15th IFAC Workshop

Intelligent Manufacturing Systems (IMS 2025)

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This proposal is endorsed by TC 5.1, TC 5.2 and TC 9.2

Invited Session Proposal:

Human Work and Skills for Advanced Manufacturing in AI and Industry 5.0 Era

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ABSTRACT
Modern manufacturing shopfloors have been experiencing a significant transformation, driven by Industry 4.0 technologies, and digitalization; including advanced robotics, additive manufacturing, predictive maintenance, artificial intelligence (AI), and automation, integrated into smart systems. The incorporation of digital tools and AI not only augments operational efficiency but reshapes the very essence of human work. This shift reduces the demand for labor in repetitive tasks while enabling workers to focus on cognitively complex responsibilities. These cognitive responsibilities range from problem solving and decision-making to innovation and collaboration. Consequently, the human workforce is transitioning from manual tasks to roles requiring advanced cognitive, technical, and socio-emotional skills. Furthermore, two parallel trends continue to dominate the smart work setting. First, technology increasingly governs how workers communicate and socialize. Second, new work arrangements (e.g.,

freelance, gig-work, task, project-based work) are becoming prevalent and are expected to reach a record high by 2030.

As we move further into the age of smart manufacturing, and the adoption of Industry 5.0 concepts and especially that of human-centricity, it becomes essential to understand the evolving roles of human operators and the skills required to thrive in these environments. The integration of AI in decision-making and operational settings, coupled with the rise of cyber-physical systems (CPS) call for a re-examination of human-centered approaches to maintain a healthy symbiosis between humans and machines. AI, autonomous systems, and collaborative robots (cobots) are transforming the dynamics between machines and humans. Machines no longer merely substitute human labor; instead, they complement and enhance human capabilities. In many settings, AI itself improves its capabilities and outcomes, benefiting from human interaction. This synergy between humans and technology demands the development of new skills, including data literacy, problem-solving, creativity, and the ability to collaborate with AI-driven systems.

These developments require agility, adaptability, and continuous upskilling among workers to stay relevant. Furthermore, the rapid evolution of smart manufacturing requires continuous skill development to adapt to technological changes. New tools and frameworks are essential for managing digitized workflows, alongside a reorganization of work environments. Studies on human factors should explore the interplay between technology and human skills, providing industries with advanced methods to foster an agile, human-centered manufacturing approach. These studies should emphasize the intricate relationship between digital technologies and human skills, equipping high-tech and industrial firms with cutting-edge strategies and tools to cultivate an agile, human-centered approach to smart manufacturing. This session invites high-quality contributions that investigate the latest theoretical developments, methods, practical tools, and real-world applications related to human work, skills, and interactions with technology in the context of Industry 5.0. These contributions may address the main research challenges, reviews, case studies and applications related to (but not limited to) the following topics:

- Human centered systems to assist workers in their increasingly complex tasks.
- Innovative tools and technologies to enhance the human work.
- Original industrial and real-world case studies to test the adoption execution of human skills in smart manufacturing settings.
- Implementing new technologies to meet the demand vs. supply of new skills in smart manufacturing settings.
- The role of AI in reshaping and enhancing human work in smart manufacturing environments.
- Multidisciplinary approaches to design human work in smart tech-based and unique work settings.
- Human factors and associated new skills affecting the performance of smart manufacturing environments (technical, cognitive and socio-emotional skills)
- New skills and competencies for the digitized smart work environment.
- Work organization in smart manufacturing environments.
- Industrial Smart Work Theory and Practice.
- Human-AI work adoption frameworks.
- Human-AI work skills/ competencies assessment and complementarity.
- Human-AI symbiosis synergies and collaboration
- Concepts, frameworks, and applications of human – technology integration in Industry 5.0
- Reskilling and Upskilling for Industry 5.0
- Requirements, designs, and assessment approaches for human-centred smart manufacturing.

- Methodologies for and applications of human-centric designs for AI-enabled workflows
- Joint, collaborative or sliding decision making and work sharing between humans and AI-enabled systems in manufacturing.
- Human-centered digital twins in manufacturing
- Human wellbeing and performance management in manufacturing work environments

Timeline:

- **December 16, 2024:** Deadline for paper submission

- **March 03, 2025:** Notification of acceptance/rejection

- **April 07, 2025:** Final paper submission

- **September 11-12, 2025:** 15th IFAC IMS Workshop (IMS 2025), Koszalin, Poland

Manuscript Preparation

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Upon submission, make sure to use the **Invited session identification code: to be announced latter**

For any further information, please contact the Special Session Technical Committee

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