

Adapt, Align, and Advance: Reconciling Practices for Continuing Engineering Education In Society 5.0 Across Academia, Industry, and Professional Organisations

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Abstract

The transition to Society 5.0 highlights the need for more human-centred, sustainable, and collaborative approaches to engineering, reinforcing the importance of quality lifelong learning (LLL) and Continuing Engineering Education (CEE). As engineering increasingly operates at the intersection of technology and societal needs, professionals must continuously update their knowledge and skills. The CEE ecosystem is diverse, comprising universities, industry, training providers, and professional societies, each with distinct roles, motivations, and constraints. However, its overall impact depends on how effectively these stakeholders work together. This interactive workshop explores CEE in the context of Industry/Society 5.0 through multiple stakeholder perspectives. Participants will examine how different actors conceptualise and implement CEE, identify complementarities and misalignments across the ecosystem, and consider how these influence the effectiveness of and quality of experience for lifelong learning with engineers. Through collaborative activities and cross-sector dialogue, participants will map the

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CEE ecosystem and identify opportunities for greater alignment and co-design. The workshop aims to promote shared understanding and generate actionable insights to strengthen the integration and impact of CEE in supporting engineers in a rapidly evolving societal and technological landscape.

1 Background and rationale

The era of Industry 4.0 started only about 15 years ago, but within a few years there was a realisation that these new, cyber-physical systems had to be more human-centred and actively embrace society and sustainability (Barata and Kayser, 2023; Cotta et al., 2021). Enter the era of Industry/Society 5.0 that envisions “*new forms of sustainable, circular and regenerative economic value creation and equitable prosperity*” (ESIR, 2022, p6) with Industry 5.0 focusing more on the technology and Society 5.0 adopting a more “*systems approach to observe how encapsulated social, political and economic sub-systems can co-create value*” (Troisi et al., 2024). Importantly, Industry/Society 5.0 has been advocated by the European Union/Commission and frames current policy and research initiatives.

Specifically, Industry/Society 5.0 requires new forms of collaboration between a range of stakeholders (universities, industry, policy makers, society and citizens). Carayannis and Morawska-Jancelewicz (2022) advocate for the Quintuple Helix Model as a driver for the required shift and innovation to meet this dynamic, non-linear generation, diffusion and use of knowledge. Specifically, it encourages us to extend our thinking beyond the Knowledge Triangle of Innovation, Research, and Education (Markkula, 2009; Lappalainen et al., 2013) to consider the public and natural environmental systems and the interplay between these. As may be anticipated, to achieve such change in a complex system is not simple and requires new ways of working with associated challenges.

While the value of learning remains constant, the how and what is needed is evolving, with technological developments like Massive Open Online Courses and shifting occupational boundaries necessitating opportunities for upskilling and reskilling (Broo et al., 2022). Luna et al., (2024) identifies five challenges for education, namely 1) adoption of Industry 5.0 technologies amongst stakeholders, 2) barriers and facilitators within the educational context, 3) pedagogical [andragogical/heutagogical] shifts required, 4) increased opportunity for personalised learning, and 5) how to sustain and scale investment of these changes. Specifically, within engineering education, then we need to reshape learning to provide “*a new synergy between technology and human-centred values*” (Arregi Lopez et al., 2025). This raises the need for stakeholders to work together to ensure that learning meets the needs of engineers across their lifetime of learning and working, sustains high quality of learning, and aligns with the recognition that lifelong learning (LLL) is seen as pivotal to Industry 5.0 (Rial-Gonzalez et al., 2024).

We need to actively bring different stakeholders together to explore these new approaches in response to Industry/Society 5.0 and this is the focus of the Continuing Engineering Education (CEE) and Lifelong Learning (LLL) Special Interest Group workshop.

2 Workshop objectives

2.1 Target audience

This workshop is designed for participants involved in engineering education and professional development across different sectors, including:

- Academics and educators involved in curriculum design, lifelong learning, and continuing engineering education (CEE).
- Industry professionals and employers responsible for workforce development, upskilling, and training strategies.
- Representatives from professional societies and accreditation bodies.
- Policy makers and researchers interested in the future of engineering education and Society 5.0.

The workshop particularly benefits participants interested in cross-sector collaboration and the alignment of continuing engineering education within a broader ecosystem.

2.2 Expected learning outcomes

By the end of the workshop, participants will be able to:

1. **Identify** key engineering trends linked to Society 5.0 that drive the need for LLL and CEE.
2. **Compare** how academia, industry, and professional bodies approach CEE, including their motivations, constraints, and definitions of impact.
3. **Analyse** complementarities and misalignments within the CEE ecosystem and their impacts on the effectiveness/quality of lifelong learning for engineers.
4. **Outline** initial steps toward co-designing approaches to continuing engineering education within a more integrated ecosystem.

3 Workshop design

The workshop is designed (Table 1) as an interactive session to explore how different stakeholders understand and implement CEE in the context of Society 5.0, and to identify opportunities for greater alignment across the ecosystem. Participants will first engage in stakeholder perspective activities, where they examine CEE from the viewpoints of academia, industry/employers, and professional societies, reflecting on motivations, constraints (e.g., time, systems, quality considerations, technology, etc.), and priorities. These perspectives will then be shared and discussed in a cross-sector dialogue to surface complementarities and misalignments in how CEE is conceptualised and operationalised. Building on these insights, participants will collaboratively map key actors and practices within the CEE ecosystem and identify potential leverage points for improving coordination and impact. The workshop concludes with a synthesis of insights and discussion of possible next steps to promote collaboration and co-designing approaches to continuing engineering education across stakeholders for Society 5.0.

Table 1. Workshop Design and Activity Timeline

Run time	Activity	Specifics
8 min	Introduction • Industry/Society 5.0 and lifelong learning. • The CEE ecosystem (academia, industry, professional societies). • Key challenge: aligning the ecosystem.	To provide a shared understanding of workshop goals.
20 min	Interactive Activity 1 – Stakeholder Perspective Labs Purpose: Surface how CEE is understood, valued, and operationalised across sectors. Output: Each group develops a short stakeholder perspective on CEE priorities and challenges.	Step 1 – Assign roles (3 min): Participants form small groups and adopt one stakeholder perspective: Academia / Universities, Industry / Employers, Professional Societies / Accreditation bodies. Step 2 – Stakeholder inquiry (17 min): Groups discuss prompts: What does CEE mean for us in Society 5.0? What motivates us (incentives, funding, accountability)? What constraints do we face (policy, accreditation, market pressures)? What change would we prioritise (one radical, one realistic)? Groups prepare two key insights to share.
15 min	Discussion – Cross-Sector Dialogue Output: Shared list of cross-sector insights about the CEE ecosystem for Society 5.0.	Step 1 – Rapid stakeholder statements: Each group delivers a 60–90 second statement summarising their perspective. Facilitator records key insights on a shared board under stakeholder columns (Academia / Industry / Professional Societies). Step 2 – Cross-sector discussion: Facilitated reflection on the statements. Guiding questions: Where are assumptions misaligned? Where are interests complementary? Who defines quality and impact in CEE? Who holds decision-making power and who carries risk? Insights are clustered into themes such as misalignments, complementarities, and structural barriers.
10 min	Interactive Activity 2 – Rapid Ecosystem Mapping + Micro Gallery Walk Output: Collective view of the CEE ecosystem and potential leverage points for improvement.	Step 1 – Ecosystem mapping (5 min): Groups sketch a quick map of the CEE ecosystem identifying key actors (universities, companies, professional bodies, training providers, governments, learners) and practices (microcredentials, Continuing Professional Development [CPD] systems, short courses, industry partnerships). Groups identify one key leverage point to improve alignment of CEE for Society 5.0.

		Step 2 – Micro gallery walk (5 min): Participants view other maps and add one note identifying a promising point or collaboration opportunity.
7 min	Conclusions and Next Steps Output: Key messages and potential directions for the CEE/LLL SIG, and future collaboration or research within SEFI.	Facilitator synthesises key takeaways: differences in stakeholder perspectives, shared goals across the ecosystem, and promising leverage points for aligning CEE. Invite participants to reflect on one collaboration between sectors that should exist but currently does not. Key topics collated and to inform SIG Annual Plan for 2026/27.

4 Workshop results

To be added after SEFI Conference.

References

- Arregi Lopez, A., Igartua, J. I., Retegi, J., Eguren, J. A., & Ibarra, D. (2025). Addressing the challenges associated with Industry 5.0 in higher education: a training concept approach. *The TQM Journal*, 1-19.
- Barata, J., & Kayser, I. (2023). Industry 5.0—past, present, and near future. *Procedia Computer Science*, 219, 778-788.
- Broo, D. G., Kaynak, O., & Sait, S. M. (2022). Rethinking engineering education at the age of industry 5.0. *Journal of Industrial Information Integration*, 25, 100311.
- Carayannis, E. G., & Morawska-Jancelewicz, J. (2022). The futures of Europe: Society 5.0 and Industry 5.0 as driving forces of future universities. *Journal of the Knowledge Economy*, 13(4), 3445-3471.
- Cotta, J., Breque, M., De Nul, L., & Petridis, A. (2021). Towards a sustainable, human-centric and resilient European industry. *Luxembourg: Publications Office of the European Union*.
- ESIR (2022). Industry 5.0: A Transformative Vision for Europe. ESIR Policy Brief No. 3.
<https://www.horizon-europe.gouv.fr/sites/default/files/2022-01/industry-5-0-pdf-5324.pdf>
- Lappalainen, P., Markkula, M. & Kumpulainen, M. (2013). The Knowledge Triangle: Re-Inventing the Future. European Society for Engineering Education SEFI.
- Luna, A., Chong, M., & da-Silva-Ovando, A. C. (2024, March). Challenges for education in the new era: Education and training in industry 5.0 roles. In *2024 IEEE World Engineering Education Conference (EDUNINE)* (pp. 1-5). IEEE.
- Markkula, M. (2009). Forefront Developments—Innovation and Practice, of Continuing Education. In SEFI and TKK Dipoli (Eds) *European Continuing Engineering Education, Conceptualizing the Lessons Learned* (pp. 61-74). ISBN 978-2-87352-002-1
- Rial-Gonzalez, P., Sarceda-Gorgoso, M. C., & Santamaría Queiruga, O. (2024). Lifelong learning as a response to the challenges of Industry 5.0 within the context of Horizon 2030. *Educar*, 60(2), 305-319.
- 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.