# ESTEP SPRING DISSEMINATION EVENT

**5-6 JUNE 2025 KRAKOW (POLAND)**


# Artificial Intelligence in Steel Production: Questions of Augmentation, Optimisation and Accountability

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# Data and de-centralised AI for a competitive and green European Metallurgy Industry

- **EU Horizon 2020 funded interdisciplinary project (2022-2025): ALCHIMIA**
  - Partners – technology development partners, two steel industry corporations, two universities Alchimia Project | (alchimia-project.eu)
- **Optimization of EAF scrap-mix by means of MACHINE LEARNING:**
  - AI – Federated Learning & Continual Learning
  - Industry 5.0
- **Principles: Human-centered design, Trustworthy AI (ALTAI), compliance with HLEG AI guidelines**
- **ALCHIMIA will be developed for and deployed at 3 Electric Arc Furnace plants and within one automotive brake disc manufacturer and a further forgery (recently added)**
- **Scalability and replicability of ALCHIMIA for more efficient and environmentally friendly metallurgy industry**
- **Technological innovation and transition = workforce implications… i.e. Human Factors**

# ‘Human Factors’ of ALCHIMIA

- **Industry 4.0 and Industry 5.0:**
  - From digitalisation of manufacturing (cyberphysical systems, big data, internet of things, etc.) to Industry 5.0 and human centred, sustainable and resilient workers for ‘smart factories’
- **Digital Technology:**
  - Highly rewarding work for some and technology induced unemployment for others – particularly for lower skilled workers
- **Artificial Intelligence**:
  - ALCHIMIA is a form of Artificial **Narrow** Intelligence i.e. Machine Learning and application of statistical methods to perform tasks and make predictions from large data-sets without explicit programming
  - Workers not passive recipients of algorithmic results but social actors playing an active role in shaping and appropriating technological systems
  - New skill needs – T-shaped Skills (Technical and **Transversal**)
- **Human Centred Design**:
  - Enhanced acceptability of technologies and interactive systems, more efficient and effective use, fewer adverse consequences when users involved during development, implementation and use.
  - International Organisation for Standards = ISO 9241-210: 2019 Ergonomics of human system interaction – Part 210: Human-centred design for interactive systems local managements/workers as users / senior managements, firms, designers as stakeholders

# ‘Human Factor’ Research

- Four Research Sites:
  - Italy (Automotive parts)
  - France, Poland, Spain (secondary steel production)
- Ex-ante surveys and interviews at 4 sites (Italy, Poland, France, Spain)
  - Between May and June 2023
  - current roles, patterns of work and perspectives/awareness of AI and ALCHIMIA
- Ex-post surveys and interviews – 1-1.5 years after ex-ante stage
  - post-insertion perspectives and evaluation of ALCHIMIA
- Deliverables:
  - Guidelines for trust, safety and human use of AI tools in heavy industrial environments, including recommendations for human-centred technology development and insertion
  - Skills development strategy, training, education plan and products

# The Ex-Ante Data: Optimisation of Production Processes and Changes to Work Processes

- **Some divergence of opinion as to the potential to optimize some production processes through changes to work processes, e.g. in scrap sorting**

- **Diverse imaginaries/expectations:**
  - intensification of work processes
    - (e.g. sensor maintenance, data labour, accuracy of readings, AI training data)
  - de-intensification of work processes
    - (e.g. fewer checks, fewer points of intervention)
- **Overall: No or little change to:**
  - work processes
  - job security

*'No, I don't think workers can be replaced by the system. Certainly not at the production level; at the follow-up level a series of "OK, you can lighten a series of checks, however less frequent", but still you have to do them. So, I'm having a hard time seeing where it can physically be reduced the number of people as checks still need to be done… they will not get rid of hourly check hourly control because it's mandatory and obligatory'* (AutoCo.IT1).

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# The Ex-Ante Data: AI and the Augmentation (or not) of Steel Workers' Capacities

- **Range of perspectives on:**
  - the potential for the AI to augment steelworkers' capacities:
  - the implications of augmentation in terms of leading to either cognitive complacency, de-skilling and diminution of workers' capacities, OR upskilling, enhance knowledge, widen skills profiles

- **Consequences for:**
  - the potential for steelworkers to successfully transition to be a Resilient Operator 5.0 i.e. 'human operator resilience and human-machine systems resilience…. [for]… future of work in smart resilient manufacturing systems in the emerging Industry 5.0' *Romero and Stahre 2021: 1089)

*'Now we are focusing attention basically on knowledge about artificial intelligence, data management, data engineers and data scientists. So, we think that in the near future we will need more of this…[AI PLATFORM], I think it will make the people increase. I don't think they will lose their job. I mean with [AI PLATFORM], it's more a question, that they will have to deal with new tools, and we have to train them to know these new tools…**my view is that we will require less people in production** but in the other hand, **we will require more people in maintenance**, so this is something that we see quite clear that maybe they will move people from production to maintenance because this new computers needs to maintain, need people who takes care of them'* (SteelCo.ES7).

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# Blurring Accountability for Decision-Making

- The AI technology, ALCHIMIA, will be a *partially autonomous system* with distributed agency for decision making between workers and the AI'
- ALCHIMIA is being designed to holistically optimize processes and be capable of making decisions affecting tasks and whole processes that are currently taken by operators
- Outcome:
  - Will likely reduce agency in the furnace control
- But:
  - Differing perspectives about the potential for the AI to affect workers' autonomy and decision-making:
    - de-skilling around critical thinking and decision-making
    - Blurring accountability for decision-making

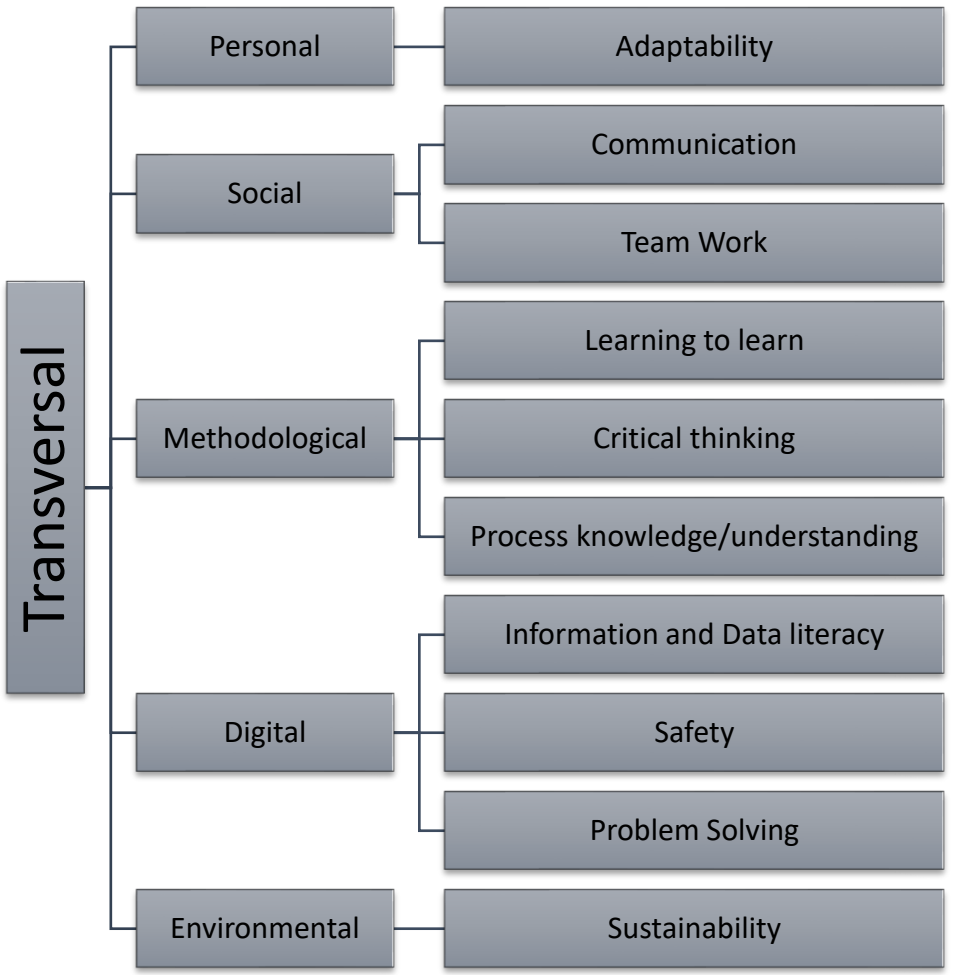
# Blurring Accountability for Decision-Making

*'If [AI PLATFORM]* ***were to automate decisions, the short-term risk is that work becomes duller as operators just need to oversee an automated process. In the long run, there is a considerable risk of de-skilling****. So, you are offering to me a system [AI PLATFORM] that provides us with continuous forecasts, and we try to follow along with that. On one side, it diminishes firm's know-how and depletes employees who are supposed to grow [in terms of knowledge acquisition]. When you use this system, you are given pre-digested information. So, you don't have to make any sort of effort to understand it…to understand how you got there'*. (AutoCo.IT1).

***'They don't see it [AI PLATFORM] as a threat to them because it's basically a support because at the end of the day, they're in charge of making decisions about it****. So just another tool to factor in while taking decisions'* (AutoCo.IT3, interpreter summary).

*'[AI PLATFORM] will be something that supports the worker and doesn't replace them because* ***it's still a suggestion instead of a command****. So, it can give you an alert, do this or watch out or there might be a problem, but it's still the worker who makes the final decision on it. It can definitely open further avenues for implementing further AI into their daily routine. However,* ***that might even spark some concerns about is the human still allowed to make decisions, or are we just, should we just follow along what AI says. But [AI PLATFORM] definitely like lies within this safe perimeter of leaving the final decision to the worker****'* (AutoCo.IT6, interpreter summary).

# Transversal Skills

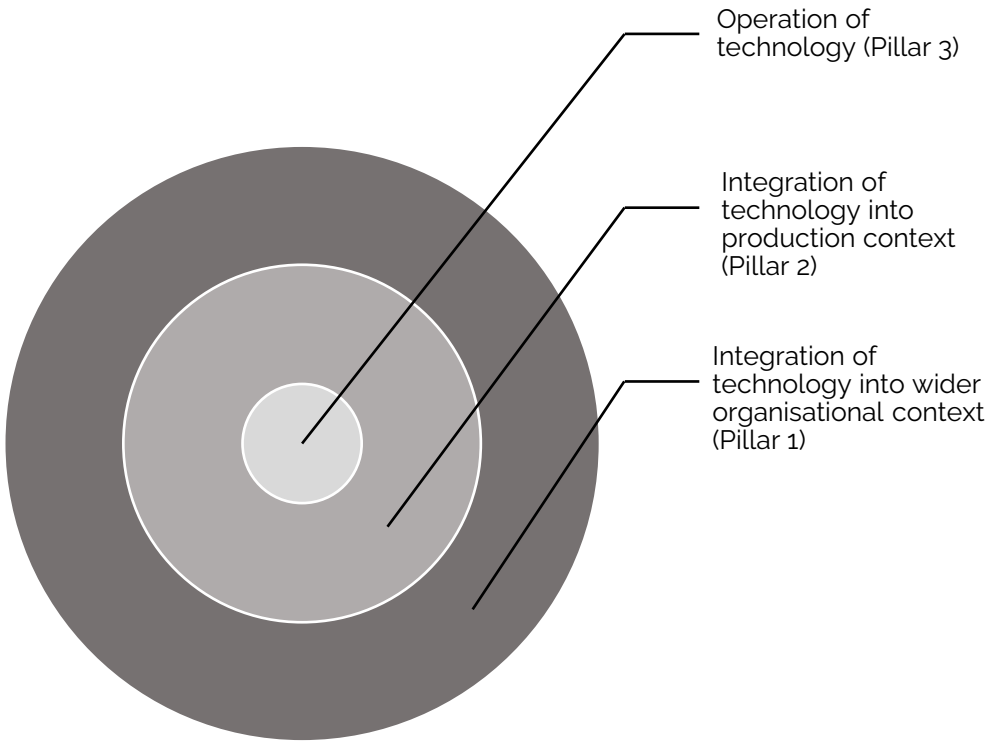





This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N° 1010700463

# Pillars of Training

- Pillar 1: general transversal skills required for the wider digital transformation of companies
- Pillar 2: specific transversal skills requirements arising from the integration of the ALCHIMIA system into specific production contexts
- Pillar 3: transversal skills requirements related to the operation of the ALCHIMIA system

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# Three Pillars – Training Programme

| Pillar | Aspect | Who | When | Why | Competence type | Sub-Category | Specific Competence Requirements | Details |
|---|---|---|---|---|---|---|---|---|
| 1 | Working in a company using ALCHIMIA system (and other digital technologies) | All staff | Before/ during/ after insertion | Ways of working that indirectly contribute to optimal use of ALCHIMIA system | General Transversal Competences | Personal<br>Social<br>Digital<br>Methodological<br>Environmental | Adaptability; **Strategic Thinking**; **Leadership**<br>Communication; Team Work; **Project Management**<br>Information/ Data Literacy; Problem Solving; **Cybersecurity**<br>Process knowledge/ understanding; Learning to Learn; **Regulatory compliance**<br>Sustainability; **Corporate Sustainability** | Section 4.3 (Tables 2-13) |
| 2 | Interacting with parts of production system directly affected/ controlled/ impacted by ALCHIMIA system | All staff whose work directly affects ALCHIMIA system output | Before/ during insertion | Ways of working that directly contribute to optimal use of ALCHIMIA system | Technology-Specific Transversal Competences | Personal<br>Social<br>Digital<br>Methodological | Adaptability<br>Communication; Team Work<br>Information/ Data Literacy; Problem Solving<br>Process knowledge/ understanding; Learning to Learn | Section 4.4 (Tables 17-20) |
| 3 | Practical operation and use of ALCHIMIA system | All staff operating ALCHIMIA platform via interfaces | Before/ during insertion | Optimal use of ALCHIMIA system | Technology-Specific Transversal Competences | Digital<br>Environmental | Information and data literacy; Safety; Problem Solving<br>Sustainability | Section 4.5 (Table 15) |



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# THANK YOU!

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