Research on the Relationship Between Library Professional Competence and the Construction of a Framework for Human Information, Knowledge, and Intelligence: Postprint

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Abstract

[Purpose/Significance] This study examines the value and significance of library professional competencies in human knowledge activities from the perspective of constructing information context frameworks, knowledge context frameworks, and intelligence context frameworks within information science. [Method/Process] The study investigates the functional roles of professional competencies—including document retrieval languages, catalogs and indexes, and abstracting and reviewing services—in traditional library practices within the construction of document information context frameworks; analyzes the relationship between knowledge organization, knowledge association, and knowledge service competencies in the digital library era and the construction of knowledge context frameworks; and discusses the essentials of intelligence context framework construction in the post-digital library era and its expectations for the development of library professional competencies. [Results/Conclusion] The findings indicate that library professional competencies continuously evolve in tandem with the transformation of library functions, that the core content of these competencies is intricately linked with the "information-knowledge-intelligence" conversion process, and that they play a demonstrative, leading, and exploratory role in the construction of the "three frameworks."

Full Text

A Study on the Relationship Between Library Professional Capabilities and the Construction of Human Information, Knowledge, and Intelligent Background Frameworks

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Abstract:

[**Purpose/Significance**] This paper examines the value and significance of library professional capabilities in human knowledge activities from the perspective of constructing information background frameworks, knowledge background frameworks, and intelligent background frameworks in information science. [**Method/Process**] The study first investigates the functional role of traditional library professional activities—such as literature retrieval languages, catalogs, indexes, and abstract reviews—in the construction of document information background frameworks. It then analyzes the relationship between knowledge organization, knowledge association, and knowledge service capabilities in the digital library era and the construction of knowledge background frameworks. Finally, it discusses the essentials of intelligent background framework construction in the post-digital library era and its expectations for library professional capability development. [**Result/Conclusion**] Research shows that library professional capabilities continuously evolve with functional transformations in libraries, with core content closely linked to the "information-knowledge-intelligence" conversion process, playing a demonstrative, guiding, and exploratory role in the construction of the "three frameworks."

Keywords: library professional capability; information-knowledge-intelligence transformation rules; information background framework; knowledge background framework; intelligent background framework

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2 Background Framework

2.1 Information Background Framework in Information Transfer

Information transfer refers to the process where information is sent from one entity (the sender) and received by another entity (the receiver). Wang Huanchen posits that an "information background framework" represents the mutual agreement between sender and receiver regarding information representation methods during information transfer [2]. The information background frameworks of senders and receivers generally exhibit five states, as illustrated in [Figure 1: see original paper].

Research in [2] demonstrates that in State A of [Figure 1: see original paper], where the sender's and receiver's information background frameworks completely align, ideal information transfer can be achieved. While this state is relatively attainable for simple, unambiguous information or binary-choice scenarios, in practice, information transfer between information actors is often complex. Even with clear agreements, limitations in subjective and objective conditions of individual information actors make this ideal state difficult to achieve. States B, C, and D represent the normal condition of information background frameworks between information actors—partial alignment—while State E resembles the common expression "playing the lute to a cow," indicating com-

plete communication failure. Therefore, the information background framework is crucial for information transfer. People complete information transmission and acquisition within a commonly agreed-upon signal system of "information background framework," enabling the conversion of ontological information into epistemological information.

2.2 Traditional Library Capabilities and the "Document Information Background Framework"

Traditional library theories—whether element theory, communication theory, contradiction theory, or law theory [4]—all center around the "Five Laws" [5] in conducting document information transfer and fulfilling social functions. Through extensive development, libraries have established a unique disciplinary theory and accumulated professional capabilities, forming a comprehensive document information signal system that constructs a stable document information transfer system with knowledge society. Classification systems, subject headings (descriptor languages), and other literature retrieval language systems (including document shelving methods), together with catalog indexes, abstract reviews, card catalog methodologies, and the intellectual labor of librarians, collectively constitute the library's document information background framework for "connecting people with books and books with people."

The document information background framework constructed by libraries differs fundamentally from those in other industries. Document classification methods, subject approaches, and descriptor systems employ prescribed artificial languages to replace natural languages, establishing agreements for document information transfer signals. These signals are organized into systematic frameworks constrained by knowledge systems, grammatical rules, or standards. The classification system constructs a document information background framework under specific philosophical guidance, applying principles of knowledge classification and logical methods to divide literature from all disciplines into major categories based on content, form, genre, and user purpose, with each major category subdivided into smaller classes, which are further divided into subclasses. Ultimately, every document can be assigned to a specific category, each with a class number [6], forming a systematic and logically rigorous classification literature information framework based on number combinations and symbolic markings. As long as readers master the classification principles and number combination rules, they can continuously approach State C in [Figure 1: see original paper] for the information background framework between libraries and users.

Subject methods (such as descriptor and keyword approaches) construct document information background frameworks by using standardized language to reflect document content based on themes. These methods provide more intuitive signals for document transfer, unconstrained by disciplinary hierarchies, and readily satisfy specific literature retrieval needs [7]. From the perspective of a single document theme, subject methods achieve State A in [Figure 1: see

original paper]; from the relationship between total information provided by libraries and total information demanded by users, they achieve State D. Library shelving methods represent the refinement of States A, B, C, and D in [Figure 1: see original paper]—precise positioning methods for information background frameworks. Catalog indexes function like bookmarks or folded page corners inserted during reading, effectively shortening information distance when relocating specific information points [2], which explains the information-intensive function of traditional library index compilation from an informatics perspective. Abstract reviews and card catalogs reduce user labor through compressed processing and analogical induction of document content, representing important components of the library document information background framework despite not being essential to the "agreement" itself.

Traditional library promotion, user education, and reference services can resolve receivers' comprehension questions, overcome information reception barriers, and promptly address potential negative impacts during information state transitions [2], serving as empirical measures ensuring effective operation of the document information background framework. These capabilities largely satisfy user demands for convenient and rapid document information access.

2.3 Value and Significance of Traditional Library Capabilities in Document Information Background Framework Construction

(1) Demonstrating scientific, practical, comprehensible, and communicable signal "agreements" in information background framework construction [2], reflecting the exemplary role and dominant position of library capabilities.

Literature classification and subject methods represent the most mature scientific knowledge and specialized methodologies in library science [7], as well as the most fundamental approaches for handling group literature knowledge transfer. The library document information background framework system reflects the rich theoretical knowledge of classification accumulated by librarians. Before information transfer, libraries also process epistemological information through identification, screening, storage, and ordering (including cleaning of ontological information and sequencing of epistemological information), incorporating it into the framework. Through "agreements" in information states most suitable for users, the document information background framework interface becomes more user-friendly, embodying the intellectual labor of library workers. Additionally, librarians, as "knowledgeable individuals" [2] and "generalists" [8], leverage their experience to provide invaluable tacit knowledge for the 良性 operation of document information background frameworks. For instance, a librarian can not only identify the class name for cooking books classified to four decimal places and their location in the collection but also explain why an older blue-covered edition of *Happy Cooking* is superior to newer versions [9]. These professional capabilities, permeating the document information background framework, demonstrate how libraries facilitate "unity of knowledge and

action" [10] in human knowledge activities by completing information reception and conversion to knowledge.

(2) Knowledge organization theory originating in libraries and literature retrieval languages as signal technologies provide the academic foundation and technical methodology for transitioning from traditional library document organization to digital library knowledge organization, opening pathways from document information background frameworks to knowledge background frameworks.

As early as 1929, American librarian H. E. Bliss proposed knowledge organization concepts based on library classification [11], subsequently studied by J. H. Shera and others from perspectives of library science epistemological foundations and modern bibliographic organization [12-13]. Practice proves that classification, as a fundamental organization method for any knowledge collection, finds widespread application in reference book compilation and network database organization, maintaining relevance for digital library knowledge organization [7]. Subject methods apply to both manual and computer retrieval systems, particularly keyword approaches using natural or minimally standardized terms, enabling rapid automation of subject indexing and index compilation while facilitating natural language retrieval [7]. With rapid development in computer and artificial intelligence technologies, classification and subject methods rooted in library and information science have demonstrated value for broader applications, such as constructing conceptual models through keyword cloud maps and tag clouds, and applying literature retrieval languages in keyword clustering analysis [14], realizing predictions made by Zhang Qiyu two decades ago [15]. Today, retrieval language research has deepened to the knowledge content level, ushering digital library knowledge organization into a new stage where theoretical and methodological systems for evolving document information background frameworks into knowledge background frameworks are taking shape.

3 Digital Library Era: Library Capabilities Dedicated to Constructing the "Knowledge Background Framework"

3.1 Knowledge Background Framework in Information Systems

Information theorists posit that knowledge is systematized information. Humans require information background frameworks to receive and comprehend information, but more importantly, they need systematic understanding of knowledge—systematic comprehension of systematized information. Experts thus define the systematized information background framework as a "knowledge background framework" [2], noting its systematic characteristic: possible information states within it can not only transition between each other but also possess meaningful associations, forming a systematic network (see [Figure 2: see original paper]). Human knowledge exchange, production, and proliferation occur through the interconnection, mutual supplementation, and perfection of

various information background frameworks within this networked knowledge background framework.

Digital libraries, following the definitional requirements of knowledge background frameworks, systematically and network-wise reconstruct and integrate various information background framework states based on original document information background frameworks. They organize knowledge in ways suited to network-era knowledge production and dissemination characteristics (intensification of morphological, utility, and content knowledge), promoting combinations of different information states and knowledge associations (content knowledge correlation and utility knowledge matching), thereby leading the construction of knowledge background frameworks that serve users in discovering, describing, mining, associating, and utilizing knowledge [17].

Digital library knowledge services implement personalized and targeted services according to different users' information background frameworks, enabling users to obtain appropriate positioning within systematized knowledge background frameworks and establish proper associations with relevant knowledge in their own knowledge background frameworks. Traditional library tracking services, selective dissemination of information, and subject services' pursuit of States A, B, and C (see [Figure 1: see original paper]) are now infused with systematization and networking requirements within knowledge background frameworks.

3.2 Digital Library Capabilities and Knowledge Background Framework

The digitization of literature inaugurated the digital library era, challenging the document information background framework constructed by libraries in several ways: (1) diversified document carriers (paper, digital, multimedia) weakened single-format paper document dissemination; (2) diversified information publication by libraries, data publishers, institutional repositories, and self-media users diminished libraries' dominance as information transmitters; and (3) the emergence of knowledge as a core concept [7], with knowledge service representing a new growth point for library and information work [16], alongside contemporary theories of knowledge organization, knowledge service, and discovery services—all requiring libraries to evolve from document information background frameworks to knowledge background frameworks.

The knowledge network background, social network environment, and global physical network conditions of digital libraries demand that knowledge background frameworks address multi-form, multi-source knowledge organization based on deep interdisciplinary content associations—constructing a knowledge background framework about knowledge association.

From the perspective of knowledge network description and discovery, libraries employ one-stop retrieval systems to publish and link structured online data, creating links between previously unconnected data sources (different institutional databases across regions or different data systems within a single institu-

tion) to form "linked data" [18], achieving multi-dimensional information state transitions in knowledge networks while avoiding State E in [Figure 1: see original paper]. From the knowledge mining perspective, libraries conduct research collaboration behavior association analysis for technical activity mining, co-occurrence association analysis for technology convergence mining, technical association analysis for technology development trend mining, and keyword-based morphological association analysis for technology opportunity mining [19-20], striving to expand the extension and intension between information senders and receivers in States B, C, and D of [Figure 1: see original paper]. From the association and utilization perspective, libraries establish extensive connections between service objects, databases, service items, and research project management institutions [21], ensuring expanded knowledge association degree (global network and full knowledge domain), association strength (availability, shortest information distance, highest relevance), and knowledge density (relative concepts of object knowledge quantity and density) to achieve the holistic state depicted in [Figure 2: see original paper].

3.3 Value of Library Capabilities in Knowledge Background Framework Construction

(1) Libraries' early application of knowledge association theories and methods in knowledge service literature organization has formed systematic capabilities for information background framework systematization, reflecting libraries' guiding role and important position in knowledge background framework construction and in knowledge acquisition, mining, and proliferation.

In international academia, from D. J. de Solla Price's "science citation network" to M. M. Kessler's "bibliographic coupling," from E. Garfield's "citation analysis" to N. Steven's visualization of literature citation coupling [22], from metadata to knowledge ontologies, and from knowledge maps to linked data [23], library science experts have been primary leaders in knowledge association research. Since the 1980s, Chinese research has explored knowledge association concepts, connotations, characteristics, types, structures, and measurements theoretically, while experimenting with patent citation analysis, co-word analysis, clustering analysis, and semantic-based knowledge association methods practically. The library and information profession has become a vital force in knowledge association research.

Recent library initiatives have approached digital library information resource association and aggregation from perspectives of hyper-network environments, multi-dimensional resource characteristics, author citation and collaboration networks, and user retrieval behavior patterns, applying various theories to visualize resource aggregation implementation technologies and final query results [22]. Concurrently, libraries have built "subject service platforms" for "target knowledge" [24], "personalized service platforms" addressing differences between "knowledge information volume" and "information volume needed to

reach knowledge" [25], and "discovery service platforms" based on "knowledge association degree" [26]. These efforts form deep processing that achieves mutual information state transitions and meaningful associations, completing the systematization and networking of document information background frameworks to create knowledge background frameworks that serve human knowledge acquisition, mining, and proliferation, promoting the transformation from knowledge to intelligence and leading the conversion of knowledge into wisdom.

(2) As the core content of knowledge background framework systematization and networking, association theory and technology are becoming central to library professional capabilities, preparing libraries to participate in constructing intelligent background frameworks for knowledge creation.

Linked data's natural integration capability makes it the optimal tool for various signal system integrations. Today, the scope of library professional capabilities has fundamentally transformed. Professional librarians must not only be familiar with literature form and spatial positioning identification systems (such as classification, subject, and shelving methods) but also master computer technology and numerous software tools, particularly information content depth (mining) and breadth (association) related to linked data, knowledge mining, and knowledge discovery methods and tools [27]. Library and information science curricula have changed dramatically [28], with the library discipline and profession integrating into information science and intelligence science domains [29], making libraries' role as important participants in constructing intelligent background frameworks for knowledge creation undeniable.

Due to the complexity of literature carriers and physical/social networks, the diversity of signal senders and receivers, and the fact that knowledge association technology centered on linked data relies more on research and tool usage from other industries, knowledge background frameworks cannot be constructed unilaterally by libraries but require multi-party cooperation and collaborative development under the banner of co-construction and sharing—demonstrating why libraries must pursue collaborative paths. Traditional library network and digital library alliance theories and methods remain relevant in the post-digital library era.

4 Post-Digital Library Era: Library Capabilities Pursuing the "Intelligent Background Framework"

4.1 Intelligent Background Framework in Knowledge Systems

Currently, information science research has not explicitly defined the intelligent background framework for knowledge systems. However, the unified information-knowledge-intelligence theory provides relevant concepts, such as definitions of intelligence and research on intelligence generation mechanisms [2, 30]. Additionally, the theory of global network information structure (where

all information states can directly transition between each other) [2] greatly informs this study. The prerequisite for intelligent background frameworks is the knowledge background framework forming a global network knowledge information structure. This paper attempts to describe the "intelligent background framework" as a systematized knowledge background framework, characterized by relatively perfect knowledge background frameworks that can not only transition between each other but also interact meaningfully, ultimately forming a systematic network (see [Figure 3: see original paper]). This transition occurs across multi-dimensional knowledge spaces, and this interaction involves intelligent strategies and behaviors [31], representing ideological collisions and inspiration for knowledge creation.

Human knowledge production, accumulation, and proliferation occur through the interweaving of knowledge background frameworks, fusion of spiritual and physical spaces, and mutual stimulation among people and between people and intelligent systems, generating intelligent strategies and behaviors that form sources of innovation and creativity.

4.2 Post-Digital Library Capabilities and Intelligent Background Framework

Today, as digital library resource and technology systems mature and become widely applied, increasing numbers of users access information, documents, data, and knowledge online anytime and anywhere. Libraries have begun transcending traditional print-centered services, crossing boundaries toward becoming urban and campus "third spaces." The post-digital library era characterized by ubiquitous knowledge environments has arrived [32].

From an information theory perspective, the post-digital library era is also an era of relatively mature knowledge background frameworks, where libraries pursue the "dual value of place and service" [33]. This drives library functions toward intelligent innovation services, endowing library professional capabilities with new connotations and steering them toward interactive services that stimulate human intelligence innovation and intellectual creation through spatial organization, multi-dimensional space integration, cross-boundary collaboration, and other humanistic and technological innovations exploring intelligent background framework construction.

Network and intelligent technologies connect web pages, cloud services, creative spaces, and other services and functions [41]. In maker spaces, libraries provide social platforms facilitating ideological collisions, stimulating users' intelligent strategy inspiration, offering "new knowledge tools," and enlightening users' intelligent behavioral capabilities. Libraries strive to establish the broadest social connections, obtaining greater social support through comprehensive collaboration with schools, institutional groups, and social organizations [42], effectively "connecting the dots" between users and society to maintain active, unobstructed communication between human and information systems [43]. This

enables market-driven research and development and allows entrepreneurs to realize value, completing libraries' full participation in the "unity of knowledge and action" human intelligence system and providing the new interactive environment depicted in [Figure 3: see original paper] for users' intelligent strategic behaviors and inspiration.

Through spatial organization, multi-dimensional space integration, and cross-boundary collaboration, libraries apply their professional "wisdom," operate and apply library science's unique "knowledge about knowledge," and construct various spaces encompassing resources, environments, facilities, technologies, and operational modes suitable for users' intellectual generation. Through intellectual integration and collaborative innovation (strengthening action capabilities), libraries strive to approach and satisfy intelligent background framework construction requirements, achieving intellectual development, knowledge production, and scientific creation.

4.3 Value and Significance of Library Capabilities in Intelligent Framework Construction

(1) Post-digital library capabilities have transcended traditional document formats, updated knowledge service concepts, and moved toward physical space reorganization to achieve interaction between social and spiritual spaces.

Libraries apply spatial integration and reorganization concepts to multi-dimensional knowledge spaces and multi-state knowledge background framework transitions. Using maker spaces as a form and supported by information technology, social collaboration, and librarians' intellectual labor, libraries explore intelligent background framework construction through interaction as the link. This is reflected in space organization and integration, where the post-digital library era proposes "reconstructing library spatial cognitive systems," emphasizing the fit between physical and spiritual spaces and advocating the maximization of sociality and interactivity in library physical spaces [34], constructing social "cultural education squares" with virtual-physical space associations [35]. Scholars worldwide consider shared workspaces and informal social learning as future innovation points for library services. Some libraries have established dedicated spaces for workspaces, social learning, and industry collaboration, enabling user co-learning across physical and digital spaces [36].

To innovate library services, many libraries have adopted "maker space" concepts, technologies, and facilities to achieve service goals for innovators and participatory creation [37-39]. By implementing architecture and practicing web-scale information technology, running global computing models on library facilities, and reconsidering various positioning relationships at multiple levels [40], Library 4.0 is proposed to feature intelligence, big data processing, augmented reality, user context awareness, creative spaces, and other characteristics [41]. This not only provides users with a new intelligent behavioral space but

also presents new requirements for libraries' information resource aggregation capabilities, intelligent creative experience service capabilities, and collaborative innovation participation capabilities, greatly promoting theoretical and technical updates in library professional capabilities and injecting strong momentum into intelligent background framework exploration.

Under modern scientific and technological conditions, discovery of complex patterns and generation of new knowledge cannot rely solely on induction or deduction but necessarily involves dialectical interaction between them [31]. Through creative experiences and virtual-physical intersection services, libraries generate interactive ideological collisions and inspiration among users, enabling mutual transitions between knowledge background frameworks, transforming morphological knowledge, activating utility knowledge, generating content knowledge, and achieving knowledge-to-intelligence conversion (gaining decision-making capability) [44]—an innovation in service theory and methodology.

(2) Library capabilities across the three frameworks manifest as theoretical research and methodological innovation in all "agreements" for information processing and knowledge organization. However, the effectiveness of these theories and methods depends on receivers' capabilities. If users know nothing about signal agreements or knowledge organization principles within background frameworks, internal system communication and operation become impossible, particularly in knowledge and intelligent background framework operations where sender and receiver boundaries are blurred. This requires all participants to share certain foundational information capabilities.

Consequently, libraries have long undertaken user education, from business guidance and reference services to information literacy courses and frameworks [45], making human information literacy (digital literacy, action literacy) a unique library research domain. Libraries actively shoulder the responsibility of cultivating human information literacy, dedicating themselves to popularizing library professional capabilities and effectively facilitating communication, eliminating barriers, and enabling interaction among information actors across the three frameworks. Recently, the IFLA Digital Literacy Declaration proposed elevating digital literacy as a fundamental right and an important force for promoting individual, social, and economic development and enhancing civic participation [46], which is highly meaningful for achieving scientific and efficient goals in human knowledge activities.

The information background framework forms the foundation of information transfer. Converting ontological information into epistemological information and transforming it into knowledge depends on the construction quality and operational state of the information background framework. The knowledge background framework is a systematized information background framework; converting morphological and content knowledge into utility knowledge depends on the construction quality and operational state of the knowledge background framework. The intelligent background framework is a systematized knowledge

background framework; stimulating knowledge into problem-solving strategies and achieving intelligent conversion and intellectual creation depends on the construction quality and operational state of the intelligent background framework. These three background frameworks are interconnected and successive, matching the evolution of the entire social knowledge ecosystem and human knowledge activity processes, serving as three hubs in the information-knowledge-intelligence conversion system.

Libraries demonstrate the construction of document information background frameworks through literature integration and reorganization capabilities, lead the construction of knowledge background frameworks through knowledge organization and association capabilities, and explore the construction of intelligent background frameworks through space reorganization (reconstruction), connection, and user interaction service capabilities. This analysis of the significance and value of library capabilities across these three frameworks provides a mechanism and pathway explanation for the unified information-knowledge-intelligence theory, illustrating the status and role of library capabilities, reflecting their inheritance and innovation, and achieving systematization of library professional capabilities. This paper also demonstrates from the mechanism of human intelligence development that information literacy in library professional capabilities constitutes the foundational capability for general professional capabilities across society, providing references for library science basic theory research and disciplinary and curriculum system construction.

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Study on Relationship of Library Professional Capability and Background Frame Construction of Human Information, Knowledge and Intelligent

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Abstract: [Purpose/significance] This paper studies the value and significance of library professional ability in human knowledge activities from the perspective of background frame construction of human information, knowledge and intelligent. [Method/process] At first, this paper investigated the function effects of professional capabilities on the background frame construction of document information, and these professional capabilities including literature retrieval languages, catalog indexes and abstract reviews from professional activities. Then, it analyzed the relationship of knowledge background frame construction and library professional capabilities in digital library era that including knowledge organization, knowledge association and knowledge service. Finally, the paper discussed intelligent background frame construction in the post-digital library era and it's expectation towards the development of library vocational ability. [Result/conclusion] Research shows that library vocational ability changes continuously with the development of library function, and the core content of library professional capabilities and the conversion process of information-knowledge-intelligent are interlocked. Besides, the above findings play an active role in modeling, guiding and exploring the construction of these "three frames".

Keywords: library professional capability; transformation rules of information-knowledge-intelligent; information background frame; knowledge background frame; intelligent background frame

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