Post-knowledge Service Era: Concepts, Perspectives, and Post-print Transformation

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Abstract

[Purpose/Significance] Knowledge services have entered a new era, comprehensively influenced by various technological and social environments, and are facing new opportunities and challenges. This study investigates the developmental trajectory of knowledge services, exploring the concepts, perspectives, and transformation pathways for knowledge services in the new era, thereby fostering the development of knowledge service theory and practice. [Method/Process] Knowledge services are divided into two stages: pre-knowledge services and post-knowledge services. Through comparative analysis, the distinct environments and characteristics of each stage are revealed. Looking forward, developmental strategies and requirements for the post-knowledge services era are proposed from three dimensions: concept, perspective, and transformation. [Results/Conclusion] The pre-knowledge services era emerged from the transformation of information services, exhibiting three major orientations: technologization, informatization, and digitalization. The post-knowledge services era necessitates conceptual renewal and perspective expansion, facilitating the transformation of knowledge services through the integration of technology and humanities, multidisciplinary cross-fertilization, and intelligentization.

Full Text

Post-Knowledge Service Era: Ideas, Horizons, and Transformation

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Abstract

[**Purpose/Significance**] Knowledge services have entered a new era. Under the combined influence of various technological and social environments, knowledge services face new opportunities and challenges. This study examines the developmental trajectory of knowledge services, exploring the concepts, horizons, and transformation strategies required in this new era to advance both theoretical and practical development in the field.

[**Method/Process**] Knowledge services are divided into two stages: the pre-knowledge service era and the post-knowledge service era. Through comparative analysis, this paper reveals the distinct environments and characteristics of each stage. Looking toward the future, it proposes developmental approaches and requirements for the post-knowledge service era from three perspectives: conceptual renewal, horizon expansion, and transformation implementation.

[**Result/Conclusion**] The pre-knowledge service era emerged from the transformation of information services, characterized by three major directions: technologization, informatization, and digitalization. The post-knowledge service era demands updated concepts and expanded horizons, promoting the transformation of knowledge services through the integration of technology and humanities, multidisciplinary cross-fertilization, and intelligentization.

Keywords: knowledge service; information service; knowledge technology; service transformation

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Knowledge services have actually been a topic that gained popularity before cooling down. The enthusiasm for knowledge services at the end of the 20th century has passed. By the early 21st century, knowledge had become established as a "force," "value," "productivity factor," and "resource," forming the cornerstone of knowledge services. After extensive development in both breadth and depth, knowledge services have evolved into a relatively mature interdisciplinary field. As a specialized service based on knowledge and wisdom that employs knowledge technologies and methodologies to meet knowledge needs and solve various problems, knowledge services—characterized by knowledge-intensive intellectual services, professional value-added services, and knowledge-based innovative services—have played an important role in promoting economic and social development, particularly in knowledge innovation and advancement. Today, as knowledge services enter a new era, important questions arise: What concepts and horizons define this new era, and how should knowledge services transform?

1. Periodization of Information Services and Knowledge Services

Theoretical research has long been entangled in conceptual distinctions between information services and knowledge services, without transcending D.D.

Rourke's model regarding the relationship among data services, information services, and knowledge services [4]. Although numerous studies have discussed knowledge service models and operational mechanisms, most have presented either conceptual theoretical models detached from practice or theoretical models based on empirical experience summaries. Few have achieved pioneering theoretical innovation that drives breakthroughs in practice.

The transition from information services to knowledge services represents a transformation that involves not merely conceptual renewal and redefinition of themes, but also changes in horizons, particularly profound reforms in theory and practice, methodology, technology, and application. In a sense, this constitutes a revolutionary change in the field. If the transformation of information services at the beginning of the 21st century represented an information revolution and a watershed between the information service era and the pre-knowledge service era, then today's transformation of knowledge services can be called a new knowledge revolution, ushering knowledge services into a new era—the post-knowledge service era. If we trace back to the 1990s when the European Union's report first introduced the concept of "Knowledge-Intensive Business Services" [1], knowledge services have been proposed for over 20 years. When China's knowledge services began is difficult to determine precisely. These three eras—the information service era, pre-knowledge service era, and post-knowledge service era—constitute the historical trajectory of knowledge service transformation and development.

2. Pre-Knowledge Service Era

Compared with the information service era, the pre-knowledge service era exhibits the following characteristics:

2.1 Knowledge Management-Based Services Having experienced the evolution from simple to complex information management or information resource management during the information service era, classic theories and techniques of information management emerged, exerting profound influence across many industries. In the pre-knowledge service era, whether knowledge services were oriented toward enterprises or toward libraries, information institutions, or other social organizations, they all applied a fundamental concept of knowledge management—knowledge sharing. When organizing the compilation of the textbook *Introduction to Information Management*, the focus was primarily on organizational information systems construction and information industry management [5]. By the time of writing *Knowledge Management*, the focus had shifted to knowledge management systems and Chief Knowledge Officers (CKOs) [6]. Thus, my *Knowledge Management* represents one of many works from that period, clearly bearing the limitations of its time. Meanwhile, the emphasis on intellectual capital in business management, the focus on the knowledge economy and knowledge commodification in economics, the technological orientation in computer science, the emphasis on knowledge

organization and knowledge services in library and information science, the focus on knowledge equity and knowledge services in public management, and the emphasis on knowledge dissemination in communication studies all reflect the multidisciplinary characteristics of knowledge services and their different positions within various related disciplines. Simultaneously, many elements of modern service science were integrated. Therefore, knowledge services during this period constituted a new field grounded in the theoretical foundations of knowledge management and service science.

2.2 Information-Based Services In the information service era, "information" had already emerged as a new production factor and valuable resource. From discovering information's value to fully utilizing it, information economics, information society theory, and even information philosophy achieved substantial development. Although the pre-knowledge service era emphasized knowledge's value and importance in the value chain, fundamentally it did not break through the category of "broad information," essentially representing an advanced form of information services. The main manifestation was the "knowledge-ization" of information resources, accelerating information aggregation on the "raw data—raw information" chain and incorporating knowledge thinking and methods. Simultaneously, it strengthened the transformation from information to knowledge, initially forming the basic information chain of "data—information—rough knowledge."

2.3 Technology-Based Services In the information service era, technology was the most influential factor on society, fundamentally transforming all industries and even people's values, thereby establishing information technology's position in services. In the pre-knowledge service era, people attempted to distinguish information technology from knowledge technology, seeking new technologies that could change the world. Consequently, a series of technological innovations began. Starting from existing information technology, efforts were made to reduce material content and increase knowledge content in machine production, enhance innovation and accelerate renewal cycles in software manufacturing, and continuously strengthen the knowledge-ization of technology. From the perspective of information production, traditional models such as "computer-aided," "online uploading," and "paper-to-digital conversion" were replaced with direct knowledge production as the starting point, promoting knowledge processing and original innovation in the digitalization process. From the perspective of information dissemination, knowledge visualization was explored based on information visualization, and synchronous knowledge dissemination evolved from remote knowledge dissemination, almost overturning traditional models of information transmission.

Overall, the pre-knowledge service era presented three major directions: technologization, informatization, and digitalization. During this process, three schools emerged: first, the enterprise knowledge service school, driven by promoting original knowledge innovation, integrating enterprise informatization and ERP

to serve the enterprise knowledge value chain; second, the library and information knowledge service school, committed to knowledge processing and dissemination, vigorously developing digital libraries and digital resource construction to promote value-added services for literature and information; third, the social knowledge service school, applying knowledge to related fields, promoting social transformation of traditional concepts, reinterpreting the proposition that "knowledge is power," expanding knowledge application space, and enhancing knowledge utility.

3. Post-Knowledge Service Era

Knowledge services' entry into the post-knowledge service era results from the comprehensive influence of various technological and social environments, with many important indicators. Most importantly, the big data environment—from McKinsey's May 2011 report "Big Data: The Next Frontier for Innovation, Competition, and Productivity," to the World Economic Forum's 2012 report "Big Data, Big Impact" [7], to China's full implementation of the national big data strategy in 2017 and the accelerated construction of a digital China through the "five-in-one" approach [8]—has rapidly advanced "Internet Plus" across all industries and facilitated industrial and service transformation. Compared with the pre-knowledge service era, the post-knowledge service era exhibits the following characteristics:

3.1 Synchronized Integration to Address Diverse and Complex Environments Knowledge services cannot exist independently of information and technological environments. The post-knowledge service era faces an unprecedentedly complex environment that no longer manifests as a pure information environment. Its increasing complexity promotes the integration of information environments and ubiquitous knowledge environments, with the impact from digitalization to big data being the most important feature. The evolving media environment is reflected in the transition from "network media—multimedia" in the information service era, to "self-media—omnimedia" in the pre-knowledge service era, and further to "new media—media convergence" in the post-knowledge service era.

The dual nature of the post-knowledge service era is more severe and pronounced, although this characteristic had already emerged in the information service era. This duality breaks the original single mechanism, transforming the original "one-to-one" unitary world into a "one-to-many" or "many-to-many" pluralistic world. The simplest example is that traditional letter writing and telephone calls were one-to-one, but with networks and mobile phones, people can simultaneously contact multiple individuals and chat in WeChat groups. For knowledge services, this duality manifests in three aspects: first, dual spaces, where virtual and real knowledge communication occur synchronously, requiring knowledge services to alternate between both spaces; second, dual systems, where paper-based and digital knowledge carriers exist simultaneously, and

knowledge services cannot abandon either; third, dual trends, where knowledge processing becomes both integrated and fragmented simultaneously, presenting knowledge services with more choices.

This duality has both advantages and disadvantages. Its benefits include: first, diversity protection—the original single mechanism was prone to knowledge overload or loss, whereas duality provides more channels, media, and choices for knowledge preservation, ensuring broad dissemination and cross-generational inheritance after knowledge production; second, convenient access—more channels and dissemination routes facilitate faster knowledge sharing and updating, enabling people to acquire knowledge more rapidly and conveniently, thereby breaking through knowledge blockades or monopolies; third, favorable conditions for long-term preservation—knowledge accumulation and storage have better conditions and guarantees, solving the enormous risk of knowledge destruction due to disasters, wars, and human factors. The disadvantage is that this duality actually brings great distress to humanity, continuously increasing the costs of knowledge preservation, the pressure of knowledge processing, and the difficulty of knowledge control. Taking scientific output as an example, according to *Science* magazine, a new paper is published every 20 seconds on average [9]. The growth of digital data is even more astonishing, with the digital universe generating 5-1,200 exabytes of data annually [10]. If this growth exceeds human expectations and limits, it will become quite terrifying.

Currently, the effective measure to address this duality is synchronized integration—on one hand, achieving synchronization between the two spaces, two systems, and two trends to prevent separation or disconnection; on the other hand, promoting mutual integration between them to make them a unified whole. In a sense, this represents a return from complex pluralism to integrated unity.

3.2 Deep Human-Centered Approach to Address Negative Technological Effects In the pre-knowledge service era, technological functions had been fully exploited, yet isolated technological development gradually deviated from knowledge's origins, reaching a technological dead end and ultimately increasing its negative effects. These negative effects manifest as one-sided emphasis on machinery and equipment while neglecting human roles; a technology-only epistemology leading to the erroneous path of technology replacing everything; and traditional service models such as knowledge intensive processing and deep knowledge development being replaced by so-called new knowledge service models that are actually technologically-driven extensive models. Therefore, the post-knowledge service era must address technology's impact on human intelligence and solve the human-centered problem of knowledge technology. The post-knowledge service era will redefine human roles in knowledge services, not only correcting the weakened position of humans but also emphasizing the active roles of both knowledge service providers and recipients. This dual active role facilitates two-way knowledge flow and transforms the traditional "demand—

service" model into a new "demand—demand" model. In a sense, users becoming the new focus and mutually serving as service providers or recipients will become a norm in the post-knowledge service era. In fact, the post-knowledge service era has completed a fundamental change in the concept of "users"—users are no longer passive recipients of services in the traditional sense but are redefined as new roles in knowledge services.

3.3 Intelligentization The pre-knowledge service era, grounded in knowledge management theory, is clearly inadequate for the new situation. The post-knowledge service era requires redefinition and establishment of a theoretical framework for knowledge services, with a new theoretical foundation—knowledge science. The Knowledge and Systems Sciences (KSS) international conference has been held 18 times since 2000, with the 19th KSS conference in 2018 hosted by the University of Tsukuba's School of Business with the theme: "Acquiring Knowledge from Structured and Unstructured Data for an Effective Society" [15]. Among the hot research areas in knowledge science, the three most representative fields are knowledge integration, knowledge fusion, and knowledge services, with knowledge services considered the output link of knowledge science [16]. My work *Knowledge Science Research* [17] opens a broader horizon for knowledge services and foreshadows their transformation.

After artificial intelligence became the latest hotspot, the concept of "intelligence" quickly became associated with various industries, giving rise to many frontier fields such as smart cities, smart communities, smart factories, smart agriculture, smart transportation, and smart campuses. The post-knowledge service era needs to address the transformation from knowledge to intelligence and pay attention to key links in the intelligentization process. A noteworthy issue is that although technology in the pre-knowledge service era replaced manual labor and some mental labor, "foolproof" devices and one-click operations have created excessive dependence on technology and equipment, resulting in reduced thinking and diminished human brain function. Over time, this makes humans increasingly dull in the face of technology and machines. Will intelligent knowledge services make people smarter? Will they become smarter with use? This represents an important direction for developing intelligentization.

In the new environment, knowledge innovation relies more heavily on individual and team intelligence, and knowledge conflicts intensify. These conflicts can both promote organizational innovation and development while simultaneously posing challenges [14], particularly in knowledge-based organizations.

3.4 Interdisciplinary Cross-Fertilization and Integration In the pre-knowledge service era, problems requiring knowledge services were not particularly complex. Typically, a specialized information service for a scientific research field only required relevant disciplinary background knowledge, and embedded disciplinary services merely emphasized personnel with disciplinary backgrounds deeply integrating into research projects, teams, and teaching cur-

ricula. In the post-knowledge service era, however, knowledge services require interdisciplinary thinking. Knowledge service concepts based on computer science emphasize knowledge processing and transformation, developing the advantages and roles of knowledge technology in knowledge services; those based on library and information science emphasize knowledge organization and transfer, leveraging library and information functions in the knowledge value chain; and those based on management emphasize knowledge value-added and knowledge management, excavating management potential in knowledge services to maximize effectiveness.

In addition to developing original disciplinary fields, the post-knowledge service era must also focus on emerging interdisciplinary areas, seeking possibilities for new cross-fertilization in services and establishing dynamic mechanisms to promote development in these emerging fields. Digital humanities, evolving from humanities computing in the late 1940s to today's multidisciplinary hotspot, has gone through four stages: startup (1949-1970), consolidation (1970-1980), new development (1980-1990), and the Internet era (1990-present) [18]. Its research spans 102 disciplinary areas, with concentrations in computer science, linguistics, literature, information science, library science, history, art, psychology, engineering, science and technology, and the humanities [19], representing a typical example of the contemporary trends of technology-humanities integration and interdisciplinary cross-fertilization.

The post-knowledge service era must possess strong frontier awareness, moving from serving frontier fields to proactively initiating frontier research, from tracking disciplinary frontiers to discovering them, and playing a leading role in generating new problems, ideas, and methods. This pushes knowledge services from their original backstage position in scientific research to the forefront. The comprehensive disciplinary characteristics of knowledge services begin to emerge—not only do knowledge service workers need multidisciplinary backgrounds to solve complex problems, but knowledge services themselves are no longer exclusive to any single discipline. Instead, they are becoming a comprehensive discipline that applies multidisciplinary knowledge to solve complex interdisciplinary problems and is widely applied across all disciplines.

Currently, knowledge services are in a transitional period. How should they transform from the pre-knowledge service era to the post-knowledge service era? Through gradual change or mutation? Zhang Xiaolin's concept of "disruptive transformation" aims to redefine knowledge discovery, knowledge representation, knowledge literacy, and knowledge services, promoting structural reform on the supply side of knowledge services [20]. If the transition from information services to knowledge services represented a mutation, then the transition from pre-knowledge to post-knowledge services occurs through alternating gradual and sudden changes. The dynamic mechanism for knowledge service transformation lies in two drivers: demand-driven and technology-driven.

On one hand, new technological fields such as big data, artificial intelligence, the Internet of Things, blockchain, online identity, digital humanities, and dig-

ital twins will completely transform traditional knowledge services, enabling large-scale replacement of basic and manual knowledge services by machines or knowledge platforms. Knowledge acquisition, explicit knowledge conversion, and rough knowledge processing will become fast and efficient, further amplifying technology's role. On the other hand, as knowledge exists as a new culture, unlimited knowledge domains increase the complexity of knowledge aggregation and innovation. The demand for talent in knowledge services is more urgent than in any previous period. Taking big data talent as an example, the first "Big Data Talent Report" released by DataUnion shows that China has only 460,000 big data talents, with a projected shortage of 1.5 million in the next 3-5 years [21]. A McKinsey article indicates that by 2018, the U.S. market would face a shortage of 150,000 people who understand data analysis, while demand for business managers with data analysis capabilities and business thinking would exceed 1.5 million [21]. Human status in knowledge becomes more important, and human potential will become the most important resource.

References

[1] MILES I, MASTRINOS N, BILDERBEEK R, et al. Knowledge-intensive business services, users, carriers and sources of innovation[J]. Second national knowledge infrastructure set up, 1998, 44(4): 100-128.

[2] ZHANG Xiaolin. Toward knowledge services: Finding growth points for library and information work in the new century[J]. Journal of Library Science in China, 2000, 26(5): 32-37.

[3] WU Yishan. A brief discussion on moving from information services to knowledge services[J]. China Information Review, 2005(12): 30-31.

[4] ROURKE D D. The semantic grid: a future e-science infrastructure[EB/OL]. [2008-06-04]. http://www.semanticgrid.org/documents/semgrid-journal/semgrid-journal.pdf.

[5] KE Ping. Introduction to information management[M]. Beijing: Science Press, 2002: 149-251.

[6] KE Ping. Knowledge management[M]. Beijing: Science Press, 2007: 281-330.

[7] YU Liping. Big data and big data economics[J]. China Soft Science, 2013(7): 177-183.

[8] WANG Chunhui. Constructing the "five-in-one" strategy for national big data[EB/OL]. [2018-09-28]. http://www.legaldaily.com.cn/commentary/content/2017-12/13/content_{7419152}.htm?node=34251.

[9] Science. The rise of open access[EB/OL]. [2018-09-28]. http://science.sciencemag.org/content/342/6154/58.

[10] HUANG Changzhu. Some thoughts on the development of information science[J]. Journal of Information Resources Management, 2018(1): 4-8.

[11] STONE P, BROOKS R, BRYNJOLFSSON E, et al. Artificial intelligence and life in 2030[EB/OL]. [2018-09-28]. http://pages.cs.wisc.edu/~shavlik/ai_{{{100}}}*{{report}}*{083116}.pdf

[12] Gartner. Gartner's top 10 strategic technology trends for 2017[EB/OL]. [2018-09-29]. https://www.gartner.com/smarterwithgartner/gartners-top-10-technology-trends-2017/.

[13] Gartner. Gartner top 10 strategic technology trends for 2018[EB/OL]. [2018-09-29]. https://www.gartner.com/smarterwithgartner/gartner-top-10-strategic-technology-trends-for-2018/.

[14] QU Ran, YUAN Panyu. Research on knowledge conflict mechanisms and strategies in new knowledge-based organizations[J]. Information Science, 2018(9): 148-152.

[15] Systems Engineering Theory & Practice. 19th International Conference on Knowledge and Systems Sciences (KSS2018)[EB/OL]. [2018-09-29]. http://sysengi.com/CN/column/item164.shtml.

[16] QIU Junping, HAN Lei. Progress and trends in domestic knowledge science research in the past decade[J]. Library, 2016(12): 1-7.

[17] KE Ping. Knowledge science research[M]. Beijing: National Library of China Publishing House, 2017: 323-330.

[18] ADAMS J L, GUNN K B. Keeping up with digital humanities[EB/OL]. [2017-07-20]. http://www.ala.org/acrl/publications/keeping_{{{up}}}*{{with}}*/*digital*{humanities}.

[19] KE Ping, GONG Ping. Analysis of the evolutionary path and hot fields of digital humanities research[J]. Journal of Library Science in China, 2016(6): 13-30.

[20] ZHANG Xiaolin. Disruptive transformation and the post-library era: Promoting structural reform on the supply side of knowledge services[J]. Journal of Library Science in China, 2018(1): 4-16.

[21] DataUnion. DataUnion successfully co-hosted the first big data human resources forum[EB/OL]. [2018-09-30]. https://article.pchome.net/content-1943474.html.

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