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Human-centric Industry 5.0: Combining Technological and Social Innovation

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Real Data Matter

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Setting the Scheme: Digital, Green, and Social Transition

Starting point:

A lot of technological innovation is not being used and implemented

- **Every technological or economical innovation is also a social innovation process**, which is decisive for or at least co-determining efficiency and effectiveness, success and failure of an innovation.
- Technology as an **enabler** of innovation. "A New Nature of Innovation" (OECD 2010)
- Every technological innovation is **made by people for people** (Klaus Schwab, Founder of the World Economic Forum, The Fourth Industrial Revolution, 2017)

Solution:

Digital, Green and Social Transition

Combining technological innovation with a social innovation process

Stakeholder and user involvement in a co-creation process

Considering impact, organisational and personnel development right from the beginning

New Innovation Paradigm: Central Elements

1. Integration of innovations in social innovation processes
2. Modified, more comprehensive objectives: solutions for societal challenges and impact are in focus
3. Subjects of innovations are changing: new technologies alone are not solving recent and upcoming societal challenges, new or modified social practices are needed as well as cross-sector embedding innovations

From Industry 4.0 to Industry 5.0

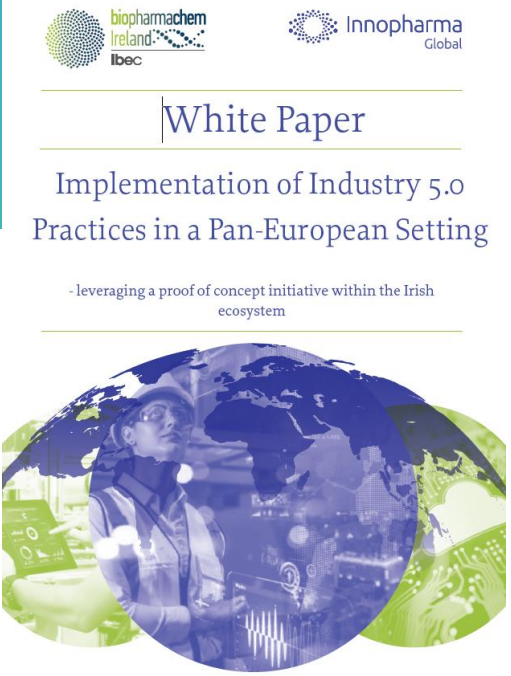
Industry 5.0 **complementing** the primarily technological and economic oriented **Industry 4.0** with its focus on being:

- Human-centric: using technology primarily for the benefit of people
- Sustainable: not harming the environment
- Resilient: contributing to the security of supply and autonomous supply chains

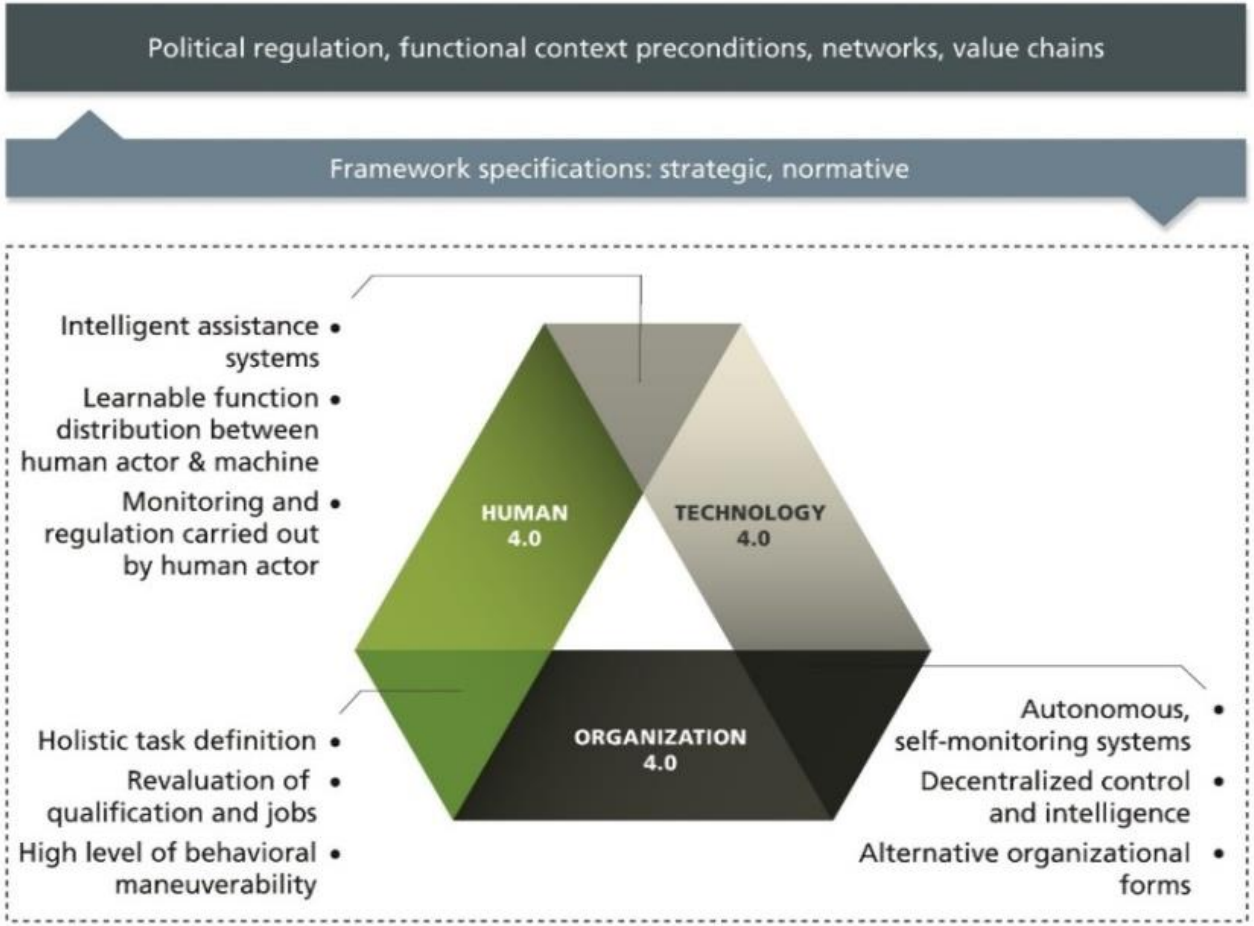
(European Commission, Industry 5.0, Policy Brief 2021, pp. 14).

This human-centric perspective is leading to **changing social practices** (in the sense of Social Innovation):

- Considering impact of new technologies on future of jobs, business models and welfare
- Better integration of social and green priorities in technological innovation (technological development as a social innovation process)
- Close involvement of workers in technological design and development, integrating their experience of the workplace
- Empowerment of workers, proactive re- and upskilling,
- New human-machine collaboration and work division
- Simultaneously developing technology and training
- Combining technological trends with pro-active skills adjustment
- Effective supply chain resilience



Interfaces between Technology – Organisation – Human/Work

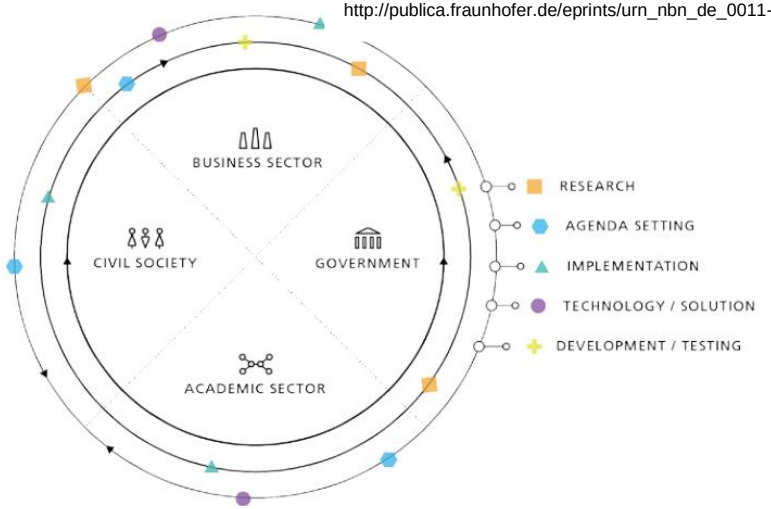


Combining Technological and Social Innovation

Societal Readiness Levels		Technology Readiness Levels
SRL 9 – successful deployment in real stakeholder context	TRL9	TRL 9 – successful user deployment in real life
SRL 8 – final testing in real stakeholder context (check SRL 1)	TRL8	TRL 8 – final user testing in real life (check TRL 1)
SRL 7 – demonstrated in operational stakeholder context	TRL7	TRL 7 – demonstrated in operational user environment
SRL 6 –demonstrated in simulated stakeholder context	TRL6	TRL 6 – demonstrated in simulated user environment
SRL 5 – validated in simulated stakeholder context	TRL5	TRL 5 – validated in simulated user environment
SRL 4 – stakeholder context validated	TRL4	TRL 4 – validated in lab
SRL 3 – stakeholder context proof of concept	TRL3	TRL 3 – experimental proof of concept
SRL 2 -- proposed solution in stakeholder context	TRL2	TRL 2 – technology concept
SRL 1 – societal problem in stakeholder context	TRL1	TRL 1 – basic principles

INTERCONNECTED PROCESSES
of social and technological innovation

Fraunhofer Policy Paper:
Social Innovation – The Potential for Technology Development, RTOS and Industry, 2019
http://publica.fraunhofer.de/eprints/urn_nbn_de_0011-n-5349272.pdf



Ecosystem Approach (Quadruple Helix)

Industrial Symbiosis Readiness Levels

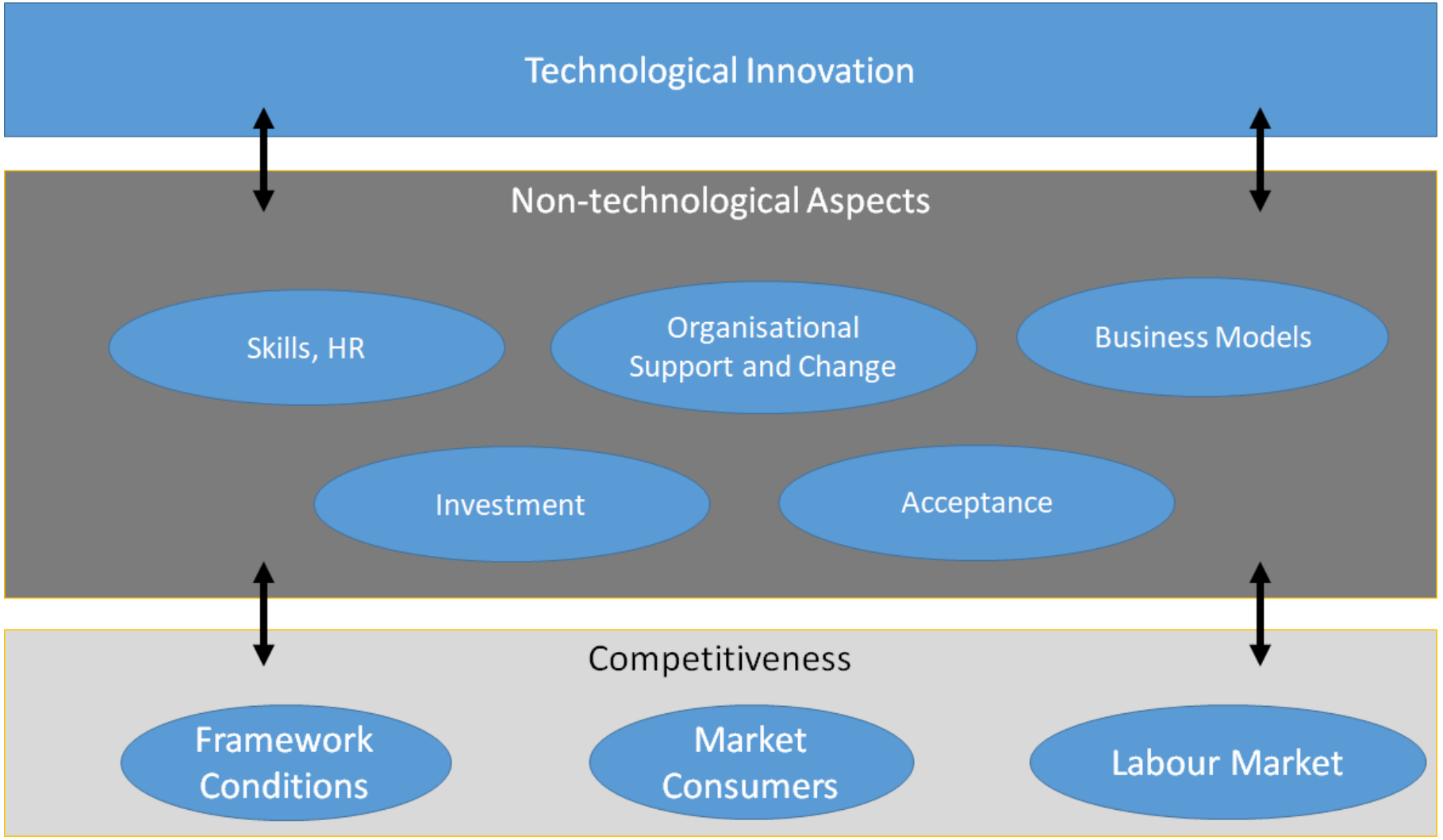
9	All resources quantified and posted on matching tool/or company is actively looking for solutions
8	Resources prioritised for IS with management buy-in to advance IS opportunities
7	Check costs, regulations and other technology specifications to be met for IS opportunities
6	Resources identified, quantified and characterised for IS
5	Internal data sources identified for quantification
4	Initial ideas on which resources might suit IS
3	Processes mapped and targeted for IS
2	Initial ideas of where company can engage
1	Awareness of IS and potential benefits

Adapted by the CircLean project from Sommer 2020

Level 1 means your company has an awareness of IS but has not carried out anything active to instigate industrial symbiosis.

Level 9 means your company has posted resources on the matching tool and/or is actively looking for solutions.

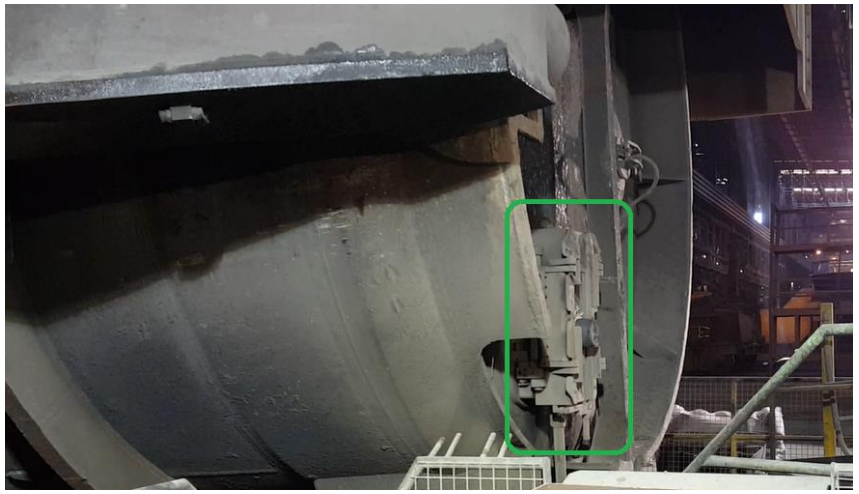
Relevance of Non-technological Aspects



- **To be considered / integrated in a co-creation process combining technological and social innovation**

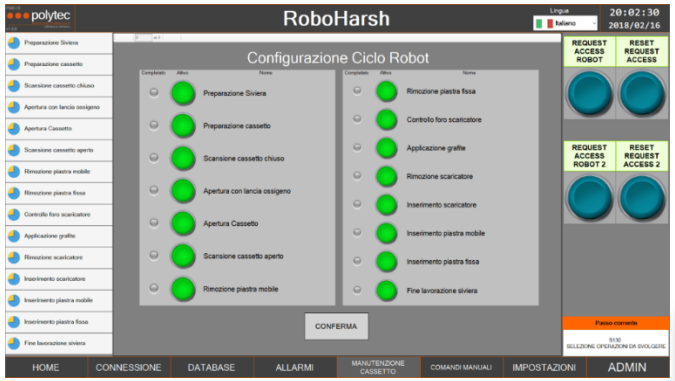
ROBOHARSH: Human-Robot-Interaction

- Technological solution for a modified and reorganized working environment: Improvement of working conditions
- Technological development by integrating the experience of the operators
- Integrating workplace and practice oriented skills and knowledge
- From operator to supervisor: Higher qualification and robot support



ROBOHARSH: New Task Allocation From Operator to Supervisor

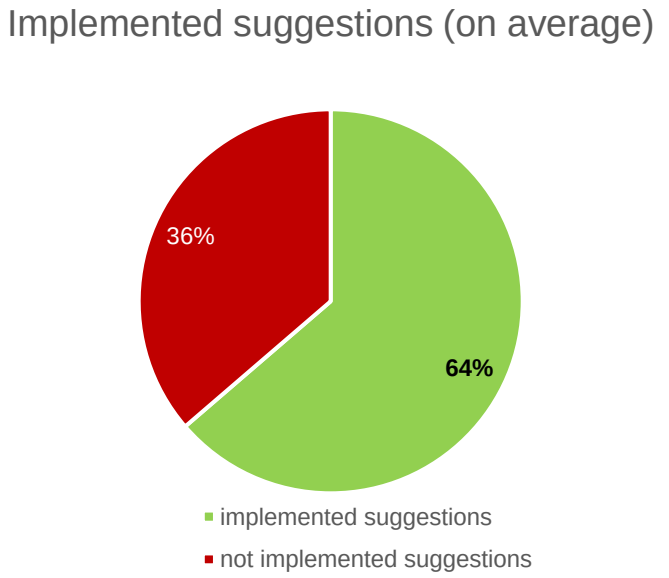
39 operator tasks were depicted at the beginning. Most of them are now done by the robot and the operator from inside the pulpit (esp. the heavy weight and hazardous ones). Only 8 of them are remaining manually outside.



ROBOHARSH: Social Innovation Co-creation Process

High integration of users/operators, stakeholders in the innovation process (co-creation):

- Operators: range from daily to yearly involvement
- Foremen: weekly or monthly involvement
- HR Department: several times a year
- Project Partners: mainly daily or weekly



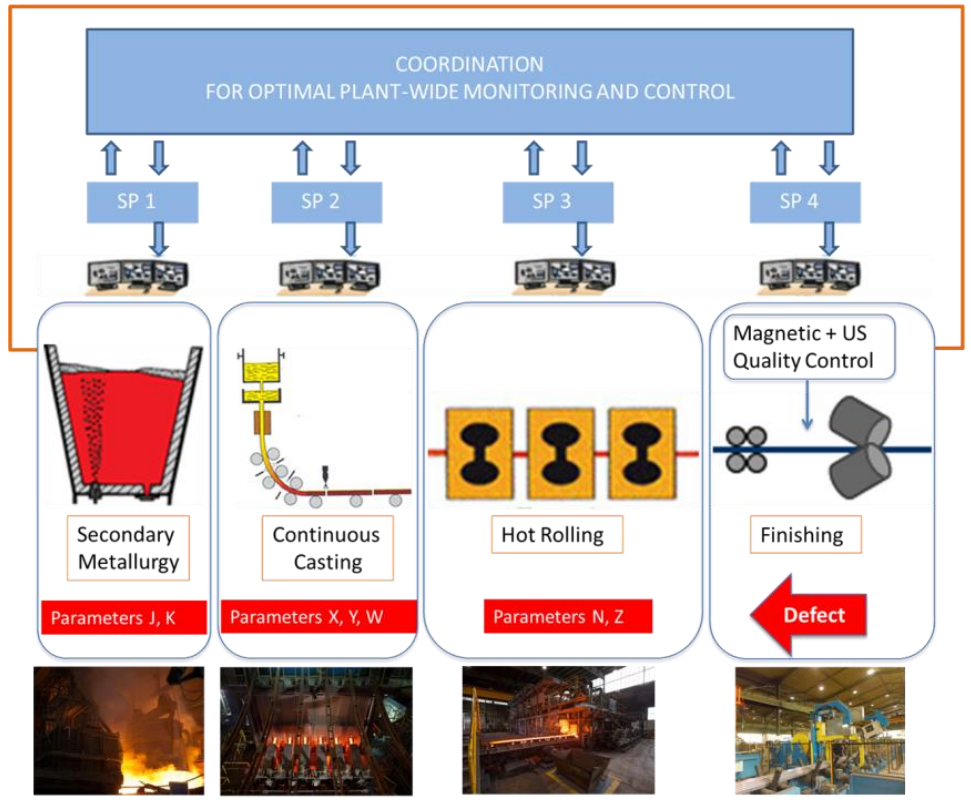
Number of improvement suggestions
from users/operators and stakeholders:

- Ranging from 5 to 50, average = 21
- Number of changes based on these suggestions :
- Ranging from 4 to 30, average = 12

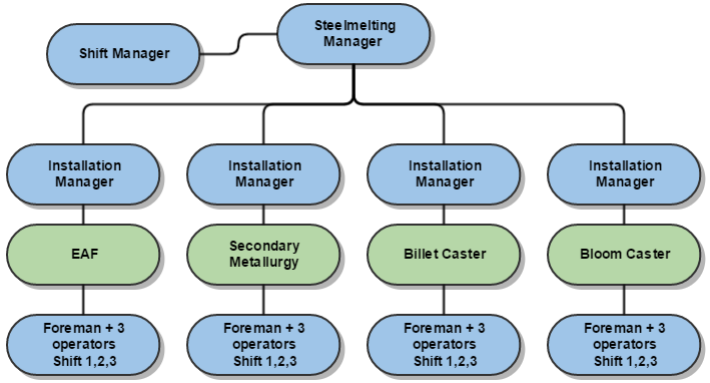
Conclusion of the developers:
The user involvement was sufficient, their opinions were heard and taken up, they got all the needed information and the management was supporting the user involvement

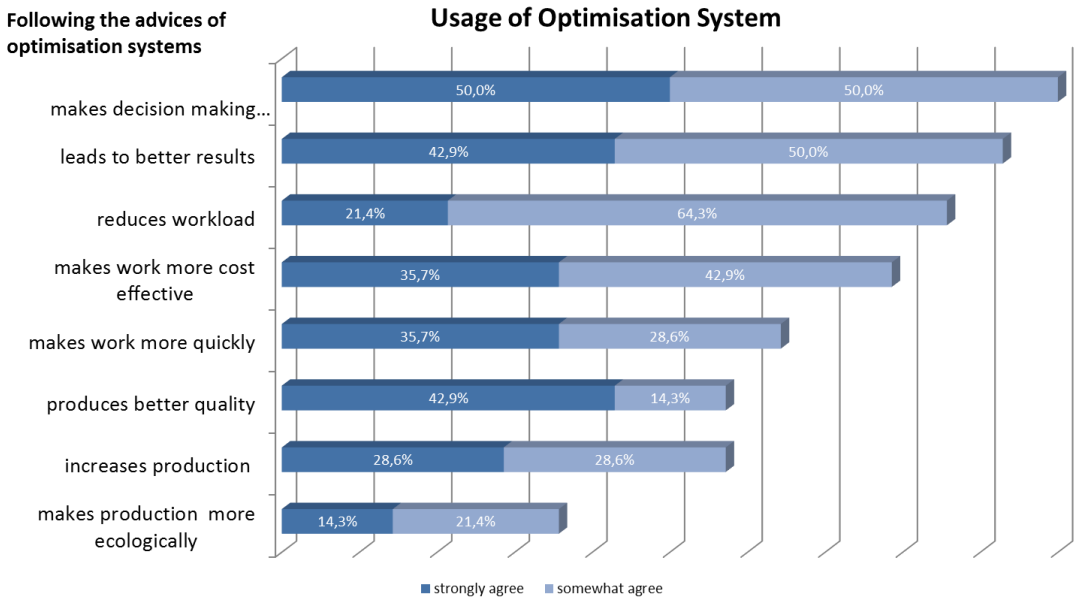
COCOP:
Coordinating Optimisation of Complex Industrial Processes

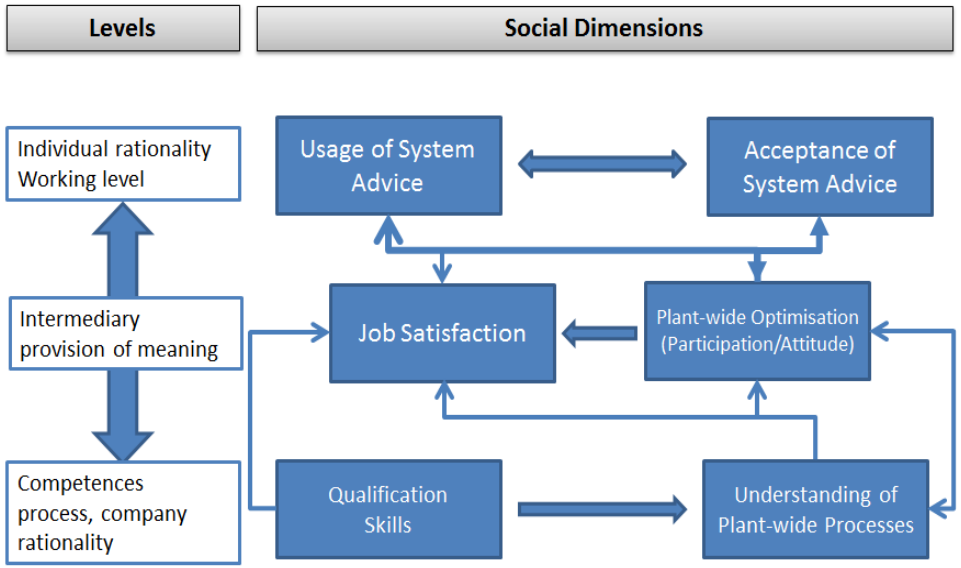
- Development of a steel manufacturing plant-wide monitoring and control tool in order to **reduce the surface and sub-surface defects** in micro-alloyed steels in as-rolled state
- Addressed sub-processes:
  Secondary metallurgy, continuous casting and hot rolling
- Combining technological development with a **social innovation process** of co-creation and co-development for improving effectiveness and impact of the innovations and operator acceptance



COCOP SI Operationalisierung







Interviews at SIDENOR – Requirements

Requirements – general matters

- The COCOP system should support the work of users: problem solving, ensuring quality, environmental and safety issues
- (Future) users are missing data and evaluation procedures for existing data
- They want to get to know the effects of other sub-processes on their owned process
- They want to get to know the effects on other sub-processes and on the final product

People-related requirements

- Education and training will be a relevant condition for successful implementation
- Operators should be involved in developing new skills for PWO
- "If *all involved employees* ***understand*** this kind of optimisation and if it is achieved that all these employees ***benefit*** from optimisation, the goal of optimisation will be achieved."

New Skills Agenda
Erasmus+: Sectoral Blueprints (Skills Alliances)

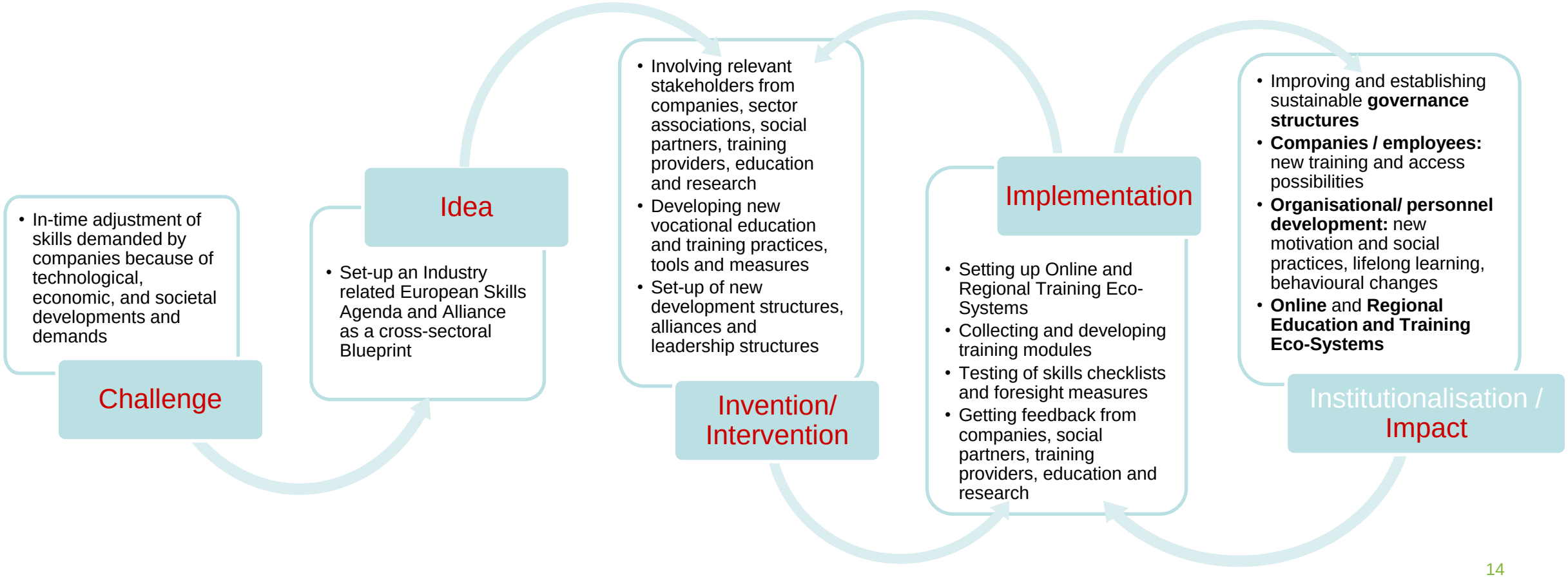
2018
- Automotive
- Maritime Technology
- Space - Geo Information
- Textile
- Tourism

2019
- Additive manufacturing
- Construction
- Maritime Shipping
- Steel Industry

2020
- Industrial Symbiosis
- Digitalisation of Energy
- Batteries
- Defence
- Bio-Economy
- MicroElectronics

2021
- Blockchain
- Cultural heritage
- Cybersecurity
- Rail supply and transport industries
- Work integration social enterprises
- Software services

Skills Alliance and Strategy Building as a Social Innovation Process



Skills Alliance for Industrial Symbiosis (SAIS) – A Cross-sectoral Blueprint for a Sustainable Process Industry (SPIRE)

EU Programme: ERASMUS+ "New Skills Agenda"

- Duration: January 2020 – December 2023
- Funding: 4 Mio Euro
- 24 Partners + 11 associated partners
- Already 25 funded sectoral blueprints

Key components of SPIRE-SAIS:

- Build on existing SPIRE coordination, projects and activities
- Cross-sectoral approach, covering all the eight SPIRE energy intensive industry sectors
- Sector associations as central communication and dissemination intersection

Co-funded by the Erasmus+ Programme of the European Union

Project Number
612429-EPP-1-2019-1-DE-EPPKA2-SSA-B

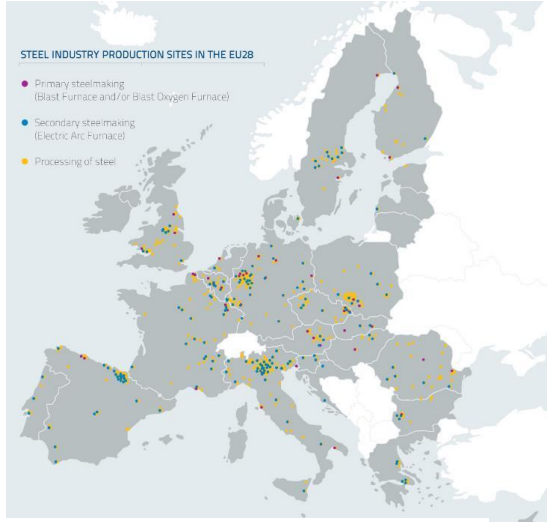
Multi-stakeholder Approach:
European Steel Skills Alliance (ESSA)
Skills Alliance for Industrial Symbiosis (SPIRE-SAIS)

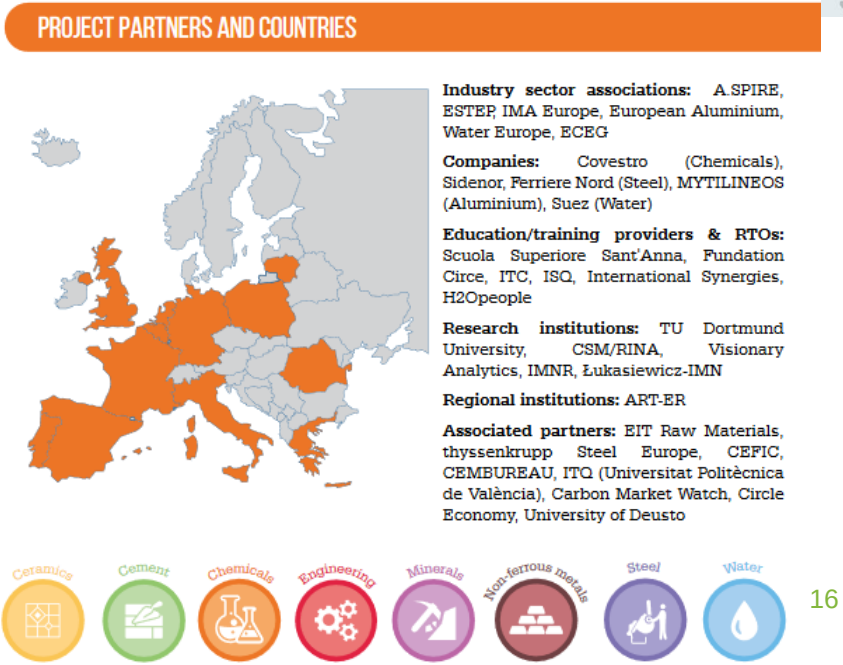
- **Science/Research:**
  Universities and research institutes

- **Business:**
  Companies (production and value chain)

- **Education and training institutions:**
  Company-wide and national, public educational institutions

- **Politics:**
  European Commission, EU member states,
  associations and social partners (employers and employees)





Thanks for your attention

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