International Journal of Education and Humanities
ISSN: 2770-6702 | Vol. 24, No. 2, 2026

Value Co-creation Mechanisms in Digital and Intelligent Innovation Ecosystems: A Perspective based on Resource Orchestration and Algorithm Empowerments

Hao Jiang*

School of Economics and Management, Southwest Petroleum University, Chengdu, Sichuan 610500, China
* **Corresponding author**: Hao Jiang (Email: 13541867648@163.com)

Abstract: With the explosive evolution of digital-intelligent technologies such as generative AI, deep learning algorithms, and the Internet of Things (IoT), the innovation ecosystem is undergoing a profound transition from a "connection-driven" digital ecosystem to a "computation- and adaptive intelligence-driven" digital-intelligent ecosystem. However, existing research has largely focused on static connections and factor sharing among two-sided platforms, leaving a theoretical "black box" regarding how digital-intelligent technologies reshape the mechanisms of collaborative transmission among multiple actors within the ecosystem. Based on resource orchestration theory and the perspective of algorithm empowerment, this paper systematically explores the mechanisms, evolutionary pathways, and governance strategies of value co-creation within digital-intelligent innovation ecosystems. The study finds that digital-intelligent innovation ecosystems exhibit three core characteristics: algorithmic dominance, architectural decoupling, and adaptive emergence; value co-creation follows a dynamic three-stage micro-evolutionary logic of "data sensing and resource structuring-algorithm empowerment and resource bundling-scenario emergence and resource leveraging"; and the effective operation of multi-actor value co-creation depends on the synergistic coordination of algorithmic governance and ecological relational contracts. This paper challenges the linear understanding of value creation on digital platforms found in existing literature, expands the applicability of resource orchestration theory in intelligent contexts, and provides a theoretical framework for digital and intelligent enterprises to orchestrate ecosystem resources and achieve a win-win outcome for all parties.

Keywords: Digital and Intelligent Innovation Ecosystem, Value Co-creation Mechanism, Resource Orchestration Theory, Ecosystem Governance.

1. Introduction

A new generation of digital and intelligent technologies-including generative artificial intelligence, deep learning algorithms, smart contracts, and edge computing-is integrating into the real economy at an unprecedented pace, reshaping corporate innovation paradigms and the sources of competitive advantage[1]. In the past, digital innovation centered on "connectivity" and the "digitization of factors of production," relying on centralized platforms to reduce transaction costs, connect complementary parties, and achieve network effects; today's digital and intelligent innovation has advanced further into the stages of "computation" and "adaptive intelligence." Data is no longer merely a static asset or a carrier of information; rather, it is highly integrated with predictive algorithms and adaptive models, becoming a dynamic factor of production with autonomous decision-making and real-time response capabilities[2]. This qualitative shift in the technological paradigm has driven profound changes in the innovation ecosystem. Within the digital-intelligent innovation ecosystem, interactions among cross-sectoral actors are no longer limited to static interface integration and data sharing but, through algorithmic empowerment, enable dynamic business reorganization, real-time matching, and intelligent decision-making[3]. However, the rapid evolution of practice has also exposed a significant theoretical lag. In a digital-intelligent context characterized by high uncertainty and dynamic evolution, key questions that have garnered significant attention in academia include: how diverse and heterogeneous actors can break through organizational boundaries to achieve resource decoupling and dynamic reorganization through the underlying empowerment of digital-intelligent technologies, and how the micro-mechanisms and evolutionary pathways of the value co-creation underlying these processes evolve[4]. Clarifying these issues is not only a cutting-edge exploration aimed at overcoming the limitations of traditional innovation management theory but also a pressing practical necessity for guiding enterprises in securing sustainable competitive advantages within their ecosystems in the digital-intelligent era.

Academic research on digital ecosystems and value co-creation has yielded a wealth of findings[5]; however, in light of the new characteristics of "digital intelligence," two significant theoretical gaps remain. First, research perspectives are often limited to static connections and two-sided relationships, overlooking the dynamic empowerment mechanism of "algorithms" as the central hub of the ecosystem. Existing research on digital ecosystems is primarily based on the "platform-complementor" bilateral opposition or centralized control frameworks[3,6], often treating digital platforms as static infrastructure that provides generic technical interfaces. However, the core of digital-intelligent technology lies in the dynamic deconstruction and automated orchestration of factor resources by "algorithms" [7]. Algorithms are no longer merely passive tools for facilitating transactions; they have evolved into the central hub of ecosystem governance, possessing predictive, empowering, and self-regulating capabilities[8]. Existing literature has failed to thoroughly dissect how algorithmic governance integrates with the complementary behaviors of ecosystem actors, and lacks a systematic analysis of the micro-level process of “algorithmic empowerment.” Furthermore, the mechanisms of value co-creation tend to be described in conceptual terms, lacking a dynamic transmission chain linking “resources, capabilities, and value.” Although there is a wealth of literature on value co-creation in ecosystems, most studies focus on exploring the macro-level impact of “trust, sharing, and complementarity” on value creation from the service-dominant logic (S-D Logic) or a relational perspective[9], exhibiting a tendency toward “process black-boxing.” Digital and intelligent innovation ecosystems contain vast amounts of unstructured data and highly dispersed technical capabilities. Currently, there is a lack of a rigorous micro-level process transmission framework to explain how multiple actors transform disordered, heterogeneous resources into dynamic capabilities for collaborative innovation and ultimately achieve the explosive “self-emergence” of ecosystem value[10].

To bridge the aforementioned research gap, this paper introduces the theory of resource structuring as a core analytical lens and closely links it to the concept of algorithmic empowerment. Resource orchestration theory emphasizes that merely possessing or acquiring resources is insufficient to generate a competitive advantage; the key lies in how management (or ecosystem leaders) dynamically manage resources through a combination of structuring, bundling, and leveraging[11,12]. In digital and intelligent innovation ecosystems, resource structuring manifests as the distributed sensing, standardized decoupling, and real-time consolidation of dispersed, heterogeneous data elements and knowledge assets within the ecosystem through underlying digital and intelligent infrastructure; resource bundling manifests as the deep integration of decoupled data resources with algorithmic models and industry knowledge through AI algorithms and automated rules, forming cross-sectoral, complementary modular capability packages; Resource leveraging (Leveraging) is manifested in leading enterprises and complementary ecosystem participants utilizing these intelligent capabilities to conduct agile commercial incubation across a rich array of upper-layer application scenarios, thereby triggering the dynamic emergence and multi-party sharing of ecosystem value. Therefore, the theory of resource orchestration provides a highly suitable deconstruction framework for revealing how digital and intelligent technologies transform “static data resources” into “dynamic collaborative innovation capabilities.”

As a qualitative study grounded in theoretical deduction and mechanism deconstruction, this paper aims to reveal the underlying logic of value co-creation in innovation ecosystems driven by digital and intelligent technologies through systematic logical deduction and framework construction. The research closely follows the main thread of “conceptual definition-mechanism deconstruction-governance strategies” and is specifically divided into the following three progressive modules. First, the conceptual deepening and characteristic analysis of the digital-intelligent innovation ecosystem. Through literature comparison and rational deduction, this section traces the paradigm shift from the “digital innovation ecosystem” to the “digital-intelligent innovation ecosystem,” clearly defines the core essence of the digital-intelligent innovation ecosystem, and qualitatively summarizes its key characteristics-such as algorithm-driven nature, architectural decoupling, and adaptive emergence-that distinguish it from traditional platforms. Second, the micro-mechanisms of value co-creation are deconstructed based on Resource Orchestration Theory (ROT). By applying ROT across disciplines to the context of digital-intelligent ecosystems and integrating an algorithm-empowerment perspective, a qualitative analytical framework is established comprising “antecedents (data/algorithm elements), processes (resource orchestration), and outcomes (emergence of scenario value).” We provide a detailed breakdown of the collaborative behaviors and interaction logic among multiple actors across three dynamic phases: “data perception and resource structuring,” “algorithm empowerment and resource bundling,” and “scenario emergence and resource leverage.” Finally, the governance logic and practical strategies for digital-intelligent innovation ecosystems are constructed. Addressing real-world challenges in digital-intelligent ecosystems-such as “ambiguity in data property rights, lack of trust in algorithmic black boxes, and resistance to cross-sector collaboration”-this study derives, from a qualitative perspective, a decoupled collaborative governance framework that balances “hard technical constraints” with “soft relational contracts,” and provides targeted strategic recommendations for core enterprises (leaders), complementary actors, and policymakers.

The rest of the paper is structured as follows. Section 2 establishes the theoretical framework and clarifies core concepts, including the essence and characteristics of digital and intelligent innovation ecosystems and the fundamental logic of resource orchestration theory. Section 3 systematically deconstructs the micro-mechanisms of value co-creation across three progressive evolutionary phases. Section 4 discusses ecosystem governance strategies from the perspectives of core leading enterprises, complementary actors, and the institutional environment. Finally, Section 5 summarizes the main research conclusions, addresses the limitations of this study, and proposes directions for future research.

2. Theoretical Framework and Definition of Concepts

2.1. The Essence and Characteristics of the Digital and Intelligent Innovation Ecosystem

2.1.1. The Concept and Essence of the Digital and Intelligent Innovation Ecosystem

The evolution from a “Digital Innovation Ecosystem” to a “Digital-Intelligence Innovation Ecosystem” marks a paradigm shift in the innovation system-from being “connection-driven” to being “computation- and adaptive intelligence-driven.” In traditional digital innovation ecosystems, digital platforms primarily serve as “connectors” and infrastructure with low transaction costs, emphasizing the transmission of information and the sharing of factors through bilateral/multilateral network effects[6]. However, with the integration of cutting-edge technologies such as generative AI, deep learning algorithms, large language models, and AIoT (Artificial Intelligence of Things), the operational logic of these ecosystems has undergone a fundamental restructuring [13]. This paper defines the digital-intelligent innovation ecosystem as an adaptive symbiotic network [13,14]built upon a core foundation of digital-intelligent technologies, comprising diverse and heterogeneous entities-including core leading enterprises, algorithm and technology providers, complementary developers, professional service organizations, and end-users-that are dynamically empowered and self-organized through an algorithmic hub. Within this system, data is no longer merely a static information asset; rather, it is deeply integrated with algorithms to become a dynamic factor of production capable of real-time perception, self-evolution, and autonomous decision-making[15]. The interactive relationships within the system increasingly transcend the control models of traditional linear supply chains or centralized platforms, relying instead on nonlinear value co-creation linked by "data-algorithm" synergy.

2.1.2. Core Characteristics of the Digital and Intelligent Innovation Ecosystem

Compared to traditional digital innovation ecosystems, digital-intelligent innovation ecosystems exhibit the following three distinctive characteristics. First is algorithmic governance and leadership. Algorithms are not merely technical tools; they have evolved into the governance hub of the ecosystem and the formulators of collaborative rules. Leading enterprises use algorithmic rules to achieve seamless task allocation, capability matching, and performance evaluation, thereby significantly reducing transaction friction among multiple stakeholders[16]. Algorithms analyze network-wide demand and resource supply at an extremely high frequency, shifting ecosystem governance from "post-event manual intervention" to "real-time intelligent scheduling." Second is architectural decoupling and reconfigurability. Digital-intelligent technologies possess strong modularity and "decoupling" capabilities. Complex business processes, technical capabilities, and data assets are decoupled at a fine granularity into reusable APIs, algorithmic models, and data components[17]. This loosely coupled architecture endows the ecosystem with exceptional agility, enabling heterogeneous entities to rapidly reorganize and redevelop different modules in a "building-block" style in response to rapidly changing market conditions. Finally, there is dynamic self-adaptation and emergence. The boundaries of a digital-intelligent ecosystem are no longer rigidly defined by core enterprises but instead exhibit dynamic characteristics of self-organization and self-evolution. When vast numbers of heterogeneous entities interact frequently under algorithmic rules, the system spontaneously gives rise to entirely new business paradigms, cross-scenario applications, and innovative products that go beyond the scope of any single entity's original expectations. This "self-emergence" is the essential source of sustained, explosive innovation for digital-intelligent ecosystems.

2.2. Theory of Resource Orchestration

Resource Orchestration Theory (ROT), proposed by Sirmon et al., seeks to break away from the traditional Resource-Based View (RBV)'s fixation on "static resource ownership" and emphasizes that competitive advantage stems from management's dynamic management and orchestration of resources[11,12]. Typical resource orchestration encompasses three core components: Resource Structuring-selecting, acquiring, divesting, and consolidating resources; Resource Bundling-integrating resources to build unique technological and organizational capabilities; and Resource Leveraging-deploying the built capabilities into specific business contexts to realize their implementation and capture value[18]. In traditional theoretical applications, ROT has been primarily confined within the boundaries of a single organization. However, the emergence of digital and intelligent innovation ecosystems has broken down these closed organizational boundaries. Since resources such as data, algorithms, and computing power in digital and intelligent ecosystems are highly dispersed among a large number of independent entities, core enterprises cannot manage these resources through direct ownership[19]. Therefore, resource orchestration must extend to the cross-organizational network level (Ecosystem-level Orchestration). Resource orchestration at the ecosystem level no longer relies on administrative directives but instead depends on the design of the ecosystem's "attractiveness, open architecture, and collaboration rules" to indirectly guide and induce the convergence and integration of cross-organizational resources.

3. Value Co-creation Mechanisms in the Digital and Intelligent Innovation Ecosystem

A digital and intelligent innovation ecosystem is an open, adaptive, and collaborative network in which multiple stakeholders-including enterprises, suppliers, users, and technology platforms-must jointly integrate resources to achieve co-creation of value[20]. Unlike traditional value creation models centered on a core enterprise, research has found that value co-creation in digital and intelligent ecosystems often exhibits characteristics of decentralization, collaboration, and spontaneous emergence[19]. Even in the absence of a clearly defined central enterprise, participants within the ecosystem can autonomously generate innovative outcomes and achieve mutual benefit through connections enabled by digital technologies and data-driven interactions.

3.1. Resource Aggregation and Perception Mechanisms

The first phase of the digital-intelligent ecosystem focuses on the cross-boundary flow and sensing of data resources. At this level, a wide range of digital-intelligent technologies enable various types of data elements to flow freely across industrial and geographical boundaries. Various "human-machine" participants within the ecosystem-including user terminals, sensors, smart devices, and enterprise systems-continuously generate and share data, thereby forming massive heterogeneous data streams[21]. Cloud computing and platform technologies provide unified data access and storage services, while edge computing and smart sensing enable distributed, real-time data sensing and processing, thereby facilitating rapid responses to the environment and user needs[22]. As previous studies have pointed out, in digital service ecosystems, multiple different participants generate vast amounts of ecosystem data, and artificial intelligence can leverage this data to drive personalized services, decision support, and cross-boundary innovation [23]. This low-friction data aggregation capability provides the informational foundation for subsequent collaborative innovation.

3.2. Algorithm-Driven Empowerment and Collaborative Generation Mechanisms

In the second phase of the digital-intelligent ecosystem, algorithms and AI technologies deeply empower the innovation process. First, advanced algorithms can deconstruct and reorganize complex R&D tasks and business processes. As illustrated by the theory of resource orchestration, leading enterprises or platforms can finely allocate ecosystem resources through "construction, integration, and utilization"[7]: that is, by employing strategies such as resource reorganization, bundling, and utilization, they organically combine internal and external innovation factors-such as data, technology, and talent-to enhance collaborative R&D efficiency and innovation capabilities. Second, AI entities play a human-like yet non-human leading role within the ecosystem; they can process massive amounts of data, extract knowledge, and make autonomous decisions. Existing research indicates that AI systems now possess the ability to work side by side with human actors, integrating resources from diverse sources and participating in value creation[23]. Specifically, technologies such as machine learning and deep learning make tacit knowledge explicit: by mining massive amounts of data to discover new patterns and regularities, they accelerate technological innovation and the restructuring of business models[24]. At the same time, collaborative platforms-such as algorithm-driven intelligent recommendation systems and collaborative simulation tools-facilitate interactive knowledge mining and sharing among participants, enabling multiple parties to jointly iterate on new solutions within an open data environment[25]. In short, at this stage, algorithms serve not only as "data analyzers" but also as "innovation catalysts," promoting collaborative creation among ecosystem actors through automation and intelligence: relying on algorithmic tools, all parties jointly develop new technologies and products, achieving deep cross-organizational collaboration and value creation.

3.3. Value Emergence and Dynamic Capture Mechanisms

In the final stage of value co-creation, the results of collaboration within the ecosystem begin to generate tangible user value and commercial value, which are then captured and distributed through dynamic mechanisms. First, intelligent prediction and analysis enable highly personalized products and services. By modeling user behavior and preferences in real time, the ecosystem can provide customized, scenario-based experiences for different user groups. For example, digital and intelligent technologies can use predictive algorithms to identify user needs in advance, thereby generating new usage scenarios and service content in virtual or real-world settings, which in turn creates diverse opportunities for added value[19]. This scenario-based emergence of value transforms users from passive recipients into active participants in value creation on digital platforms and social networks.

Second, in terms of value distribution, digital and intelligent ecosystems have gradually established dynamic revenue-sharing mechanisms that enable a win-win outcome for all parties. For example, technologies such as blockchain and smart contracts provide transparent ledgers and programmable contractual mechanisms for distributed collaboration[26]. Under this mechanism, all parties undergo automated settlement based on their level of contribution and predefined rules, thereby reducing trust costs and ensuring the fair distribution of benefits (such as automatically triggered payments and royalty sharing). This decentralized distribution method allows value to flow more equitably among participants, thereby incentivizing more organizations to engage deeply in collaboration.

4. Strategies for Co-Creating Value and Governance in a Digital and Intelligent Innovation Ecosystem

This chapter focuses on value co-creation strategies and governance within digital and intelligent innovation ecosystems, analyzing theoretical mechanisms at three levels: leading firms, complementary players, and the institutional environment. At the level of leading firms, drawing on theories of resource orchestration and algorithmic governance, the chapter proposes an ecosystem orchestration approach based on open interfaces and algorithmic empowerment, illustrating practical pathways through case studies such as NIO in Shanghai; At the level of complementary players, based on S-D logic and a dynamic capabilities perspective, the chapter emphasizes the importance of rapid responsiveness and ecosystem embedding, and demonstrates co-creation models through the "multiple roles" of AI platform partners; at the institutional level, it proposes recommendations for institutional improvements regarding data property rights protection, algorithm regulation, and cross-sector standards. Finally, the chapter summarizes and presents three testable hypotheses, pointing the way for future empirical research.

4.1. Ecosystem Orchestration Strategies of Core Enterprises (Market Leaders)

Resource orchestration theory posits that core firms should assume the role of "building, integrating, and utilizing" resources to form a competitive advantage through the deliberate coordination of external factors[12]. The service-dominant logic, on the other hand, emphasizes that co-creation of value requires resource integration and service exchange, with core firms facilitating value creation by connecting all parties[23]. Meanwhile, algorithm governance theory argues that incorporating algorithmic systems into the governance process will enhance decision-making efficiency but simultaneously weaken the autonomous discretion of governance actors[27]. Combining the above theories, core enterprises can coordinate the actions of ecosystem participants by designing an "algorithm-driven + protocol framework" governance model, thereby implementing a control mechanism characterized by "rule-driven pre-action and incentive-based coordination during action." For example, Springer et al. (2025) point out that different platform types correspond to different structures of control and decision-making authority, giving rise to models such as unified governance, collaborative governance, regulatory governance, and algorithmic governance[28]. It is evident that core enterprises need to rely on algorithms and platform rules to shape open yet orderly ecosystem boundaries.

4.2. Complementary Species' Agile Responses and Ecological Integration Strategies

The service-dominant logic posits that users and complementary parties are essentially value co-creators who must create value through the integration of resources. Complementary parties must leverage their unique resources (such as technical expertise, distribution channels, user data, etc.) to generate complementary effects with the platform and other actors[29]. At the same time, the dynamic capabilities perspective within resource orchestration theory suggests that complementary partners should enhance their adaptability and innovation capacity in the face of environmental changes through a "perceive-capture-reorganize" process. Specifically, by effectively orchestrating heterogeneous resources and acting swiftly, complementary partners can transition from a passive follower to an active co-creator.

4.3. Institutional and Environmental Support Strategies

At the institutional level, we can draw on institutional theory and governance frameworks. Institutional theory emphasizes the "incentive-constraint" role of institutional arrangements on actors, while the theory of "polycentric governance" posits that multi-stakeholder collaboration can enhance institutional effectiveness[30]. From the perspective of the digital and intelligent ecosystem, it is necessary to establish a dynamic balance between "regulation and innovation" by integrating laws and regulations, technical standards, and self-regulatory mechanisms. At the same time, legal requirements for algorithm governance mandate that platforms ensure algorithmic transparency, user control, and social responsibility[31]. These theories and policies provide guidance for institutional design: rules must be established at the legal level, traceability mechanisms must be built at the technical level, and ethical standards must be fostered at the societal level to achieve multi-stakeholder governance.

5. Conclusion and Outlook

5.1. Research Findings

Based on the theory of resource orchestration and the perspective of algorithm-driven empowerment, this paper addresses the core question of how digital and intelligent technologies are reshaping the logic of value co-creation within innovation ecosystems, and arrives at the following three main conclusions.

First, digital and intelligent innovation ecosystems exhibit three core characteristics that distinguish them from traditional digital ecosystems. Algorithm-driven governance is reflected in the fact that algorithms have evolved from mere tools to become the central hub of ecosystem governance, shifting governance from ex post intervention to real-time intelligent orchestration. Architectural decoupling is manifested in the fact that digital and intelligent technologies deconstruct complex capabilities into fine-grained, reusable modular components, endowing the ecosystem with a high degree of agility in reorganization. Dynamic self-emergence is manifested in the fact that when a vast number of actors interact frequently under algorithmic rules, they can spontaneously generate innovative paradigms and business scenarios that exceed the scope anticipated by any single actor. Together, these three characteristics constitute the essential attributes of the digital and intelligent innovation ecosystem.

Second, value co-creation within the digital-intelligent ecosystem follows a dynamic, three-stage micro-evolutionary logic. In the initial stage, diverse entities use digital-intelligent infrastructure to extensively sense and collect heterogeneous data elements scattered across various locations. They then perform cleaning, annotation, and standardization, transforming unstructured raw data into identifiable, actionable foundational information assets. In the second stage, algorithmic systems become deeply involved in resource integration, organically fusing structured data with industry knowledge and technical capabilities. Through automated rules, isolated resources are bundled into modular capability packages that can be called upon by diverse entities as needed, thereby lowering the barriers to collaboration and facilitating the explicit expression of tacit knowledge. In the final stage, the intelligent capabilities formed through integration are deployed into specific application scenarios, efficiently transforming value from a potential form to a tangible one through commercial practice. Moreover, due to the ecosystem's openness and self-organizing characteristics, this transformation often generates emergent effects that exceed linear expectations. These three stages form a cyclical iteration within the ecosystem's continuous operation, with each cycle providing a higher-level data foundation and capability reserve for the next round of innovation.

Third, the effective operation of multi-stakeholder value co-creation relies on the synergistic coordination of algorithmic governance and ecosystem relationship contracts. As the governance hub, algorithms provide efficient and transparent technical constraints through preset rules and automated execution, significantly reducing coordination costs and trust friction. However, the rigidity and universality of algorithmic rules struggle to account for the constantly emerging situational heterogeneity and relational complexity within the ecosystem. This necessitates ecosystem relationship contracts as a flexible supplement. Through the appropriate delegation of decision-making authority, the fair design of contribution rewards, and the continuous cultivation of cross-organizational trust, these contracts foster stable expectations for long-term collaboration. The decoupled yet synergistic interaction between the two constitutes a dual-drive mechanism for digital and intelligent ecosystem governance.

5.2. Limitations of the Study and Future Prospects

This paper still has several limitations. First, the study is primarily based on theoretical deduction and logical reasoning and falls within the realm of qualitative research; the proposed three-stage evolutionary logic and the proposition regarding the synergy between algorithmic governance and relational contracts have yet to be empirically tested using a large sample. Future research could develop measurement scales based on the framework presented in this paper and conduct empirical validation through methods such as questionnaire surveys, case studies, or regression analysis of secondary data.

Second, this paper categorizes the value co-creation process into three progressive stages. While this linear representation offers logical clarity, the actual evolution of digital-intelligent ecosystems may exhibit nonlinear characteristics such as feedback loops, leapfrog evolution, and parallel progression across multiple stages. Future research could employ longitudinal case tracking or computer simulation methods to more deeply characterize the nonlinear dynamics of ecosystem evolution.

Finally, this paper focuses on the mechanisms of value co-creation within a single digital-intelligent ecosystem, whereas in practice, competition, collaboration, and cross-boundary integration among different ecosystems are becoming increasingly common. Future research could expand the unit of analysis to the level of inter-ecosystem interactions, exploring cross-ecosystem value co-creation models, governance and coordination mechanisms, as well as the resulting competitive dynamics and institutional challenges, thereby further broadening the theoretical horizons of this field.

References

[1] Wang, Y., Shi, M., Liu, J., Zhong, M., & Ran, R. (2025). The impact of digital-real integration on energy productivity under a multi-governance framework: the mediating role of AI and embodied technological progress. Energy Economics, 142, 108167. https://doi.org/10.1016/j.eneco.2024.108167

[2] Xie, J., Sun, L., & Zhao, Y. F. (2025). On the data quality and imbalance in machine learning-based design and manufacturing-a systematic review. Engineering, 45, 105–131. https://doi.org/10.1016/j.eng.2024.04.024

[3] Zahra, S. A., Liu, W., & Si, S. (2023). How digital technology promotes entrepreneurship in ecosystems. Technovation, 119, 102457. https://doi.org/10.1016/j.technovation.2022.102457

[4] Xing, X., Zhang, M., & He, W. (2026). Digital technology-driven value co-creation in the business model of social media platforms: a system dynamics approach. Technovation, 155, 103598. https://doi.org/10.1016/j.technovation.2026.103598

[5] Nambisan, S. (2018). Architecture vs. ecosystem perspectives: reflections on digital innovation. Information and Organization, 28, 104–106. https://doi.org/10.1016/j.infoandorg.2018.04.003

[6] Gawer, A. (2022). Digital platforms and ecosystems: remarks on the dominant organizational forms of the digital age. Innovation, 24, 111–124. https://doi.org/10.1080/14479338.2021.1965888

[7] Tian, H., & Zhao, L. (2026). How does digital intelligent knowledge orchestration enhance green service innovation in manufacturing enterprises? Based on the perspective of enterprise relationship resilience. Technological Forecasting and Social Change, 226, 124575. https://doi.org/10.1016/j.techfore.2026.124575

[8] Zhang, X. (Elliott), Tong, S. (Jack), Luo, X., Lin, Z., & Li, J. (n.d.). AI orchestrator: how recommendation algorithms shape complementor strategy and market equality. Strategic Management Journal. Advance online publication. https://doi.org/10.1002/smj.70073

[9] Lajante, M. (2025). Viewpoint: what S-D logic doesn't say: value, labor, and the political economy of service under neoliberalism. International Journal of Quality and Service Sciences, 17, 613–619. https://doi.org/10.1108/IJQSS-11-2025-197

[10] Peng, H., Lu, Y., & Gupta, S. (2023). Promoting value emergence through digital platform ecosystems: perspectives on resource integration in China. Technological Forecasting and Social Change, 189, 122338. https://doi.org/10.1016/j.techfore.2023.122338

[11] Sirmon, D. G., Hitt, M. A., & Ireland, R. D. (2007). Managing firm resources in dynamic environments to create value: looking inside the black box. Academy of Management Review, 32, 273–292. https://doi.org/10.5465/amr.2007.23466005

[12] Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource orchestration to create competitive advantage: breadth, depth, and life cycle effects. Journal of Management, 37, 1391–1412. https://doi.org/10.1177/0149206310385695

[13] Secundo, G., Spilotro, C., Gast, J., & Corvello, V. (2025). The transformative power of artificial intelligence within innovation ecosystems: a review and a conceptual framework. Review of Managerial Science, 19, 2697–2728. https://doi.org/10.1007/s11846-024-00828-z

[14] Huang, Y., Song, F., & Liu, C. (2026). Decoding AI innovation: how R&D alliances drive technological breakthrough. Technology in Society, 85, 103165. https://doi.org/10.1016/j.techsoc.2025.103165

[15] Luo, J. (2023). Data-driven innovation: what is it? IEEE Transactions on Engineering Management, 70, 784–790. https://doi.org/10.1109/TEM.2022.3145231

[16] Romeo, E., Rosa, A., Durst, S., & Smrčka, L. (2026). Navigating the AI frontier: a holistic framework for algorithmic governance and responsible innovation in organizations. Management Decision. Advance online publication. https://doi.org/10.1108/MD-09-2025-2615

[17] Korabayev, R., Fan, Z., & Peng, L. (2026). Algorithmic management and employee innovation: unveiling the mediating mechanisms of perceived fit, perceived control and job crafting. Frontiers in Psychology, 17, 1832770. https://doi.org/10.3389/fpsyg.2026.1832770

[18] Carnes, C. M., Chirico, F., Hitt, M. A., Huh, D. W., & Pisano, V. (2017). Resource orchestration for innovation: structuring and bundling resources in growth- and maturity-stage firms. Long Range Planning, 50, 472–486. https://doi.org/10.1016/j.lrp.2016.07.003

[19] Leong, C., Hua, W., Xiao, X., Yu, J., & Zhou, Y. (2026). Value co-creation in a digital ecosystem: exploring autonomous co-creation in a digital influencer ecosystem. Information & Management, 63, 104251. https://doi.org/10.1016/j.im.2025.104251

[20] Li, Y., & Wu, L. (2024). Multi-group symbiotic evolutionary mechanisms of a digital innovation ecosystem: numerical simulation and case study. PLOS ONE, 19, e0300218. https://doi.org/10.1371/journal.pone.0300218

[21] Wang, Y., Sun, X., Xiong, W., & Onishi, M. (2026). Beyond technology: exploring public value creation mechanisms and outcomes in platform-to-government data sharing. Government Information Quarterly, 43, 102129. https://doi.org/10.1016/j.giq.2026.102129

[22] Maciá-Lillo, A., Mora, H., Jimeno-Morenilla, A., García-D'Urso, N. E., & Azorín-López, J. (2025). AI edge cloud service provisioning for knowledge management smart applications. Scientific Reports, 15, 32246. https://doi.org/10.1038/s41598-025-14429-7

[23] Hansmeier, P., Schäfer, J. M., & zur Heiden, P. (2026). Artificial intelligence in digital service ecosystems-towards a taxonomy and archetypes. Electronic Markets, 36, 22. https://doi.org/10.1007/s12525-026-00879-y

[24] Viberg, D., & Eslami, M. H. (2020). The effect of machine learning on knowledge-intensive R&D in the technology industry. Technology Innovation Management Review, 10, 88–98. https://doi.org/10.22215/timreview/1340

[25] Liu, Q., Du, Q., Tang, C., Hong, Y., & Fan, W. (2025). An exploration and exploitation of value cocreation-based machine learning framework for automated idea screening. Decision Support Systems, 196, 114504. https://doi.org/10.1016/j.dss.2025.114504

[26] Han, G., Feng, Z., Chen, S., Xue, X., Wu, H., Yang, Z., & Chen, H. (2023). Building a decentralized industrial alliance with the information system empowered by blockchain. Journal of King Saud University – Computer and Information Sciences, 35, 101581. https://doi.org/10.1016/j.jksuci.2023.101581

[27] Gritsenko, D., & Wood, M. (2022). Algorithmic governance: a modes of governance approach. Regulation & Governance, 16, 45–62. https://doi.org/10.1111/rego.12367

[28] Springer, V., Randhawa, K., Jovanović, M., Ritala, P., & Piller, F. T. (2025). Platform design and governance in industrial markets: charting the meta-organizational logic. Research

Policy, 54, 105236. https://doi.org/10.1016/j.respol.2025.105236

[29] Bai, W., Wu, D., Yang, M., & Liu, T. (2026). Value co-creation in B2B industrial digital platforms: a platform-native perspective under service-dominant logic. Technovation, 153, 103516. https://doi.org/10.1016/j.technovation.2026.103516

[30] Pascucci, S. (2025). Theorizing polycentric governance of global socio-ecological challenges through a meso-institutional perspective. Journal of Institutional Economics, 21, e45. https://doi.org/10.1017/S1744137425100325

[31] Cao, J. (2025). From principle to practice: value alignment in AI ethics and governance. German Law Journal, 26, 1117–1148. https://doi.org/10.1017/glj.2026.10185