

Integrated Cultivation Paths of Archivists' Professional Competence and AI Literacy in the Digital-Intelligent Era

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Abstract: Digital intelligence technology deeply penetrates the entire archives business process, and archive information services and users' archive-searching behavior have undergone a fundamental transformation, making it difficult for archivists to meet users' diversified and personalized information needs with their single occupational competencies. This paper draws on the core theories of supply and demand matching and service subject competence in Information Service and User Research, combines them with the reality of archive industry transformation, reconstructs the framework of composite vocational competence for archivists in the era of digital intelligence, bases it on the goal of optimizing user information service, and proposes an integration path in five dimensions, namely, ideological guidance, hierarchical training, practical implementation, system improvement, and cultivation of security ethics, to cultivate archive composite talents suitable for the intelligent service scenario and promote the high-level upgrading of archive information services.

Keywords: Digital Intelligence Era; Archivist; AI Literacy; Archival Information Services; User Needs

1. Introduction

1.1 Research Background and Problem Statement

With big data and artificial intelligence widely used in daily archival work, the industry has entered an intelligent development phase. Working alongside intelligent tools has changed what archivists do and their core job roles. Instead of only taking care of physical archives and handling in-person visitor requests, they now also take charge of data management and various smart service work. The core idea of information service research lies in keeping archivists

abilities aligned with users' ever-changing information demands [1]. This theoretical viewpoint lays a solid foundation for the analysis framework adopted in this paper.

As archives move forward with digital upgrades, a noticeable gap has formed between available service capacity and actual user needs. Many archive workers find new tech hard to grasp, and the training programs offered by their institutions rarely fit the real work they do every day. Most staff feel uncomfortable using these new tools and even anxious, and the old set of job skills simply cannot keep up with today's smart archive service requirements. Current papers have discussed archivist abilities, AI related skills, and intelligent archive tools separately, yet few studies combine professional expertise and digital know how as a whole. They also fail to design training plans based on different groups of users and only provide vague suggestions without actionable talent cultivation plans. This paper addresses these gaps with focused analysis and research.

1.2 Research Significance

As digital transformation moves forward, archives keep accumulating more and more materials. Smart tools are now used across every step from filing to document search and resource access, which greatly cuts down repetitive manual work for archive staff. However, this also brings multiple challenges, such as talent capability transformation, data security, and algorithm ethics [2]. This paper focuses on the realistic pain points in talent development within the archival industry, analyzes the intrinsic logic of integrating archivist professional skills with AI literacy, and constructs a comprehensive cultivation and implementation pathway. On a theoretical level, enrich research on the digital competency of archival talent, addressing the current gap in which existing studies focus more on technology and less on service supply-demand matching; on a practical level, provide directly applicable solutions for archives

at all levels to enhance staff digital skills and optimize intelligent archive services, supporting the archive industry in upgrading from digitalization to intelligence.

2. Theoretical Framework for the Integration of Professional Competencies and AI Literacy of Archivists in the Era of Digital Intelligence

2.1 The Transformation Logic of Archivists' Professional Competencies under Intelligent Digital Transformation

In the traditional archival work environment, archivists' skills are focused on practical tasks such as organizing archives, archival storage management, offline borrowing, and basic retrieval, with a relatively narrow skill set. As we enter the digital and intelligent development stage, archival service scenarios are continuously expanding, and the needs of the service population are becoming more diverse. The original skill set can no longer keep up with the industry's development pace.

Following the widespread adoption of intelligent technology, the industry has begun exploring comprehensive competency standards for archivists. Existing research generally suggests that archivists need to build a multi-layered, cross-disciplinary competency system that includes professional knowledge, digital practical skills, a strong sense of professional ethics, and innovative awareness [3-6]. Considering the current state of the entire archival process and existing research findings, it is clear that the skill set required for practitioners is continuously expanding. Core competencies include archival theory, operation of digital equipment, application of industry regulations, and other fundamental skills. In addition to traditional tasks such as archival storage management and physical organization, new business areas like intelligent system maintenance, archival data processing, and smart retrieval optimization also demand new capabilities from professionals. Archivists must also develop digital service thinking and consciously adhere to the industry's professional standards.

2.2 The Four-Dimensional Composition System of Archivist AI Literacy

AI literacy is a fundamental skill that archivists must develop at this stage. While AI literacy shares certain similarities with traditional

information literacy and data literacy, archival work features strict confidentiality requirements and public service attributes that distinguish it from other industries, thus forming a unique connotation of archival AI literacy. Existing studies usually divide AI literacy into three basic dimensions, including technical cognition, practical operation, and ethical norms. Nevertheless, universal industry standards are not fully applicable to archival scenarios. It is necessary to make targeted adjustments according to the actual work characteristics of confidential file management and grassroots public archival services [7,8]. Further international research adds that archivists' AI knowledge system should also include identifying algorithm bias, delineating responsibilities between humans and machines, and ensuring ethical oversight throughout every stage of intelligent operations [9].

Based on research findings and frontline practical scenarios in archives, an archivist's complete AI literacy can be broken down into four progressively advanced capability modules. First, archivists need to establish a basic understanding, roughly grasp fundamental AI concepts, distinguish the applicable scenarios for various intelligent tools in tasks such as digitalization, restoration, and retrieval of archives, and clarify the boundaries of responsibility between humans and machines. Second, they must possess practical operational skills and be able to independently operate intelligent devices to complete routine tasks such as archive scanning and digitization, automatic document classification, and daily maintenance of online consultation platforms. Third, they need to master archive data processing skills, independently recognizing, filtering, and deeply analyzing archive data, and using accumulated backend data to understand the genuine retrieval needs of the public [10,11]. Lastly, they must have security and ethical control capabilities, strictly adhering to laws and regulations when using AI to handle confidential documents and personal information in archives related to people's livelihoods, and from the source, avoid risks such as document tampering and information leakage.

Professional competence in archives is the foundation for implementing AI literacy. AI literacy is an extension of the ability to adapt to digital and intelligent transformation. The two mutually integrate to form a comprehensive

competency system for archivists.

2.3 Opportunities and Dual Challenges of AI Empowering Archive Business

Artificial intelligence has fully penetrated core processes such as archiving, classification, restoration, retrieval, and utilization, reshaping the industry's operational model from the perspectives of work efficiency and service formats. Regarding the value of AI-enabled archival services, existing research has formed a consensus: intelligent recognition, automatic classification, and cross-database retrieval can significantly reduce the costs of digitalization and manual sorting of archives, expanding the scope of archival services [12-14]. After the Zhejiang Province Smart Archives Platform was equipped with intelligent search functions, the scale of online self-service archive inquiries by the public increased by 62%, and the pressure on offline service windows was noticeably alleviated.

Meanwhile, implementing technology presents multiple real-world challenges. Most studies point out that after AI replaces repetitive, basic positions, archivists need to reconstruct their professional value, which can easily lead to career anxiety and a crisis of professional identity [15,16]; archival data is confidential and contains a large amount of personal privacy, so there are risks of information tampering and leakage during AI data collection and analysis [17]; The rapid pace of technological iteration makes it difficult for older librarians or those with weak information technology foundations to keep up with updates, and the technical adaptation problem has persisted for a long time. The industry's current situation, with both opportunities and challenges, requires talent development to focus on enhancing technical skills and ensuring safety and ethical management.

3. Changes in Archive User Needs and New Constraints on Librarians' Abilities in the AI Environment

3.1 Hierarchical Structure of Archive Users and Differentiated Intelligent Archive Search Needs

Based on digital user behavior and information needs layer theory, the target audiences for archive services can be divided into three categories: government affairs and public

administration, academic research, and the general public for livelihood matters [1]. Different groups have varying requirements for AI-related capabilities of archivists. Staff from government departments look up records to track policy origins or complete project reviews, so they hope to get full sets of archival materials quickly. This means archivists need to know how to run batch intelligent searches, screen confidential files automatically, and organize data summaries. Researchers come for historical evidence and document checks. They often use AI tools to read scanned texts and compare records across different databases, which asks archivists to be skilled at digging deep into data and developing valuable archival resources. Ordinary citizens mostly check documents related to household registration, property ownership, and marriage certificates. Their requests come in frequently and piece by piece, and they prefer to look up files themselves online via automated chat tools. Such daily service work puts forward higher requirements on archivists' ability to maintain online intelligent systems and improve search functions.

3.2 New Characteristics of Archive User Information Behavior in Intelligent Scenarios

The popularization of intelligent archival systems has fundamentally changed how users obtain archival resources, forming four typical user behavioral characteristics. To begin with, remote online inquiry has become mainstream. Most users prefer to retrieve archival materials through official websites and WeChat mini-programs, and the frequency of traditional offline on-site file checking keeps decreasing. In addition, users tend to complete retrieval operations independently. Any identification errors or missing matching results generated by intelligent systems will directly undermine their overall service experience. Furthermore, users' informational demands have become more diversified. Beyond simply browsing original archival files, they also raise various personalized and value-added service needs, including digital file downloading, data statistical analysis, customized historical material sorting, and intelligent content interpretation. Finally, users have grown increasingly concerned about information privacy and security. Since online archival services involve a large amount of sensitive personal data, the safety protection of user

information in AI-driven processing has become a key focus of public attention.

3.3 Misalignment of User Supply and Demand Promotes the Integration and Upgrading of Archivists' Capabilities

Users' archival inquiry habits and information demands have undergone tremendous changes, gradually overturning the industry's traditional working mode that emphasizes physical file preservation while ignoring public service provision. According to information service supply and demand matching theory, it is clear that the current capabilities of archival staff are no longer sufficient to meet the public's diverse and intelligent archive search needs. From the perspective of service implementation, the public now prefers to access archives through online intelligent channels, which requires archivists to be proficient in practical skills such as AI-assisted classification, intelligent archive restoration, and deep data mining. Meanwhile, the search goals of three user groups - government officials, researchers, and ordinary citizens - are markedly different, necessitating that archivists use intelligent systems to build layered user profiles and deliver more targeted, highly relevant archival resources. Additionally, the public's increasing concern for personal information security is driving archivists to standardize all AI operational procedures, thereby firmly safeguarding the core principles of archival confidentiality and public privacy protection.

4. The Existing Conflicts in the Integrated Development of Archivists' Professional Competence and AI Literacy

4.1 Personnel Cognition and Mindset have Biases.

Some archivists are overly concerned about potential technical risks, which makes them reluctant to adopt digital upgrades. In contrast, young archival practitioners often fall into another extreme. They rely excessively on intelligent systems to finish routine work, ignoring the rigorous professionalism and unique humanistic value inherent in archival business. Such cognitive deviations not only affect archivists' daily work behaviors but also weaken their willingness to take the initiative to improve digital service competencies. As a result, they find it difficult to use intelligent tools to explore

the public's archival needs or to optimize online and offline services. According to information supply and demand matching theories, both outright rejection and over-reliance on AI can solidify their own service capabilities, making it difficult to adapt flexibly to the diverse and intelligent archival inquiry needs of online users, thereby continuously disrupting the balance between archival service supply and demand.

4.2 The Existing Training System has Obvious Shortcomings.

Currently, most archival institutions offer information technology training, but the course content tends to focus on general theories without integrating specific business design elements such as archival sorting and intelligent document retrieval. The training methods are also relatively uniform, mainly consisting of offline lectures and online recorded sessions, lacking hands-on practical components. The homogeneous, non-tiered training model is a core obstacle to implementing the technology [18]. Even after taking relevant training sessions, plenty of archive staff still struggle to handle intelligent devices on their own. Another obvious flaw of existing training plans is the lack of customized arrangements. Trainers rarely create separate learning materials for employees in different positions or with varying years of experience, so lessons cannot match each person's actual learning needs. Such one-size-fits-all training arrangements deliver limited learning outcomes, leaving workers unable to grasp the AI operational skills needed to support users with different types of information requests.

4.3 Insufficient Integration of Technology and Business

While grassroots archival institutions have generally purchased and deployed full sets of intelligent management systems, daily business operations still follow conventional working routines. Most built-in AI functions are left idle, and archivists only make use of the simplest operational features, which prevents in-depth data analysis and value mining through intelligent platforms. Current human-machine cooperation is limited to basic auxiliary work, failing to realize complementary advantages between professional manual judgment and efficient intelligent technology. In fact, newly launched intelligent systems need continuous

functional iteration and targeted optimization based on practical operational feedback to adapt to evolving archival work scenarios. However, most archive institutions have not implemented this process, making it difficult to use backend user query data to optimize service models and achieve the service goals of on-demand supply and dynamic adjustment of supply as proposed by the demand-supply matching theory.

4.4 Imperfect Assessment and Incentive Mechanisms

Currently, the performance evaluation of archive institutions still relies on traditional business indicators, without incorporating the effects of AI applications and intelligent services into the assessment system. Within the industry, there is no unified standard for AI capabilities, and archivists lack clear goals for improvement. Their enthusiasm for actively learning new technologies and methods is generally low. Due to the lack of evaluation metrics such as user satisfaction and the effectiveness of intelligent services, archivists lack initiative in operating online intelligent consultations and optimizing personalized recommendations. As a result, online consultation responses are delayed, resource pushes are rough, and this directly reduces users' willingness to stay.

4.5 Insufficient Cultivation of Normalizing AI Safety and Ethics

The normalization of AI safety and ethics cultivation is lacking, and archives contain confidential documents and the public's private information. The existing training system lacks regular data security training, AI ethics learning, and warning education. The entire AI process lacks standardized safety review procedures, and archivists have weak risk prevention awareness, which can easily lead to security risks such as information leaks and accidental disclosure of confidential content [17].

5. Integration Path for Archivists' Professional Skills and AI Literacy

5.1 Strengthen Ideological Guidance and Correct Cognitive Biases

Archive management units need to standardize mental health guidance. By combining practical cases that have already been implemented, they can visually demonstrate how intelligent tools reduce repetitive workloads and improve the

efficiency of public record searches, helping archivists clearly understand that artificial intelligence is just an auxiliary tool for work and will not completely replace the professional work of archivists. Regular internal exchange and sharing sessions should be organized, where skilled archivists proficient in operating intelligent devices share practical insights, fostering a positive atmosphere within the archive for proactive learning of digital technology. For archivists spanning a wide age range and varying levels of digital literacy, one-on-one communication and guidance should be provided to help everyone objectively view the industry's digital transformation and foster a proactive learning mindset centered on the public's needs for record searches.

5.2 Layered Design Training System, Tailored to Actual Business Needs

Learning groups are segmented by job role and digital infrastructure, with tailored training content. For management personnel, training focuses on smart construction planning, archive data governance, and overall intelligent service coordination. For frontline business archivists, the emphasis is on practical operational methods for intelligent tools, combined with real-world business scenarios such as archive digitization and online record searches, to provide hands-on training. Relevant empirical studies show that diverse teaching models, practical exercises, and joint instruction by industry and academia can significantly improve the effectiveness of training implementation and conversion. These methods effectively address the limitations of single theoretical teaching and target the development of AI service skills required for different positions [19].

5.3 Building Practical Scenarios to Deepen Human-Machine Collaboration Applications

Integrate intelligent technology comprehensively across all processes, including archive organization, data statistics, and online consultation, and require archivists to proactively use various intelligent tools in their daily work. Guide archivists to retrieve user data from the system backend, analyze public access patterns to archives and existing service shortcomings, and build layered user profiles using AI. This enables targeted delivery of suitable archive resources and transforms digital technologies into high-quality external service capabilities.

Within the archives, pilot positions for intelligent and digital services can be established, with key personnel first exploring practical approaches to intelligent consulting and archive data mining. Once the operational model is mature, it will be promoted across the archives, fully leveraging intelligent technology to optimize archival services.

5.4 Improve the Assessment and Incentive Mechanisms, and Establish a Long-Term Safeguard.

In line with the new work content brought about by the digital transformation of archives, the unit's internal performance evaluation standards are being adjusted accordingly. Practical proficiency in AI tool operation, intelligent service quality, and online user satisfaction are included in the routine performance evaluation system. Meanwhile, exclusive incentive mechanisms for intelligent services have been set up to reward archivists who actively explore digital technologies and optimize users' archival inquiry experience with intelligent tools. In addition, unified criteria for evaluating archival staff's AI literacy have been gradually formulated, which clarify differentiated digital capability requirements for various job positions and offer explicit improvement directions for archivists. The combination of restrictive assessment rules and positive incentive measures can sustain the long-term and steady improvement of practitioners' comprehensive digital competencies.

5.5 Maintaining Ethical Principles and Advancing Professional Safety Literacy

All archivists should receive regular training covering standardized file management rules, data security specifications, and ethical norms for AI applications. Combined with real industry cases involving information leakage and improper user data usage, targeted warning education can help archivists abide by operational standards throughout all AI-based work procedures and effectively protect user privacy. Additionally, manual security review procedures should be embedded into all intelligent service workflows to preempt potential security hazards. As vital institutions responsible for preserving historical records, archival departments bear rigorous confidentiality obligations in daily work. The development of intelligent technology must

prioritize ethical safety, which is also the fundamental requirement of professional ethics in the archival industry and information service ethics. Data security and privacy protection are essential to maintaining the balance of supply and demand in archival services. Only by safeguarding this security baseline can we continue to earn public trust and ensure the long-term stability of online intelligent archival services.

6. Conclusion

Intelligent digitalization has become an irreversible trend in the archives industry, with artificial intelligence fully integrated into all aspects of archive management and external services. The traditional skill model for archivists can no longer adapt to the current industry environment. Promoting the in-depth integration of archivists' professional expertise and AI competency is critical to the sustainable development of the archival industry. It also serves as a core solution to balance the supply and demand of archival information services and better accommodate users' diverse inquiry demands.

Technological innovation continuously reshapes public service modes, and the overall comprehensive capacity of archival staff directly influences final service quality. Existing domestic studies have clarified the basic framework and core content of AI literacy for archival practitioners and pointed out common problems including inadequate cognition, imperfect training systems, insufficient practical experience, and flawed institutional arrangements. To address these practical dilemmas, comprehensive improvements are required. Specific measures include updating professional cognition, optimizing hierarchical training systems, strengthening scenario-based practical exercises centered on real user service demands, and refining supporting mechanisms for assessment, incentives, and safety supervision.

In the future, emerging technologies such as generative AI and big data will continue to advance, bringing continuous changes to archival service modes and industry operation mechanisms. Accordingly, the archival field needs to adjust its talent training system dynamically. It is essential to improve the professional capabilities of serving archival staff and synchronize university talent cultivation

plans with the digital and intelligent development trends of the industry. When archivists' comprehensive abilities keep pace with technological progress and real user demands, intelligent tools can exert their maximum practical value, which further supports the stable and long-term development of modern archival undertakings.

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