Editorial

EDITORIAL: Advancing Industrial Innovation and Human-Centric Technologies in the Era of AI

By: U. Marjanovic   iD 0000-0002-8389-6927

Editor-in-Chief, *International Journal of Industrial Engineering and Management*
Professor of Industrial Engineering and Management

University of Novi Sad,
Faculty of Technical Sciences,
Novi Sad, Serbia

umarjano@uns.ac.rs

In 2025, *International Journal of Industrial Engineering and Management* (**IJIEM**) received so far over 350 manuscript submissions, marking a clear signal of the vibrant growth of industrial engineering and production management research. What is striking is that across the three issues of Volume 16 (March, June, September) many of these submissions coalesce around the theme of Artificial Intelligence (**AI**) and its deepening role in industrial systems. Within the March and June issues, for example, we see manuscripts focused on machine-learning-driven scheduling in smart manufacturing, human-resource and machine-integration in Industry 4.0 settings, and cybersecurity and IoT for power, agro-supply-chain and manufacturing infrastructures. The September issue then brings several studies directly addressing AI in production: a self-assessment model for digital retrofitting of legacy manufacturing systems; federated-learning approaches for predictive maintenance; reinforcement-learning plus digital twin frameworks for energy-efficient production scheduling.

Together, these contributions reflect a pattern: AI is no longer an "emerging topic", it is becoming foundational. It is reshaping digital services, yes—but more importantly, it is actively fueling a re-industrialization agenda. We see that national economies and manufacturing organizations are channeling AI-driven manufacturing, smart infrastructure and autonomous production systems as strategic levers to regain, sustain and elevate their industrial capacities. This industrial resurgence, powered by innovations in machine learning, robotics, data analytics and cyber-physical production systems, signals a paradigm shift. We are moving toward intelligent, responsive, and human-centric industrial ecosystems. Design-for-human-AI collaboration, optimization of energy and resource flows, and retrofitting of legacy equipment into digital-native workflows all feature prominently in 2025's scholarly output.

As Editor-in-Chief, I believe the articles in this year's volumes provide a rich snapshot of where the field stands and where it is heading. They illustrate not only technological advancement but also an orientation towards integration: of people, machines, data, and organizational routines. They highlight that the next frontier in industrial engineering and production management is as much about governance, skills, and ecosystem orchestration as about algorithms and hardware.

The aim and structure of this Issue

The final issue of IJIEM in 2025 (Vol. 16, No. 4) showcases a compelling blend of technological advancement and human-centric innovation that defines the evolving frontiers of industrial engineering and production management. The eight featured articles reflect the field's strategic shift—from merely digitizing systems to building intelligent, sustainable, and adaptable ecosystems. This issue brings together diverse themes such as artificial intelligence, digital twins, smart manufacturing, leadership for next-generation workforces, and the transformative journey of small and medium-sized enterprises (SMEs) through servitization and lean methodologies.

The first article "Digital Twin-Enabled Just-In-Time and Kanban Implementation Framework for Industry 4.0 Transformation in SMEs" by *Aldouri,* introduces a pragmatic digital-lean integration strategy. Tested across twelve automotive SMEs, the framework delivers strong performance metrics—inventory reduction, lead time shrinkage, and improved equipment effectiveness—making digital transformation accessible to resource-limited firms.

The shift toward service-based value creation is analyzed in "Orchestrating Resources and Capabilities for Platform-Based Servitization: Recommendations for SMEs to Overcome Tensions" by *De Zabala et al.* Through a case study in the food and beverage sector, the paper provides a nuanced view of the organizational tensions and ecosystem strategies required for successful digital servitization.

Human capital challenges in manufacturing are tackled in "NextGen 5.0 Leadership in Manufacturing: Tackling Workforce Challenges with a Multicountry and Multicompany Perspective" by *Salvadorinho et al.* Addressing Gen Z workforce dynamics, the paper proposes the "NextGen 5.0 Leadership Model," emphasizing growth mindsets, emotional intelligence, and triple-purpose leadership to combat disengagement and talent attrition.

In "Deep Learning Enhanced Predictive Maintenance Framework Using Industrial Internet of Things Sensors for Smart Manufacturing Systems," *Zokirov et al.* develop a hybrid CNN-LSTM model to predict equipment failures with 94.3% accuracy. The model, validated across industrial plants, significantly reduces downtime and maintenance costs, highlighting the operational power of AI-driven predictive maintenance.

Operational efficiency in traditional industries is addressed in "Performance Outcomes of Supply Chain Management Practices: Evidence from Pakistan's Fan Manufacturing SMEs" by *Akbay and Hafeez.* Their empirical study of 100 firms reveals that customer and supplier relationship management strongly influence organizational performance, offering actionable insights for SMEs in developing economies.

The article "An Industry 4.0 Framework for the Smart Production Management of Renewable Energy and Water Systems: An Application of AI, IoT, and Digital Twin Technologies" by *Mukhitdinova et al.* introduces an integrated framework that boosts system efficiency and sustainability using neural networks, IoT, and digital twins—achieving measurable improvements in energy utilization and environmental performance.

From the education domain, *Freires et al.* present "Development of a Didactic Solution for Teaching Concepts Related to Digital Twins Using Educational Robot." This innovative pedagogical model leverages 3D-printed robots and real-time simulations to enhance engineering students' understanding of digital twin concepts, contributing to the future workforce's readiness for Industry 4.0.

Finally, "Kanban in Aviation Maintenance: A Case Study of a Chinese Aircraft Maintenance Enterprise" by *Zhang et al.* applies lean principles to the aviation sector. The study demonstrates how Kanban implementation streamlines maintenance processes, reduces costs, and enhances sustainability within a rapidly growing industry.