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MULTIPLIER EVENT E3

MAPPING AND SELECTION OF INDUSTRY 4.0 CONTRIBUTIONS ELIGIBLE FOR EDUCATION



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Univerza v Ljubljani



**RZESZOW UNIVERSITY
OF TECHNOLOGY**



**POLITECNICO
DI TORINO**



Intelligent
Automation

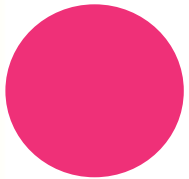
Phase-1: I4.0 SUSTAINABLE TECHNOLOGIES ELIGIBLE FOR EDUCATION



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MAESTRO



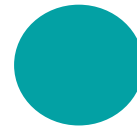
Key Question

What are I4.0 technologies that can be implemented inline with the UN sustainability goals to be considered in engineering education?



I4.0 Technologies

What are I4.0 technologies?



I4.0 sustainability

What is the influence of I4.0 on the achievement of the SDGs?



Sustainable I4.0 technologies eligible for education

What are the eligible contents for engineering education?

What is I4.0 ?



Definitions

- **Industry:** transformation of materials into a product (**added value**)
- **I4.0** is meant to rapid transformations in the design, manufacturing, operation and services related to manufacturing systems or products.

I4.0 Enablers

1. *Industrial Internet of Things*
2. *Big Data & analytics*
3. *Cloud Computing*
4. *Simulation*
5. *Augmented Reality*
6. *Additive Manufacturing*
7. *Horizontal & Vertical System Integration*
8. *Autonomous Robots*
9. *Cybersecurity*

- **Collection of technologies**
- **Higher level classification**



How to bridge this gap ?



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IDENTIFYING I4.0 TECHNOLOGIES



**Assign Enabler(s)
to group**

2

Group's
discussion



**Review the
Elements**

4

Group's
discussion



**Identify
enablers**

1

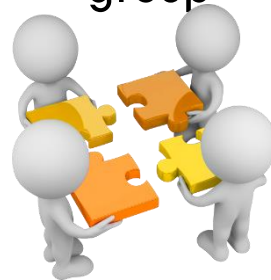
Literature



**Identify the
Elements**

3

Individual
group



**Refine the
Elements**

5

Individual
group



What is the result ?

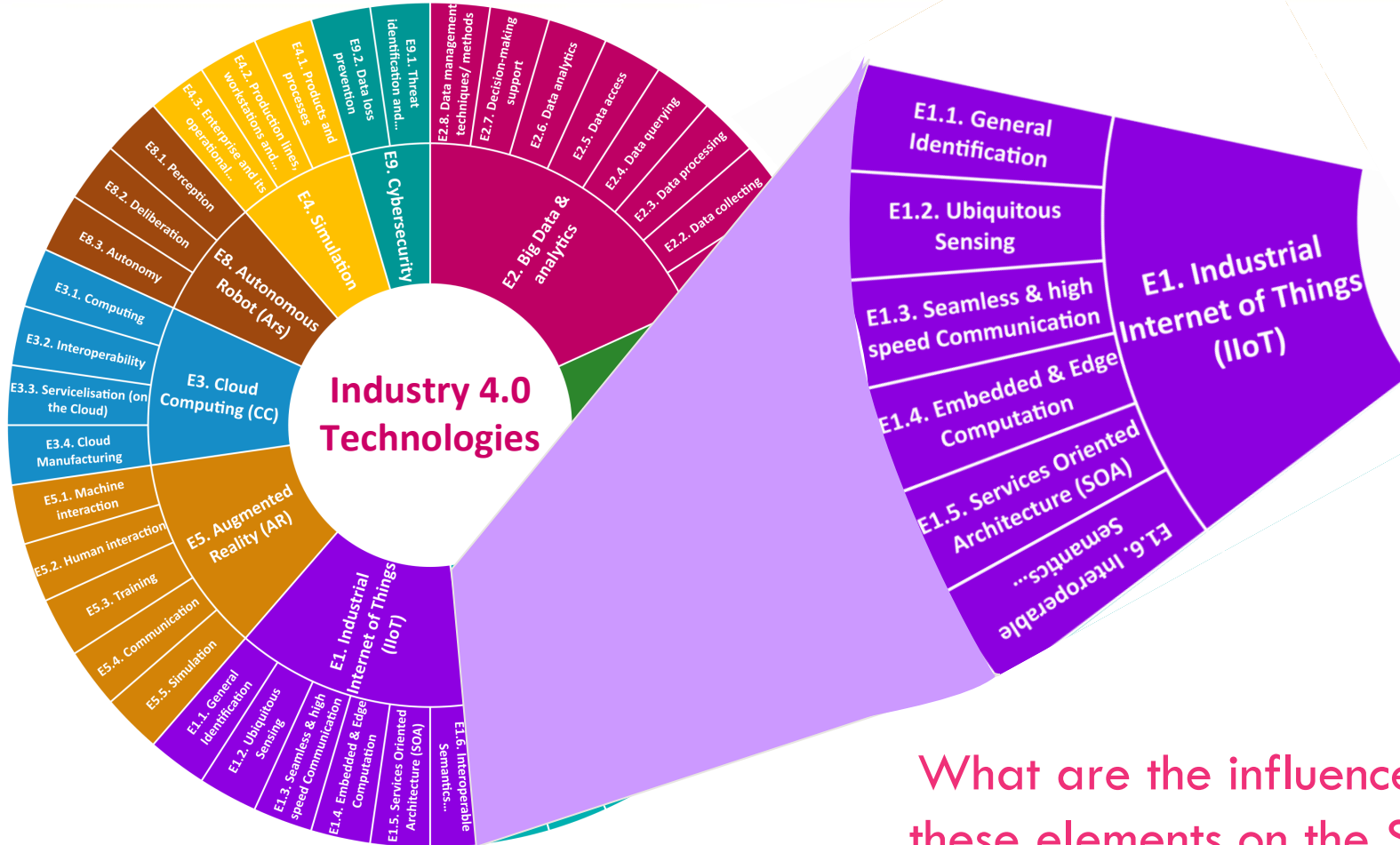


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14.0 ELEMENT TECHNOLOGIES



What are the influences of these elements on the SDGs ?



MAPPING METHOD



Questionnaire

Discuss the result

Design a measure

1

Group's discussion



2

Individual group



Aggregate Analyze

3

LBORO group



4

Group's discussion



5



How to measure the influence ?

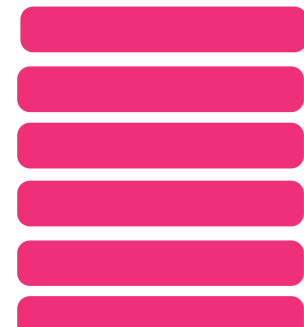
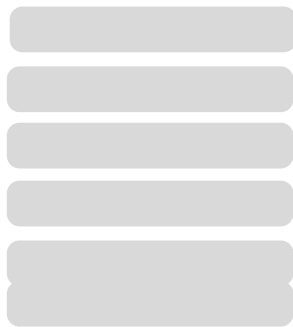
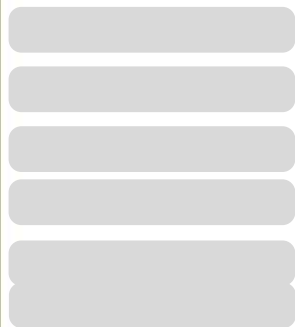
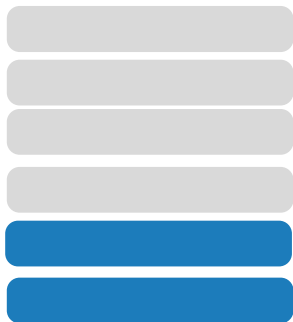
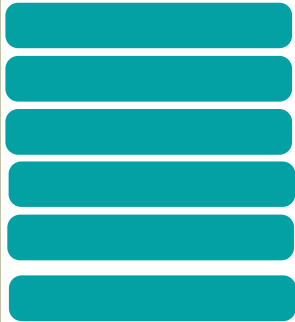


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INFLUENCE MEASURE



+03

Direct

+01

Non-direct

00

No Influence

-01

Non-direct

-03

Direct

What is the result ?



Rzeszow, Poland, 12 June 2021



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

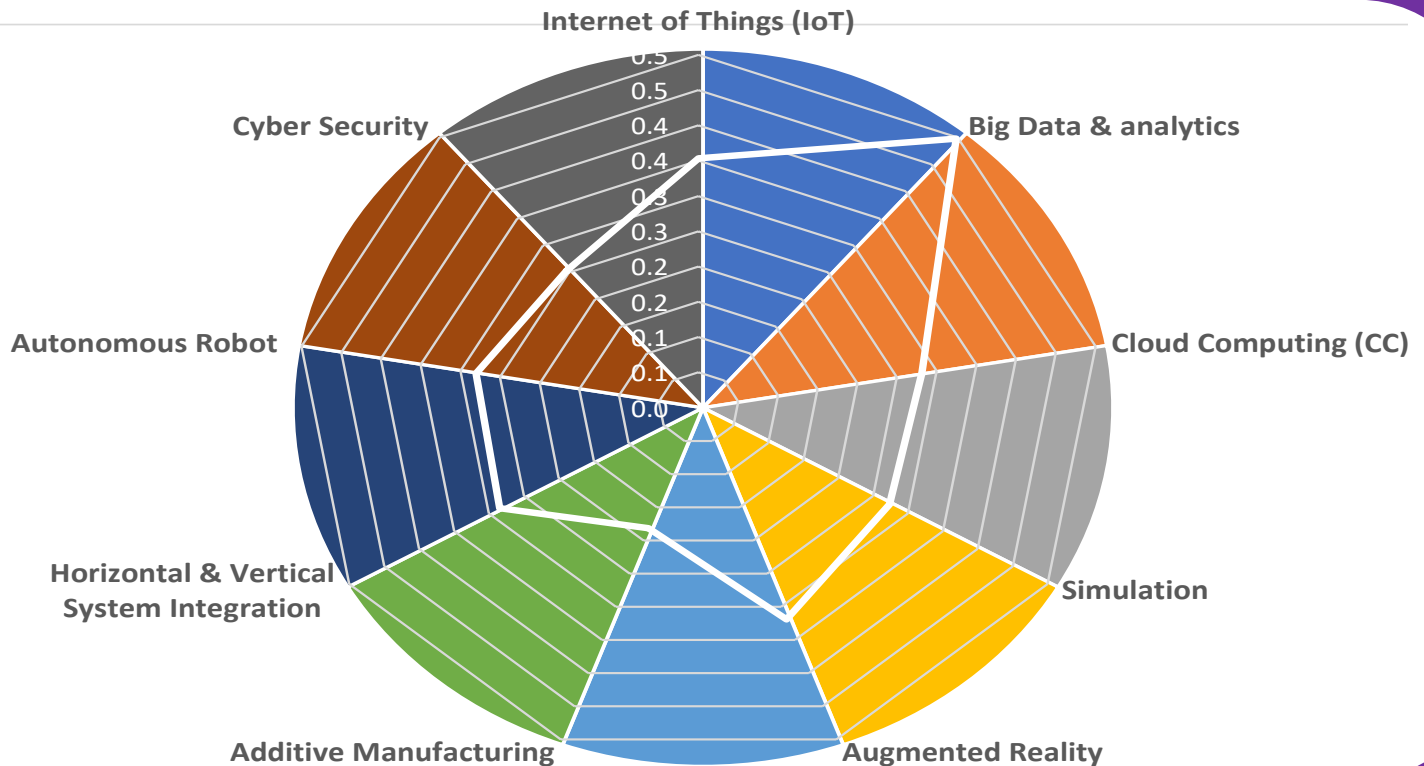


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MAPPING RESULT



Average Enablers

SD

IIoT Influence

Effects on SDGs

Enablers Influences

What are the eligible I4.0 Sust. Tech. for Eng. education ?



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ELIGIBLE I4.0 SUST. TECH. CONTRIBUTIONS FOR ENG. EDUCATION



Huge contribution of I4.0

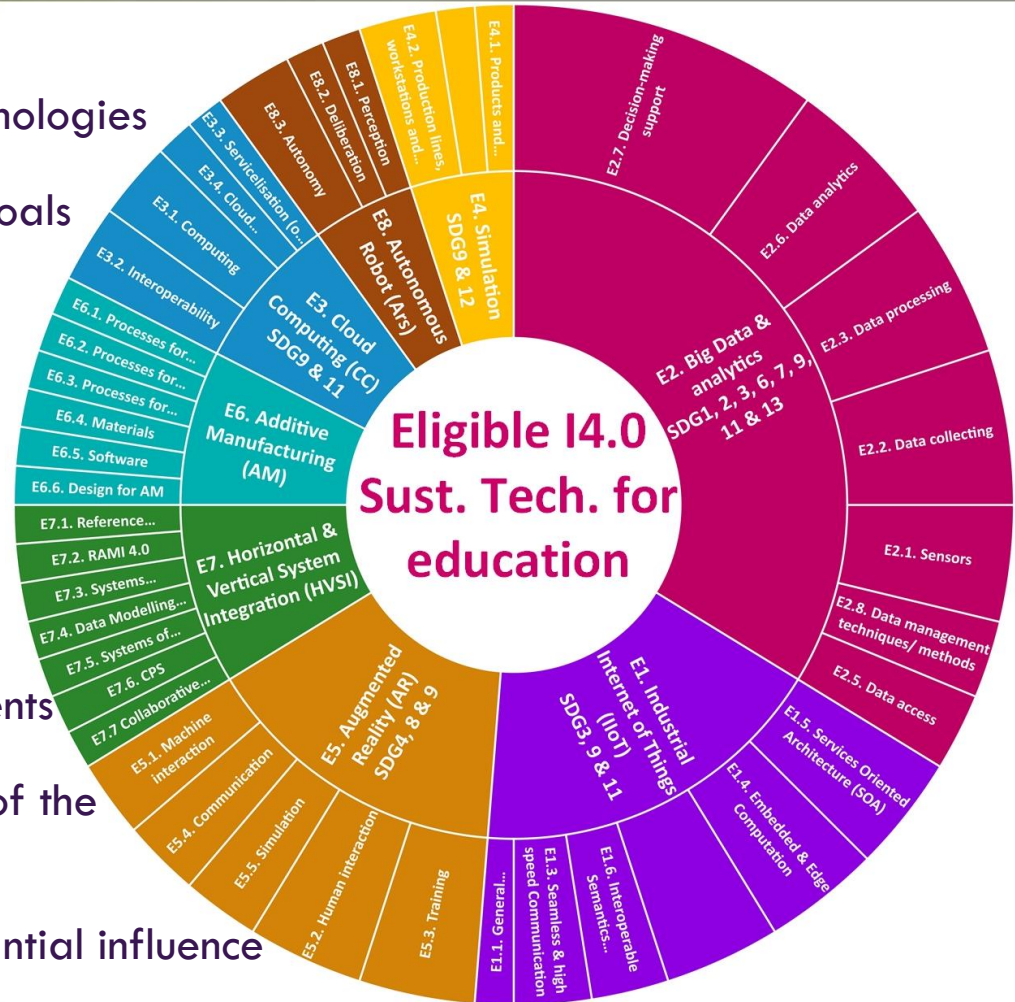
- Majority of the 44 element technologies influence most of the 17 goals.
- 748 combinations of elements-goals

Prioritize the contributions

- It is not possible to consider all contributions at once.
- Prioritize high influences
- An average score of +2 is selected as a cut-off.

Eligible contributions

- 11% of the highest effect elements-goals are selected.
- They are accountable for 25% of the influence.
- 41 elements are considered.
- It was believed to have a substantial influence on 11 goals





CONCLUSION & FUTURE WORK



- 01. 14.0 Elements Tech.**
- 44 elements technologies
 - Most technologies are not new
 - Deployment way is the most important

- 02. Positive Influences**
- Most of the effects are positive
 - A consensus has been reached on most of the results

- 03. Effects on SDGs**
- Highest is on goals related to industry
 - Lowest is on goals related to social aspect

- 04. Eligible Tech. for education**
- Huge contribution of the element-goals
 - The highest influence combinations are prioritized to be considered in engineering education for the first step.

- 01. Technology maturity**
- Identify technologies at high maturity level

- 02. Sust. engineering courses**
- Sust. content development approach
 - Sust. contents assessment approach

- 03. Expand the mapping**
- Expand the expert's panel
 - Investigate industrial experts' perspectives

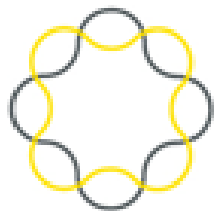
- 04. Influence on individual SDGs**
- Focus on Individual goals, particularly goals with less consensus



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