# Postprint: Research on Enterprise Knowledge Integration for Innovation Ecosystems

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## Abstract

[目的/意义] Based on the innovation ecosystem context, this study investigates enterprise knowledge integration to provide a new perspective for enhancing knowledge integration effectiveness and improving enterprise innovation capabilities. [方法/过程] Through a theoretical review of innovation ecosystems and knowledge integration, it explores the process and dynamics of knowledge integration around the two essential characteristics of "innovativeness" and "ecological nature," and proposes corresponding safeguard measures. [结果/结论] Within the innovation ecosystem context, enterprise knowledge integration undergoes two stages—external knowledge intake and internal knowledge assimilation—achieving effective knowledge integration through the synergistic action of enterprise innovation endogenous motivation, industry-university-research cooperation auxiliary force, and innovation environment driving force. This article proposes safeguard measures for the effective realization of knowledge integration from three dimensions: the innovation environment, universities and research institutes, and enterprises.

## Full Text

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## Research on Enterprise Knowledge Integration Oriented Towards Innovation Ecosystems

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**Abstract:**

[**Purpose/Significance**] Based on the innovation ecosystem scenario, this study explores enterprise knowledge integration, providing a new perspective

for improving knowledge integration effectiveness and enhancing enterprise innovation capability. [**Method/Process**] Through a theoretical review of innovation ecosystems and knowledge integration, this paper examines the process and dynamics of knowledge integration around the two essential characteristics of "innovativeness" and "ecologicalness," and proposes safeguard measures. [**Result/Conclusion**] In the context of innovation ecosystems, enterprise knowledge integration undergoes two stages: external knowledge intake and internal knowledge assimilation, achieving effective knowledge integration through the synergistic action of enterprise innovation source power, industry-university-research cooperation assistance power, and innovation environment driving force. The article proposes safeguard measures for effective knowledge integration from three levels: innovation environment, universities and research institutes, and enterprises.

**Keywords:** innovation ecosystem; knowledge integration; process; dynamics
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In the knowledge economy era, knowledge is regarded as a crucial strategic resource for enterprises to respond to environmental changes, enhance innovation capabilities, and gain competitive advantages. However, as innovation activities become increasingly networked and complex, it is difficult for any single enterprise to possess all the knowledge required for innovation independently, and innovation activities can no longer be completed within a single organization [1]. Collaboration between enterprises and among enterprises and other relevant organizations has become a new trend in research and development. Consequently, against the backdrop of innovation-driven development, the innovation ecosystem has emerged as a complex system for exploring interactions among innovation actors and between innovation actors and their environment.

Through literature review, existing research has primarily examined knowledge stock, flow, and value-added issues within innovation ecosystems from a systemic perspective, failing to focus further on individual enterprises. As enterprises serve as the engine of innovation ecosystems [9], clarifying how they can enhance innovation capabilities through knowledge integration processes is crucial for ecosystem development. This paper therefore conducts research at the micro level, defining an innovation ecosystem as a dynamic complex system based on knowledge and oriented toward innovation, comprising innovation actors (enterprises, universities, and research institutes) and an innovation environment (organic environment including government, institutions, and users; and inorganic environment including economy, society, and culture). This study investigates how enterprises achieve effective knowledge integration through interactions with other innovation actors and the innovation environment, aiming to provide theoretical insights and practical implications for guiding enterprise knowledge integration activities and improving their effectiveness.

# 1 Overview of Related Research

## 1.1 Innovation Ecosystem

In 1993, J.F. Moore first proposed the concept of a business ecosystem by analogizing biological systems to corporate competition [10]. This concept gradually merged with innovation system ideas throughout its evolution until the President's Council of Advisors on Science and Technology formally introduced the "innovation ecosystem" in 2003 [11]. Since then, innovation ecosystems have attracted scholarly attention and become a research hotspot. Oriented toward innovation, innovation ecosystems encompass two stages: innovation generation and application. Innovation generation requires support from new knowledge resources, while innovation application connects these resources with entrepreneurial ventures [12]. As knowledge constitutes the foundation of innovation, the effective operation of innovation ecosystems depends on knowledge resources. Current scholarship primarily explores the relationship between innovation ecosystems and knowledge resources from three perspectives: First, innovation ecosystems emphasize the co-evolution of knowledge resources and innovation paradigms, where possessing knowledge resources is a prerequisite for systemic innovation. Zhang Yongyun et al. consider knowledge an independent production factor in innovation ecosystems [3], while Li Qiwei et al. further demonstrate that knowledge advantages drive sustainable system development and significantly impact innovation efficiency [13]. Second, knowledge stock in innovation ecosystems is a precondition for innovation, while promoting knowledge flow represents the implementation pathway. Li Wan et al. argue that innovation ecosystem advantages lie in their ability to mobilize internal resources more efficiently and facilitate effective knowledge and information flow among core partners [14]. Chen Qiang et al. suggest that in knowledge-intensive service innovation ecosystems, knowledge flows from universities, research institutes, and vocational training institutions to core enterprises [15]. Third, innovation ecosystems focus on open innovation and value creation, with innovation processes incorporating knowledge learning processes. Bai Xuefei and Du Juan propose that through inter-organizational knowledge learning, sharing, and transfer, innovation ecosystems develop into knowledge creation communities [16]. Zou Xiaodong and Wang Kai argue that innovation ecosystem environments affect the effectiveness of mutual learning and knowledge collaborative innovation among innovation actors [7].

## 1.2 Knowledge Integration

Scholarly research on knowledge integration from different perspectives can be summarized into four aspects: First, studies focusing on the connotation and scope of knowledge integration. B. Kogut and U. Zander define knowledge integration as a capability to combine existing knowledge and discover potential knowledge based on a capability perspective [17], while J. Farrell et al. view knowledge integration as the process of creating new knowledge from a process perspective [18]. Regarding scope, existing research can be categorized into

inter-organizational and intra-organizational knowledge integration. The former emphasizes acquiring external knowledge resources in open innovation environments, where crossing organizational boundaries to effectively integrate internal and external knowledge has become a new paradigm for enterprise innovation [19-20]. The latter focuses on effectively integrating existing organizational knowledge, examining different types [21] and levels [22] of internal knowledge integration. Second, studies examining influencing factors, identifying various subjective and objective factors that affect knowledge integration to improve efficiency. Motivation represents an important subjective factor: Song Zhe et al. categorize knowledge integration motivations into altruism, reciprocity, and reputation [23], while Yuan Hongjun defines integration motivation as the internal driving force of knowledge integration [24]. Environment is considered a crucial objective factor: Liu Yanfang and Yuan Yongjiu argue that appropriate organizational environments actively promote knowledge integration [22], while Liu Yanfang and Xu Jianzhong suggest that social network environments affect knowledge integration effectiveness [25]. Third, research from the perspective of knowledge integration processes and steps, viewing knowledge integration as innovation-oriented and undergoing different stages to achieve knowledge flow, transformation, and reconfiguration. S.R. Tiwari and R. Gupta divide knowledge integration into four stages: identification, sharing, fusion, and utilization [26], while X. Ruan et al. apply social network analysis to study knowledge integration processes in collaborative and competitive work systems [27]. Fourth, studies on the effects of knowledge integration, arguing that effective integration transforms knowledge from static storage to dynamic application, thereby improving innovation output and enhancing innovation capabilities. H. Chesbrough suggests that many enterprises have realized that integrating external knowledge and other innovation resources positively impacts reducing innovation input and increasing innovation output [28], while M. Gloet et al. indicate that innovation capability results from continuous knowledge integration [29].

Through literature review, scholars have emphasized different aspects of knowledge integration according to their research needs. However, knowledge resources are environmentally dependent. Although some scholars have examined enterprise knowledge integration from environmental or process perspectives, research on enterprise knowledge integration within innovation ecosystems remains scarce under the background of innovation-driven development. As enterprises constitute essential components of innovation ecosystems, clarifying the uniqueness of their knowledge integration in this context helps improve integration effectiveness. On one hand, enterprise knowledge integration in innovation ecosystems is innovation-oriented, helping to increase innovation output and enhance innovation capabilities, reflecting the characteristic of innovativeness. On the other hand, as knowledge serves as an independent production factor in innovation ecosystems, enterprises achieve knowledge flow and value-added through knowledge integration processes in their competitive, interdependent, and interactive relationships with other innovation actors and the environment, further optimizing knowledge resource allocation, stabilizing distribution, and enabling

co-evolution [30-31], reflecting ecological characteristics. Therefore, this paper argues that enterprise knowledge integration in innovation ecosystems possesses dual characteristics of innovativeness and ecologicalness, and explores the process, dynamics, and safeguards of knowledge integration based on enterprises' role as knowledge consumers to facilitate effective implementation.

## 2 Enterprise Knowledge Integration for Innovation Ecosystems

Drawing on P.N. Bloom and J.G. Dees' "core-periphery" system structure concept [32], this paper posits that innovation ecosystems similarly consist of a core layer containing innovation actors and a periphery layer containing the innovation environment, which can become a unified whole through knowledge circulation and flow (see [Figure 1: see original paper]). Studying enterprise knowledge integration within innovation ecosystems emphasizes crossing organizational boundaries to first acquire external knowledge resources and then apply them internally, with knowledge flowing from other innovation actors and the innovation environment toward enterprises. Unlike previous inter-organizational knowledge integration models, this paper argues that enterprise knowledge integration in this context features innovativeness and ecologicalness. On one hand, enterprise knowledge integration couples with innovation ecosystem goals—being innovation-oriented, gathering knowledge resources from different sources and forms both inside and outside the organization, and promoting their mutual fusion and synergistic effects to meet innovation demands. On the other hand, enterprises achieve optimized allocation, stable distribution, and co-evolution of knowledge resources within the system through interactions with other innovation actors and the environment, playing the role of knowledge consumers. Analogous to the biological concept of "ingestion-assimilation" in natural ecosystems, this paper defines innovation actors' "ingestion-assimilation" of knowledge resources in innovation ecosystems as knowledge acquisition and application, reflecting systemic innovation vitality. Therefore, based on the characteristics of innovativeness and ecologicalness, this paper argues that enterprise knowledge integration for innovation ecosystems is innovation-oriented and can be divided into two stages: external knowledge intake and internal knowledge assimilation.

### 2.1 External Knowledge Intake Stage

Changing external environments enhance enterprises' demand for new knowledge, and the open innovation concept further emphasizes the importance of external knowledge resources for enterprise innovation. Enterprises must identify and acquire external knowledge resources needed for innovation through interactions with other innovation actors and the innovation environment, a process reflecting dual characteristics of innovativeness and ecologicalness. Based on knowledge flow processes, the external knowledge intake stage in innovation ecosystems involves knowledge flowing from external knowledge sources

(comprising other innovation actors and the innovation environment) to enterprises' internal knowledge repositories, essentially promoting sufficient knowledge flow, leveraging knowledge synergies, and effectively achieving knowledge value-added, as shown in [Figure 2: see original paper].

The external knowledge intake stage includes two steps: knowledge identification and knowledge acquisition. First, in the knowledge identification stage, external knowledge sources contain both basic knowledge (papers, monographs, books, etc.) and technological knowledge (patents, technological breakthroughs, award-winning achievements, etc.) created by universities and research institutes as knowledge producers, as well as auxiliary knowledge stored in the innovation environment (government policies, consulting services, user demands, environmental atmosphere, etc.). Therefore, knowledge identification is the process of identifying effective knowledge that can positively contribute to enterprise strategy realization and innovation activities from large amounts of dispersed external knowledge resources, guided by enterprise innovation demands. Enterprises can use knowledge level-enterprise matching, knowledge content-enterprise necessity, and knowledge cost-enterprise benefit as important indicators for identifying effective knowledge needed for innovation [33]. Possessing knowledge is a prerequisite for enterprise innovation. After identifying effective knowledge, enterprises need to flexibly acquire the required knowledge. Second, in the knowledge acquisition stage, knowledge can be categorized as explicit or tacit based on its attributes. Enterprises can use tangible or intangible levers to extract knowledge from unprocessed and unstructured texts, data, etc. (explicit knowledge sources) and experience, skills, etc. existing in human brains (tacit knowledge sources) within the innovation ecosystem to expand their internal knowledge repository. Generally, under equivalent conditions, tacit knowledge is more difficult and costly to acquire than explicit knowledge, but externally acquired tacit knowledge better maintains competitive advantages and monopoly positions. In summary, the more effective knowledge enterprises identify and acquire during the external knowledge intake stage, the more conducive it is to innovation activities.

### 2.2 Internal Knowledge Assimilation Stage

R.M. Grant argues that enterprises are organizations that integrate and apply knowledge rather than create it [34]. Therefore, enterprises primarily play the role of knowledge consumers in innovation ecosystem knowledge chains. Guided by innovation demands, enterprises coordinate and fuse external and internal knowledge within the organization, transforming dispersed knowledge resources into systematic knowledge systems and rationally utilizing knowledge to achieve knowledge value transformation, thereby realizing optimized allocation and distribution of knowledge resources within the innovation ecosystem (see [Figure 3: see original paper]). This process demonstrates that the internal knowledge assimilation stage in innovation ecosystems also features dual characteristics of innovativeness and ecologicalness.

The internal knowledge assimilation stage includes two steps: knowledge fusion and knowledge utilization. First, in the knowledge fusion stage, enterprises effectively fuse newly acquired external knowledge with existing knowledge in their internal repositories, achieving coordinated development of knowledge depth and breadth. Knowledge fusion is not like simply assembling Lego blocks [35]; rather, it is a process where enterprises consciously fuse various types of knowledge under innovation orientation to maximize knowledge synergies and transform knowledge from dispersed to systematic forms. For example, effective fusion of external market demand intelligence and internal R&D personnel's professional knowledge helps enterprises develop products that better satisfy consumer needs. Second, in the knowledge utilization stage, enterprises cannot fully utilize all their knowledge. For enterprises in innovation ecosystems, knowledge utilization has two aspects: On one hand, enterprises apply the knowledge advantages derived from fused systematic knowledge to products or services, creating value in tangible or intangible forms to promote organizational development and achieve knowledge market value transformation. For instance, proprietary systematic knowledge formed through cooperation with universities and research institutes helps enterprises implement differentiation strategies and provide unique products or services. On the other hand, knowledge is applied to organizational change and process optimization to maintain organizational operation, achieving knowledge application value transformation. Based on resource-capability transformation theory, both market value transformation and application value transformation of knowledge resources jointly promote the formation and enhancement of enterprise innovation capabilities. In summary, stronger knowledge fusion and utilization capabilities during the internal knowledge assimilation stage better facilitate knowledge value transformation, meet enterprise innovation demands, and achieve strategic objectives.

## 3 Dynamics of Enterprise Knowledge Integration for Innovation Ecosystems

In innovation ecosystems, different innovation actors and environments play different roles with distinct missions. The innovation environment, comprising organic and inorganic environments, serves as the external environment for enterprise knowledge integration. Universities and research institutes are knowledge producers, while enterprises act as knowledge consumers. Enterprise knowledge integration is innovation-oriented. To promote continuous knowledge flow toward enterprises and achieve effective knowledge integration, a knowledge integration dynamic model must be constructed. Using organizational boundaries as the criterion, this paper divides the dynamics of enterprise knowledge integration from an innovation ecosystem perspective into internal dynamics (enterprise innovation source power) and external dynamics (industry-university-research cooperation assistance power and innovation environment driving force). These dynamics work synergistically, coordinate with each other, and jointly promote effective knowledge integration. Based on relevant research, this paper designs a dynamic model for enterprise knowledge

integration oriented toward innovation ecosystems, as shown in [Figure 4: see original paper].

### 3.1 Enterprise Innovation Source Power

Enterprise innovation is knowledge-based, and possessing knowledge is a prerequisite for innovation. Without knowledge as a foundation, enterprise innovation cannot be realized. In the knowledge economy era, enterprises cannot independently possess all knowledge required for innovation, nor can they complete innovation activities within a single organization. Required knowledge resources are widely dispersed outside organizational boundaries, meaning enterprises must cross these boundaries to acquire external knowledge resources, fuse them internally, and utilize them to achieve knowledge value transformation and accelerate innovation processes. For example, when enterprises discover during new product development that internal knowledge alone cannot support product innovation, a knowledge gap emerges in their product innovation demands [36]. To fill this gap, enterprises generate knowledge integration motivation under innovation demand guidance. Enterprises can identify and acquire heterogeneous knowledge within the innovation ecosystem through consulting intermediaries or cooperating with universities and research institutes, using methods such as knowledge mining and information linking to fuse acquired effective knowledge with existing knowledge, thereby providing systematic knowledge for new product development. Therefore, as an important component of innovation ecosystems, enterprise innovation demand constitutes a crucial internal source power for knowledge integration, driving enterprises to proactively acquire external knowledge resources and reconfigure internal and external knowledge to achieve effective integration.

### 3.2 Industry-University-Research Cooperation Assistance Power

In enterprise knowledge integration processes within innovation ecosystems, universities and research institutes serve as knowledge creation sources, playing the role of knowledge producers. Large amounts of basic and technological knowledge required for enterprise innovation are widely distributed in the knowledge repositories of universities and research institutes. Industry-university-research cooperation can break knowledge communication barriers, accelerate knowledge flow speed, and lay a solid foundation for enterprise knowledge integration. As an important form of cross-organizational cooperation, enterprises can efficiently obtain required knowledge resources and integrate them to enhance innovation capabilities and achieve innovation strategies by forming cooperative alliances with universities and research institutes. In other words, from an enterprise perspective, industry-university-research cooperation can be viewed as a process where enterprises cross organizational boundaries to seek external knowledge resources and effectively fuse them with internal knowledge to enhance core competitiveness [37]. For example, in rapidly changing markets or environments, enterprises need to continuously acquire new knowledge to ac-

celerate product updates. Developing industry-university-research cooperation and forming integrated innovation carriers help enterprises absorb and utilize the advanced basic and technological knowledge possessed by universities and research institutes more quickly, promoting commercial knowledge utilization and improving knowledge conversion rates. Therefore, in innovation ecosystems, positive cooperation attitudes and favorable cooperation atmospheres in industry-university-research collaboration are conducive to enterprise knowledge integration, representing an important assistance power for the process.

### 3.3 Innovation Environment Driving Force

Environment is an important objective factor affecting enterprise knowledge integration. In innovation ecosystems, the innovation environment comprises the sum of external environments where innovation actors survive and grow. For enterprises, the external innovation environment can be divided into organic and inorganic environments. Regarding the organic environment, laws, regulations, and administrative rules issued by governments at all levels guide the direction of enterprise knowledge integration. For example, the "mass entrepreneurship and innovation" wave has aroused public attention to innovation and entrepreneurship and stimulated enterprise demand for innovation knowledge. Intermediary, financial, and consulting institutions can provide services for enterprise knowledge integration, offering not only knowledge such as market dynamic competitive intelligence but also legal consultation services on intellectual property issues [38]. Finally, as end-users of enterprise innovation products, users' personalized demand orientation directly affects the criteria for effective knowledge discrimination during enterprise knowledge integration. In summary, the external organic environment composed of government, institutions, and users constitutes a direct driving force for enterprise knowledge integration. Regarding the inorganic environment, sufficient financial capital, favorable social environments, and innovative cultural atmospheres collectively create an optimized external inorganic environment for enterprises. Capital aggregation, talent concentration, and cultural appropriateness indirectly affect knowledge integration effectiveness. For example, adequate financial capital in innovation ecosystems attracts more factor flows to the system and provides economic support for knowledge integration. Talent aggregation effects bring innovation talent sources to enterprises, and with the flow of innovation talent, tacit knowledge flows into enterprise organizations. An innovative cultural atmosphere of "daring to be first and tolerating failure" facilitates innovation-oriented enterprise knowledge integration. Therefore, the external inorganic environment composed of economy, society, and culture serves as an indirect driving force for enterprise knowledge integration.

## 4 Safeguard Measures for Enterprise Knowledge Integration for Innovation Ecosystems

The rich knowledge stock contained in innovation ecosystems helps enterprises absorb external new ideas and enhance overall innovation capabilities. However, the large amount of scattered knowledge resources within the system simultaneously creates difficulties for enterprises in identifying and acquiring effective knowledge. Therefore, how to leverage the advantages of innovation ecosystems while avoiding their drawbacks becomes a problem requiring solutions. To address this issue and promote knowledge flow toward enterprises and effective knowledge integration in the innovation ecosystem context, this paper proposes safeguard measures from three levels: innovation environment, universities and research institutes, and enterprises.

### 4.1 Innovation Environment Level

A key characteristic distinguishing innovation ecosystems from other innovation systems is their dynamic self-organizing evolution. Therefore, at the innovation environment level, to better exert environmental driving forces and reduce difficulties in identifying effective knowledge caused by redundant knowledge, construction should focus on the underlying level to create a more suitable innovation environment. On one hand, governments can provide policy support for enterprise knowledge integration by strengthening policy guidance, establishing information service centers, and investing in professional infrastructure. Intermediary, financial, and consulting institutions can serve as bridges to help enterprises identify and acquire required knowledge more quickly. Consumers' digital participation in R&D and innovation further helps enterprises rapidly obtain personalized demand information. On the other hand, sufficient financial capital, favorable social environments, and innovative cultural atmospheres collectively create an optimized external inorganic environment, activating knowledge resource vitality and improving knowledge sharing mechanisms, which facilitates the transformation of knowledge resource value into market value. The harmonious unity and synergistic action of organic and inorganic environments jointly create a favorable innovation environment for enterprise knowledge integration, enabling innovation actors to coordinate and cooperate under innovation orientation and allowing knowledge flows to circulate efficiently within the system, thereby promoting knowledge flow from creators and owners to demanders.

### 4.2 Universities and Research Institutes Level

As knowledge producers, universities and research institutes help enterprises quickly identify and acquire effective knowledge needed for innovation from redundant knowledge resources within the innovation ecosystem. The 凝聚力 of industry-university-research alliance forces facilitates long-term cooperation and complementary advantages between enterprises and universities/research institutes [39-40]. As an important assistance power for enterprise knowledge integration, when universities and research institutes demonstrate strong knowledge

sharing willingness and alliance cooperation attitudes, they are more conducive to breaking knowledge flow barriers, promoting knowledge flow toward enterprises, achieving effective knowledge integration, and stimulating knowledge value transformation. For example, enterprises can cultivate interdisciplinary talents through industry-university-research cooperation, promoting tacit knowledge flow to enterprises, enhancing knowledge absorption and digestion capabilities, and ultimately fulfilling enterprise innovation demands.

### 4.3 Enterprise Level

Enterprise knowledge integration can be divided into external knowledge intake and internal knowledge assimilation stages. To safeguard effective knowledge integration, enterprises should first improve their ability to identify and acquire effective knowledge externally. Large amounts of heterogeneous knowledge are stored in external knowledge sources, and clarifying criteria for effective knowledge discrimination according to innovation demands is the starting point for enterprise knowledge integration. After establishing clear discrimination criteria, enterprises should assess their ability to acquire effective knowledge, as this ability further affects knowledge application effectiveness. Second, enterprises should enhance their capacity for internal knowledge fusion and utilization. At the individual employee level, this manifests as improving employee quality and strengthening training to deepen individual knowledge depth while broadening knowledge breadth. At the organizational level, it involves establishing incentive mechanisms conducive to knowledge integration and creating a cultural atmosphere suitable for knowledge integration, encouraging member communication and cooperation to promote knowledge flow [41].

## 5 Conclusions and Future Prospects

Based on the innovation ecosystem scenario, this study examines enterprise knowledge integration around the two essential characteristics of "innovativeness" and "ecologicalness" from three aspects: knowledge integration process, dynamics, and safeguard measures. The research conclusions are as follows: First, according to organizational boundaries, the enterprise knowledge integration process can be divided into external knowledge intake and internal knowledge assimilation stages. As knowledge consumers, enterprises guided by innovation demands ultimately achieve knowledge value transformation through the knowledge flow process of knowledge identification-knowledge acquisition-knowledge fusion-knowledge utilization. Second, enterprise knowledge integration dynamics can be categorized into internal and external dynamics based on their sources, and further refined into enterprise innovation source power as knowledge consumers, industry-university-research cooperation assistance power as knowledge producers, and innovation environment driving force as external environment. These dynamics coordinate with each other and jointly promote effective knowledge integration. Third, to better leverage the knowledge stock advantages of innovation ecosystems while reducing difficulties

in identifying and acquiring effective knowledge caused by redundant knowledge, this paper proposes safeguard measures from three levels: innovation environment, universities and research institutes, and enterprises.

Studying enterprise knowledge integration in innovation ecosystem contexts helps enterprises conduct knowledge management activities and enhance innovation capabilities. By identifying and acquiring effective knowledge from external sources and fusing it with internal knowledge, enterprises can transform knowledge from dispersed to systematic forms and realize both application and market value transformation. This helps enterprises effectively conduct knowledge management, break free from knowledge resource constraints, and utilize knowledge resources to enhance innovation capabilities. Additionally, this study provides theoretical references for knowledge resource flow and allocation, knowledge value application, and innovation capability formation and enhancement in innovation ecosystems. Since innovation ecosystems can self-regulate based on their environment, providing underlying environmental cultivation rather than top-level structural design better enables innovation ecosystems to self-adjust knowledge resource allocation, distribution, and evolution based on the innovation environment, thereby enhancing overall innovation ecosystem capabilities.

This study has certain limitations: First, it provides theoretical analysis of enterprise knowledge integration based on innovation ecosystem scenarios, offering exploratory theoretical insights that should be further explored through case studies and empirical research. Second, future research could combine reverse knowledge transfer theory to explore knowledge sharing models where enterprises simultaneously serve as both knowledge producers and consumers in innovation ecosystems, investigating knowledge flow and integration mechanisms from a holistic innovation ecosystem perspective.

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**Author Contributions:** Liu Chang: Chart drawing, paper writing; Li Jianhua: Research design.

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**Abstract:** [Purpose/Significance] Based on the innovation ecosystem scenario, this paper explores the knowledge integration of enterprises, and provides a new perspective for improving the knowledge integration effect and innovative ability of enterprises. [Method/Process] Through the theoretical review of the innovation ecosystem and knowledge integration, this paper studies the

process and dynamics of knowledge integration around the two essential characteristics of “innovative” and “ecological”, and proposes safeguard measures. [Result/Conclusion] In the context of innovation ecosystem, the knowledge integration of enterprises has undergone two stages: external knowledge intake and internal knowledge assimilation. The effective integration of knowledge is realized under the synergy of enterprise innovation source power, industry-university-research cooperation motivation and innovative environment driving force. This paper proposes safeguard measures for the effective realization of knowledge integration from three levels: innovation environment, universities and research institutes, and enterprises.

**Keywords:** innovation ecosystem; knowledge integration; process; dynamics

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