

From Industrial Systems to Intelligent Ecosystems: Redefining Value Creation in the Industry 5.0 Era

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Introduction

The landscape of industrial management is undergoing a profound transformation that extends far beyond the digitalization agenda introduced by Industry 4.0. Over the past decade, organizations have invested heavily in artificial intelligence, cyber-physical systems, the Internet of Things (IoT), cloud computing, robotics, and advanced analytics to improve productivity and operational efficiency. While these technological advances have fundamentally reshaped manufacturing and service operations, they have also revealed the limitations of a purely technology-centric perspective. Increasing environmental uncertainty, societal expectations, workforce transformation, and sustainability challenges have shifted managerial attention from maximizing operational performance alone toward creating broader economic, environmental, and social value. As a result, Industry 5.0 has emerged not as a replacement for Industry 4.0, but as its strategic evolution—one that places human well-being, resilience, sustainability, and collaborative intelligence at the center of industrial development (Troisi et al., 2024; Enose Kamalabai et al., 2025).

This evolution reflects a deeper paradigm shift in the way organizations understand value creation. Traditionally, industrial systems were designed as relatively linear, efficiency-driven entities that optimized internal resources and operational processes. Success was primarily measured through productivity, cost reduction, quality improvement, and financial performance. However, the increasing interconnectedness of markets, technologies, stakeholders, and societal expectations has fundamentally challenged this logic. Modern organizations no longer operate as isolated production systems but as participants in dynamic ecosystems where value is co-created through continuous interactions among firms, customers, suppliers, governments, technology

providers, research institutions, and society at large. Consequently, industrial management is gradually moving from managing organizational boundaries toward orchestrating interconnected ecosystems capable of generating shared and sustainable value (Jourabchi Amirkhizi et al., 2025; Mouazen et al., 2025). Industry 5.0 provides the conceptual foundation for this transition by redefining the relationship between technology, people, and organizations. Rather than viewing digital technologies as ends in themselves, the Industry 5.0 paradigm emphasizes their role as enablers of human-centered innovation, sustainable development, and resilient industrial ecosystems. This perspective recognizes that artificial intelligence, robotics, digital twins, blockchain, and advanced automation create their greatest impact when they augment human creativity, support collaborative decision-making, and contribute to societal well-being instead of merely replacing human labor (Khosravy et al., 2023). In this context, technological intelligence and human intelligence become complementary capabilities, jointly shaping organizational adaptability and long-term competitiveness. Such a transition represents one of the most significant conceptual departures in the history of industrial revolutions.

Equally important is the growing recognition that value itself has become a multidimensional construct. The industrial logic of maximizing shareholder returns is increasingly giving way to a broader understanding of value that simultaneously encompasses economic prosperity, environmental stewardship, social inclusion, knowledge creation, and stakeholder well-being. Recent studies argue that Industry 5.0 introduces an entirely new hierarchy of value priorities in which technological advancement is meaningful only when it contributes to sustainable development and human welfare (Jourabchi Amirkhizi et al., 2025). This emerging perspective aligns closely with the principles of the triple bottom line and Innovation 5.0, where organizational success is measured not only by operational outcomes but also by the capacity to generate long-term societal and environmental benefits through collaborative innovation ecosystems (Mouazen et al., 2025).

The transition toward intelligent ecosystems also requires a fundamental rethinking of organizational architecture. Rather than optimizing individual processes independently, organizations must coordinate increasingly complex networks of cyber-physical systems, digital platforms, intelligent machines, human expertise, and distributed decision-making capabilities. Recent research suggests that competitive advantage in Industry 5.0 will depend less on the adoption of individual technologies and more on the capability to integrate heterogeneous technological, organizational, and human resources into coherent ecosystem architectures (Ordieres-Meré et al., 2023; Amirkhizi et al., 2024). Such integration enables continuous learning, adaptive decision-making, knowledge sharing, and resilience across organizational boundaries, allowing industrial ecosystems to respond more effectively to uncertainty and disruption.

Another defining characteristic of this new industrial paradigm is the convergence of digital ecosystems and collaborative innovation networks. The rapid expansion of digital platforms has

transformed traditional value chains into interconnected ecosystems in which multiple actors simultaneously create, exchange, and capture value. These ecosystems facilitate mass customization, knowledge diffusion, service innovation, and sustainable resource utilization while strengthening organizational agility and responsiveness (Babkin et al., 2022). At the same time, advances in industrial artificial intelligence are enabling more sophisticated forms of human–machine collaboration, where intelligent systems augment managerial capabilities through predictive analytics, cognitive decision support, autonomous coordination, and real-time optimization rather than simply automating repetitive tasks (Khosravy et al., 2023). This convergence signals an important shift from technology deployment toward ecosystem orchestration. Against this backdrop, this editorial argues that the future of industrial management lies not merely in building smarter factories or adopting more advanced digital technologies, but in redesigning industrial systems as intelligent, human-centered, and sustainable ecosystems. The articles presented in this issue collectively illustrate different dimensions of this transformation, ranging from digital servitization and industrial symbiosis to healthcare ecosystems, customer-centric supply chains, innovation systems, renewable energy, cybersecurity, and intelligent decision-making. Together, they reveal that the next frontier of industrial management is defined by the ability to orchestrate complex ecosystems where technology, people, knowledge, and sustainability interact to create shared value. By synthesizing emerging insights from Industry 5.0 scholarship and connecting them with the diverse contributions of this issue, this editorial seeks to frame a broader conversation on how industrial management can move beyond system optimization toward ecosystem intelligence, ultimately redefining value creation for a more resilient, inclusive, and sustainable industrial future.

Insights from This Issue

The articles presented in this issue collectively demonstrate that industrial management is experiencing a conceptual transition that extends well beyond the adoption of advanced technologies. Rather than viewing digital transformation as an isolated organizational initiative, the contributions in this volume reveal a broader movement toward ecosystem-oriented industrial management, where value is generated through the interaction of technologies, organizations, stakeholders, and society. Across diverse application domains including retail, healthcare, humanitarian logistics, renewable energy, innovation management, and industrial supply chains the studies consistently emphasize integration, collaboration, and system-wide intelligence as the new foundations of competitive advantage. This shared perspective closely aligns with the emerging principles of Industry 5.0, which advocate balancing technological progress with human-centricity, sustainability, and resilience (Troisi et al., 2024; Mouazen et al., 2025). Collectively, these studies illustrate that future industrial success depends less on optimizing individual organizational functions and more on orchestrating intelligent ecosystems capable of continuously adapting to rapidly changing technological and societal conditions. A second prominent insight

emerging from this issue concerns the evolution of managerial decision-making. Nearly every contribution employs sophisticated analytical methodologies including Data Envelopment Analysis (DEA), PROMETHEE II, hybrid fuzzy multi-criteria decision-making models, simulation techniques, stakeholder salience analysis, and meta-synthesis approaches to address increasingly complex industrial challenges. These methodological choices are not merely technical preferences; they reflect the growing recognition that contemporary industrial ecosystems cannot be effectively managed through conventional linear decision models. As industrial environments become more interconnected and data-intensive, managers require intelligent decision-support systems capable of integrating multiple objectives, uncertain information, and diverse stakeholder perspectives simultaneously. This trend mirrors recent discussions in the Industry 5.0 literature, where artificial intelligence and advanced analytics are viewed not as replacements for managerial judgment but as collaborative tools that augment human decision-making and improve organizational adaptability (Ordieres-Meré et al., 2023; Khosravy et al., 2023).

The issue also highlights the expanding boundaries of value creation beyond organizational performance. Several articles examine digital servitization, customer-centric supply chains, industrial symbiosis, renewable energy systems, healthcare service ecosystems, and innovation financing, demonstrating that organizational value increasingly emerges through collaboration across interconnected networks rather than within organizational boundaries alone. The study on digital servitization, for example, illustrates how organizations are redefining competitive advantage by integrating digital capabilities with service-oriented business models. Likewise, the investigation of industrial symbiosis emphasizes resource sharing and circularity as mechanisms for simultaneously enhancing environmental performance and operational efficiency. Together, these contributions reinforce the Industry 5.0 proposition that sustainable value creation requires organizations to coordinate technological innovation with environmental responsibility and stakeholder engagement rather than pursuing isolated efficiency improvements (Jourabchi Amirkhizi et al., 2025; Mouazen et al., 2025). Another recurring theme across this issue is resilience as an ecosystem capability rather than a purely organizational attribute. Whether addressing cybersecurity risks in IoT-enabled retail, humanitarian logistics under environmental constraints, healthcare supply chains, or resilient renewable energy systems, the articles consistently recognize uncertainty as a defining characteristic of contemporary industrial environments. Instead of focusing exclusively on risk mitigation, the studies emphasize the development of adaptive capabilities through interconnected technologies, collaborative governance, and intelligent resource allocation. Such findings resonate strongly with recent Industry 5.0 scholarship, which argues that resilience emerges from the coordinated interaction between human expertise, digital intelligence, organizational learning, and technological infrastructures (Sheikh et al., 2025; Enose Kamalabai et al., 2025). This ecosystem perspective significantly broadens the traditional understanding of resilience by recognizing it as a dynamic property of interconnected industrial networks rather than an isolated organizational competency.

Taken together, the contributions in this issue portray industrial management as a discipline that is progressively shifting from managing organizations to orchestrating ecosystems. While the research topics span diverse industries and methodological traditions, they collectively converge on a common message: the future of value creation depends on the integration of digital technologies, human capabilities, sustainability objectives, and collaborative governance into coherent industrial ecosystems. The diversity of empirical settings represented in this volume from retail analytics and healthcare ecosystems to digital servitization, industrial symbiosis, humanitarian logistics, and innovation systems demonstrates that Industry 5.0 is not simply a technological evolution but a managerial transformation that redefines how organizations interact with stakeholders and create shared value. Consequently, this issue offers more than a collection of independent studies; it provides compelling evidence that the next frontier of industrial management lies in designing intelligent ecosystems capable of simultaneously advancing economic competitiveness, societal well-being, and environmental sustainability.

Future Research Agenda

The transition from industrial systems to intelligent ecosystems opens a broad and interdisciplinary research agenda that extends beyond the technological focus traditionally associated with digital transformation. Future studies should move toward developing comprehensive theoretical frameworks that explain how intelligent ecosystems are designed, governed, and continuously evolved across organizational and industrial boundaries. While current research has extensively examined individual technologies such as artificial intelligence, digital twins, robotics, and the Internet of Things, considerably less attention has been devoted to understanding how these technologies collectively interact with human capabilities, organizational culture, institutional environments, and stakeholder networks to create sustainable value. Advancing ecosystem-oriented theories that integrate technological, organizational, and societal dimensions will therefore become essential for both industrial management scholarship and managerial practice (Troisi et al., 2024; Mouazen et al., 2025). Another important avenue for future research concerns the governance of Industry 5.0 ecosystems. As organizations increasingly rely on interconnected digital platforms and collaborative networks, new questions emerge regarding trust, data governance, cybersecurity, ethical artificial intelligence, interoperability, and ecosystem resilience. Researchers should investigate how governance mechanisms can simultaneously promote innovation, protect stakeholder interests, and ensure transparency and accountability in increasingly autonomous industrial environments. Furthermore, greater emphasis should be placed on developing metrics that capture multidimensional value creation by integrating economic performance with environmental sustainability, human well-being, knowledge generation, and social impact. Such measurement frameworks would enable organizations to evaluate ecosystem performance beyond traditional financial indicators and better align industrial strategies with the

broader objectives of Industry 5.0 and Society 5.0 (Jourabchi Amirkhizi et al., 2025; Sheikh et al., 2025).

Finally, future investigations should embrace interdisciplinary and longitudinal perspectives capable of capturing the dynamic evolution of intelligent ecosystems. Emerging technologies such as generative artificial intelligence, cognitive digital twins, collaborative robotics, edge intelligence, and autonomous decision systems are expected to fundamentally reshape industrial value creation over the coming decade. Understanding their long-term implications will require collaboration among scholars from industrial management, computer science, operations management, economics, behavioral sciences, and public policy. Equally important is the need for empirical research across diverse industrial contexts and geographic regions to identify the organizational capabilities, leadership approaches, and policy interventions that enable successful ecosystem transformation. By moving beyond isolated technological innovations toward integrated ecosystem thinking, future research can provide the conceptual foundations necessary for building industrial systems that are simultaneously intelligent, resilient, human-centered, and sustainable.

Conclusion

The contributions presented in this issue collectively demonstrate that industrial management is entering a new stage of evolution in which the central managerial challenge is no longer the optimization of isolated organizational systems but the orchestration of intelligent, interconnected, and sustainable ecosystems. Industry 5.0 represents a significant conceptual shift by repositioning technology as an enabler of human creativity, collaborative intelligence, resilience, and sustainable value creation rather than an end in itself. Across the diverse studies included in this volume, a common narrative emerges: organizations create greater and more enduring value when digital technologies, human capabilities, stakeholder collaboration, and sustainability objectives are integrated into coherent ecosystem architectures. This transformation reflects a broader redefinition of industrial competitiveness, where long-term success increasingly depends on the ability to balance technological advancement with societal and environmental responsibility. Looking ahead, the convergence of intelligent technologies, ecosystem thinking, and human-centered innovation will continue to reshape the theory and practice of industrial management. The future will belong to organizations capable of coordinating complex networks of people, technologies, knowledge, and institutions while continuously adapting to uncertainty and societal expectations. We hope that the studies presented in this issue stimulate further scholarly dialogue and inspire researchers, practitioners, and policymakers to explore new pathways toward ecosystem-based industrial development. By embracing the principles of Industry 5.0, industrial management can move beyond operational excellence to become a driving force for inclusive innovation, sustainable prosperity, and resilient economic development in an increasingly interconnected world.

References

- Amirkhizi, P. J., Pedrammehr, S., Pakzad, S., Asady, Z., Arogbonlo, A., & Asadi, H. (2024, April). Emerging synergies: industry 5.0 integration of complex systems. In *2024 IEEE International Systems Conference (SysCon)* (pp. 1-8). IEEE.
- Babkin, A., Tashenova, L., Mamrayeva, D., & Shkarupeta, E. (2022, April). Industry 5.0 and digital ecosystems: scientometric research of development trends. In *International Scientific Conference "Digital Transformation on Manufacturing, Infrastructure & Service"* (pp. 544-564). Cham: Springer Nature Switzerland.
- Enose Kamalabai, N., Hannola, L., & Donoghue, I. (2025). Role of industrial artificial intelligence in advancing human-centric sustainable development of industry 5.0. In *Contemporary Issues in Industry 5.0: Towards an AI Integrated Society* (pp. 325-371). Cham: Springer Nature Switzerland.
- Jourabchi Amirkhizi, P., Pedrammehr, S., & Pakzad, S. (2025). A system-based approach to value prioritization in industry 5.0 for sustainable value creation. *Discover Sustainability*, 6(1), 364.
- Khosravy, M., Gupta, N., Pasquali, A., Dey, N., Crespo, R. G., & Witkowski, O. (2023). Human-collaborative artificial intelligence along with social values in industry 5.0: A survey of the state-of-the-art. *IEEE Transactions on Cognitive and Developmental Systems*, 16(1), 165-176.
- Mouazen, A. M., Hernández-Lara, A. B., Chahine, J., & Halawi, A. (2025). Triple bottom line sustainability and Innovation 5.0 management through the lens of Industry 5.0, Society 5.0 and Digitized Value Chain 5.0. *European Journal of Innovation Management*, 28(5), 1965-2005.
- Ordieres-Meré, J., Gutierrez, M., & Villalba-Díez, J. (2023). Toward the industry 5.0 paradigm: Increasing value creation through the robust integration of humans and machines. *Computers in Industry*, 150, 103947.
- Sheikh, R. A., Ahmed, I., Faqihi, A. Y. A., & Shehawy, Y. M. (2025). Global perspectives on navigating Industry 5.0 knowledge: Achieving resilience, sustainability, and human-centric innovation in manufacturing. *Journal of the Knowledge Economy*, 16(5), 15997-16032.
- Troisi, O., Visvizi, A., & Grimaldi, M. (2024). Rethinking innovation through industry and society 5.0 paradigms: a multileveled approach for management and policy-making. *European Journal of Innovation Management*, 27(9), 22-51.