Research on Influencing Factors and Mechanism of Knowledge Service Effectiveness in University Libraries (Postprint)

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Abstract

[Purpose/Significance] Knowledge service constitutes a crucial initiative for empowering the high-quality development of the library sector. Investigating its influencing factors and underlying mechanisms holds significant importance for enhancing the effectiveness of knowledge services in university libraries. [Method/Process] Multi-source textual data were obtained through semi-structured interviews, knowledge Q&A platforms, and social media platforms. Grounded theory was employed to extract knowledge service elements from the data, based on which the influencing factors and mechanisms of knowledge service effectiveness were analyzed. [Results/Conclusion] Guarantee, cognition, and behavior represent the primary factors influencing knowledge service effectiveness. Guarantee factors impact knowledge service effectiveness across five dimensions of ecological elements, while cognitive and behavioral factors influence knowledge service effectiveness across twelve dimensions of perceptual elements, agency elements, and interactive elements. To improve knowledge service effectiveness, university libraries should construct academic communities, develop professional insight, stimulate the agency of knowledge service, and achieve value co-creation.

Full Text

Preamble

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Research on Influencing Factors and Mechanisms of Knowledge Service Efficiency in University Libraries

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Abstract: [Purpose/Significance] Knowledge service is a crucial measure to empower the high-quality development of library undertakings. Exploring its influencing factors and mechanisms holds significant importance for enhancing the knowledge service efficiency of university libraries. [Method/Process] This study obtained multi-source textual data through semi-structured interviews, knowledge Q&A platforms, and social media platforms, and employed grounded theory to extract knowledge service elements from the data, analyzing the influencing factors and mechanisms of knowledge service efficiency from these elements. [Result/Conclusion] Guarantee, cognition, and behavior are the main factors influencing knowledge service efficiency. Guarantee factors affect knowledge service efficiency across five dimensions of ecological elements, while cognitive and behavioral factors influence knowledge service efficiency across twelve dimensions of perceptual, active, and interactive elements. To improve knowledge service efficiency, university libraries should construct academic communities, develop professional insights, stimulate knowledge service initiative, and achieve value co-creation.

Keywords: knowledge service; structural elements; mechanism of action; service efficiency; grounded theory; university library
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2 Literature Review

The increasing convenience of internet information access and users' growing professional ability to retrieve information independently have jointly triggered another revolution in libraries and reference services—information access disintermediation [1]. Developing, identifying, and addressing real-world knowledge needs in service contexts, and upgrading reference services through knowledge services represent key strategies for maintaining user trust and reversing the value deficit in library undertakings [1-2]. Knowledge service is indeed an important measure to empower the high-quality development of library services [3].

The main agents of knowledge service are subject librarians, whose purpose is to identify and meet users' knowledge needs through knowledge sharing and transfer, with content focused on the iterative renewal and continuous growth of knowledge. Efficiency can be used to measure the value of knowledge service, encompassing at least three aspects: quality, efficiency, and satisfaction. The core competency positioning of library and information institutions should shift from monopolistically owning resources to providing knowledge services. Knowledge service provides users with knowledge products having independent intellectual property rights, characterized by originality, embeddedness, special-

ization, personalization, and diversification [4]. After two decades of development, the transformation from information service to knowledge service has been completed, and knowledge service is now entering a post-knowledge service era driven by demand, technology, and innovation [5]. Post-knowledge service emphasizes that, under the premise of synchronously integrating diverse environments (from primitive unity to complex diversity to integrated unity), knowledge flows bidirectionally between subject and object, technology evolves from informatization to intelligence, disciplinary focus shifts from single disciplines to multidisciplinary and interdisciplinary approaches, and the importance of knowledge service capabilities becomes increasingly prominent [6].

Knowledge service efficiency refers to viewing knowledge service as a complex system where various elements interact to produce overall effects. The key to scientifically evaluating knowledge service efficiency lies in clarifying the elements contained within the knowledge service system, thereby identifying influencing factors and their mechanisms, which holds significant importance for improving service efficiency. This study will exploratorily answer two questions: What are the factors influencing university library knowledge service efficiency, and what are the mechanisms among these factors?

International scholars have also extensively discussed knowledge services in academic institutions. Universities in the United States, Italy, and some Nordic countries not only emphasize knowledge generation but also knowledge application, actively establishing deep connections with industry and society to provide scientific and technological knowledge services for regional and national economic development, and achieving knowledge transfer from universities to industry through mechanisms such as knowledge transfer offices, science parks, and incubators [7]. Additionally, knowledge sharing is a pathway to improving individual and organizational performance and innovation. Knowledge sharing in organizations occurs not only at the individual level but also at the collective level [8], and an organization's knowledge sharing capability is considered crucial for leveraging its members' resources and capabilities, particularly for providing high-quality knowledge services [9-10].

Existing research on knowledge service both domestically and internationally has primarily focused on four dimensions: content, form, mode, and management. Regarding knowledge service content, knowledge types include explicit and tacit knowledge. Explicit knowledge can be expressed and transmitted through sound, text, charts, and other carriers, while tacit knowledge can be understood as internalized mental content that is contextual, experimental, and difficult to fully articulate, yet can be transformed into explicit knowledge through comprehension, reflection, deliberate practice, and interactive communication [11]. Knowledge service not only disseminates explicit knowledge through teaching and sharing behaviors but also facilitates the transformation, transmission, and integration of valuable tacit knowledge among knowledge subjects by providing online or offline community-style interactive spaces for users, thereby generating new knowledge [12-13]. Knowledge service is regarded as

a crucial hub throughout the knowledge management process, connecting users with knowledge content, and the ability to support users' knowledge application and innovation constitutes the core intelligence of libraries [14].

Regarding knowledge service forms, these include basic resource services focused on research data collection and integration, advanced retrieval services centered on factual query analysis, high-value-added services for capability and competitiveness evaluation, comprehensive analysis services based on holistic research reports, and deep data mining services oriented toward forward-looking predictions [15-16].

Regarding knowledge service modes, these encompass digital reference consultation service models, specialized user information system service models, and knowledge management service models, with four specific service forms: real-time interaction, asynchronous, expert-based, and hierarchical [17].

From the institutional management perspective, knowledge service requires transforming subject librarians into knowledge workers, restructuring administrative departments into knowledge service teams, and shifting organizational structures from linear associations to network configurations, thereby converting the "potential" of knowledge service into "actual strength" [18].

Reviewing research themes in the knowledge service field over the past five years, existing studies have conducted relatively in-depth and detailed research across these dimensions. However, there has been limited exploration of the influencing factors and mechanisms of knowledge service efficiency in university libraries. Therefore, this study conceptualizes knowledge service as a system, using grounded theory to analyze its structural elements and, based on the conceptual categories of these elements, identify the influencing factors and mechanisms of knowledge service efficiency, constructing a theoretical framework to provide theoretical references for improving university library knowledge service efficiency.

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3 Research Methods and Data Acquisition

This study employs grounded theory and uses NVivo 11 as the research tool to conduct qualitative research on interview data, extracting ordinary and core categories, constructing relational structures, and instantiating structural elements and their relationships through exemplification. Grounded theory methodology typically uses interview data as the data source, breaking down, coding, and constructing theoretical hypotheses from interview materials, then revising through further interviews and coding in a cyclical process until no new conceptual categories emerge [19]. Considering that interview subjects are all professional librarians, the interview data, while introspective, focused, and profound, is insufficient when viewed solely from within the industry. To supplement and verify interview data, this study further collected textual data from internet

Q&A communities and social platforms, including public library accounts, subject librarians, and users. These data are characterized by autonomous, spontaneous, and self-expressive production processes, with viewpoints unaffected by the researcher's attitudes or value orientations, facilitating understanding from the user perspective. Internet data were sourced from Zhihu Q&A community and Sina Weibo.

3.1 Semi-Structured Interviews

The principles for selecting interview subjects were established as follows: (1) **Professionalism principle**: possessing associate senior professional titles or above, or master's degree or above, being familiar with knowledge service work, and having a good reputation in the profession; (2) **Diversity principle**: commissioning peers to contact subject librarians from university libraries of different scales and levels as interview subjects; (3) **Proximity principle**: selecting library directors and subject librarians from libraries where research team members work as interview subjects. Basic information about interview subjects selected according to these three principles is shown in Table 1 .

After identifying interview subjects, the semi-structured interview outline was sent to respondents to familiarize them with interview topics in advance and allow them to raise questions about concepts involved in the outline, which were clarified and explained by the interviewer. After reaching consensus on relevant concepts, formal interviews were scheduled. During formal interviews, the respondent was centered, with question order adjusted according to their familiarity with and interest in topics, or questions reduced or supplemented based on their practical work understanding. Interview duration was controlled within 1.5-2 hours. The entire interview process lasted six months (December 2020 to May 2021). Interview records were compiled to form textual data.

3.2 Q&A Community Text Data Acquisition

Using "university library" as the keyword on Zhihu platform, 494 answer texts totaling 63,000 words were obtained regarding questions related to "university library utilization, resources, subject services, and information literacy." The highest view count reached 677,000, with maximum attention of 2,809. Respondents were widely distributed across regions and majors, reflecting knowledge service-related issues across different regional and interdisciplinary cultural backgrounds to a certain extent. Due to large data volume, only partial examples are listed in Table 2 .

3.3 Social Platform Text Data Acquisition

Using "subject service" as the keyword, super-topic texts from Sina Weibo were obtained. Super-topic texts feature accurate thematic clustering, strong semantic association, and limited length, distinguishing them from general weakly-regulated, thematically divergent Weibo texts, making them better suited for

viewpoint mining. A total of 556 relevant records were collected, identifiable from account names and content to include at least three library public accounts, several subject librarian accounts, and ordinary user accounts. Relevant attributes of the three libraries are shown in Table 3 .

4 Text Data Encoding

4.1 Open Coding

Open coding must be rooted in the most original textual data. Interview data and Q&A community texts were studied, compared, classified, and conceptualized. For instance, the concept "venue guarantee" was extracted from the reference point "the library is a carrier, providing knowledge and environment…" Similar concepts include "conceptual transformation," extracted from "librarians should break away from gossipy, matronly attitudes." This stage extracted a total of 35 concepts, detailed in Table 4 .

4.2 Axial Coding

Examining differences and connections among the 35 concepts extracted during open coding, concepts with relatively close associations and similar categories were refined to form a category. For example, eight concepts—venue guarantee, low efficiency sense, knowledge dissemination, cultural inheritance, social facilitation, thinking stimulation, vision expansion, and library-user co-construction—were extracted to form the "user perception" category. During axial coding, 11 categories were extracted. To distinguish them from core categories to be extracted in the next stage, these 11 categories are called ordinary categories, as shown in Table 4.

4.3 Selective Coding

Analyzing the 11 categories obtained from axial coding to identify their relationships, group them, and conduct further analysis reveals "service efficiency" as the core category. The relationship structure between core and ordinary categories was constructed and instantiated into structural elements and relationships of university library knowledge service, shown in Table 5 .

4.4 Theoretical Saturation Testing

After completing coding, concept extraction, and revision of interview data and Zhihu texts, text data from Sina Weibo (including 556 messages posted by three types of accounts: libraries, subject librarians, and users) underwent three-level coding and concept extraction. No new conceptual categories emerged, indicating theoretical saturation.

5 Research Results and Analysis

5.1 Structural Elements of University Library Knowledge Service

From a systems theory perspective, this study conducted grounded theory analysis on multi-source textual data, identifying four categories of elements for university library knowledge service: perceptual elements, ecological elements, interactive elements, and active elements. The relationship between each element and knowledge service efficiency is shown in Figure 1 [Figure 1: see original paper].

(1) Perceptual Elements. Perceptual elements include eight dimensions: venue guarantee, social facilitation, thinking stimulation, knowledge dissemination, vision expansion, cultural inheritance, low efficiency sense, and library-user co-construction. Based on perception, users construct knowledge service contexts in their subjective worlds that are both ubiquitous (from venue to social interaction) and profound (from thinking to knowledge); both sentimental (from vision to culture) and rational (from low efficiency sense to library-user co-construction). F.D. Davis's Technology Acceptance Model (TAM), proposed in 1986, has been widely applied to explain users' acceptance of information technology, with perceived ease of use and perceived usefulness as core concepts [20]. Perceived ease of use and perceived usefulness affect usage attitudes and intentions, while perceived usefulness positively influences post-use satisfaction and continued usage intentions [21]. The TAM model can also explain users' perception of knowledge services. Users perceive library knowledge services across three dimensions—space, resources, and services—and make evaluations of "I think it's useful" or "I think it's easy to use." Regarding user evaluation content collected in this study, perceived usefulness evaluations exceeded perceived ease of use evaluations, as reflected in statements like "The internet provides information, while libraries provide knowledge and thinking spaces," "Libraries' subject services demonstrate value," and "Libraries are landmarks and irreplaceable venues." This indicates that, compared to perceived ease of use, users attach greater importance to perceived usefulness, following a perception-construction-evaluation path to arrive at satisfaction evaluations and form intentions for continued use.

(2) Ecological Elements. Ecological elements include five dimensions: policy orientation, institutional innovation, talent cultivation, technology-driven development, and academic environment, which collectively determine the survival and development state of knowledge services. Numerous studies and practices have confirmed that institutional innovation, talent cultivation utilizing the knowledge service environment, and technology-driven support for knowledge discovery are important supports for transforming knowledge services from having formal frameworks to having substantive content [4,12,22-23].

Policy plays a benchmark and reference role in the top-level design of knowledge services [24], but the innovative and value-added nature of knowledge services requires policies to play a guiding role at higher levels. The Programme for

International Student Assessment (PISA) conducts educational policy orientation research across four aspects: efficiency (competitiveness), lifelong learning, social equity, and cost-effectiveness, with its findings profoundly influencing educational policy reflection and reform in the United States, France, Finland, Australia, the United Kingdom, Japan, and other countries [25-26]. In contrast, domestic knowledge service institutions have relatively adequate policy texts regarding social equity and cost-effectiveness, such as charters, regulations, and evaluation methods, but lack policy orientation concerning knowledge service efficiency and guiding users toward lifelong learning, such as building and cultivating the scientific literacy of knowledge service subjects and objects (ability to identify scientific issues, use scientific evidence, and scientifically explain phenomena), developing their skills and interest in acquiring or applying knowledge, and maintaining long-term motivation and capability for broad participation [26].

The academic environment provides fertile soil for knowledge services and is the foundation for their sustainable development and vitality. In interviews, Librarian B mentioned: "Encourage librarians to have more contact with frontline teaching and research faculty, receive academic influence, develop academic awareness, and reduce gossipy, matronly attitudes." Librarian F stated: "To encourage librarians to conduct research exploring practical work problems, the library has established special funds to support in-house research projects, which all librarians can apply for."

Interviews also revealed that knowledge service subjects' sensitivity to and awareness of existing policy orientation correlates with their professional rank, with associate senior rank (associate research librarian) being the watershed. Librarians at or above associate senior rank are familiar with existing policies and possess the ability to conduct research integrating policy, while those below associate senior rank generally express being "unclear" or "completely unaware." Librarian B noted: "The city issued documents on intellectual property protection, and our library has the capability to conduct research in this area and now collaborates with peer institutions on intellectual property information services." However, librarians below associate senior rank generally stated they were "unclear," "uninformed," or "completely unaware."

(3) Active Elements. Active elements include two dimensions: service expectations and service motivation. Service expectation levels depend on subjects' assessment of efficacy and value in achieving goals, while service motivation strength is governed by intrinsic motivation (intrinsic rewards such as recognition, satisfaction, and love), extrinsic motivation (extrinsic rewards such as money and material goods), and perceptions of resource allocation "fairness." Interviews revealed that librarians providing knowledge services hold simple expectations about "benefits"—demonstrating professional insights and capabilities while being altruistic. Librarian F stated: "We must help service objects solve practical problems so they find library services useful." Librarian D expected evaluation system improvements: "Current evaluation systems favor

those who 'socialize well' and 'have good interpersonal relationships.' If these systems could consider those who work diligently, professional librarians would suffer less injustice." Interviewees' expressions regarding service motivation can be summarized as two points: "Librarians gain a sense of achievement and value during service processes, with professional capabilities growing" and "Hope for paid services."

(4) Interactive Elements. Interactive elements include two dimensions: needs identification and communication cooperation, representing the process of exchange, interaction, and cooperation between subject and object in the knowledge service context, with goals of proposing, identifying, tracking, and meeting needs.

Identifying user needs is the primary task of knowledge service work. Interviews found that questionnaires and interviews are conventional methods for needs identification. Approaches using big data technology and IoT sensing devices to collect data on users' knowledge acquisition and application behaviors, then mining and analyzing user behavior data for needs identification, remain in the research and discussion stage and have not been widely promoted.

The premise of communication cooperation is establishing or temporarily establishing an equal, trusting service relationship. In knowledge service contexts, service relationships roughly fall into three categories: (1) between knowledge service subject and object; (2) between institutions where knowledge service subject and object are located; and (3) among team members within knowledge service teams. In service relationships, dialogue is conducted with the other party's needs as orientation, based on joint participation, responsibility, and sharing, to explore or set reasonable, achievable, and mutually recognized knowledge service goals. Clear service goals enable knowledge service implementation within technical frameworks.

5.2 Influencing Factors and Mechanisms of University Library Knowledge Service Efficiency

To analyze how structural elements affect university library knowledge service, this study repositioned elements into conceptual categories: perceptual and active elements belong to the cognitive category, interactive elements belong to the behavioral category, and ecological elements belong to the guarantee system category. Thus, the influencing mechanism of university library knowledge service efficiency includes three factors: cognition, behavior, and guarantee. Combined with dimensional items contained in each element, the mechanism of these three factors' influence on service efficiency is presented in Figure 2 [Figure 2: see original paper].

Knowledge service, grounded in guarantee system construction, runs through the entire process of subject-object cognition and behavioral interaction, dedicated to achieving high-efficiency knowledge service in university libraries. Practically, knowledge service efficiency in university libraries 主要取决于 three points:

(1) whether users continuously use services and develop dependence; (2) whether academic concepts supporting service behaviors gain professional recognition; and (3) whether knowledge service business expands simultaneously in depth and breadth.

The guarantee system supports the library knowledge service process through five aspects: policy, institution, technology, academia, and talent. Subject librarians shape their cognition based on service concepts and motivation, influencing behaviors to achieve needs identification, communication cooperation, and other specific knowledge service behaviors to meet user needs. Users perceive service usefulness and ease of use during usage, thereby constructing satisfactory service efficiency (high efficiency sense) evaluations, or conversely, unsatisfactory service efficiency (low efficiency sense) evaluations.

Limitations in guarantee capabilities may affect university library knowledge service efficiency overall. Policy orientation functions rank first among guarantee capabilities, yet policy stakeholders are unaware of available policies, possibly due to two reasons: (1) inadequate policy communication; and (2) low policy sensitivity among stakeholders, preventing policy orientation from fully playing its role and achieving multi-level, comprehensive policy and development planning adapted to local conditions. Therefore, strengthening communication and promotion of existing knowledge service policies to ensure policy ideas can be fully utilized down to the "nerve endings," coupled with planning new policies matching development needs, holds "pull-one-hair-and-move-the-whole-body" significance for building university library knowledge service guarantee systems and constitutes an important measure for enhancing knowledge service efficiency.

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6 Implications for Improving University Library Knowledge Service Efficiency

In the university library context, this study used multi-source textual data as research data, employing grounded theory to extract four structural elements of knowledge service (perceptual, ecological, interactive, and active elements), then inductively analyzed each element's conceptual categories to derive three factors influencing knowledge service efficiency (guarantee, cognition, and behavior) and their mechanisms. The theoretical value of this research lies in introducing knowledge service efficiency into the knowledge service research domain, distinguishing it from effectiveness, efficiency, and benefits: efficiency emphasizes the matching degree and satisfaction between supply and demand sides, effectiveness qualitatively characterizes goodness, efficiency emphasizes output per unit time, and benefits associate with economic returns. Therefore, using efficiency as a knowledge service influencing factor or evaluation indicator clearly better suits non-marketized, non-profit knowledge service activities, providing a new path for evaluating knowledge service activities.

6.1 Constructing Academic Communities

Within the guarantee system determining knowledge service ecology, needed improvements include strengthening policy orientation and expanding policy promotion coverage, along with enhancing academic environment construction. Specifically, the academic environment within knowledge service institutions should first nourish librarians, enabling them as knowledge service subjects to receive long-term academic influence in a quality academic environment, thereby cultivating strong academic awareness and capabilities, before they can substantively embed in teaching and research activities to enhance service efficiency. Quality academic environments should allow questioning and criticism, encourage expressing different viewpoints, and enable academic activities under audit culture to dare to reject short-term gains, permit failure, and allow starting over [30-32].

6.2 Developing Librarians' Professional Insight

In the behavioral process of subject-object interaction, professional quality determines knowledge service competency. Research has constructed a knowledge consultation competency model (knowledge consultation is considered to have evolved from reference consultation, serving knowledge needs rather than information needs, belonging to the same conceptual category as knowledge service), whose theoretical framework offers reference value for this study. "User needs identification capability" and "needs satisfaction (satisfaction) evaluation" are two indicators under the professional quality dimension of this model, while "team cooperation" is an indicator under the communication and coordination dimension [34]. While "identifying needs" and "evaluating needs satisfaction" belong to the professional quality dimension, the parallel dimension of "communication and coordination" also requires professional quality support. Lacking professional quality affects adequate communication, leading to coordination difficulties. Therefore, professional quality is a necessary condition for evaluating competency; only by permeating professional quality through all aspects of interactive behavior can needs be precisely identified, communication integrated, and dynamically changing knowledge needs followed up due to cognitive iteration.

6.3 Stimulating Librarians' Initiative in Knowledge Service

In the cognitive pattern governing librarians' subjective initiative, university librarians' service expectations are also met while helping users solve problems—the sustainable growth and development of service concepts and professional capabilities precisely drive their continuous altruistic behaviors. While institutional improvements and service compensation will be more practical extrinsic motivations, the satisfaction of service expectations constitutes intrinsic motivation.

6.4 User Participation in Knowledge Value-Added Process and Value Co-Creation

In user-perceived and constructed knowledge services, users expect to occupy the same subject position as librarians rather than being passive recipients, even having willingness to contribute knowledge and participate in the knowledge value-added process. Therefore, university libraries should provide channels for users to contribute knowledge, integrate user knowledge resources, and enhance knowledge service efficiency.

This study's limitations mainly include: compared to quantitative research, qualitative research inherently has unavoidable subjectivity, and interview data were predominantly generated from double-first-class universities in North China, limiting geographical distribution of sample collection. Future research will expand sample size, reasonably distribute sampling geographically, treat service efficiency and the three influencing factors as research variables, conduct quantitative research, and further investigate influencing factors and mechanisms of university library knowledge service efficiency to verify, revise, and improve this study's conclusions, making the research more universally significant and valuable.

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Author Contributions

Tu Yuhong: Paper topic selection, interviews, paper framework determination, paper writing and revision.
Yao Wei: Research methodology guidance, idea determination, paper revision and finalization.
Yang Xiaoping: Theoretical guidance, paper revision and proofreading.

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Keywords: knowledge service; structural elements; mechanism of action; service efficiency; grounded theory; university library

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