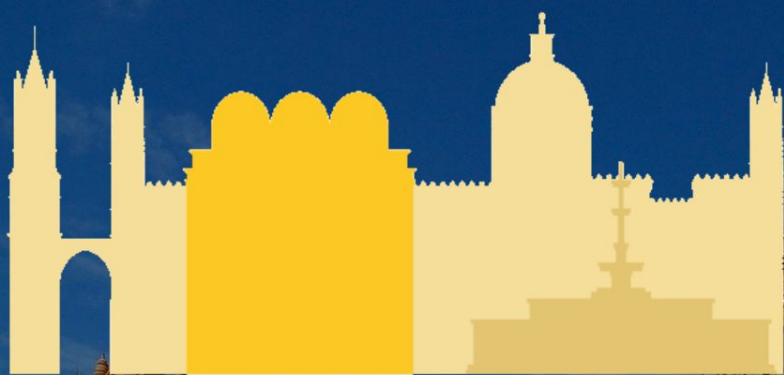


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HELMeTO 2022

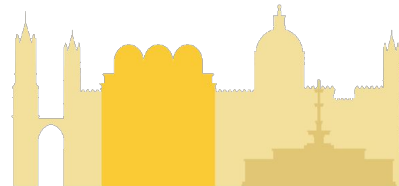
4th International Conference on Higher Education
Learning Methodologies and Technologies Online

September 21-23, 2022

Palermo, Italy



University of Pisa
DICI



***¹Department of Civil and Industrial Engineering
CAFRE***

***²Interdepartmental Center for Lifelong Learning,
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MAESTRO***

***Manufacturing Education for a Sustainable
fourth Industrial Revolution***



Additive Manufacturing for Sustainability

Francesco Lupi¹ and Michele LANZETTA^{1,2}



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SUSTAINABLE DEVELOPMENT GOALS

un.org/sustainabledevelopment

1 NO
POVERTY



2 ZERO
HUNGER



3 GOOD HEALTH
AND WELL-BEING



4 QUALITY
EDUCATION



5 GENDER
EQUALITY



6 CLEAN WATER
AND SANITATION



7 AFFORDABLE AND
CLEAN ENERGY



8 DECENT WORK AND
ECONOMIC GROWTH



9 INDUSTRY, INNOVATION
AND INFRASTRUCTURE



10 REDUCED
INEQUALITIES



11 SUSTAINABLE CITIES
AND COMMUNITIES



12 RESPONSIBLE
CONSUMPTION
AND PRODUCTION



13 CLIMATE
ACTION



14 LIFE
BELOW WATER



15 LIFE
ON LAND



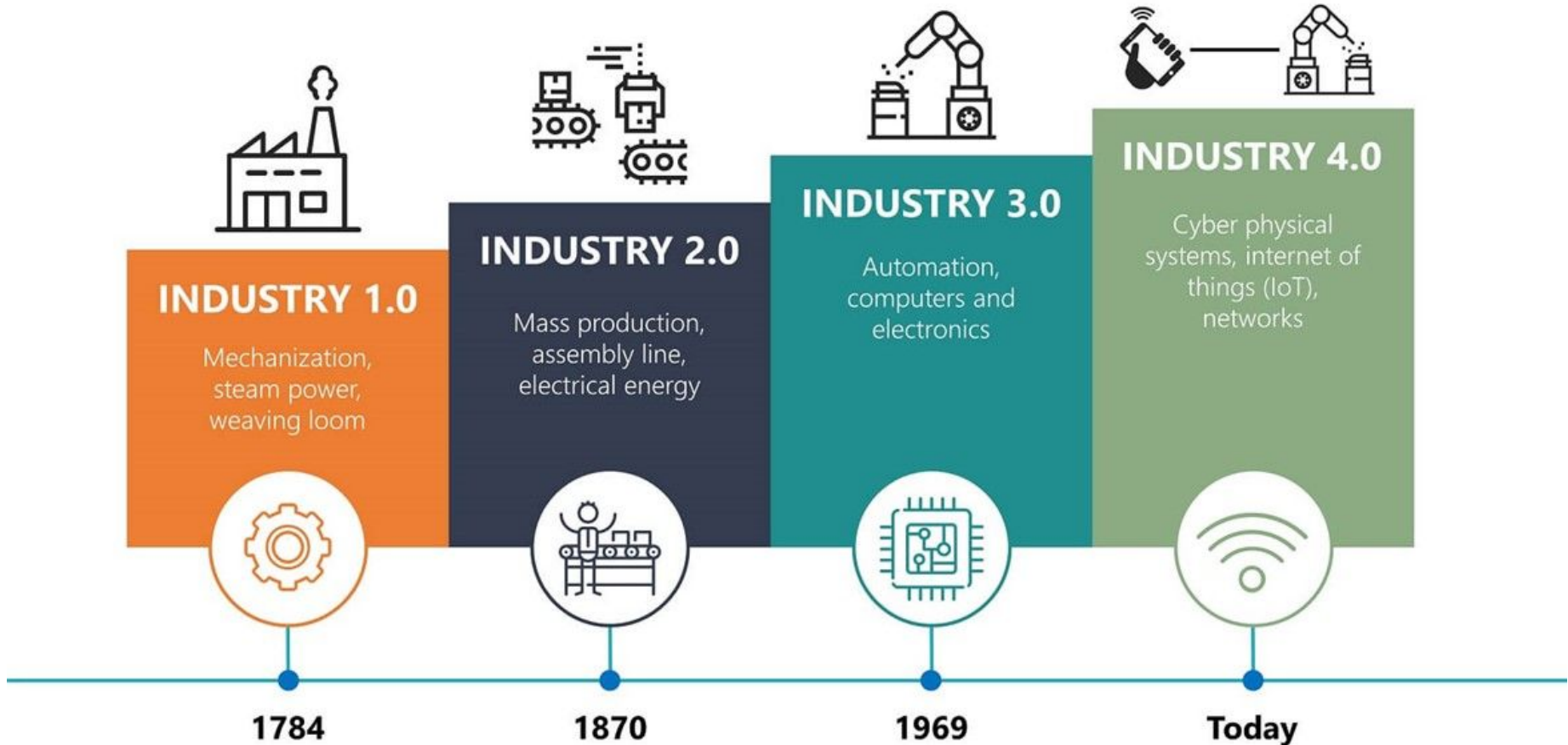
16 PEACE, JUSTICE
AND STRONG
INSTITUTIONS

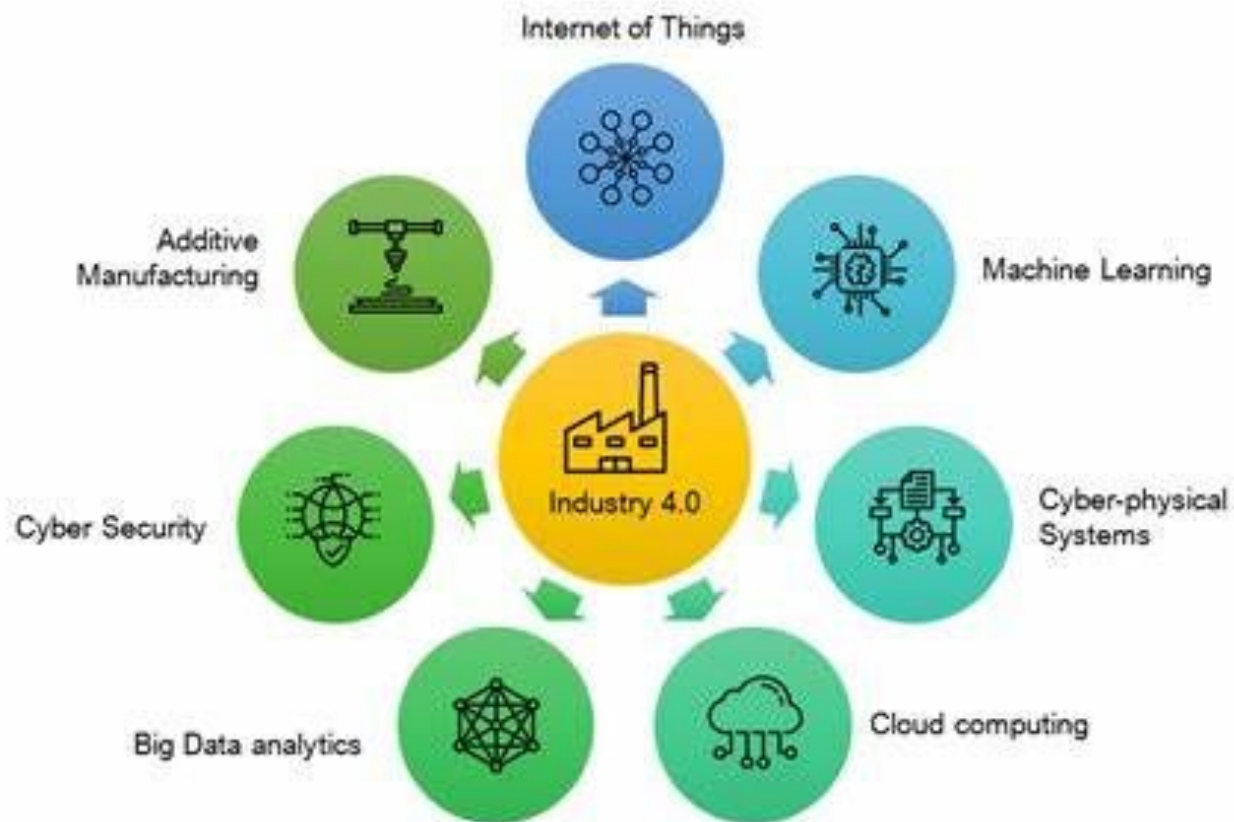


17 PARTNERSHIPS
FOR THE GOALS



A fourth “announced/provoked” industrial revolution





Push/pull strategy in education?



Typical push strategy in education

Higher educational blogs



Higher educational articles

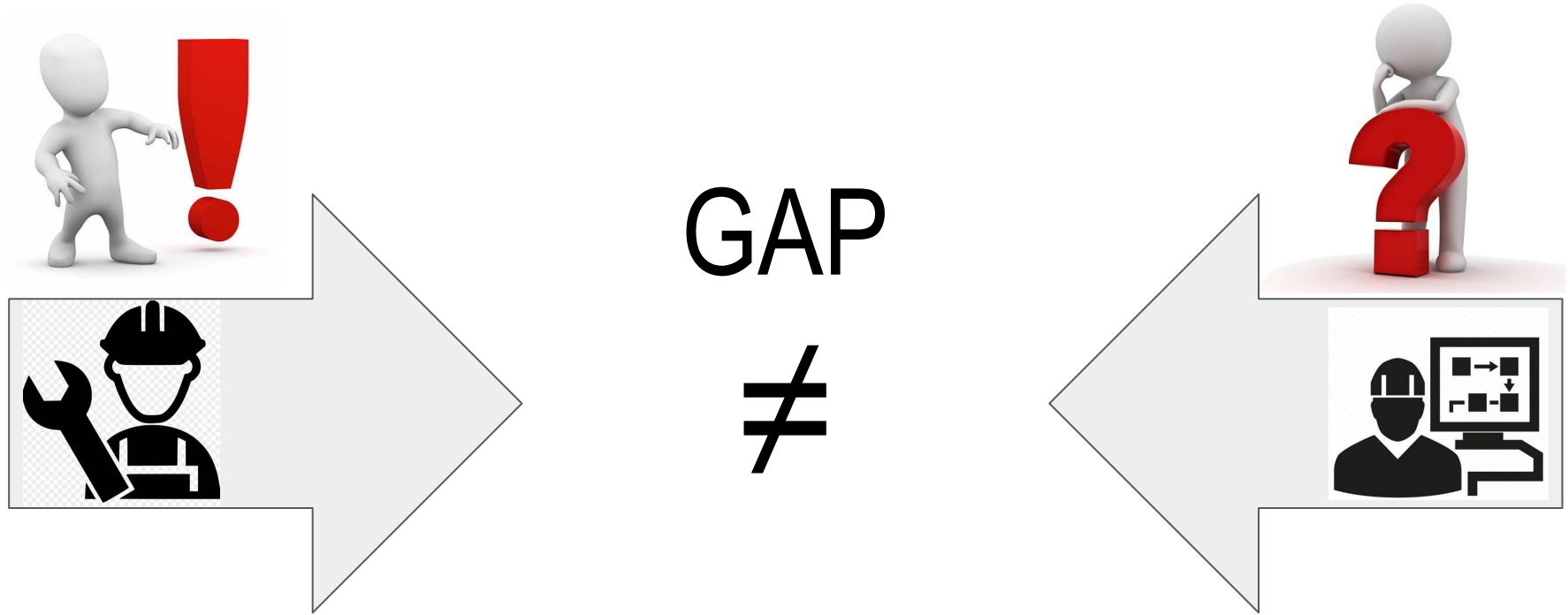


University websites



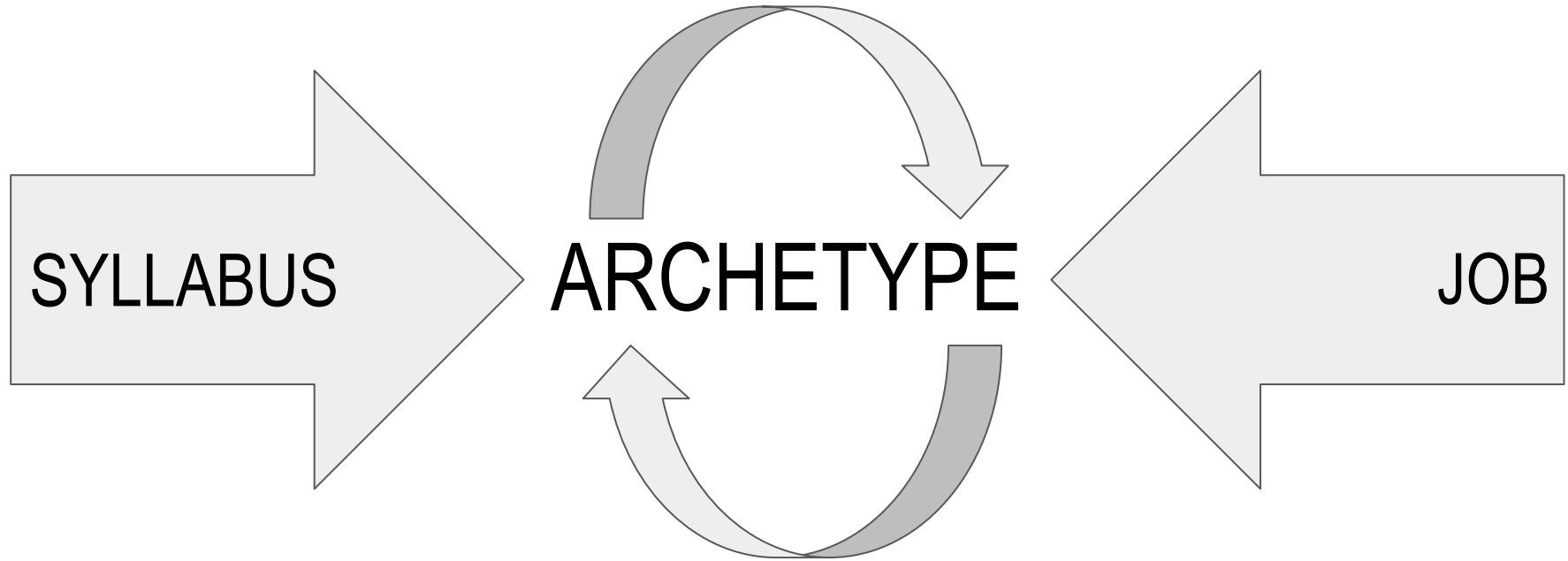
SKILLS

Misalignment risk



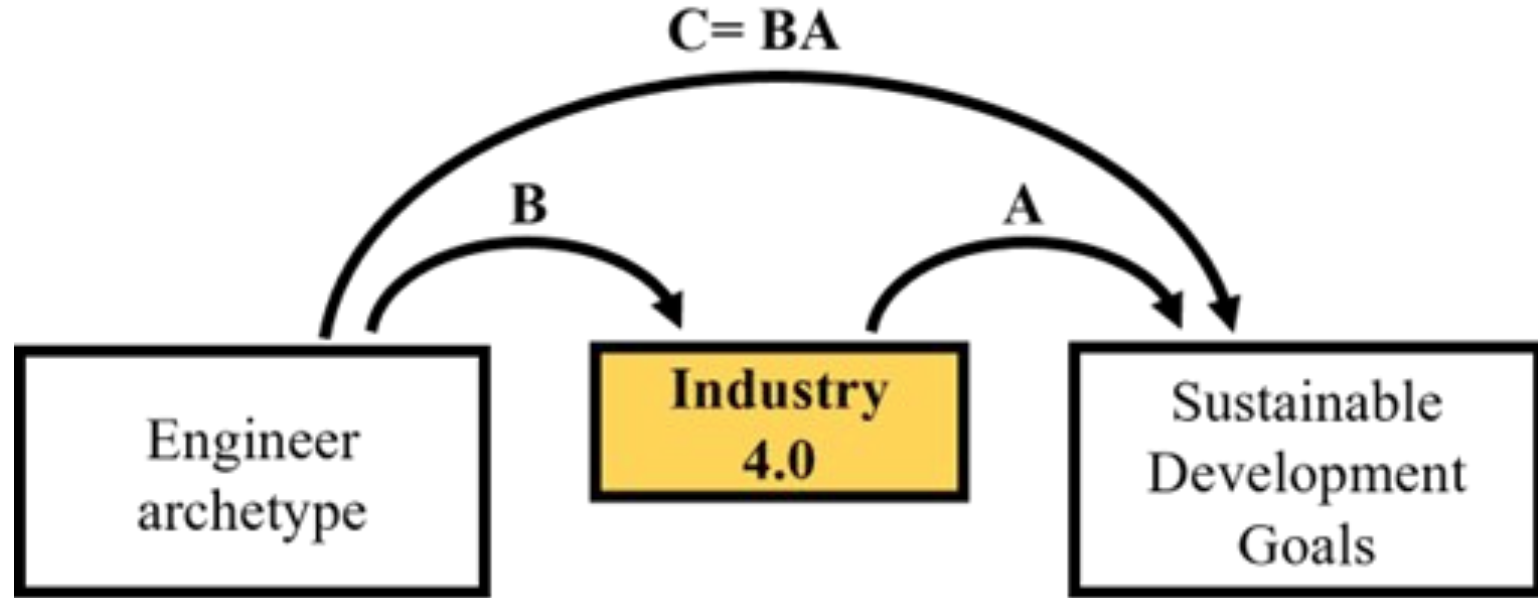
Push/pull/virtuous loop strategy in education

ACADEMIA



MARKET/INDUSTRY

Defining skills

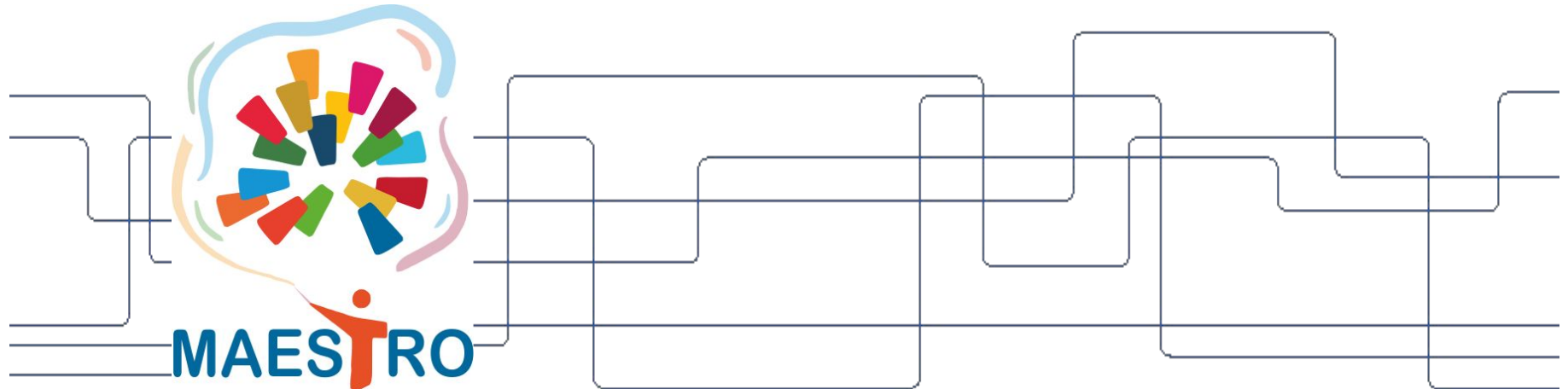




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Erasmus + KA203 - Strategic Partnerships for higher education





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im. IGNACEGO ŁUKASIEWICZA



MA nufacturing Educa**t**ion for a Sust**a**inable fourth industrial Rev**O**lution

Univerza v Ljubljani



POLITECNICO
DI TORINO



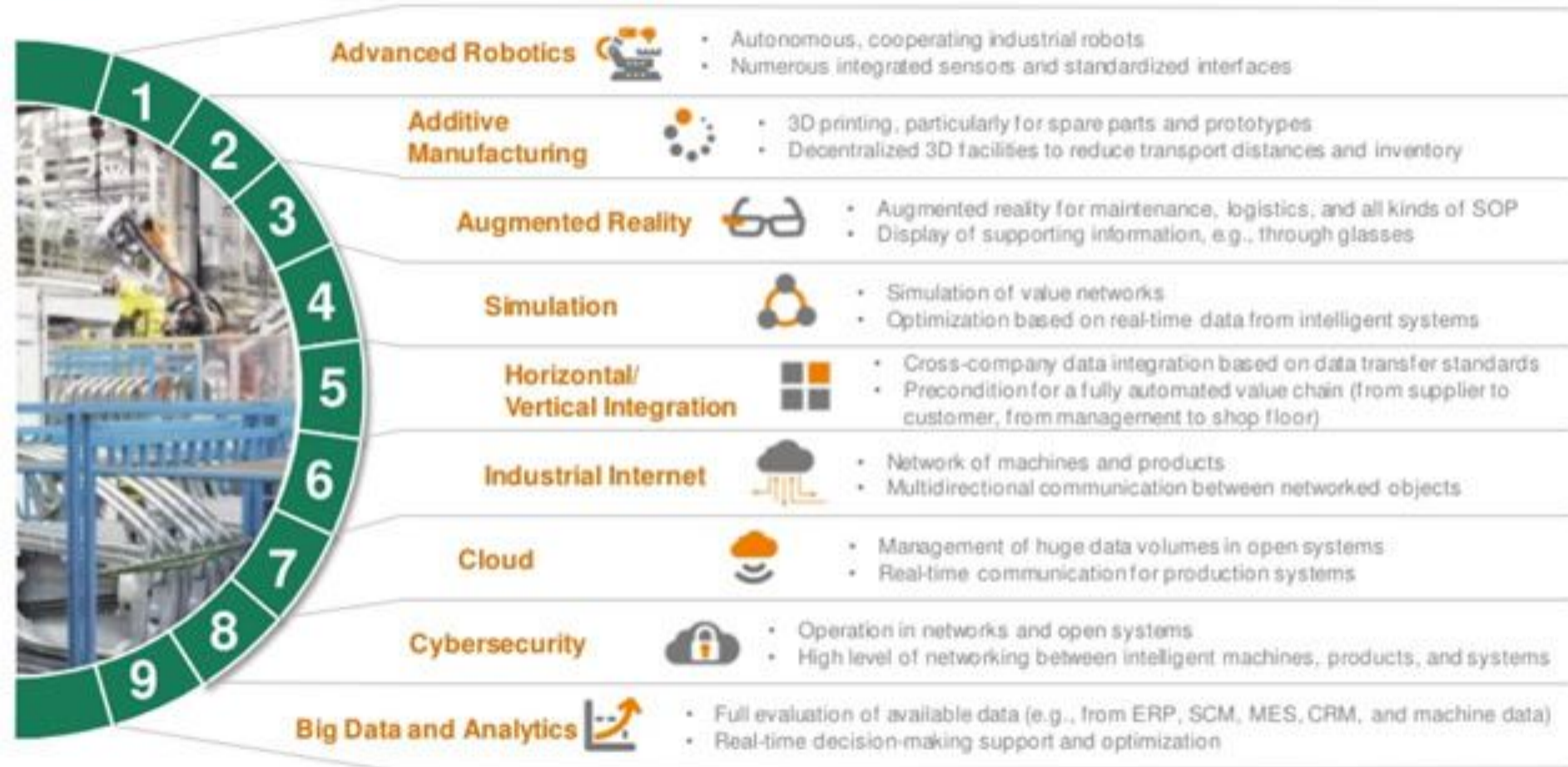
UNIVERSITÀ DI PISA



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maestro.w.prz.edu.pl

Enabling technologies for a fourth industrial revolution



Additive manufacturing



Constructive alignment course design



LEGENDA

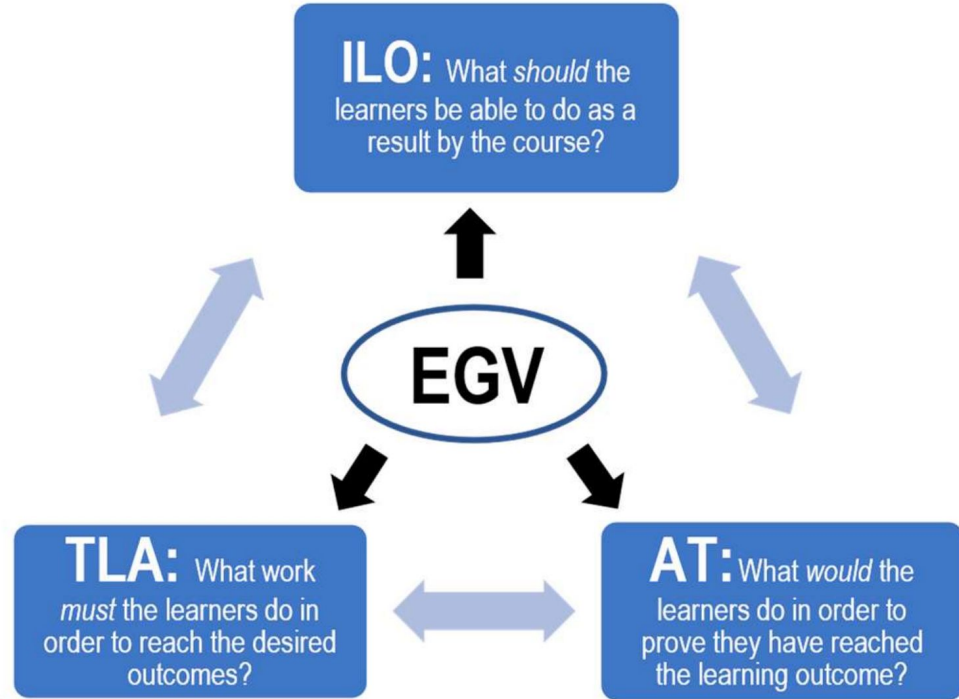
EGV Educational Goal Verb

ILO Intended Learning Outcome

TA Teaching Activities

LA Learning Activities

AT Assessment Task



Method implementation, Teaching Activities

TA 1.1: Present and explain energy analysis for rapid prototyping approaches, design methodology, pros/cons, environmental impact frameworks and standards

TA 1.2: Provide updated case studies through seminars on medicine and AM prosthesis by a sustainable perspective

TA 1.3: Set brief and provide ongoing feedback on project work. Organise students into groups of three or four and provided with a real case study project

TA 1.4: Provide prompt feedback to each group during the project development

Method implementation, Learning Activities

LA 2.1: Listen, query, discuss with peers and produce an infographic to explain, describe, and visualise the information at the end of each lecture

LA 2.2: Listen, query, discuss with peers and seminar guests experts as well

LA 2.3: Discuss within the group members and provide/share ideas by a 30 minute final presentation. Check understandings with one another. Take back to the group and improve the project in a second round based on peers and teacher review

LA 2.4: Provide 1 hour final presentation to the whole class

Method implementation, Assessment Task

AT 3.1: Each project group presents a final written report of the project to the professor. The group is assessed on the main standard attributes of the project: Problem presentation, CAD design, AM software and implemented solution, practical prototype realization and sustainability assessment

Case studies

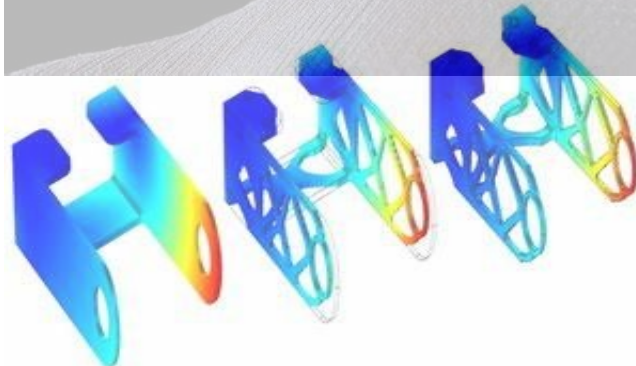
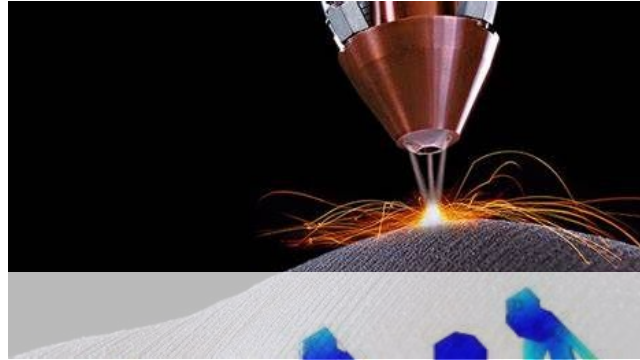


Surface Filter



Volumetric Filter

weight reduction, materials
and energy saving



topological optimization

6 CLEAN WATER
AND SANITATION



12 RESPONSIBLE
CONSUMPTION
AND PRODUCTION



9 INDUSTRY, INNOVATION
AND INFRASTRUCTURE



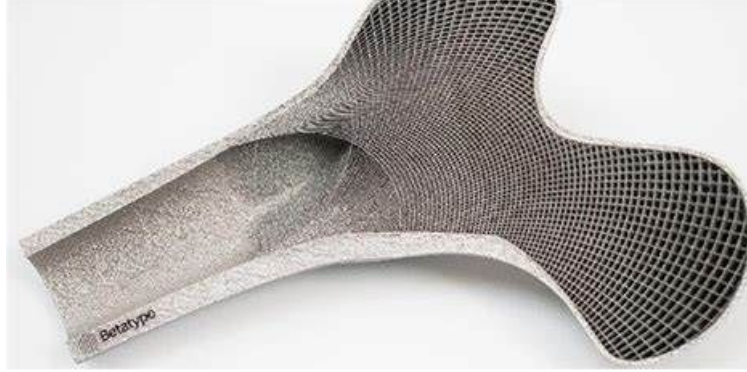
Case studies, Medical



scaffolds for cell culture



dental



trabecular structures

3 GOOD HEALTH
AND WELL-BEING



prosthesis (hip joint)

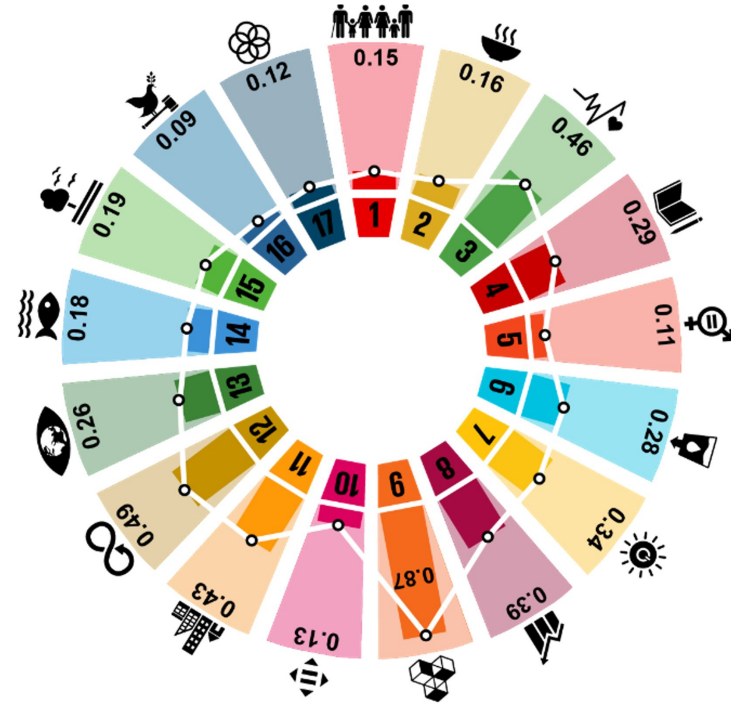
Results from survey

Affected SDGs are NOT only

SDG 9: Industry, Innovation, and Infrastructure
Build resilient infrastructure, promote inclusive and eco-friendly industrialisation and foster innovation

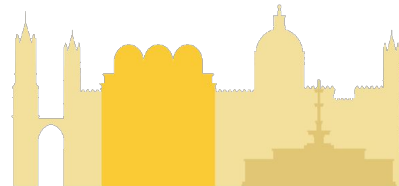
SDG 3: Good Health and Well-being
Ensure healthy live and promote well-being for all at all ages

Instructors/experts (4) vs students (20) advice





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