendation algorithms, meanwhile, assess metadata (title, summaries, author) and text content to calculate book similarities, then suggest related titles (Liu Yue-xue b, 2016)[7]. The combination of these two approaches allows smart recommendation systems to balance personal preferences with book characteristics, delivering more accurate and diverse suggestions that resonate with readers.

Furthermore, intelligent recommendation systems can enhance the quality and timeliness of recommendations through real-time updates and dynamic adjustments. For instance, the system can

promptly adjust its recommendation strategies based on readers latest reading behaviors or feedback, ensuring content consistently aligns with their interests. By integrating natural language processing and speech recognition technologies, libraries can also provide more convenient interaction methods, such as voice commands for searching book catalogs or retrieving book summaries (Jin Jing, 2023)[8]. This user-centric design philosophy not only boosts reader engagement but also significantly elevates the personalization and intelligence of library services. Ultimately, developing and applying intelligent book recommendation systems not only helps meet readers diverse needs but also opens new possibilities for optimizing library resources and facilitating knowledge dissemination.

4.3 Virtual guide function

The virtual reading assistant represents an innovative application of AI technology in library services. By creating intelligent guides to provide reading guidance, book analysis, and related support, it significantly enhances the reading experience. This technology primarily relies on advanced solutions including natural language processing (NLP), speech synthesis, and knowledge graphs. For instance, NLP enables the assistant to interpret reader queries and deliver natural responses, helping users efficiently access information. Simultaneously, speech synthesis allows voice interactions, creating a multimodal communication approach that not only aligns with human communication patterns but also delivers intuitive and convenient service experiences (Jin Jing, 2023)[8].

Furthermore, the virtual reading guide function leverages knowledge graph technology to conduct in-depth analysis of book content, offering readers comprehensive and detailed interpretation services. For instance, when readers inquire about a books core viewpoints or author background, the virtual guide can swiftly retrieve relevant information through knowledge graphs and present it in structured formats. This knowledge graph-based interpretation service not only enhances readers understanding of the content but also stimulates their reading interest, promoting deeper knowledge dissemination (Jin Jing, 2023)[8]. Notably, the virtual reading guide demonstrates high flexibility and scalability. By continuously learning and updating its knowledge base, the virtual guide adapts to diverse book interpretation needs and optimizes service quality based on reader feedback. Therefore, this virtual reading guide not only represents a significant innovation of AI technology in library services but also provides new directions for intelligent and humanized development of future library services.

5. Challenges in implementing new service concepts and functionalities

5.1 Technical challenges

In the AI era, libraries face particularly prominent technical challenges when implementing new service concepts and functionalities. First, data security and privacy protection have become one of the most urgent core issues to address. With AI technology extensively collecting and analyzing user behavior data, libraries need to process massive amounts of sensitive reader information, including reading preferences, borrowing records, and search histories. Any leakage of such data would severely infringe on readers privacy rights and potentially trigger legal disputes and trust crises (Jin Jing, 2023)[8]. Moreover, the stability and reliability of AI technologies pose significant obstacles. For instance, the implementation of intelligent recommendation systems and virtual reading guidance functions relies on complex algorithm models. However, these models may produce inaccurate outputs due to insufficient data quality or algorithmic biases in practical applications, thereby affecting user experience and service effectiveness. Simultaneously, libraries must cope with the pressure of rapid technological iteration, ensuring that adopted AI technologies can continuously adapt to evolving technical environments and service demands.

To effectively address these challenges, libraries must implement multi-layered technical safeguards. On one hand, they should enhance the application of data encryption technologies and access control mechanisms to reduce data leakage risks. On the other hand, establishing a robust security audit system is crucial—this involves regular monitoring and evaluation of system operations to promptly identify and fix potential vulnerabilities (Jin Jing, 2023)[8]. Additionally, libraries need to focus on improving the robustness of AI technologies by adopting hybrid intelligent algorithms and optimizing data cleaning processes, thereby enhancing system resilience against interference and decision-making accuracy. However, these technological improvements often require substantial resource investment and demand strong technical R&D capabilities from libraries, which undoubtedly further complicates implementation at the technical level.

5.2 Challenges at the personnel level

Beyond technical challenges, librarians face significant hurdles in adapting to new technologies. The AI era has fundamentally transformed library services, with traditional passive approaches being replaced by proactive recommendations and personalized services – demands that elevate professional requirements. Many librarians, lacking digital literacy and technical expertise from conventional work experiences, struggle to adapt to emerging technologies. For instance, operating intelligent search systems or maintaining virtual reading platforms requires programming skills and data management capabilities – competencies that pose substantial learning barriers for some staff members.

Secondly, the transformation of service philosophy poses a significant challenge for librarians. In traditional library environments, librarians primarily function as resource managers and service providers. However, in the AI era, they must prioritize user needs and utilize technological means to deliver precise, personalized services. This paradigm shift from "resource-centric" to "user-centric" not only requires librarians to develop stronger user awareness but also necessitates continuous adjustments in their working mindset and methods during daily operations (Long Jianglan, 2012). Nevertheless, some librarians may resist change due to ingrained mindsets or professional burnout, hindering the effective implementation of new service philosophies.

To address these challenges, libraries should develop systematic training programs to enhance librarians technical proficiency and service philosophy. For instance, they could organize specialized workshops and practical exercises to teach staff the fundamentals and operational skills of AI technology. Simultaneously, librarians should be encouraged to participate in cross-departmental collaborations and industry exchanges, which will broaden their perspectives and boost innovation capabilities[1]In addition, library management should also pay attention to the psychological state of librarians. By setting up incentive mechanism and career development channel, librarians learning enthusiasm and reform motivation can be stimulated, so as to lay a solid foundation for the smooth implementation of new technologies and new ideas.

5.3 Resource challenges

At the resource level, challenges in capital investment, equipment upgrades, and digital infrastructure development cannot be overlooked. First, implementing AI technologies and deploying smart devices requires substantial financial support, posing significant pressure on library budgets. For instance, building intelligent search systems demands high-performance servers and storage solutions, while developing virtual reading guidance features necessitates heavy investments in algorithm development and interface design (Zheng Xiuxiu, 2020)[5]. However, many libraries—especially small-to-medium public libraries and university libraries—face tight budgets that struggle to cover these costly technological investments. This funding gap not only limits the adoption of new

technologies but may also cause libraries to lag behind in their digital transformation efforts.

Secondly, the development and integration of digital resources remain a critical bottleneck for libraries implementing innovative service concepts and functionalities. With the advancement of AI technology, libraries need to consolidate diverse digital assets—including e-books, academic papers, and multimedia materials—to support features like intelligent recommendations and virtual reading guides. However, the varying format standards and technical interfaces among different resource providers often complicate and prolong the integration process (Li Jing, 2018)[10]. Furthermore, copyright issues pose additional challenges for libraries. When acquiring and utilizing third-party resources, institutions must strictly comply with relevant laws and regulations to avoid legal risks arising from infringement.

To overcome resource limitations, libraries need to adopt flexible strategies. On one hand, they should rationally allocate funds to prioritize projects crucial for service enhancement, such as upgrading smart search systems or developing virtual reading guidance platforms. On the other hand, libraries can reduce operational costs by collaborating with other institutions to share technologies and resources. For instance, university libraries could jointly develop AI applications with campus IT departments, while public libraries might partner with local cultural institutions to build regional digital resource repositories (Li Jing, 2018)[10]. Additionally, libraries should actively seek government support and community donations through special funding applications or public welfare initiatives, thereby broadening funding channels and ensuring sufficient resources for implementing new technologies and features.

6. Strategies to meet challenges

6.1 Technical response strategies

In the AI era, libraries face particularly prominent technical challenges when implementing new service concepts and functionalities. Data security and privacy protection remain paramount concerns, especially given the widespread collection and analysis of user behavior data. Ensuring sensitive information remains unexposed has become a critical issue. To address this, strengthening the application of data encryption technologies proves essential. By adopting Advanced Encryption Standard (AES) and Transport Layer Security (TLS), data security during storage and transmission can be effectively guaranteed (Jin Jing, 2023)[8]. Additionally, establishing comprehensive security audit mechanisms is indispensable. Through real-time monitoring and periodic review of system operation logs, potential security threats can be promptly identified and addressed, thereby enhancing the overall systems protective capabilities.

Meanwhile, the stability and reliability of AI technology require equal attention. As library services depend on complex algorithmic models and automated systems, any technical failure could lead to service disruptions or degraded user experience. Therefore, enhancing the robustness of AI systems has become an urgent priority. On one hand, redundancy designs and fault-tolerant mechanisms can be implemented to strengthen the systems anti-interference capabilities. On the other hand, continuous integration and deployment (CI/CD) processes should be utilized to regularly update and optimize the system, ensuring it remains in optimal operational condition (Jin Jing, 2023)[8]. Furthermore, integrating artificial intelligence with expert systems can partially compensate for AIs limitations in specific scenarios, thereby improving the accuracy and reliability of its decision-making.

In conclusion, by enhancing data encryption, establishing secure audit mechanisms, and optimizing the stability and reliability of AI technologies, libraries can lay a solid technical foundation for implementing new service concepts and functionalities. These measures not only help address current technological challenges but also provide crucial references for future technological innovations.

6.2 Personnel training strategy

In the AI era, librarians are transitioning from traditional document managers to knowledge service providers, which raises higher demands for their technical capabilities and service philosophies. To adapt to this transformation, systematic technical training has become crucial. First, libraries should develop detailed training programs covering artificial intelligence fundamentals, data analysis tool usage, and intelligent system operations to equip librarians with essential skills. Second, organizing specialized lectures and workshops where industry experts share cutting-edge technological trends and practical experiences can broaden librarians knowledge horizons. Additionally, encouraging librarians to participate in online learning platforms like Coursera or edX through relevant courses allows them to enhance technical proficiency in a flexible manner.

Beyond technical training, the transformation of service philosophy is equally crucial. Librarians must shift from the traditional "resource-centered" mindset to a modern "user-centric" approach. This requires them to prioritize uncovering and fulfilling user needs in daily operations. To achieve this, libraries can organize internal exchange activities that facilitate knowledge sharing and creative discussions among staff, thereby stimulating innovative thinking (Long Jianglan, 2012). Simultaneously, encouraging librarians to participate in user research and feedback analysis helps them gain deeper insights into readers actual requirements and translate these into concrete service improvements. This practice-based learning approach not only enhances librarians service awareness but also elevates their comprehensive capabilities.

In conclusion, through technical training and organized exchange programs, librarians can achieve dual improvements in both technical competence and service philosophy, thereby better adapting to the demands of the AI era. These strategies not only help address current personnel challenges but also cultivate a high-quality talent pool for the long-term development of libraries.

6.3 Resource optimization strategy

In advancing the implementation of innovative service concepts and functionalities in libraries, resource-related challenges demand equal attention. Funding allocation and equipment upgrades stand as pivotal issues. With the rapid advancement of AI technology, libraries must continuously adopt cutting-edge hardware and software systems to support emerging features like intelligent search and virtual reading guidance. However, substantial costs often become a bottleneck for institutional development. Therefore, strategic budget planning proves essential. Libraries should establish dedicated funds within annual budgets to fund technological innovation and equipment upgrades, prioritizing projects that directly enhance service quality (Zheng Xiuxiu, 2020)[5]. Additionally, diversifying funding sources through government grants, social donations, and corporate partnerships can help alleviate financial pressures.

Meanwhile, the development and integration of digital resources constitute a crucial aspect of resource optimization. In the AI era, library services have expanded beyond traditional print materials, evolving toward digital and multimedia-oriented models. This transformation makes enhancing digital resource development and integration an essential imperative. Libraries can diversify their digital collections through self-built databases or partnerships with third-party organizations. Furthermore, leveraging big data technologies and semantic analysis tools enables in-depth mining and correlation analysis of existing resources, thereby improving utilization efficiency (Li Jing, 2018)[10]. Additionally, strengthening collaborations with other libraries, universities, and research institutions to establish shared resource platforms serves as an effective strategy for optimizing resource allocation. Such initiatives not only reduce operational costs for individual institutions but also achieve complementary resource distribution and synergistic effects.

In conclusion, through strategic funding planning, enhanced collaboration with partner

organizations, and optimized digital resource allocation, libraries can effectively support the implementation of innovative service concepts and functionalities. These measures not only help overcome current resource constraints but also establish a solid foundation for sustainable development in the library sector.

7. AI Development prospect of five laws of library science in the era

7.1 Continuous innovation of service concept

With the continuous evolution of artificial intelligence technology, library service concepts are undergoing profound transformations. Future libraries may transcend traditional knowledge dissemination functions, gradually expanding into emotionally-oriented services and cross-domain integrated services. Emotionally-focused services emphasize using AI to capture readers emotional needs, delivering more human-centered experiences. For instance, through natural language processing and affective computing technologies, libraries can develop intelligent chatbots that not only answer inquiries but also sense readers emotional states, offering psychological support or reading recommendations. Moreover, cross-domain integrated services will become a key trend in library innovation. By combining AI with multidisciplinary knowledge, libraries can establish collaborative platforms providing comprehensive services across education, healthcare, and cultural fields. For example, partnering with medical institutions, libraries could utilize AI algorithms to analyze health data and recommend relevant health management books or courses, achieving deep integration of knowledge services with real-world needs (Jin Jing, 2023)[8]. This innovative service philosophy not only enhances libraries social value but also lays a solid foundation for their sustainable development in the AI era.

7.2 Further expansion of functions

With the support of AI technology, libraries will further expand their functions, particularly in intelligent space construction and knowledge innovation services. As a crucial development direction for future libraries, intelligent spaces aim to optimize physical and virtual environments through sensing technologies, data analysis, and automated systems, providing readers with more efficient and personalized service experiences. For instance, libraries can utilize computer vision technology to track and analyze reader behaviors, thereby optimizing spatial layouts and resource allocation. Meanwhile, through natural language processing and speech recognition technologies, libraries can develop intelligent search and recommendation systems to help readers quickly find books and materials they are interested in (Jin Jing, 2023)[8]. Additionally, knowledge innovation services will become one of the core areas for library function expansion. Supported by AI algorithms, libraries can build knowledge innovation platforms to facilitate the explicit transformation of tacit knowledge and knowledge circulation. For example, by analyzing readers reading histories and preferences, libraries can customize recommended book lists for each user while encouraging collaborative creation and knowledge sharing, thereby promoting knowledge innovation and dissemination (Xu Zhengxing, 2015)[4]. The introduction of these new functions not only enhances library service efficiency but also elevates their role in the knowledge society.

7.3 Influence on library science theory and practice

The evolution of the Five Laws of Library Science in the AI era has significantly propelled theoretical refinement and practical innovation. Theoretically, these laws have been reinterpreted with fresh dimensions in the digital age, particularly through the lens of smart services, where their core

principles have undergone expansion and restructuring. For instance, the "books are for use" principle has been redefined in smart services as a pathway from knowledge acquisition to practical application, emphasizing how intelligent creativity drives knowledge innovation and circulation (Xu Zhengxing, 2015)[4]. Furthermore, the "library as a growing organism" law finds deeper expression in the digital era, where libraries achieve dynamic development and optimized resource allocation through AI integration and innovative service models (Ling Dingyang, 2017)[15]. Practically, AI technology provides libraries with novel service pathways and tools to better meet diverse user needs. Smart search systems and recommendation algorithms significantly enhance service efficiency and satisfaction, while virtual reading guides enrich readers engagement and experience (Jin Jing, 2023)[8]. This fusion of theory and practice not only expands library science research but also drives practical advancements in library operations. The future development of the industry points the way.

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