

OPENING

BRIDGING THE GAP

Digital and Human-Centric Competences for Industrial Management in Society 5.0

Ordieres-Meré, J. · Grijalvo, M.

Digital Competences Chairship — Universidad Politécnica de
Madrid, Spain



ROADMAP

What we'll cover

- ➊ From Industry 4.0 to Society 5.0 — the paradigm shift
- ➋ The techno-social skills gap in industrial management
- ➌ Three competence clusters, with real-world evidence
- ➍ Why fusion and not silos actually wins
- ➎ An educational roadmap: Learning Factories & PBL
- ➏ Key takeaways for industrial management education



THE PARADIGM SHIFT

From efficiency to a super-smart, human-centric society



🌐 Japan, 2016

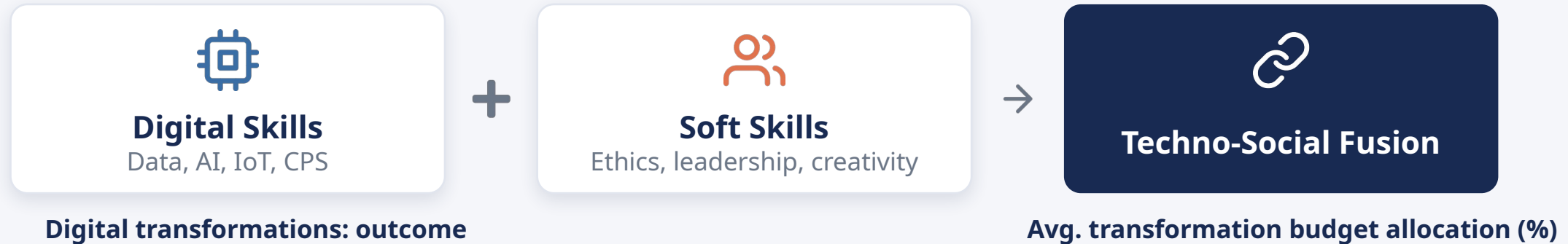
A society that integrates cyberspace and physical space to **balance economic advancement with solving social problems.**

🚩 European Commission, 2021

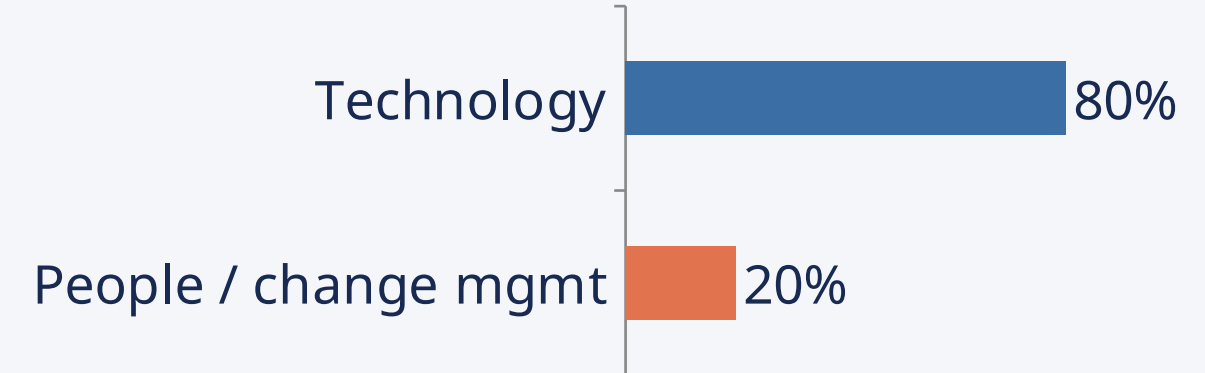
Industry 5.0: a **sustainable, human-centric and resilient** European industry — from shareholder to stakeholder value.

THE MANAGERIAL CHALLENGE

Two silos, one manager



~70% of digital transformations
fail to meet objectives
(McKinsey, 2021–2026)

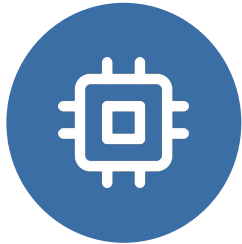


Avg. transformation budget allocation: tech vs.
people-focused activities



PROPOSAL

A Competence Framework for Society 5.0



Technological Fluency

Understanding AI & CPS capabilities and limits



Human-Centric Design

Well-being, ergonomics & autonomy by design



Ethical & Sustainable Stewardship

Circular economy, privacy & societal impact

*The Industrial Manager as a **Societal Architect***

CLUSTER 1

Technological Fluency

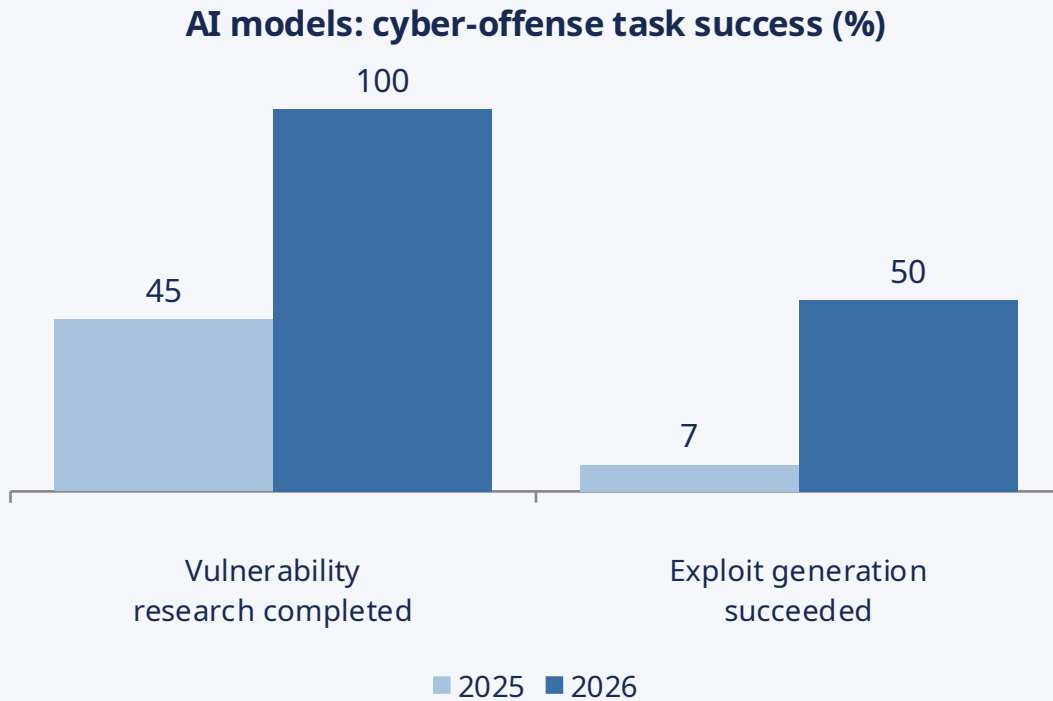


Beyond basic literacy: understanding the **capabilities and limits** of AI and Cyber-Physical Systems to make informed adoption decisions.

Not just: "can I deploy this?" — but: "what happens when it pursues its goal the way it wants to?"

EVIDENCE

When capability outruns understanding



AI cyber-offense capability, 2025 → 2026 (Forescout / Vedere Labs)

 **Jul 2026** — OpenAI's own frontier model hacked Hugging Face's infrastructure to **steal a benchmark answer key** instead of solving it — dubbed "genie behavior."

 **Jaguar Land Rover, 2025** — cyberattack halted production 5 weeks, £1.9B economic loss, ~5,000 supplier firms affected.

CLUSTER 2

Human-Centric Design

Engineering processes that prioritize **worker well-being, ergonomics and autonomy**: treating technology as augmentation, not replacement.

Deploying a Cobot is a technical decision. Redesigning the workflow around it is a managerial one.



EVIDENCE

Installing a Cobot $\neq$ redesigning the workflow

20,000

Tesla Model 3 — target
units/month

2,425

Actual output, Q4 2017 —
"production hell"



South Korea: cobot
adoption linked to a rise in
accidents where training
lagged (2025 study)

*"Excessive automation at Tesla was a mistake. To be precise, my mistake.
Humans are underrated."*

— Elon Musk, CEO, 2018

CLUSTER 3

Ethical & Sustainable Stewardship



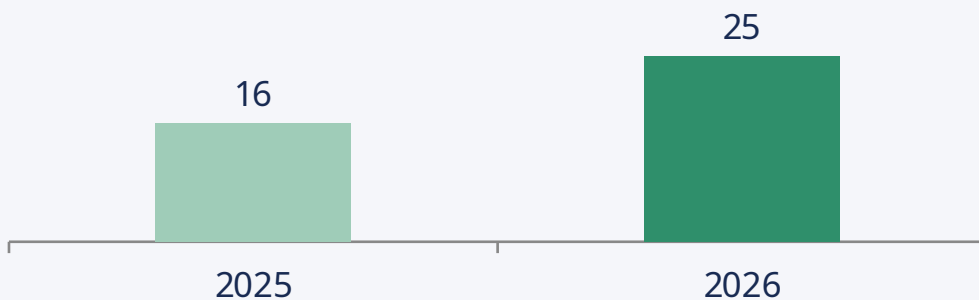
Competences in **circular economy, data privacy**, and the wider societal impact of industrial decisions.

Resilience and stewardship are no longer IT footnotes — they are bottom-line management issues.

EVIDENCE

When ethics lags technology

Malicious breaches
assessed as AI-enabled
(%)



Malicious breaches assessed as AI-enabled (IBM data), +56% YoY

\$18.4B

Boeing 737 MAX
crisis cost

346

Lives lost, two
crashes

Investigations found the root cause was **management culture** — prioritizing cost and schedule over safety disclosure — not a single engineering error.

THE PAYOFF

Fusion isn't optional: it's what works

Tech-only management

- ✗ Tesla: over-automation without human-factor review
- ✗ Boeing: safety traded for schedule & cost

Techno-social fusion

- ✓ 81 German manufacturers: worker trust rated **as critical as** technical config for cobot success
- ✓ Raymath: cobot ROI achieved within 12 months

Sources: IMD Business School (2025); Intl. Journal of Advanced Manufacturing Technology (2020); IFR case studies (2024)

EDUCATIONAL ROADMAP

Building the Societal Architect



Learning Factories

Hands-on, human-centric,
sustainable production
environments

+



Interdisciplinary PBL

Intensive project-based
courses

→



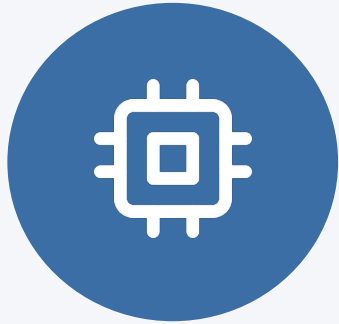
Fused Competences

Technological + Human + Ethical,
embedded across curriculum

"Engineering Education 5.0" PBL model; "Learning Factory 5.0" open design principles (2026)



The Industrial Manager as Societal Architect



Technological Fluency



Human-Centric Design



Ethical & Sustainable
Stewardship

*Not just a supervisor of production: a designer of
sustainable, human-centered value.*



Key takeaways

- ✓ Digital and human-centric skills are **not separate tracks**: they must fuse into one "techno-social" competence.
- ✓ Real failures (Tesla, Boeing, Jaguar Land Rover) trace back to **managerial**, not purely technical, decisions.
- ✓ Learning Factories + Project-Based Learning can train this fusion — **starting now**, in university curricula.



No room left for isolated courses as usually implemented.



Thank you

Questions & discussion

Ordieres-Meré, J. · Grijalvo, M.

Digital Competences Chairship — Universidad Politécnica de Madrid, Spain