POLITECNICO
MILANO 1863

Manufacturing Group
SCHOOL OF MANAGEMENT

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How to improve the relationship between Schools and Business world

Teacher's future skills improvement

Politecnico di Milano since 1863

The leading University in Italy for Architecture, Design and Engineering

- **Social Responsibility**
- **Quality**
- **Outstanding Teaching**
- **Scientific Research**
- **Passion for Innovation**
- **Transversal Partnerships**

are our driving forces for promoting research and innovation to prepare future professionals and citizens to meet the new social challenges leading to global development.

The 12 Departments of Politecnico di Milano

- Aerospace Science and Technology
- Architecture and Urban Studies
- Architecture, Built Environment and Construction Engineering
- Chemistry, Materials and Chemical Engineering “Giulio Natta”
- Civil and Environmental Engineering
- Design
- Electronics, Information and Bioengineering
- Energy
- Management, Economics and Industrial Engineering
- Mathematics
- Mechanics
- Physics

POLIMI Strategic plan 2017-2019

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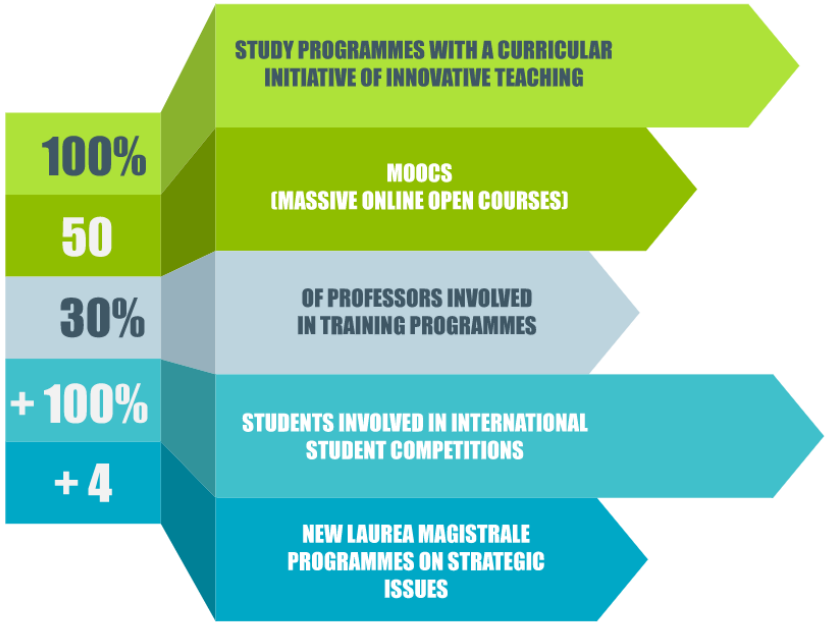
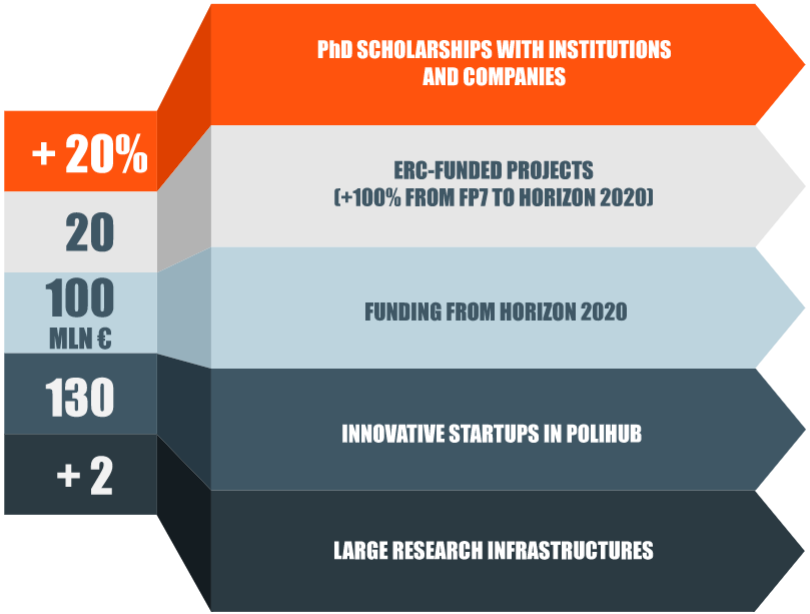




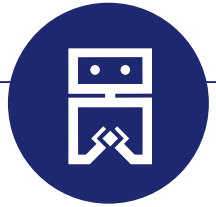
The Research Areas

Energy and Resource Efficiency in Manufacturing

Product Lifecycle Management

Asset Lifecycle Management

Social Sustainable Manufacturing



Manufacturing Services

Smart Manufacturing

Education in Manufacturing

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SMART MANUFACTURING IN EUROPE
&
RELATIONSHIP BETWEEN SCHOOLS AND BUSINESS WORLD

SMART MANUFACTURING IN EUROPE:
EDUCATION
SKILLS
&
RESEARCH PERSPECTIVES

@SMART4CPPS

@Smart4cpps

This research is supported also by

Smart4CPPS project

REALIZZATO CON IL SOSTEGNO DI

UNIONE EUROPEA
Fondo europeo di sviluppo regionale

Regione Lombardia

fesr

POR FESR 2014-2020 / INNOVAZIONE E COMPETITIVITÀ

Smart Manufacturing in Europe: Roadmap

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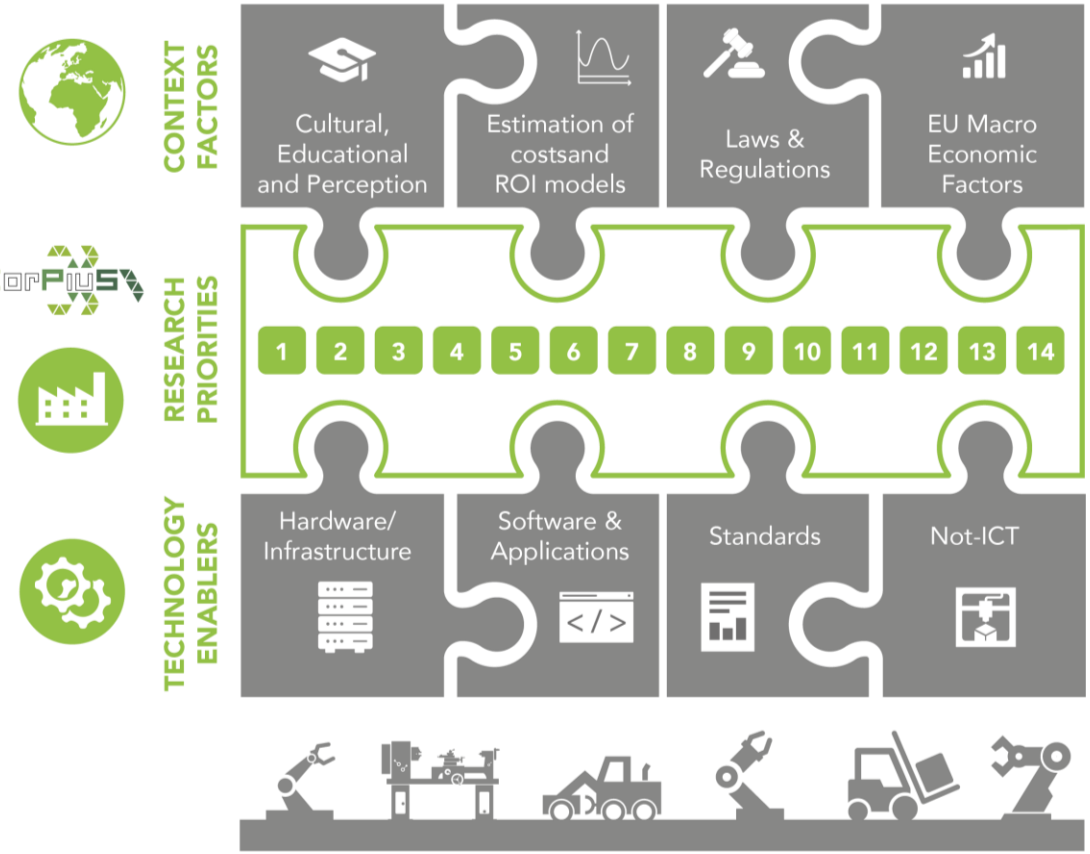

Research Priority	
1	Predictive and preventive self-learning systems
2	Caring for People in manufacturing Systems
3	Knowledge and skills for the next generation manufacturing
4	CPS Enabled reconfiguration of automated manufacturing systems
5	Novel production management tools and models for CPS-based production
6	Full Product LifeCyle data collecting and analysis
7	Cyber Native Factories
8	Digitisation of value networks
9	Next generation customer driven value networks
10	Manufacturing as a Service (MaaS) – Servitisation of autonomous and reconfigurable production systems
11	Customer at the center - from design to disposal
12	Product Service Systems (PPS): products with embedded service delivery capability
13	European Circular Economy Open Platform for CPS
14	Material and resource efficiency in manufacturing

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Smart Manufacturing in Europe: Roadmap

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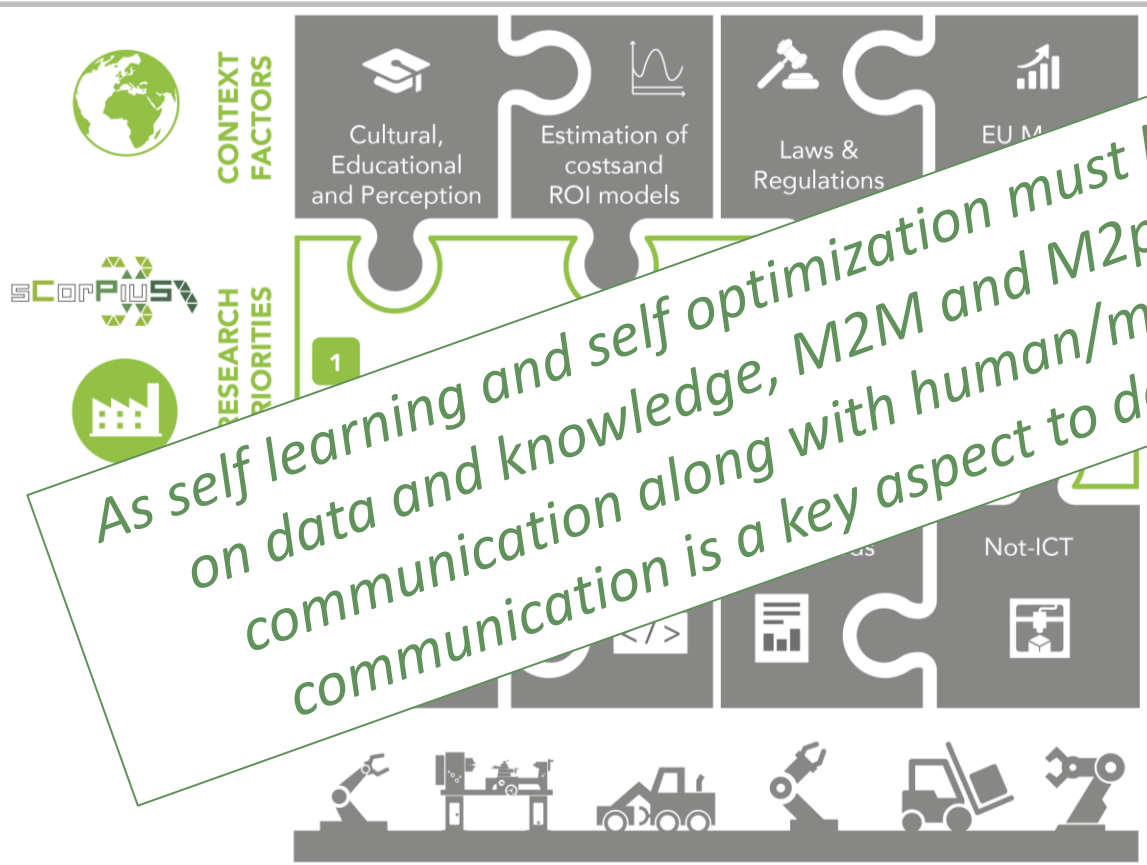

As self learning and self optimization must be based on data and knowledge, M2M and M2product communication along with human/machine communication is a key aspect to develop.

tive and preventive
arning systems

IoT-based factory with
elf-optimization

- new organizational models;
- model-based approach to describe the behavior of the system and the knowledge of the plant

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Smart Manufacturing in Europe: Roadmap

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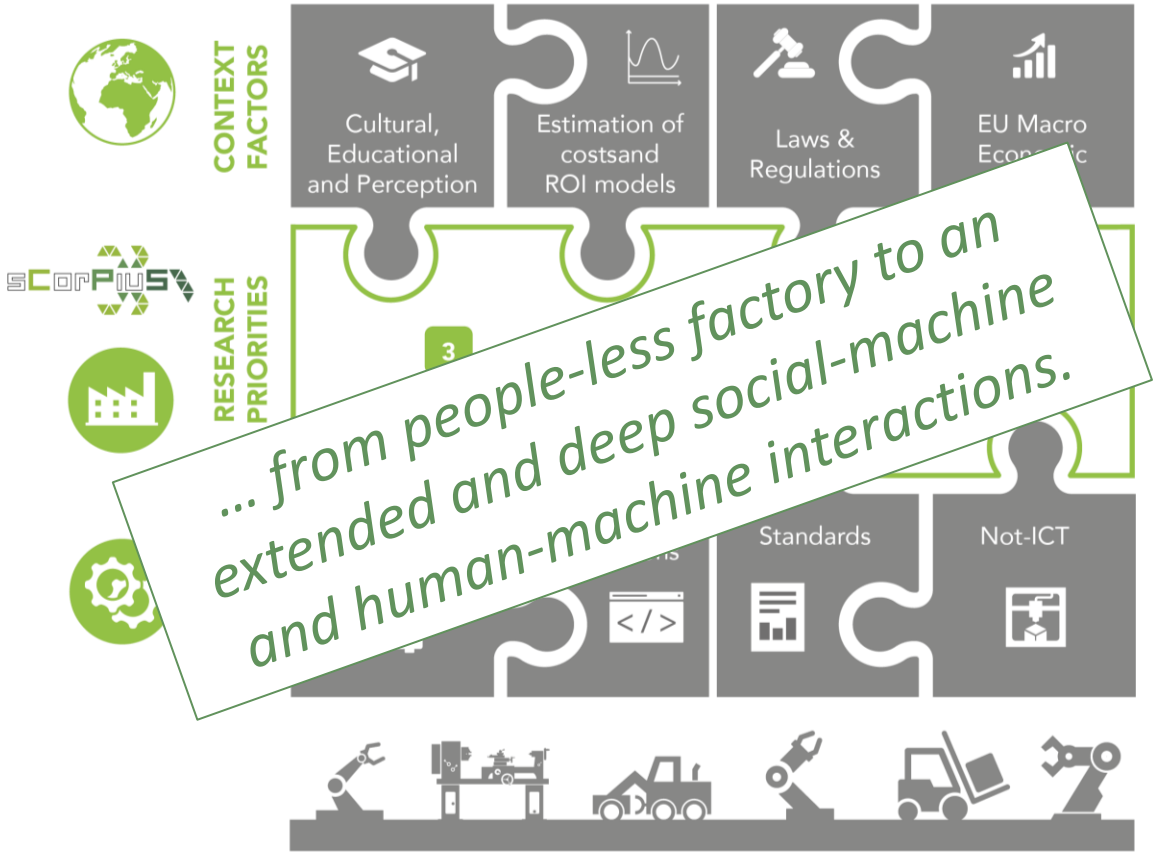

3. Knowledge and skills for the next generation manufacturing

Increasing demand for highly skilled workers in manufacturing and need for educated, flexible and knowledge-based workforce

- coherent set of tools and methodologies able to sustain the creation, development and management of advanced skills at all the levels of the company

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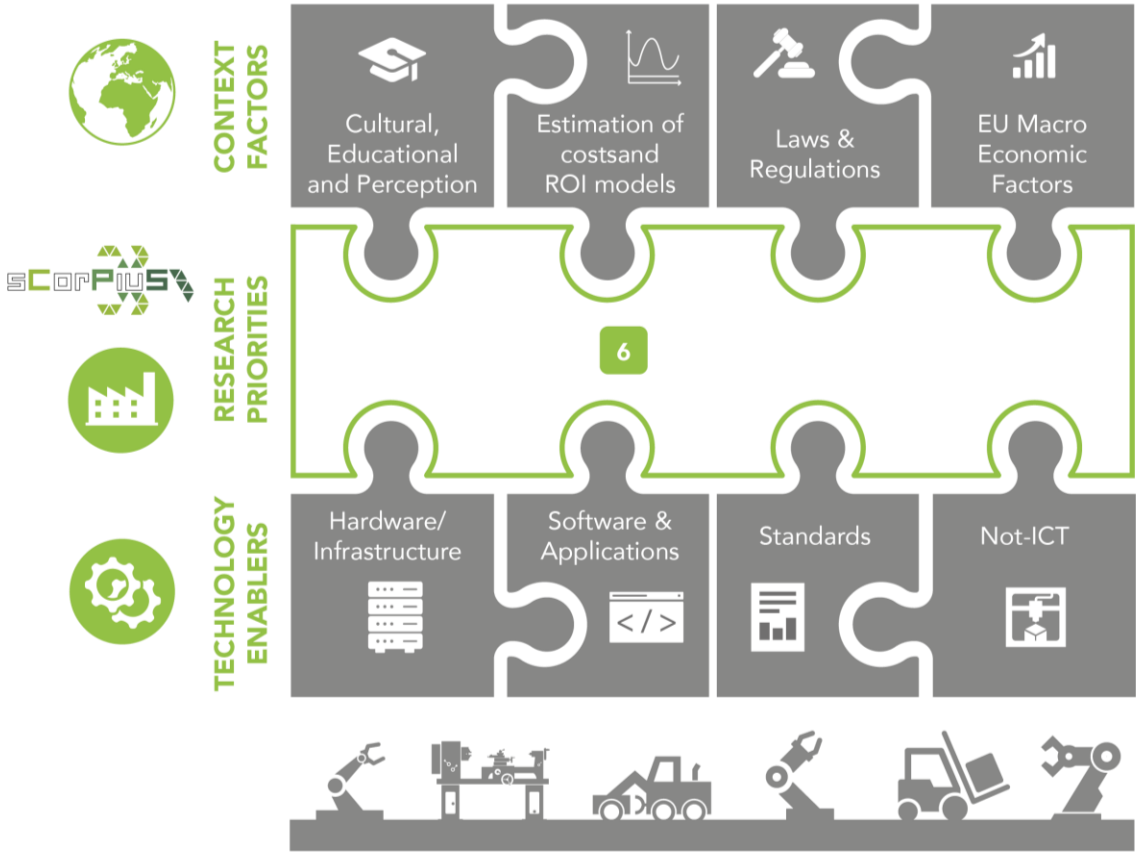
Smart Manufacturing in Europe: Roadmap



6. Full Product LifeCyle data collecting and analysis

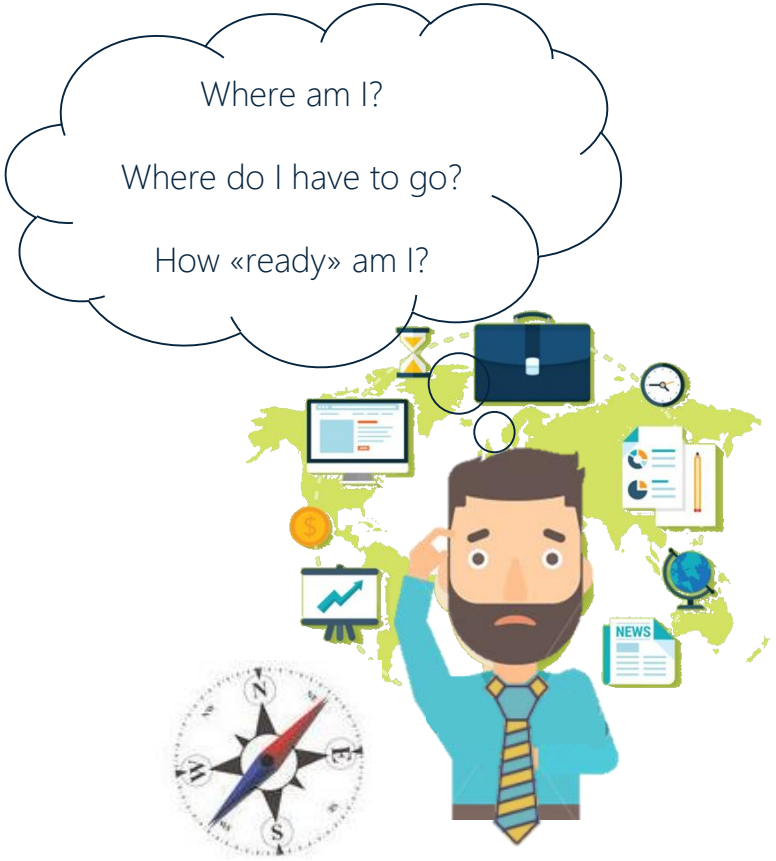
Data mining and real time analytics are the basement for novel supply chain approaches for innovative products and collaborative and mobile enterprises.

- Data mining and Real-Time analysis cannot succeed without addressing Cyber-security, Privacy, data protection, trusted third parties, data ownership, and share value of the information (ownership of value data).

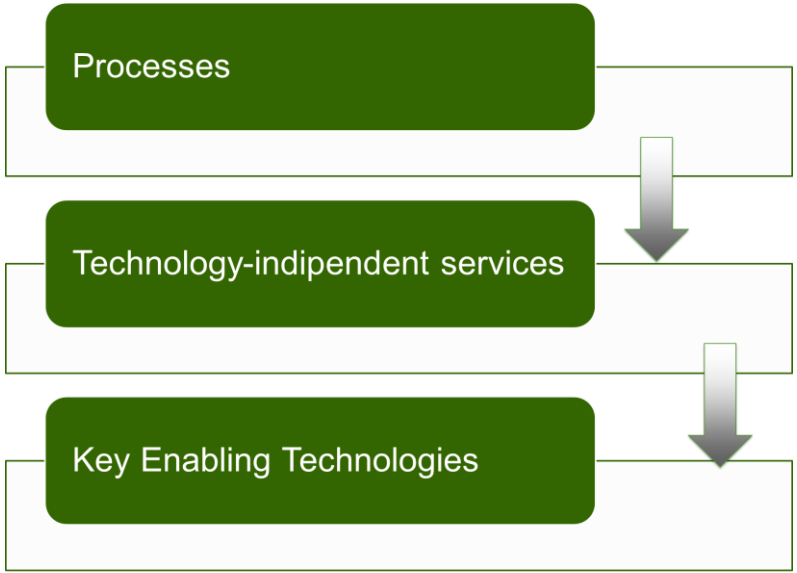
How to guide companies?

There is the need to:

- **Assess** the current state (in terms of **digital readiness**) of manufacturing companies
- **Identify the attainable benefits** they could reach based on their own **strength and weakness points**
- **Identify the opportunities** they could take, guiding them towards the digital transformation



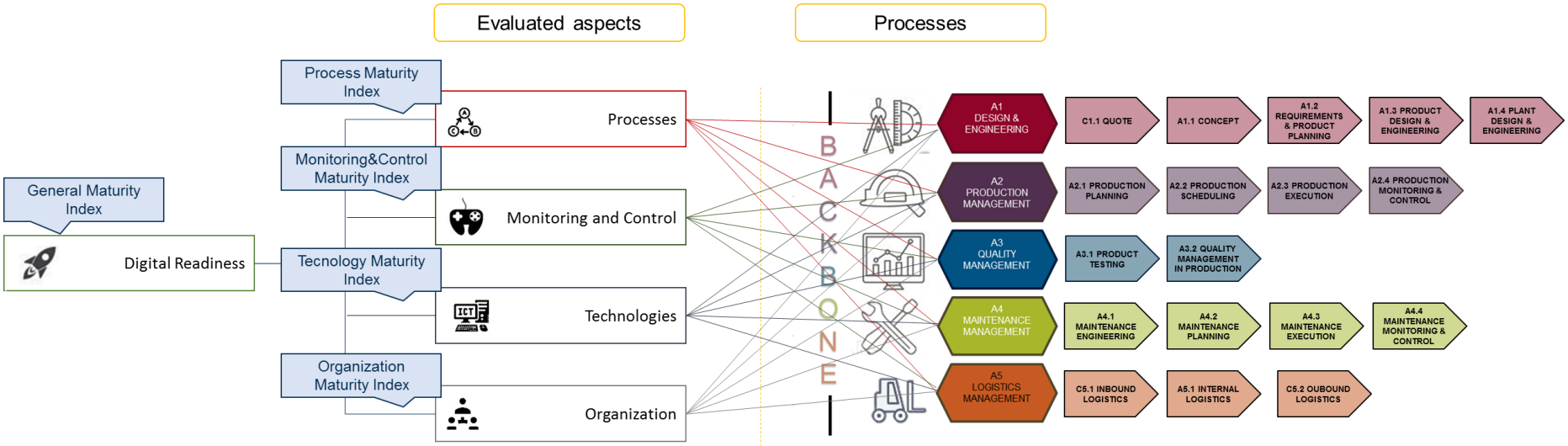
System engineering perspective



Maturity models can assess the maturity of the processes

Year	Name	Assessed processes
2010	Maintenance Maturity Assessment	Maintenance management processes
2016	DREAMY (Digital REadiness Assessment MaturitY model)	All manufacturing companies' value-added processes (product and asset lifecycle + production services)

How to guide companies?



SMART MANUFACTURING IN EUROPE: EDUCATION SKILLS & RESEARCH PERSPECTIVES

Product and factory dimensions the digital twin perspective

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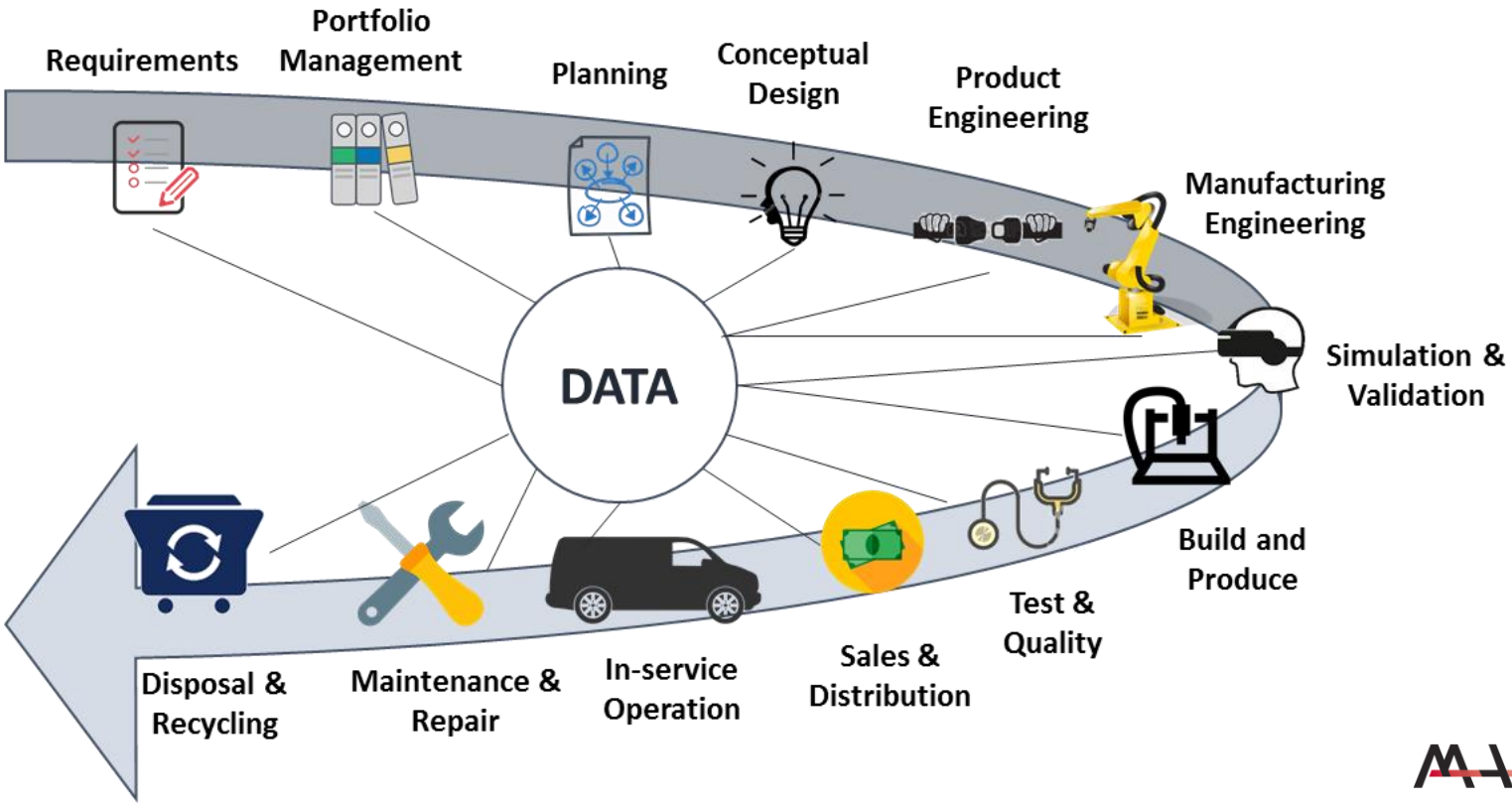

Product and factory dimensions the digital twin perspective

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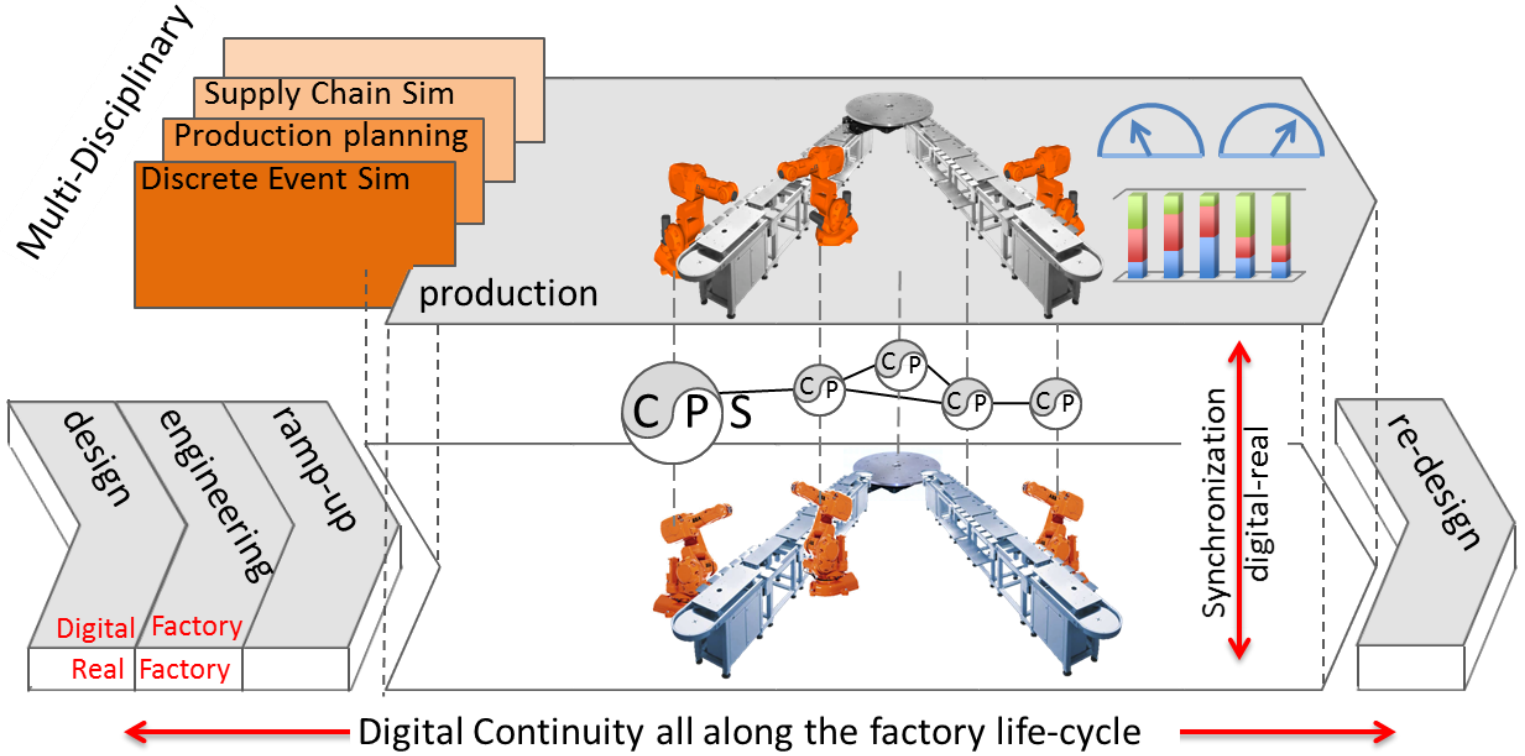

The European totally integrated vision

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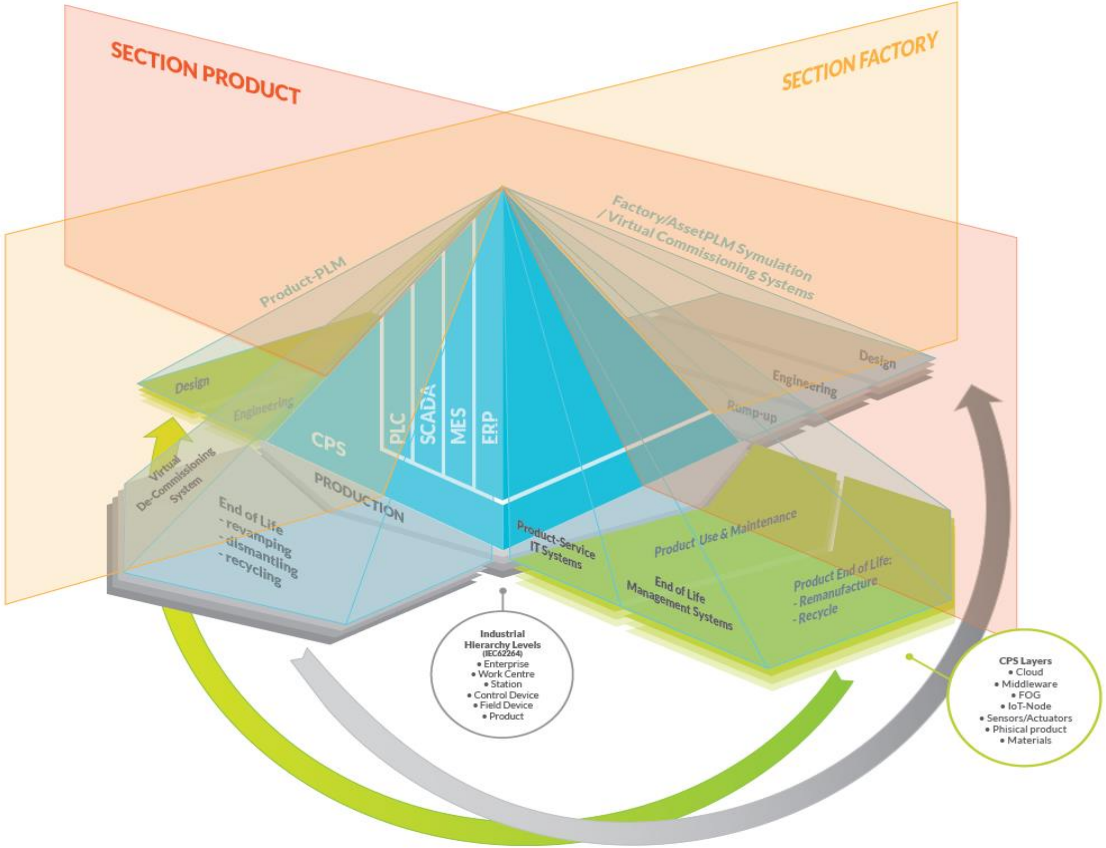

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SMART MANUFACTURING IN EUROPE:
EDUCATION
SKILLS
&
RESEARCH PERSPECTIVES

EDUCATION & RESEARCH

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25 Skills Assessed in the Data Science Survey

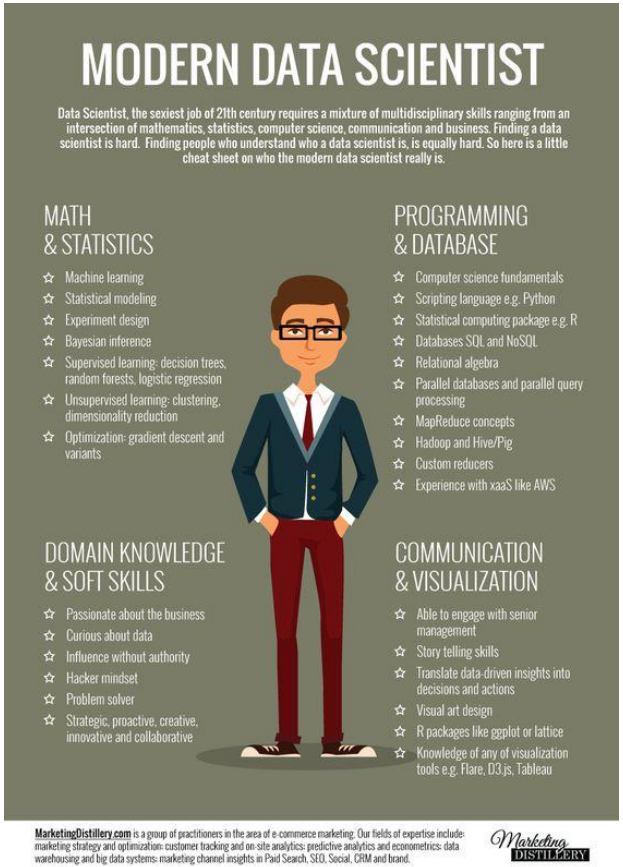
Skill Area	Skill Detail
Business	1. Product design and development
	2. Project management
	3. Business development
	4. Budgeting
	5. Governance & Compliance (e.g., security)
Technology	6. Managing unstructured data (e.g., noSQL)
	7. Managing structured data (e.g., SQL, JSON, XML)
	8. Natural Language Processing (NLP) and text mining
	9. Machine Learning (e.g., decision trees, neural nets, Support Vector Machine, clustering)
	10. Big and Distributed Data (e.g., Hadoop, Map/Reduce, Spark)
Math & Modeling	11. Optimization (e.g., linear, integer, convex, global)
	12. Math (e.g., linear algebra, real analysis, calculus)
	13. Graphical Models (e.g., social networks)
	14. Algorithms (e.g., computational complexity, Computer Science theory) and Simulations (e.g., discrete, agent-based, continuous)
	15. Bayesian Statistics (e.g., Markov Chain Monte Carlo)
Programming	16. Systems Administration (e.g., UNIX) and Design
	17. Database Administration (MySQL, NOSQL)
	18. Cloud Management
	19. Back-End Programming (e.g., JAVA/Rails/Objective C)
	20. Front-End Programming (e.g., JavaScript, HTML, CSS)
Statistics	21. Data Management (e.g., recoding, de-duplicating, Integrating disparate data sources, Web scraping)
	22. Data Mining (e.g. R, Python, SPSS, SAS) and Visualization (e.g., graphics, mapping, web-based data visualization) tools
	23. Statistics and statistical modeling (e.g., general linear model, ANOVA, MANOVA, Spatio-temporal, Geographical Information System (GIS))
	24. Science/Scientific Method (e.g., experimental design, research design)
	25. Communication (e.g., sharing results, writing/publishing, presentations, blogging)

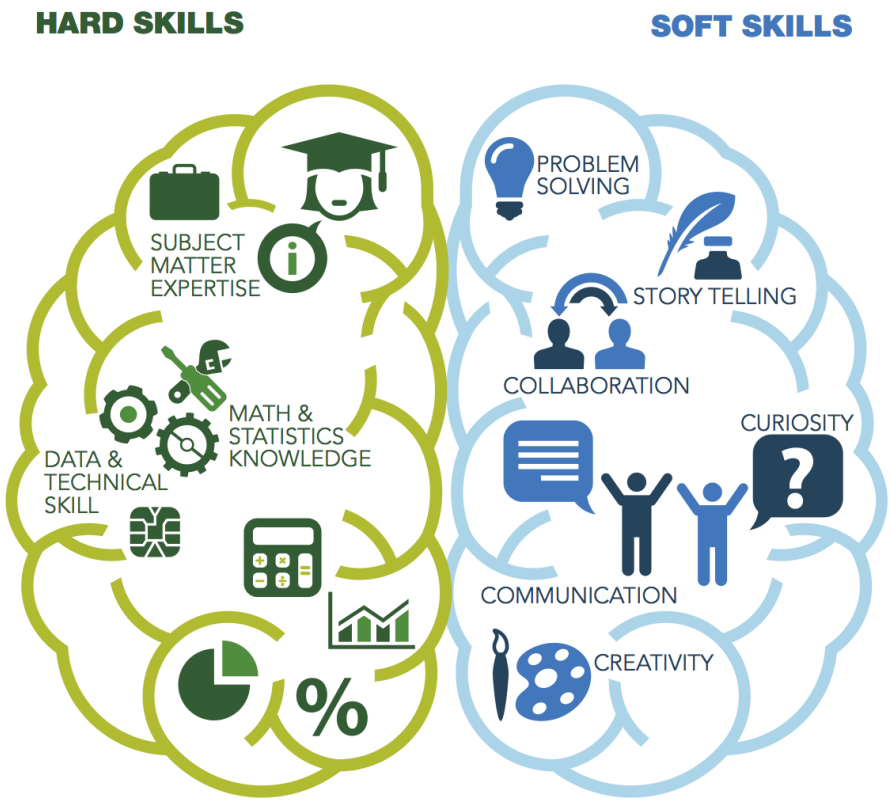
Respondents are asked to indicate how proficient they are for each of the 25 skills using the following scale: Don't Know (0), Fundamental Knowledge (20), Novice (40), Intermediate (60), Advanced (80), Expert (100).

AnalyticsWeek

BUSINESS BROADWAY

EDUCATION & RESEARCH





SMART MANUFACTURING IN EUROPE: EDUCATION SKILLS & RESEARCH PERSPECTIVES

SKILLS

- Smart manufacturing impacts the workers and engineers
- From traditional automation we are moving to a cognitive automation
- Operator is augmented in its capabilities

Collaborative automation
Man-Machine collaboration

→ New way of manual working

Monitoring & Control: machine supervisory

→ New capabilities to understand data and information

Provide support to the machines

→ New maintenance capabilities

Supply Chain & Operation Managers 2020

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COMPUTER SCIENCE & DATA MANAGEMENT

Capability to analyse data autonomously with program languages
Capability to manage and harmonize the data flow coming from the entire Supply Chain
Competences in Social and Web Sentiment Analysis

SOFTWARE & PLATFORMS

Understanding of IT architectures and collaborative Cloud platforms
Understanding of Internet of Things platforms
Cyber Security compentences to understand how to manage important data

PROCESS IMPROVEMENT

Capability to deploy technology roadmap to generate new value for the company
Capability to lean the processes through digitalization
Capability to map the processes and simulate future scenarios

MANAGEMENT OF SMART RESOURCES

Capability to manage resourses in real time through wearable or portable devices.
Capability to manage new production systems, cells, robots
Capability to be a decision maker, relying on Digital Twin simulation

SMART MANUFACTURING IN EUROPE
&
RELATIONSHIP BETWEEN SCHOOLS AND BUSINESS WORLD

Glocal perspective

Business relationship

Vested Outsourcing business model

Collaboration among teaching institutions, companies, student

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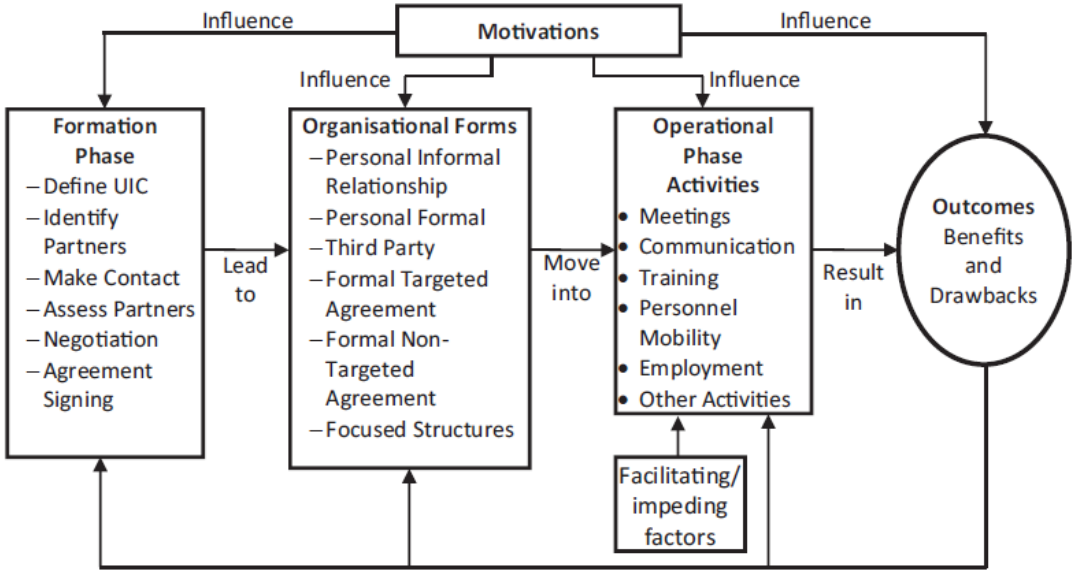

Universities - Industry Collaboration (UIC): A systematic review

Samuel Ankrah, Omar AL-Tabbaa

Evolving workforce

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Aging workforce
Older adults (ages 55 and up) are now the fastest-growing segment of the American workforce

Millenials become managers and Gen Z graduates
Tech-savvy, collaborative, team-work, flat hierarchies, ideas from anywhere

High value on diversity and inclusion
By 2065 there will be no ethnic majority in U.S. workforce

Sources: «2019 Manufacturing Trends Report» by *Microsoft Dynamics 365*

”*National Survey: Working Longer— Older Americans’ Attitudes on Work and Retirement*.” NORC Center for Public Affairs Research, 2013.

www.industry40lab.org

Industry 4.0 LAB

https://www.industry40lab.org/

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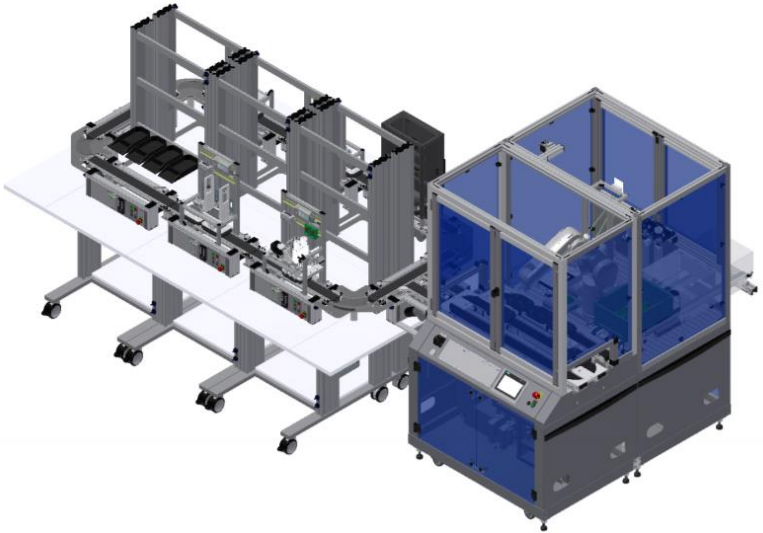
I4.0Lab is promoted and developed by Manufacturing Group of the School of Management of Politecnico di Milano

It is implementing a **tangible physical entity** where the research activity in the innovative manufacturing management and planning approaches can be carried out in conjunction with a **practical implementation in a "real-like" environment**



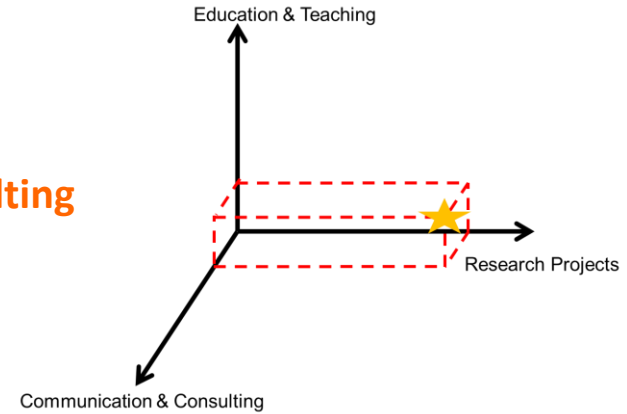
Industry 4.0 LAB

- For the exploitation perspective I4.0Lab addresses **3 main purposes**:

Education & Training

Communication and Consulting

Research Projects related activities



Industry 4.0 LAB

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Fixed staff

Master's candidate

SOM MFG-Group Team

Researchers senior &assistant

PhD students

Working on different European Projects
PERFORM; MAYA; PSYMBIOSYS; BEinCPPS; L4MS; MIDIH; M2020; Fenix; 5G; and many others…

Industry 4.0 LAB

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Enterprises

Competence Centres

Other Universities

Other Polimi Departments

Industry 4.0 LAB

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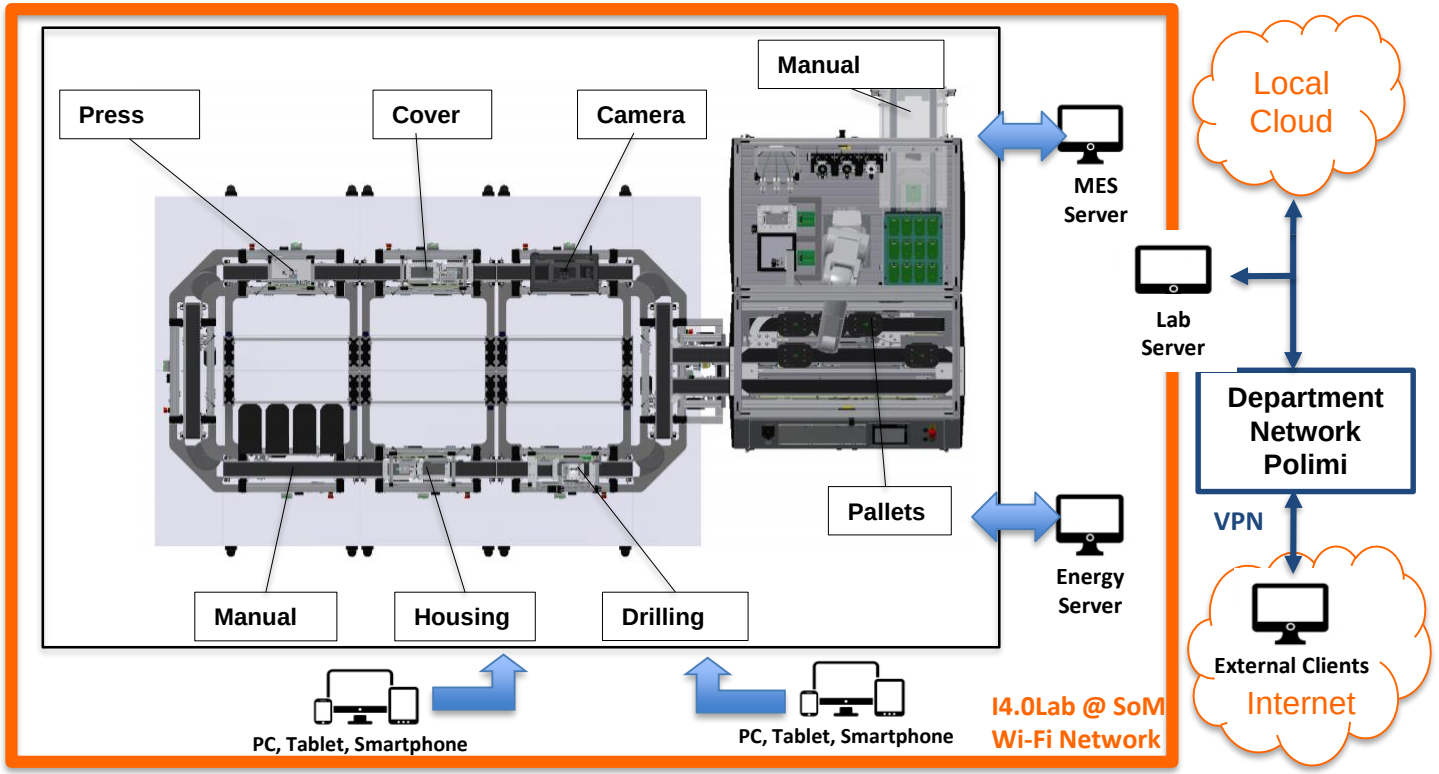

Industry 4.0 LAB video

MADE Competence Center

https://www.made-cc.eu/

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Thank you

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