R&I Brief

Human-Centric Manufacturing: Tools, Skills and AI

EFFRA
EUROPEAN FACTORIES OF THE FUTURE RESEARCH ASSOCIATION

Table of Contents

Executive Summary

This Research & Innovation (R&I) Brief outlines the strategic direction, priorities, and actions required to advance Human-Centric Manufacturing in Europe. It provides guidance for industry, policymakers, research organisations, and social partners to position people at the core of industrial transformation. Human-centricity is emerging as a defining success factor for Europe's competitiveness, resilience, and societal well-being as the manufacturing sector undergoes profound technological, environmental, and demographic change.

Human-centric manufacturing goes beyond technology deployment: it ensures that digitalisation, automation, and AI are designed and implemented with and for people, enhancing performance while improving job quality, skills, inclusion, and workplace well-being. As Europe aims to lead the global transition towards sustainable and future-proof industry, a human-centric approach is essential to secure trust, talent, innovation capacity, and fair value creation across society.

Who Is This Brief For: This brief is intended for the key actors involved in shaping and implementing Europe's industrial transformation. It addresses those engaged in R&I, industrial strategy, skills development, and the practical deployment of human-centric approaches across manufacturing. It can serve as a reference for organisations and experts contributing to a more competitive, resilient, and people-focused European industry.

Key Messages

- Human-centricity is a strategic lever for Europe's competitiveness and resilience, enabling high-performance industry while improving the quality, attractiveness, and sustainability of industrial work.

- Technology must augment and empower workers - preserving human agency and dignity, enhancing safety, well-being, and meaningful work while strengthening innovation and productivity.

- Skills, organisational transformation, and responsible AI adoption are critical enablers for effective and inclusive industrial transformation; technology alone cannot deliver impact without empowered people and a supportive culture.

- Collaboration across the industrial ecosystem is essential - industry, policymakers, research, education, and workers must jointly accelerate adoption, scale successful practices, and ensure no company, region, or worker is left behind.

- Europe has a unique opportunity to lead globally by demonstrating that economic performance, innovation, sustainability, and social progress can reinforce each other through human-centric industrial transformation.

Central message:

Human-centricity is Europe's pathway to a future where productivity and well-being advance together. By making it our strategic advantage and driving it collectively across the manufacturing ecosystem, we can build an industrial model that Europe leads, industry trusts, and people thrive in.

2. Introduction and Rationale

Europe's manufacturing sector is undergoing a profound transformation driven by digitalisation, sustainability imperatives, demographic shifts, and changing expectations around industrial work. A human-centric approach is essential to ensure that technological progress enhances resilience, competitiveness, and social sustainability.

This is especially critical as 77% of EU companies report difficulties in finding workers with the right skills[1], and 44% of EU adults lack basic digital skills[2] - both major barriers to the fair and effective deployment of emerging technologies.

2.1 Context and Drivers of Transformation

- **Technology acceleration:** AI, data, connectivity, automation and robotics are transforming roles, skills, and decision-making. In parallel, 74% of EU businesses reached at least a basic level of digital intensity in 2024[3], showing progress but also uneven diffusion across firms and sectors. The pace of innovation is challenging existing business models and requiring faster adaptation of industrial processes, governance structures, and workforce competencies to harness the full value of digital transformation.

- **Twin Transition imperatives:** Sustainability and digitalisation require deep rethinking of processes, products, and workforce development to meet Europe's 2030 targets. Integrating circularity, decarbonisation, and digital solutions demands a holistic approach that links technology investment with social and environmental objectives, ensuring that no region, company, or worker is left behind.

- **Demographic and labour-market pressures:** Persistent shortages of skilled labour constrain transformation; 77% of companies report difficulties finding workers with the necessary skills[1]. An ageing workforce, the rapid emergence of new job profiles, and evolving worker expectations are reshaping how companies attract, retain, and empower talent in industrial settings.

- **Geopolitical and competitive pressures:** Europe must strengthen industrial resilience and sovereignty through innovation based on quality, innovation, and trust. Global supply chain disruptions and rising competition from digitally advanced economies underline the urgency of reinforcing Europe's technological autonomy while preserving its social model and leadership in responsible industrial transformation.

2.2 Rationale for Action

Human-centric manufacturing is now a strategic imperative for Europe's industrial competitiveness, resilience, and social contract. As AI and automation transform work, the way Europe embeds human-centricity in technology adoption will determine whether change empowers workers or leaves them behind.

Human-centricity is essential because it:

- Enables productivity, quality, and innovation gains by augmenting human capabilities, not replacing them.
- Builds trust and acceptance of AI, robotics and automation through transparency, usability, and shared governance - echoing European public sentiment that AI in workplaces needs careful management to protect privacy and ensure transparency[4].
- Supports key EU policy priorities: European Industrial Strategy, Industry 5.0, Pact for Skills, AI Act, Social Pillar, and a fair Twin Transition.
- Strengthens talent attraction and retention, addressing critical labour and skills shortages across the sector.
- Ensures a fair and inclusive transformation that reflects European values while reinforcing industrial competitiveness and societal trust.

2.3 Opportunity for Europe

Europe is well-positioned to lead globally in human-centric manufacturing due to its strong industrial base, social model, and expertise in high-value manufacturing.

Evidence shows broad progress in firms' use of digital technologies - 74% of EU firms report using advanced digital technologies[5] - yet diffusion remains uneven, underlining the need for methods and assets that make adoption human-centric and SME-ready.

To seize this opportunity and accelerate impact, **the R&I system must**:

- Translate human-centricity into practical methods, tools, standards, and evidence that industry, especially SMEs, can deploy.
- Align industrial, policy, skills, and research agendas to accelerate scaling of what works.
- Demonstrate measurable performance and people benefits to reinforce investment and adoption.

Human-centricity is Europe's opportunity to compete not on automation volume, but on innovation quality, inclusion, and sustainable value creation - setting a global benchmark for the next era of industry.

3. State of Play

Europe's manufacturing landscape is undergoing rapid transformation driven by digitalisation, the green transition, demographic pressures, and changing expectations of industrial work. Human-centricity has gained traction across EU policy, industrial strategy, and research agendas; yet implementation remains uneven across sectors, company sizes, and regions.

Adoption of Digital and Human-Centric Practices in Europe: European industry is progressing in digital transformation, but maturity varies. Around three-quarters of EU firms report using advanced digital technologies[5], while 74% of EU businesses reached a basic level of digital intensity in 2024[3], indicating uneven diffusion and integration depth across the economy.

Workforce, Skills and Talent Outlook: Skills gaps remain one of the most critical barriers. 77% of EU companies report difficulties finding workers with the necessary skills[1], while 44% of EU adults lack basic digital skills[2], limiting equitable access to emerging roles and technologies.

Technology Maturity, Trust, and Worker Acceptance: Human-centric AI, HRC, XR and cobotics are advancing, but transparency and governance remain essential to earn trust. EU surveys show most Europeans support the use of robots and AI at work, while 84% believe AI requires careful management to protect privacy and ensure transparency[4]. In parallel, around 30% of workers report using AI tools at work, and 90% use digital devices[6], reflecting rapid diffusion at task level.

While Europe has made notable progress through policy alignment, research initiatives, and early industrial efforts, the transition to truly human-centric manufacturing remains at a pivotal stage. Promising practices exist across regions and sectors, but they often remain fragmented, small-scale, or disconnected from mainstream industrial transformation strategies.

In many organisations, human-centricity is still approached as an add-on or a complementary aspect of digitalisation, rather than a core design principle shaping how technologies, workplaces, and industrial ecosystems evolve. As a result, opportunities to enhance worker empowerment, well-being, and meaningful adoption of technology are not fully realised, particularly in fast-changing production environments.

To move from ambition to systemic impact, human-centricity must be operationalised as both a strategic driver and a competitive advantage for Europe. This requires bridging the gap between policy principles and industrial reality by integrating technology deployment with organisational innovation, workforce development, and measurable value for both people and performance. Europe is well-positioned to lead globally in demonstrating that advanced manufacturing can be both highly productive and socially sustainable.

The next sections present the key challenges and needs identified by the Working Group, followed by targeted R&I priorities and actionable recommendations designed to accelerate a scalable, inclusive, and future-ready human-centric industrial transformation.

4. Strategic Challenges & Needs

Achieving a human-centric transformation of European industry requires addressing interlinked technological, organisational, social, and policy challenges. These challenges are grouped into four strategic areas, each with specific needs to enable effective implementation.

1. Workforce Empowerment & Skills Transition: Human-centric transformation demands a skilled, empowered, and adaptable workforce capable of leveraging new technologies responsibly and effectively.

Needs:

- Strengthen lifelong learning systems and industry-driven upskilling/reskilling programmes aligned with technological evolution.
- Foster digital literacy and advanced technology competencies accessible to all workers.
- Promote new work models and organisational practices that support well-being, autonomy, and inclusion.

2. Human Tech Collaboration & Adoption of AI and Automation: To ensure technology enhances work rather than replaces it, human tech collaboration must be intentionally designed and scaled.

Needs:

- Promote responsible, useful, humancentric AI and automation that augment human capabilities, such as decision-making, sensing, and physical work.
- Develop trustworthy, transparent, and explainable AI solutions to foster user acceptance and adoption.
- Strengthen human-machine interface (HMI) and human-robot collaboration (HRC) solutions with safety, ergonomics, and inclusivity in mind.

3. Organisational and Cultural Transformation: Cultural and organisational shifts are essential to embed human-centricity as a core value across companies, ecosystems, and supply chains.

Needs:

- Enable organisational innovation that prioritises participatory approaches, cocreation, worker engagement, and social inclusion.
- Support leadership models that integrate humancentric values and empower people-driven change.
- Encourage industry adoption of human-centric performance indicators and value measurement frameworks.

4. Policy, Standards, and Ecosystem Enablement: Supportive frameworks, standards, and ecosystem collaboration are required to scale humancentric practices across Europe.

Needs:

- Align European and national policies, incentives, and regulations to foster humancentric adoption and innovation.
- Develop standards, guidelines, and certification schemes for humancentric industrial systems and AI.
- Reinforce cooperation across industry, research, social partners, and civil society to accelerate knowledge exchange and uptake.

5. Research & Innovation Priorities

Europe's competitive advantage in manufacturing will come from **human-centric innovation that augments people with trustworthy technology,** diffuses rapidly to SMEs, and measurably improves work quality and performance, fostering inclusivity and usability in human-machine collaboration.

The priorities below are structured thematically, as **fundable R&I actions** that industry, RTOs, and public programmes can implement.

5.1 Skills, Learning & Workforce Transformation

Aim: Build **adaptive, lifelong** learning systems that keep pace with technology and demographics, enabling all workers, especially in SMEs, to use, shape and improve human-centric manufacturing systems.

- Develop **modular, micro-credential learning stacks** for operators, technicians and engineers covering digital literacy, data basics, AI-in-the-loop, robotics fundamentals, HSE in digital workplaces, and human–machine teaming.

- Create **role-based "learning twins"** (competence profiles linked to workplace tasks) that map required skills to evolving tools, enabling personalised learning paths and requalification within months, not years.

- Design and validate **work-embedded training** (learning-by-doing with digital work instructions, AR job aids, and AI tutors/coplots). Develop immersive training environments that allow real-time skill assessment and certification, reducing time-tocompetence and improving retention. This would address skill gaps and support continuous learning in dynamic industrial contexts.

- Build **SME-ready training toolkits** (open content, simulated datasets, sandbox apps) that regional centres/EDIHs can deploy with minimal local adaptation.

- Advocating for tools and platforms that allow non-experts to create and deploy immersive experiences (e.g., AR/VR) without coding, facilitating broader adoption across SMEs and training centers.

- Establish **skills observatories** that continuously scan technology change (AI, XR, HRC, safety) and update curricula and micro-credentials accordingly; include mechanisms to recognise prior experiential/tacit learning.

- Develop innovative approaches to equip workers and organizations with the essential skills for effective human-AI teaming in workplaces.

- Advance **inclusive pedagogy and accessibility** (multilingual, low-literacy modes, neurodiversity-aware UX) to widen participation and reduce digital exclusion.

- Develop **assessment methods & badges** for human-centric competencies (e.g., teamwork with robots, XAI use, safe interventions), interoperable with EU skills frameworks.

5.2 Human-Centric AI, Data & Automation

Aim: Deliver trustworthy, adaptive AI and automation that keep humans in control, improve decisions and quality, and are safe, explainable and auditable in real factories.

- Design **human-in-the-loop AI copilots for production**, maintenance and quality: context-aware assistants that explain recommendations, accept operator feedback, and learn from corrections. This includes sensing technologies, augmenting human capabilities.

- Create **explainability toolkits for industry** (real-time rationales, uncertainty, counterfactuals) tailored to operators and supervisors; validate in safety-critical and regulated settings.

- Develop **low-code/no-code AI pipelines** (data ingestion, labelling, model updates, deployment) that SMEs can run with minimal IT staff; include lifecycle governance and rollback.

t

- Research **continual learning & domain adaptation** for non-stationary shopfloors (drift, new variants, tool wear), with safeguards against catastrophic forgetting and degraded safety.

- Implement **privacy-preserving and federated learning** for cross-plant collaboration; provide reference architectures for SMEs to participate without exposing sensitive data.

- Advance **safe automation orchestration** (task allocation between humans, robots, and AI) using formal safety cases, runtime monitoring, and graceful degradation/stop strategies, adaptable robot behavior based on real-time feedback from human collaborators.

- Develop methods and tools for evaluation and auditing of the trustworthiness of AI automation, including producing **reference datasets & benchmarks** (e.g. vision, scheduling decisions, task allocation, shift patterns, anomaly detection, ergonomics, robustness, explainability/ transparency) representative of European manufacturing, with human-centred metrics (trust, workload).

- **Validate AI assurance processes** (risk assessment, bias/harm testing, post-deployment monitoring) integrated into industrial QMS and HSE practices.

5.3 Human–Machine Collaboration, Robotics & XR

Aim: Make **collaborative robotics and XR** truly usable at scale: safe, intuitive, rapidly reconfigurable, and supportive of cognitive performance.

- Develop **intuitive programming and rapid re-tasking** for cobots (demonstration-by-doing, AR guidance, goal-level instruction), enabling day-scale changeovers by shopfloor staff.

- Advance **multimodal interaction** (voice, gesture, gaze, haptics) tuned for noisy, PPE-constrained environments, and adaptive user interfaces that accommodate diverse user profiles.

- Engineer **adaptive HRC safety & ergonomics:** context-aware speed-and-separation monitoring, force limits, and dynamic zones that account for human posture and movement.

- Research **cognitive load modelling in HRC/XR** scenarios; design interfaces and workflows that prevent overload and support sustained attention and decision-making.

- Create **XR work instructions & remote assistance** for complex assembly, maintenance and inspection; quantify impacts on time-to-competence, rework and first-time-right rates.

- Build **plug-and-produce connectors for cobots**, tools, and sensors using open interfaces and semantic descriptions to reduce integration costs in brownfield sites.

- Evaluate **humanoid and mobile manipulation** for specific use cases (e.g., intralogistics, kitting, ergonomic risk tasks) focusing on safety, reliability, and net value vs. simpler alternatives.

- Develop **validation protocols** for HRC/XR (safety, usability, inclusiveness), including test methods for diverse body types, abilities, and experience levels.

- Set up and extend **virtual/digital human–robot interaction laboratories and testbeds**. Create shared HRC/XR evaluation datasets and benchmarks that combine robot trajectories, environmental sensing, and rich human response data for typical collaborative tasks.

- Use **digital human models, anthropometric diversity, and gender-sensitive criteria** in HRC/XR design and validation.

5.4 Human-Centric Workplace Design, Safety & Well-Being

Aim: Design workplaces and work systems that improve well-being, safety and social inclusion (including gender, people with special needs, age perspectives) while delivering higher quality and productivity.

- Further develop **human-centric workplace design** methods that combine ergonomics, cognitive systems engineering and organisational factors; provide libraries of reference patterns for common stations and flows.

- Promote **Human Digital Twins (HDT)**, where individuals are represented through standardized digital models (e.g., AAS type 3) that integrate physiological, cognitive, and behavioural data.

- Develop **sensing & analytics for well-being and safety** (posture, exertion proxies, micro-breaks, near-miss detection) with privacy-by-design and worker consent models.

- Research **accessible & inclusive interaction** (font/contrast standards, color-blind-safe cues, tactile/aural redundancies) to support diverse and ageing workforces.

- Integrate **risk-aware work orchestration** that adapts task assignment and pacing using real-time context (skill levels, fatigue signals, process risk) while keeping humans in control.

- Establish **participatory design toolkits** enabling workers to co-create improvements, capture tacit knowledge, and feed back into process and AI model updates.

- Produce **measurement frameworks** linking human-centric changes to KPIs (quality, downtime, injuries, turnover, learning time) to underpin business cases and investment decisions.

- Validate **return-on-prevention** models for safety/ergonomics investments, including SME-friendly calculators and case repositories.

- Integrate a **gender perspective** into workplace and work system design, ensuring that tools, workstations, environmental conditions, and organisational practices are suitable for women and men across different life stages.

5.4 Organisational & Socio-Technical Innovation

Aim: Enable **sustained adoption** through new organisational practices, change models, and governance that align technology, people, and value creation.

- Develop **socio-technical transition playbooks** for factories (assessment → co-design → piloting → scaling), with templates, roles, and decision gates aligned to QMS/HSE.

- Design **participatory change models** (joint worker–management teams, champions, peer-to-peer training) and measure their impact on adoption speed, quality and trust.

- Create **human-centric business cases** that include productivity, quality, flexibility, and people outcomes; provide investment decision tools for SMEs and mid-caps.

- Research **leadership & culture levers** (incentives, recognition, goal-setting) that reinforce human-centric behaviours and continuous improvement with automation and AI.

- Build **governance patterns** for human-in-the-loop systems (accountability matrices, escalation paths, override rights, stop-work authority) integrated with digital workflows.

- Establish **knowledge capture & transfer** methods (tacit know-how capture, procedure refinement loops, AI model feedback) to mitigate demographic transitions.

- Configure **ecosystem collaboration models** to share assets - reference processes, datasets, training content - and accelerate diffusion across regions.

6. Recommendations

Europe can turn human-centric manufacturing into a competitive advantage if stakeholders act together on a focused, near-term agenda. The actions below are direct, fundable, and measurable, grouped per stakeholder category, to support FP10 preparation and to enhance industrial uptake.

6.1 For Policymakers (EU & National)

1. **Provide reinforced and coherent policy support for human-centric manufacturing:** reserve sufficient funding within the next Made in Europe Programme and beyond for skills development, trustworthy AI, human–robot collaboration, ergonomics and SME diffusion, and develop a cohesive framework supported by common milestones and human-centric KPIs.

2. **Fund SME-first adoption via networks of demo factories and EDIHs.** Provide "try-before-invest" access to cobots/XR/AI, with vouchers for integration support and post-pilot scale-up.

3. **Establish EU reference frameworks for Human-Centric KPIs.** Publish a lightweight measurement model (quality, safety, well-being, learning time, adoption speed) to anchor investment cases and programme monitoring.

4. **Align regulation and guidance for human-in-the-loop AI and HRC.** Issue implementation guidance (incl. AI assurance, post-market monitoring, XAI usability) and promote conformity pathways that are realistic for SMEs.

5. **Launch a Pact for Industrial Learning 2.0.** Co-fund modular micro-credentials, work-embedded training (AR/AI tutors), recognition of prior learning, and EU-wide skills observatories tied to tech evolution.

6. **Incentivise inclusive workplaces and safe augmentation.** Use tax credits or grants linked to ergonomic upgrades, inclusive UX/accessibility, and "return-on-prevention" outcomes.

7. **Support open assets and shared infrastructures.** Require publicly funded projects to deliver reusable datasets, reference processes, sandboxes, and playbooks that EDIHs and SMEs can deploy.

6.2 For Industry & SMEs

1. **Adopt a human-centric operating model.** Set factory-level targets for well-being, learning time, and adoption speed alongside productivity/quality; review quarterly.

2. **Pilot AI copilots and HRC with operators in the loop**. Start with 2–3 high-value use cases (quality assist, maintenance assist, changeover assist); measure impact and iterate.

3. **Invest in work-embedded learning.** Deploy digital work instructions, AR job aids, and short weekly micro-learning cycles; appoint shop-floor "learning champions".

4. **Design for inclusivity and safety from day one.** Apply accessibility and cognitive-load checks to interfaces, and build override/stop-work authority into procedures.

5. **Build internal playbooks for rapid re-tasking.** Standardise "teach-by-demonstration", low-code pipelines, and changeover patterns so teams can adapt processes in days, not months.

6. **Quantify the business case with people metrics.** Track reduced rework, faster onboarding, fewer incidents, and lower turnover; use these to unlock investment and scale beyond pilots.

7. **Collaborate with ecosystems.** Work with EDIHs/RTOs for sandboxing, share lessons learned, and contribute anonymised data to build European benchmarks.

6.3 For Research, Education & Social Partners

1. **Co-develop trustworthy, adaptive AI and HRC with end-users.** Deliver explainability toolkits, cognitive-load-aware interfaces, and validation protocols tested in real factories and brownfields.

2. **Create open, SME-ready assets.** Release reference datasets, synthetic data generators, reusable AR/AI modules, and "plug-and-produce" connectors with documentation.

3. **Advance socio-technical transition methods.** Provide factory playbooks (assessment → co-design → pilot → scale), participatory change models, and governance patterns for human-in-the-loop systems.

4. **Modernise industrial curricula.** Align micro-credentials with evolving roles (operator, technician, engineer), recognise prior/tacit learning, and embed dual education with industry placements.

5. **Measure what matters.** Develop and validate metrics linking human-centric design to performance (quality, downtime, safety, learning time, trust), and publish comparative evidence.

6. **Foster inclusive innovation.** Work with social partners to ensure accessibility, gender balance, ageing workforce needs, and fair transition practices are built into projects.

7. **Integrate ergonomics, gender-sensitive and ageing-at-work** perspectives, and human-centred data skills into industrial and engineering curricula.

Cross-Cutting “Quick Wins” Ideas

1. **Top-10 Human-Centric Use Cases Pack (open).** Ready-to-run pilots (AI copilot for quality, AR onboarding, cobot re-tasking) with datasets, code, and ROI calculators.

2. **EU Human-Centric KPI Starter.** A practical KPI set + spreadsheet to help factories measure well-being, learning time, adoption speed, and link to business outcomes.

3. **SME Learning Kit.** Five micro-credential modules (digital basics, AI-in-the-loop, HRC safety, XR instructions, data quality) with facilitator guides.

4. **Assurance-by-Design Templates.** Checklists and templates for XAI usability, risk assessment, and post-deployment monitoring integrated with QMS/HSE.

5. **Brownfield Plug-and-Produce Guide.** Integration guide for cobots/sensors in legacy lines, with open interfaces and example configs.

6. **EU Human-Centred Data, Age, Gender & Ergonomics Starter Pack.** A practical starter kit providing a small set of anonymised human-centred datasets (e.g. typical assembly and logistics tasks with ergonomic and workload indicators).

7. Conclusion

Europe is at a strategic inflection point. The global race to modernise industry is accelerating, and Europe's differentiation will not come from technology alone, but from **how effectively it integrates technology with people**. Human-centric manufacturing is no longer optional: it is a strategic imperative for competitiveness, resilience, and social sustainability.

This Working Group's brief argues that Europe can lead the next industrial era by placing human value, skills, trust and well-being at the core of innovation. Artificial intelligence, robotics, and digital technologies must be designed and deployed to augment human capacity, not replace it, through e.g. physical and cognitive support, sensing technologies etc. When workers are empowered, skilled and supported by trustworthy technology, productivity, innovation and well-being reinforce each other.

To achieve this, Europe must act decisively. The R&I priorities and recommendations set out in this document provide a **cohesive roadmap for the next decade.** They call for:

- **Mission-driven programmes** that unite skills, technology and socio-technical innovation.
- **Rapid diffusion to SMEs** through open assets, demo factories and accessible adoption support.
- **Evidence-based policies and investment frameworks** that reward human-centric value creation.
- **Cross-ecosystem collaboration** to scale what works, faster and across all regions.

Human-centricity is Europe's opportunity to set a global standard for competitive, **innovative and fair industry**. It will help attract and retain talent, accelerate digital and green transitions, strengthen industrial sovereignty and build public trust in the role of technology in society.

The EFFRA's Working Group on Human-Centric Manufacturing remains committed to turning these priorities into action: mobilising industry, research, education, social partners and policymakers to deliver measurable progress. The next phase of work will focus on implementation, shared assets, and evidence that human-centric approaches deliver tangible performance and societal value.

References

[1] European Commission (2023). European Year of Skills 2023. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-year-skills-2023_en

[2] Eurostat (2023, December 15). 56% of EU people have basic digital skills (aged 16–74). https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20231215-3

[3] Eurostat (2025). Digitalisation in Europe 2025 edition – Digital Intensity Indicator (DII). https://ec.europa.eu/eurostat/web/interactive-publications/digitalisation-2024

[4] European Commission (2024). Special Eurobarometer on attitudes towards AI and robotics – Summary findings. https://europa.eu/eurobarometer

[5] European Investment Bank (EIB) (2024). EIB Investment Survey 2024 – Digital transformation in EU firms (Press release/summary). https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/impact-digitalisation-30-eu-workers-use-ai-2025-10-21_en

[6] Joint Research Centre (JRC) (2025, October 21). Impact of digitalisation: 30% of EU workers use AI; 90% use digital devices. https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/impact-digitalisation-30-eu-workers-use-ai-2025-10-21_en

R&I Brief

European Factories of the Future Research Association (EFFRA)

Completed in January 2026 by the EFFRA's Working Group **Human-Centric Manufacturing: Tools, Skills and AI**

Chaired by: **Johan Stahre, Chalmers University - Enrico Callegati, IMA Group**

Contact: Info@effra.eu