

# HUMAN-CENTRIC MANUFACTURING CULTURE

DMI is undertaking a research study on human-centric manufacturing culture, in collaboration with the Massachusetts Institute of Technology and the International Academy of Automation Engineering. This whitepaper was written by the authors below to inform and assist in framing the DMI approach for this study.

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# DMI RESEARCH STUDY

## HUMAN-CENTRIC MANUFACTURING CULTURE

Digital transformation has increased the complexity of manufacturing enterprises due to myriad factors. Among these are continuous advancement of technologies, **increasingly complex interconnectivity of technology and people**, and extensive software and available data. Changes are necessary in business strategy, organizational strategy, technology strategy, and operations. Further, digitalisation is also driving changes in the skill profiles required in the manufacturing workforce of the future [1].

Firm adoption of Industry 4.0 has been recognized as critical to maintaining Ireland's competitive manufacturing base into the future, as discussed in Ireland's Industry 4.0 Strategy 2020-2025 [2]. One of the five goals of this strategy is to *facilitate the current and future workforce to develop the skills to deliver the Industry 4.0 transformation and exploit the new opportunities arising in manufacturing and supply chain firms through Industry 4.0 technologies*. New manufacturing roles and skillsets are recognized as essential, while at the

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same time industry is experiencing shifting demographics of the workforce and changes in the marketplace.

Industry 5.0 has emerged more recently as the next revolution in manufacturing, with three key pillars: **human-centric, resilient and**

**sustainable**. Intended to complement and extend Industry 4.0 rather than replace it, it shifts focus from techno-economic value to societal value, and from welfare of the worker to the wellbeing of the worker. Industry 5.0 aims to **merge human and technological skills and strengths to achieve mutual benefit to industry and industry workers**, where technology does not replace but rather complements humans [3]. Under this digital paradigm, the **art and science of leadership must also evolve respectively to enable a human-centric manufacturing culture**.

**What is Human-Centric Manufacturing Culture?** Human-centric manufacturing is viewed as necessary for future factories that seek to *increase flexibility, agility and competitiveness in the face of social challenges* [4]. The human-centric approach emphasizes use of manufacturing technology to serve workers, where the **technology adapts to the needs and diversity of the workforce, rather than having workers continuously adapting to the ever-evolving technology** [5]. The future workforce is envisioned to have more influence and take greater responsibility in the transition to digital manufacturing, including design and development of new technologies (e.g., robotics, AI) and re-design of manufacturing processes to leverage human preferences, capabilities, knowledge and experience. **Human-centric manufacturing is more than a new approach arising from digital transformation; it is a cultural transformation**.

Presently, **the adoption rate of digital technologies in the manufacturing industry is gradual**, which is out of sync with the rapid change in available technologies and disruptive approaches. Much focus has been placed on the technology aspects, and little on the sociotechnical and cultural aspects that are equally important. Human-centric manufacturing places core human needs and interests at the center of the production process. **Rather than considering what we can do with new technology, a human-centric approach is grounded in questions of purpose, and asks what technology can do for the workforce**. There is a desire to use technology in a manner where it can adapt production processes to the needs of the worker. For example, rather than training workers to use

increasing numbers of disparate systems, a human-centric approach envisions adapting systems to the needs and diversity of workers, and guiding them in effective and more intuitive use of the technologies. The **future workforce will be continuously learning, having opportunity to influence and have responsibility in evolving the production process.**

Human-centric manufacturing **leverages the power of digital technology, while fully engaging humans in decision making and operations where they are most needed and uniquely capable.** It considers not just human-machine interactions but also the human-to-human interactions through technology. Achieving the promise of human-centric manufacturing necessitates having the workforce deeply engaged in the design and deployment of new technologies, including robotics and AI. These are very new areas of practice, and there is a great deal yet to learn about these interactions.

**Strong leadership has always been a top driver for transformation,** and a recent survey on digital transformation in US FDA-regulated manufacturing [6] confirmed three top success factors as strong leadership, adequate collaboration and building a constant culture of change. However, this survey indicated **many manufacturing leaders are having difficulty explaining what digital transformation specifically means in context of their organization.** Another finding in that survey indicated competing priorities of senior executives, organizational silos and lack of shared digital transformation vision across all leadership levels are significant barriers. If research does not inform future programs and initiatives, it is likely that companies will continue to focus on business or technology change without sufficiently supporting the manufacturing system and workforce culture change, with its associated nuances of change management, generational differences, cultural factors, and related mindset factors.

**Human-Centric Manufacturing Culture Research Study.** DMI has organized a research study in collaboration with two research partners, IAAE and MIT, in support of this important focus for future manufacturing. The motivation is to **gain insight and knowledge to inform positioning Ireland at the forefront of both research and practice for human-centric manufacturing and workforce transformation.** The DMI research study will investigate the current state of digital transformation in Irish manufacturing firms and identify gaps that must be bridged for human-centric manufacturing to be successful. This research intends to surface the very best of how manufacturers are supporting and leading their people in context of digital transformation, as well as **identify opportunities for new directions and supports for companies** both within and beyond each sector being considered. The study will capture leadership perspectives on the social and technical challenges, enablers and barriers to human-technology interaction, adoption of newer technologies and strategies for nurturing a human-centric manufacturing culture. **Manufacturing leaders will have an important role in shaping the culture, strategies, and enabling environments that are necessary to achieve the benefits of human-centric manufacturing.**

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