ISO 30401 International Standard for Knowledge Management and Its Implications for Optimizing Innovation Ecosystems in Chinese Enterprises (Postprint)

Authors: Chu Jiewang, Chen Yongyan

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Abstract

[Purpose/Significance] Against the backdrop of economic globalization, innovation ecosystems have become a crucial source of driving force for the innovation and development of Chinese enterprises. This study interprets the ISO 30401 knowledge management standard released in 2018, aiming to provide insights for the construction and optimization of innovation ecosystems in Chinese enterprises. [Method/Process] The paper first interprets the new global standard for knowledge management, ISO 30401, using the enterprise knowledge management system as an entry point. It attempts to introduce this new knowledge management framework into the construction of China' s innovation ecosystems, analyzing aspects including the establishment of knowledge management systems, transformation of knowledge organization forms, clarification of leadership roles and responsibilities in enterprise knowledge management, technological and infrastructure innovation, and the promotion of an enterprise knowledge management culture. [Results/Conclusion] In innovation ecosystems, knowledge continuously circulates and flows among innovation entities. The establishment of a knowledge management system enables enterprises to develop systematic and standardized knowledge management capabilities, effectively utilize knowledge cycles, acquire knowledge advantages and competitive advantages, and continuously enhance their innovation capabilities.

Full Text

Knowledge Management International Standard ISO 30401 and Implications for the Optimization of China's Enterprise Innovation Ecosystem

Chu Jiewang, Chen Yongyan
Management School, Anhui University, Hefei 230039

Abstract

[**Purpose/Significance**] Against the backdrop of economic globalization, innovation ecosystems have become a crucial source of driving force for enterprise innovation development in China. This paper interprets the ISO 30401 knowledge management standard released in 2018 to provide insights for the construction and optimization of innovation ecosystems in Chinese enterprises. [**Method/Process**] Beginning with an interpretation of the new global knowledge management standard ISO 30401, this study uses enterprise knowledge management systems as an entry point to introduce the new knowledge management framework into China' s innovation ecosystem construction. The analysis focuses on establishing knowledge management systems, transforming knowledge organization forms, clarifying leadership roles and responsibilities in enterprise knowledge management, technological and infrastructural innovation, and fostering a knowledge management culture. [**Result/Conclusion**] In innovation ecosystems, knowledge continuously circulates and flows among innovation subjects. Establishing a knowledge management system helps enterprises develop systematic and standardized knowledge management capabilities, effectively utilize knowledge cycles, obtain knowledge and competitive advantages, and continuously enhance innovation capacity.

Keywords: knowledge management standard; ISO 30401; innovation ecosystem

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Against the backdrop of economic globalization and industrial digitalization, the knowledge economy has risen rapidly, making knowledge resources, knowledge capital, and knowledge products key factors for enterprises and organizations to gain competitive advantages. Knowledge management enhances an enterprise' s overall knowledge collaboration and responsiveness by developing and utilizing systematic knowledge, information, and professional expertise, enabling the formation of unique core competencies. Simultaneously, increasingly fierce global competition has promoted the systematic development of innovation. Worldwide, a new technological revolution and industrial transformation have entered a "phase transition zone," with transformative science, disruptive technologies, and destructive innovations gradually emerging. Major countries and regions are actively building excellent innovation ecosystems. Western developed nations have proposed innovation development strategies, establishing national

and regional innovation systems tailored to their conditions that tightly integrate government, enterprises, universities, research institutes, and markets to maximize innovation system performance. The Silicon Valley model represents a typical innovation ecosystem dominated by innovation clusters, jointly led by universities, government, and entrepreneurs, becoming an emulation target for innovation parks worldwide.

China' s 18th National Congress proposed an innovation-driven development strategy, explicitly making technological innovation a strategic support for improving social productivity and comprehensive national strength, and insisting on the path of independent innovation with Chinese characteristics. Under the guidance of this innovation development strategy, China' s innovation level has continuously improved. The Chinese Academy of Science and Technology for Development released the *National Innovation Index Report 2020* at the 2021 Pujiang Innovation Forum, showing that China ranks 14th globally in comprehensive national innovation index, with scientific and technological innovation capabilities rapidly approaching those of developed countries. The concept of innovation ecosystem originated from ecology. In 1993, J.F. Moore first used ecological methods in management research to understand the complex innovation environment of enterprises [1]. In innovation systems, the flow of materials, energy, and information among different innovation subjects and between subjects and the environment achieves collaborative development, gradually forming a complex system of co-opetition, symbiosis, and dynamic evolution—much like biological communities in natural ecosystems interacting and co-evolving. Innovation ecosystems thus embody the connotations and characteristics of both ecological and innovation systems, making research on innovation ecosystems a new direction in innovation theory.

Building on this foundation, M. Iansiti and R. Levin employed the ecological niche concept to understand innovation ecosystem structure, proposing that enterprises in innovation ecosystems should occupy different niches and influence each other [2]. R. Adner et al. argued that innovation is often completed through complementary cooperation with a series of collaborative organizations, and that a single enterprise cannot achieve innovation independently, while the emergence of innovation ecosystems can better accomplish this goal [3]. B. Walrave et al. proposed that innovation ecosystem success stems from combining internal consistency with external viability, and presented a theoretical framework for how core enterprises can develop into innovation ecosystems [4]. L.A. Vasconcelos et al. viewed innovation ecosystems as setups for co-creation or co-creation of value, where core enterprises, customers, suppliers, complementary innovators, and other agents interconnect and interdepend. Members face both cooperation and competition in innovation ecosystems, following a co-evolutionary lifecycle [5]. O. Granstrand et al. reviewed the innovation ecosystem concept over the past 15 years, defining it as a set of evolving actors, activities, and artifacts, plus their institutions and relationships—including complementary and alternative relationships—that play important roles in the innovation activities of both core enterprises and the entire ecosystem [6].

Recent academic research at the micro-enterprise level has mainly focused on explaining mechanisms, structures, and value co-creation in enterprise innovation ecosystems through case studies. Jiang Shimei explored the mechanism of non-technical elements in enterprise innovation ecosystems, identifying five major non-technical elements that maintain healthy ecosystem operation: market, strategy, organization, institution, and culture [7]. Wang Mingduan analyzed knowledge transfer and sharing mechanisms in innovation ecosystems from three perspectives—dynamic evolution, value reconstruction, and ecological niche [8]. A. Boni et al. focused on collaborative innovation beyond national borders in enterprise innovation ecosystems and the expansion of traditional responsibility boundaries and cooperation models under COVID-19 [9]. J. Kim et al. summarized five core capabilities of existing core enterprises from the perspective of innovation ecosystem dynamic capabilities: cooperation and networking, opportunity sensing, entrepreneurial orientation, knowledge management, and strategic flexibility [10].

Enterprises are often the concentrated source of innovation in innovation ecosystems, analogous to producers in biological ecosystems. Essentially, knowledge constitutes the foundation of enterprise core competitiveness and is the key resource throughout the entire innovation ecosystem. To achieve sustained innovation and maintain core competitiveness, enterprises and organizations need to continuously organize, excavate, and create internal knowledge. Therefore, introducing knowledge management concepts, particularly new knowledge management standards, into innovation ecosystems provides new ideas and models for innovation. China issued its first national standard in 2009, and Chu Jiewang et al. studied several influential foreign knowledge management standards while analyzing China' s relevant standards [11-12]. Guo Chunxia et al. compared domestic and foreign knowledge management standards, proposing deficiencies in China' s leadership systems, rule refinement, and promotional influence [13]. After the release of ISO 9001:2015, many scholars studied its impact. B. Dan et al. researched the standard' s influence and inspiration for organizational knowledge management in business ecosystems [14]. P. John et al. believed that knowledge and its management would become increasingly important in organizations with ISO certification requirements [15]. The release of the first international knowledge management standard, ISO 30401, in 2018 provided the field with entirely new guidance, though current research on it remains relatively scarce. Therefore, this paper attempts to explain the standard' s content architecture, discuss how knowledge management system application can build and enhance enterprise innovation capabilities within innovation ecosystems, and derive implications for China' s innovation ecosystem.

Knowledge Management in Enterprise Innovation Ecosystems

The 2019 Government Work Report stated the need to "vigorously optimize the innovation ecosystem and mobilize the enthusiasm of various innovation subjects," while the 2021 report proposed "improving the national innovation

system and creating a favorable innovation ecosystem." This indicates that innovation ecosystems as a new path for enterprise survival and development have gained national-level recognition and promotion, representing the greatest environmental challenge for enterprise survival and development. In the complex market environment of economic globalization, enterprises and organizations seeking sustained innovation and core competitiveness must base this on internal knowledge excavation and value creation. The introduction and application of knowledge management systems will make knowledge transfer, sharing, and innovation activities throughout the innovation ecosystem a dynamic, multi-dimensional, two-way, and continuous process—a spiraling and cyclical process [16].

Innovation ecosystems consist of multiple actors, including core enterprises, SMEs, startups, service institutions, investment organizations, government agencies, and research institutions [17]. Different types of innovation subjects connect through formal or informal networks to conduct knowledge sharing and exchange, forming tight horizontal and vertical relationships. By establishing knowledge transactions and reducing learning risks, they create knowledge transfer and learning processes that enable knowledge sharing, transfer, and diffusion among different innovation subjects, increasing continuous circulation within the innovation ecosystem. Through knowledge management, enterprises integrate internal knowledge resources for collaborative innovation, while acquiring, sharing, and transferring knowledge with other innovation subjects to achieve external knowledge innovation. The innovation environment plays an important role in enhancing enterprises' knowledge innovation levels through knowledge acquisition. Enterprises must actively establish close and stable cooperative relationships with other subjects based on their own cognition and value judgments, reaching consensus on cooperation, alliances, and collaborative innovation to effectively combine industry, academia, and research and promote innovation ecosystem formation and development. In Tencent' s Innovation Space [18] innovation ecosystem, open innovation with two-way knowledge flow between large enterprises and SMEs/startups enables multiple subjects to achieve win-win outcomes through joint participation in innovation activities.

Forming Knowledge Advantages in Enterprise Innovation Ecosystems

Knowledge resources widely exist in the knowledge network relationships formed by universities, research institutions, customers, suppliers, competitors, and enterprises themselves. Each subject in the innovation ecosystem possesses different knowledge resources and competitive advantages. Despite different roles and positioning, functional intersections and exchanges exist, making the ecological relationships among subjects in knowledge transfer processes dynamically interactive. Meanwhile, as external competition intensifies, enterprises increasingly struggle to achieve sustained effective innovation relying solely on spontaneous dissemination of internal knowledge resources. Instead, knowledge must be created, integrated, and applied faster than the pace of change. En-

terprises obtain competitive intelligence knowledge from external sources such as customers, competitors, and suppliers, and acquire rich, high-quality market information through knowledge cooperation with universities and research institutions. This external knowledge enters the enterprise and transforms into new knowledge resources, combining with unique internal knowledge resources to constitute enterprise knowledge stock.

Reasonable implementation of knowledge management not only helps enterprises integrate, flow, apply, and evaluate internal and external knowledge to make reasonable decisions, but also enhances their core value in market competition, enabling timely and creative application of internal and external knowledge to create new products and services, laying a solid foundation for subsequent industry development. JAC Motors [19], through combining internal R&D with university cooperation and leveraging its advantageous position in traditional automotive research, built an enterprise R&D network that effectively acquires and integrates internal and external knowledge resources, enabling rapid response and competitive advantage formation during industrial and product technology iteration. Knowledge sharing and flow among innovation subjects represent the most important driving force for the dynamic development of knowledge stock across innovation subjects and the entire innovation ecosystem. Therefore, the role of knowledge management in innovation ecosystems further promotes the formation of enterprise knowledge advantages. In collaborative innovation processes, innovation subjects continuously increase their own and systemic knowledge stock, transferring and sharing knowledge to form inter-system knowledge flow, thereby improving innovation capabilities and enhancing the competitive advantages of innovation ecosystems. Knowledge management system application improves knowledge capture, fusion, and innovation capabilities during knowledge flow processes in innovation ecosystems, increasing knowledge transfer efficiency and effectiveness, and realizing innovation advantages and innovation ecological environments for innovation subjects.

Promoting Functional Enhancement of Enterprise Innovation Ecosystems

With the arrival of the knowledge economy era, knowledge management organizes and classifies disordered knowledge resources owned by enterprises, using modern technological means to order disordered knowledge information and make enterprise innovation activities more efficient and orderly. Innovation within innovation ecosystems mainly originates from knowledge transfer and sharing. During the process of mutual fusion and exchange of explicit and tacit knowledge within and between innovation subjects, enterprises continuously form knowledge systems with organizational characteristics, path dependency, and difficulty for external acquisition and imitation—these are precisely the key factors determining innovation capability. Knowledge transformation is the core link of knowledge innovation. After knowledge conversion, forming systematic explicit knowledge and unique tacit knowledge systems can improve innovation subjects' innovation capabilities. The knowledge management process involves

not only organizing and classifying knowledge but also applying knowledge in enterprise business activities to make innovation processes more rational and orderly, achieving the goal of improving innovation capabilities and work efficiency. Yang Mingchun' s study of Baidu' s innovation ecosystem proposed that core enterprises should timely transform technology and management according to continuously changing innovation capability demands to maintain better innovation efficiency [20]. In enterprise innovation processes, constructing management mechanisms through knowledge management that can effectively absorb, retain, share, and transfer knowledge can promote the knowledge-ization, ordering, and data-ization of large amounts of disordered information, improving the close connectivity of enterprise business activities, accelerating technological innovation pace, and ensuring enterprise innovation capability enhancement.

Knowledge Management International Standard ISO 30401

3.1 ISO 30401 Since its proposal, the knowledge management concept has attracted attention from numerous researchers in various fields. However, different research perspectives based on disciplinary backgrounds and application industries have caused divergences in conceptual definitions and applications. When organizations practice knowledge management, they lack unified regulations on terminology concepts, basic principles, methods, rules, models, and processes. Consequently, countries and organizations have successively explored knowledge management-related standards, but before the release of ISO 30401, the only ISO standard mentioning knowledge management was ISO 9001:2015 Quality Management Systems Requirements. Clause 7.1.6 mentions organizational knowledge: "The organization shall determine the knowledge necessary for the operation of its processes and to achieve conformity of products and services, and shall maintain and retain this knowledge."However, as a clause within a quality standard, it only requires adequate attention to knowledge to ensure good and consistent quality of goods and services—it is neither a knowledge management standard nor does it require organizations to formalize knowledge management as a requirement.

Against this background, the world's first knowledge management standard, ISO 30401 (hereinafter referred to as "the Standard"), was released in November 2018, filling the gap for a global standard in the knowledge management field. The Standard explicitly specifies requirements needed to promote knowledge development, sharing, and effective use of knowledge within organizations, providing an updated mechanism to address relevant issues in knowledge management. Its purpose is to establish sound knowledge management principles and requirements, providing guidance for organizations seeking to optimize their knowledge value and serving as a basis for auditing, certification, evaluation, and accreditation of organizations by audit institutions. Current academic response to this standard has been swift. P.J. Corney summarized important experiences in drafting ISO 30401 and the standard' s advantages and disadvantages [21]. E.Z. Maximo et al. conducted preliminary visualization of the standard' s structure,

analyzed specific topics in ISO 30401, and emphasized its main strengths and weaknesses in practical application [22]. J. Bressler et al. recommended using ISO 30401 as a guide for value creation using knowledge [23]. D. Kudryavtsev and D. Sadykova studied how to integrate the ISO 30401 standard into enterprise architecture models, combining knowledge management with other management systems, technologies, and IT systems in organizations [24]. However, domestically in China, this standard has not yet received attention, and relevant research remains scarce.

3.2.1 Standard Architecture and Main Content The ISO 30401 standard adopts the high-level structure proposed by the ISO organization in 2012, divided into 10 chapters: Scope, Normative References, Terms and Definitions, Organizational Context, Leadership, Planning, Support, Operation, Performance Evaluation, and Improvement. The first three chapters describe the scope, normative references, and terms and definitions of the knowledge management system. In ISO 30401, knowledge management is primarily defined as management related to knowledge, adopting a systematic and holistic approach to improve learning and outcomes, including knowledge identification, creation, analysis, representation, distribution, and application to create organizational value. The knowledge management system is considered the part of an organization' s management system related to knowledge, with elements including organizational knowledge management culture, architecture, governance, and leadership; roles and responsibilities; planning, technology, processes, and operations.

The latter six chapters provide general guidelines for knowledge management system construction. Chapter 4 describes three central elements of the knowledge management system: knowledge development, knowledge conversion, and knowledge management enablers. The final five chapters cover provisions for knowledge management system implementation, maintenance, and continuous improvement, including: Leadership, Planning, Support, Operation, Performance Evaluation, and Improvement. The Standard requires organizations to play a leadership role in establishing policies and allocating responsibilities, planning knowledge management objectives, determining and providing resources needed to establish, implement, maintain, and continuously improve the knowledge management system, and describing, operating, and recording knowledge management processes. Finally, organizations should evaluate knowledge management effectiveness through internal audits and management reviews, continuously improving the knowledge management system.

ISO 30401 has three annexes: (1) Annex A defines the scope of knowledge management, using the knowledge spectrum concept to define that knowledge management addresses activities associated with all types of knowledge along the continuum of utilizing existing knowledge, creating new knowledge, and knowledge conversion; (2) Annex B defines distinctions and relationships between knowledge management and adjacent disciplines, separating knowledge

management from data management and business intelligence, which are conceptually different from knowledge management; (3) Annex C defines knowledge management culture, clarifying that at the organizational level, knowledge management culture is a supporting component of organizational culture.

3.2.2 Main Content of the Standard The primary purpose of ISO 30401 is to support organizations in establishing complete knowledge management systems that enable knowledge to effectively promote and achieve value creation. [Figure 1: see original paper] references ISO 30401 to establish a preliminary process for knowledge management systems, as well as implementation, maintenance, and continuous improvement processes. First, enterprises need to confirm their knowledge management context and strategic objectives, identify needs and expectations of internal and external stakeholders, and develop a knowledge management system based on this foundation. On this strategic basis, they should define the scope of the knowledge management system, develop context-appropriate knowledge management plans, and provide necessary material and human resources to support the system. Simultaneously, enterprises must describe, operate, and record knowledge management processes by communicating with all internal and external stakeholders and providing information about the knowledge management system. The Standard requires enterprises to evaluate knowledge management system performance through internal audits and management reviews. Finally, enterprises should continuously improve their knowledge management systems, correcting deficiencies identified by evaluation mechanisms. Leadership and culture are the two main connection points between the knowledge management system and other parts of the organization. The three core components of the knowledge management system are knowledge development, knowledge conversion, and enablers.

The various stages of knowledge development include activities for acquiring new knowledge, applying new knowledge, retaining knowledge, and handling obsolete or invalid knowledge. Second, organizations need to facilitate knowledge conversion—that is, support knowledge flow across individual, team, and organizational levels. To achieve this, organizations should promote interaction among personnel, knowledge representation and documentation, knowledge combination (forming new insights), and knowledge internalization and learning. Finally, organizations should support the system by providing appropriate human resources, process management, technology and infrastructure, and actively developing a knowledge management culture. The core elements of the knowledge management system are shown in .

Table 1 Core Elements of Knowledge Management System

Knowledge Development	Description	Examples
(1) Acquiring new knowledge: Providing knowledge previously unknown or unavailable within the organization	Knowledge creation, innovation, research, knowledge discovery and detection, classroom learning, acquiring knowledge from external sources, feedback collection, adapting existing knowledge to new applications	
(2) Applying existing knowledge: Enabling knowledge to be effective and integrating relevant existing knowledge to empower decision-making and activity improvement	Knowledge transfer, integration, sharing, codification, utilization, creative problem-solving	
(3) Maintaining existing knowledge: Protecting organizational knowledge to avoid loss	Knowledge documentation, ensuring expert knowledge isn' t lost through employee turnover, information backup, succession planning, coaching	
(4) Handling obsolete or invalid knowledge: Protecting the organization from errors or reduced efficiency from using inappropriate knowledge in current environments	Knowledge deletion, curation, archiving, updating, and retraining based on knowledge changes	

Knowledge Conversion	Description	Examples
(1) Interpersonal interaction: Exchanging and co-creating knowledge through dialogue and interaction among individuals, teams, and the entire organization	Communities of practice, brainstorming sessions, collaborative teams, knowledge/world cafés, shift handovers, knowledge inheritance plans, mentoring, storytelling	
(2) Representation: Making knowledge available through demonstration, documentation, and/or codification	Designing or writing work procedures and guidelines, classes, recording work handovers, documenting lessons learned	
(3) Combination: Synthesizing, curating, formalizing, structuring, or classifying codified knowledge to make it easily accessible and reusable	Grading and classifying captured knowledge, tagging, summarizing and structuring content, updating	
(4) Internalization and learning: Reviewing, evaluating, and absorbing knowledge and integrating it into practice	Searching and seeking knowledge, after-action reviews, briefings, checklists, using simulations, employee onboarding, e-learning	

Enablers	Description	Examples
(1) Human capital: Roles and responsibilities, including all relevant parties in the knowledge management system, ensuring knowledge management advocacy within the organization	Chief Knowledge Officer, community of practice coordinators, employee participation in knowledge management	
(2) Processes: Defined knowledge activities applied and embedded in organizational processes, including procedures, guidelines, methods, and measures	Knowledge discovery and detection, learning from failures and successes	
(3) Technology and infrastructure: Digital channels, virtual and physical workspaces, and other tools	Mobile applications, portals, wikis, search engines, cloud computing, big data platforms, collaborative workspaces, informal meeting areas	
(4) Governance: Strategies, expectations, and methods ensuring knowledge management system coherence	Knowledge management strategy, policies, service level agreements, codes of conduct	
(5) Knowledge management culture: Attitudes and norms about sharing and learning from mistakes	Recognizing and explaining mistakes is rewarded rather than punished	

Meanwhile, the Standard emphasizes knowledge management culture as a core characteristic of the organizational environment supporting the knowledge management system. Introducing knowledge management culture throughout the organization is crucial for the sustained application of knowledge management. Encouraging organizations to value and actively engage in knowledge activi-

ties, and cultivating a culture that willingly seeks, shares, develops, and applies knowledge helps establish and apply knowledge management systems within organizations. At the individual level, knowledge management culture encourages everyone to share knowledge through their own behaviors and interactions. Knowledge management culture acknowledges the value of both individual and shared knowledge because it benefits the organization.

3.3 Key Concepts of ISO 30401 The release of ISO 30401 is undoubtedly a milestone in the history of knowledge management development, playing an important role in promoting the establishment of knowledge management systems theoretically and practically. It conveys several important concepts:

First, knowledge management methods are dynamic, so the process of establishing and continuously updating the knowledge management system is its core component. This also demonstrates that knowledge management is not a panacea; only by finding appropriate implementation scenarios can it maximize its effectiveness. Additionally, knowledge management serves organizational dynamic capability building, and organizational strategic adjustment and process reorganization must be synchronized.

Second, ISO 30401 emphasizes human roles rather than technical knowledge, maintaining neutrality on existing knowledge management tools while remaining open to technological innovation. Regardless of how scientific the methods or advanced the technology, people remain the dominant factor in organizations. The ultimate standard and goal of knowledge management is also to serve people.

Third, the Standard emphasizes that culture is a key enabling factor. This emphasis on human enabling factors echoes the Standard' s main purpose: knowledge is carried by people. Current knowledge management focus concentrates mainly on technology and structure for knowledge storage, while lacking attention to people' s motivations for sharing knowledge and their cognitive levels. ISO 30401' s emphasis on establishing knowledge management culture within organizations undoubtedly facilitates transformation in this phenomenon.

Implications of ISO 30401 for Optimizing China' s Enterprise Innovation Ecosystem

The 2016 *National Innovation-Driven Development Strategy Outline* explicitly defined the functions and positioning of various innovation actors. In the context of economic globalization and complex, dynamic market environments, enterprises seeking sustained innovation and core competitiveness must base this on internal knowledge excavation and value creation. Particularly under the current background of increasingly fierce international scientific and technological competition where mastering key core technologies has become paramount, optimizing the scientific and technological innovation ecosystem urgently requires introducing knowledge management concepts, especially internationally

advanced knowledge management standards like ISO 30401, which undoubtedly provides new ideas and models for improving China' s innovation ecosystem.

Establishing Enterprise Knowledge Strategy and Building Knowledge Management Systems

In the knowledge economy era, enterprise innovation requires substantial knowledge support. When an enterprise considers establishing a knowledge management system, it must not only understand the market but also find answers to three important questions [25]: (1) What does the market want? (2) What are the driving forces? (3) How can the enterprise best provide answers? The ISO 30401 Standard provides a set of "establish, implement, maintain, and continuously improve" knowledge management system management activity processes applicable to any management system, answering these questions. First, enterprises should identify stakeholders related to the knowledge management system and understand market needs and expectations. Second, when planning the knowledge management system, enterprises must determine organizational objectives and relevant contexts, evaluating and prioritizing knowledge management system applications in knowledge areas of greatest value to the organization. Third, integrate knowledge development and application needs into organizational responsibility division and business processes, embedding knowledge development and utilization into organizational management processes to discover the enterprise' s own core competitiveness to better adapt to market demands. Through interaction and collaborative innovation with different innovation subjects in the system such as universities and research institutions, enterprises can obtain external knowledge resources, achieve two-way circulation of professional technical knowledge and market-oriented knowledge, continuously renew enterprise knowledge systems, and maintain updated innovation capabilities and competitive advantages. By conducting knowledge resource cooperation and encouraging knowledge resource integration to facilitate integrated innovation, enterprises can enhance their knowledge development and innovation capabilities, further strengthening the innovation capabilities and competitive advantages of the entire innovation ecosystem, forming a positive feedback virtuous cycle. Continuous knowledge transfer and sharing among innovation subjects transforms knowledge from disorder to order, spreading and sharing knowledge, experience, and capabilities in broader areas, laying the foundation for knowledge sharing, transfer, fusion, and innovation across the entire innovation ecosystem.

Optimizing Enterprise Knowledge Structure and Promoting Efficient Knowledge Flow

In traditional enterprise management, hierarchical management structures only allow vertical knowledge transfer through typical superior-subordinate chains of command, inhibiting horizontal knowledge transfer between levels and preventing adaptation to new knowledge management systems and knowledge innovation. Therefore, knowledge management applications impose new requirements on enterprise organizational structure. ISO 30401 also identifies organizational

structure as one of the main factors affecting knowledge management, while encouraging knowledge exchange and creation through dialogue and interaction among individuals, teams, and the entire organization.

Many knowledge-oriented enterprises increasingly tend to establish horizontal, flexible structures with fewer hierarchical levels and extensive communication at all organizational levels. Structures are becoming flatter with fewer levels to allow dialogue and teamwork among employees and encourage interaction among all company members, enabling collective learning from individually held knowledge. Flat organizational structures are flexible and efficient, capable of rapidly and accurately transmitting information to decision-makers—employees with the shortest command systems—and promoting implicit knowledge sharing and dissemination among enterprise departments, levels, and members. The continuous innovation and spiral ascent of knowledge across the entire innovation ecosystem is the most important link for achieving innovation. For example, Siemens' decentralized knowledge management approach, where all members except a few managers are treated equally, breaks down departmental controls and boundaries, greatly expands employee development space, improves objective environments for individual learning and exchange, and facilitates the formation of knowledge innovation-oriented organizational structures and learning enterprises. Therefore, enterprises should optimize team knowledge structures and promote knowledge sharing among employees internally [26].

Clarifying Leadership Roles and Responsibilities in Enterprise Knowledge Management

Knowledge sharing and teamwork in work are crucial in today' s business activities. Support from senior management and leadership for formal organizational knowledge management programs is the primary factor. ISO 30401 proposes that "top management shall ensure that responsibilities and authorities for relevant roles in the knowledge management system are assigned and communicated within the organization and with external stakeholders as necessary." When planning and implementing knowledge management programs, organizations need to establish specialized leadership roles to develop and drive the process, such as CKO (Chief Knowledge Officer) positions, appropriately allocating knowledge management responsibilities to corresponding functional departments and levels to promote individual development and knowledge innovation, ultimately obtaining innovation through management system knowledge. Characteristics and challenges of Chief Knowledge Officers include: interpersonal communication skills, visionary leadership, business acumen, strategic thinking skills, ability to withstand change, and collaborative influence. Much enterprise knowledge is often a special skill obtained by employees through long-term effort. Therefore, employees will only choose to share tacit knowledge with others when the benefits exceed the costs. Enterprises should formulate reasonable incentive measures to make employees feel that expected benefits exceed sharing costs, thereby generating willingness to share tacit knowledge. Based on employees' knowledge contribution motivations and hierarchical needs, using specific mate-

rial and spiritual incentives makes employees feel their efforts will be rewarded, thus actively participating in tacit knowledge transfer and sharing while creating an atmosphere conducive to improving team efficiency and creativity. Appropriate flexibility and sufficient group consensus facilitate high-level knowledge transfer, creation, and application. This requires strict and inclusive organizational change, which in turn requires excellent leadership training support for organizational change-related issues—the transformation process for companies and their employees is crucial.

Technological and Infrastructural Innovation Facilitating Cross-System Knowledge Conversion

Over the past decade, information technology has brought tremendous innovation to knowledge management, with key technological innovations including social media, cloud software services, mobile technology, Internet 2.0 and collaboration technologies, unstructured data, big data, IoT, and artificial intelligence. These innovations prompt organizations to consider new processes and methods for managing, transmitting, and utilizing data, information, and knowledge, emphasizing information management issues such as knowledge governance, risk and security management, leadership, innovation, business intelligence and analytics, and strategy. Enterprises can use modern information technology and AI to build open, flexible, and resilient tacit knowledge management platforms supporting storage, acquisition, transfer, exchange, transformation, and sharing of tacit knowledge. Accelerating the explicitization process of enterprise tacit knowledge quickly transforms knowledge into productivity to realize enterprise value. The ISO 30401 Standard proposes that organizations provide appropriate technology and infrastructure (such as mobile applications, portals, wikis, search engines, cloud computing, big data platforms, collaborative workspaces, and informal meeting areas) to implement their knowledge management systems. On this basis, strengthening knowledge sharing platform construction integrates information resources from different platforms to form large databases, establishing enterprise knowledge bases to facilitate data resource circulation among different subjects. This breaks temporal and geographical barriers to tacit knowledge sharing, establishing smooth communication channels that make knowledge sharing more convenient and rapid, enabling employees to quickly search for and acquire tacit knowledge. Employees can promptly publish their learning experiences and achievements to enterprise knowledge exchange platforms, effectively preventing knowledge loss due to employee turnover. Second, promoting cross-regional and cross-system knowledge platform construction within innovation ecosystems, strengthening cooperation with public internet platforms based on database characteristics, and establishing data resource alliances and industry-oriented innovation databases for knowledge and data resource cooperation among enterprises in the system, especially along industrial value chains, can better utilize knowledge resources and technological means. This achieves optimal combination of knowledge, human, capital, and information resources to create superior value realization models. iFLYTEK jointly established the iFLYTEK Alliance Center with hundreds of domestic and foreign enterprises,

investing enormous financial and human resources to build a developer platform, sharing relevant technologies to open platforms while continuously lowering innovation thresholds, committed to advancing voice interaction technology applications with various developers and improving enterprise technology transformation capabilities and innovation efficiency [27].

Promoting the Formation of Knowledge Management Culture Within Enterprises

Establishing knowledge management methods, procedures, and standards within organizations, promoting knowledge management culture, and building lifelong learning cultures are key focuses of ISO 30401 discussions. Exchanges among employees can generate information and knowledge needed for independent innovation. Through knowledge learning and sharing, both employee innovation capabilities and enterprise innovation levels will improve. However, most employees are unwilling to participate in this form of exchange because they don' t recognize themselves as part of the entire organizational ecosystem nor view organizational overall objectives as shared values, thus resisting knowledge sharing. Therefore, creating an organizational culture and work environment that shares knowledge, encouraging mutual learning and cooperation without organizational level restrictions and constraints, and adopting open systems that allow employees to speak freely and actively express their views are necessary. First, based on understanding knowledge management methods for knowledge sharing, transfer, and collaboration, encourage the establishment of communities of practice (CoP) around business and system architecture, work processes, and related policies and practices to best utilize organizational resources. Communities of practice provide forums for sharing professional expertise and building knowledge systems, encouraging employee participation and establishing cross-departmental knowledge interaction and connections where employees can share resources and knowledge with each other. Second, organizations should open their resources and knowledge to employees, establishing sound knowledge management systems and standards. Google stands out due to its special organizational culture, which highly values employee wisdom and opinions. Employees can send ideas about new products, processes, and company improvements via email to a company-wide suggestion box, where every employee can comment on and rate these ideas. Google also provides numerous intellectual stimuli, offering employees technical talks from outstanding researchers worldwide, ensuring it remains at the forefront of organizational culture and innovation processes to attract and retain high-quality employees [28].

In the Internet big data era, innovation ecosystems have become an important model for promoting innovation development in China, with knowledge continuously flowing among various innovation subjects. Based on interpretation of the new global knowledge management standard ISO 30401, this paper introduces the new knowledge management system into China' s innovation ecosystem construction, analyzing from perspectives of enterprise knowledge manage-

ment system introduction, knowledge development and utilization, knowledge structural adjustment, platform construction, and knowledge management culture. The following insights are obtained: (1) Establish enterprise knowledge strategy and build knowledge management systems. During innovation, enterprises must both explore core competitiveness internally to establish knowledge management systems and establish partnerships with universities, research institutions, and other enterprises in the system to expand knowledge resources and build market-oriented, long-term stable innovation ecosystems. (2) Optimize enterprise knowledge structure so that innovation subjects continuously improve knowledge resource integration capabilities through active participation in knowledge flow and sharing within the innovation ecosystem knowledge cycle, obtaining new innovation resources from original knowledge transformation. (3) Clarify leadership roles and responsibilities in enterprise knowledge management, ensure relevant roles in the knowledge management system and understand their responsibilities and authorities, and actively conduct knowledge sharing. (4) Conduct technological and infrastructural innovation, build knowledge management platforms, achieve cross-regional integration and flow of knowledge, human, capital, and information resources to create greater value. (5) Establish enterprise knowledge management culture and integrate knowledge management into enterprise processes. Although this paper studies the establishment of a new knowledge management system for innovation ecosystems, it remains preliminary theoretical exploration. Without analyzing different types of enterprises or enterprises at different life cycle stages, the theory' s rationality and applicability need testing through practice. Knowledge management influencing factors of different innovation subjects and complex relationships between different industries will become future research directions.

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Author Contributions: Chu Jiewang: research design and paper revision guidance; Chen Yongyan: paper writing and revision.

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