

# *Science in the Innovation Ecosystem*

## Educating for sustainable development – a systemic curriculum change?

Anette Kolmos



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<http://www.un.org/sustainabledevelopment/>

Commitments Made  
at UN Summit to  
Kickstart  
Implementation of  
Sustainable  
Development Goals



UN Sustainable Development Summit 2015

Search



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# Are our students ready to deal with these goals?



<http://www.globalgoals.org/>



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**Mode 1  
Academic**

Orientation to  
academia and  
theory



Teaching  
Knowledge

Collaborative  
knowledge  
construction  
Competences

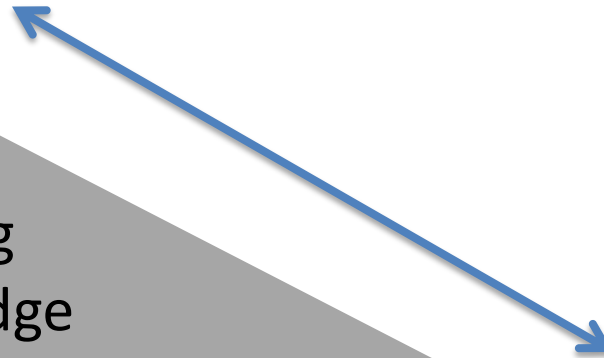
Peer learning  
Skills  
Employability

**Mode 2  
Market-driven  
Innovation**

Orientation to  
Companies  
and  
instrumental  
practice

**Mode 3  
Hybrid Learning –  
Social responsibility**

Orientation to  
community and  
sustainability  
development  
goals



# Comparing

## Education for Sustainable Development **ESD** and Problem Based Learning principles **PBL**

### **ESD**

- Contextual
- Interdisciplinary
- Examples; interactive
- Holistic; systemic thinking;
- Motivation
- Life long learning

*(Guerra 2014)*

### **PBL**

- Contextualised
- Interdisciplinary
- Exemplary
- Action oriented
- Theory – practice relation
- **Starts with a problem**

*(Graff and Kolmos 2003)*

# Comparing Education for Sustainable Development **ESD** and Problem Based Learning principles **PBL**

## **ESD - Form:**

- Group work
- Learner-centred
- Inclusive
- Critical reflection
- Dialogic teaching
- Empowering;
- Case studies;
- Practical exercises;

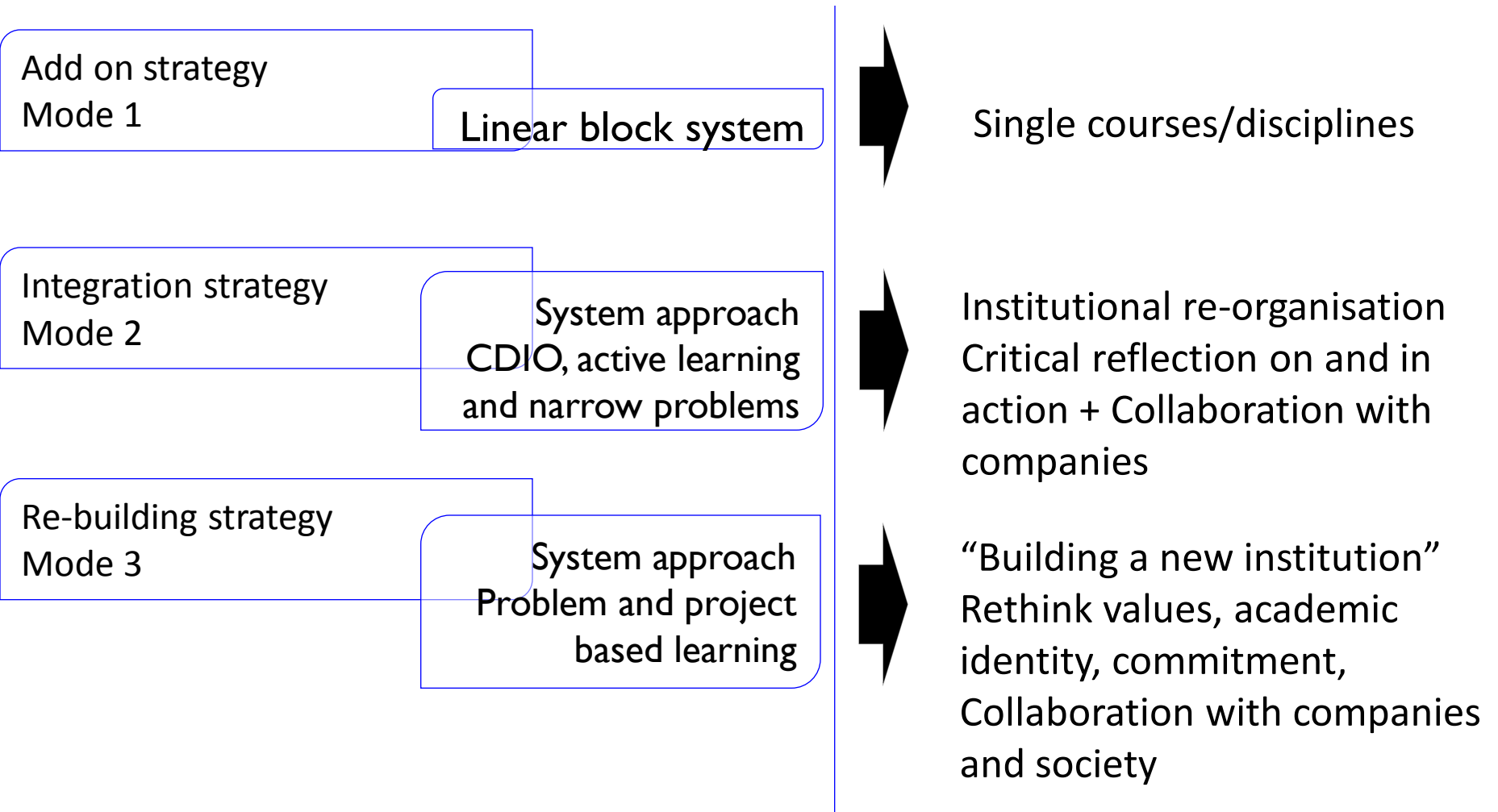
*(Guerra 2014)*

## **PBL - Form:**

- Team organised
- Participant directed
- Experience based
- Critically reflection
- Dialogic and democratic
- A facilitating  
tutor/teacher
- Project organised or case  
based

*(Graff and Kolmos 2003)*

# Curriculum strategies for change



# Add on strategies – mode 1

- One more course - or change in one course
- Central located centers, e.g. on transferable skills, project management where students do have to take a certain amount of credits
- Extra to the curriculum as co-curricular activities outside the curriculum not giving any formal credits



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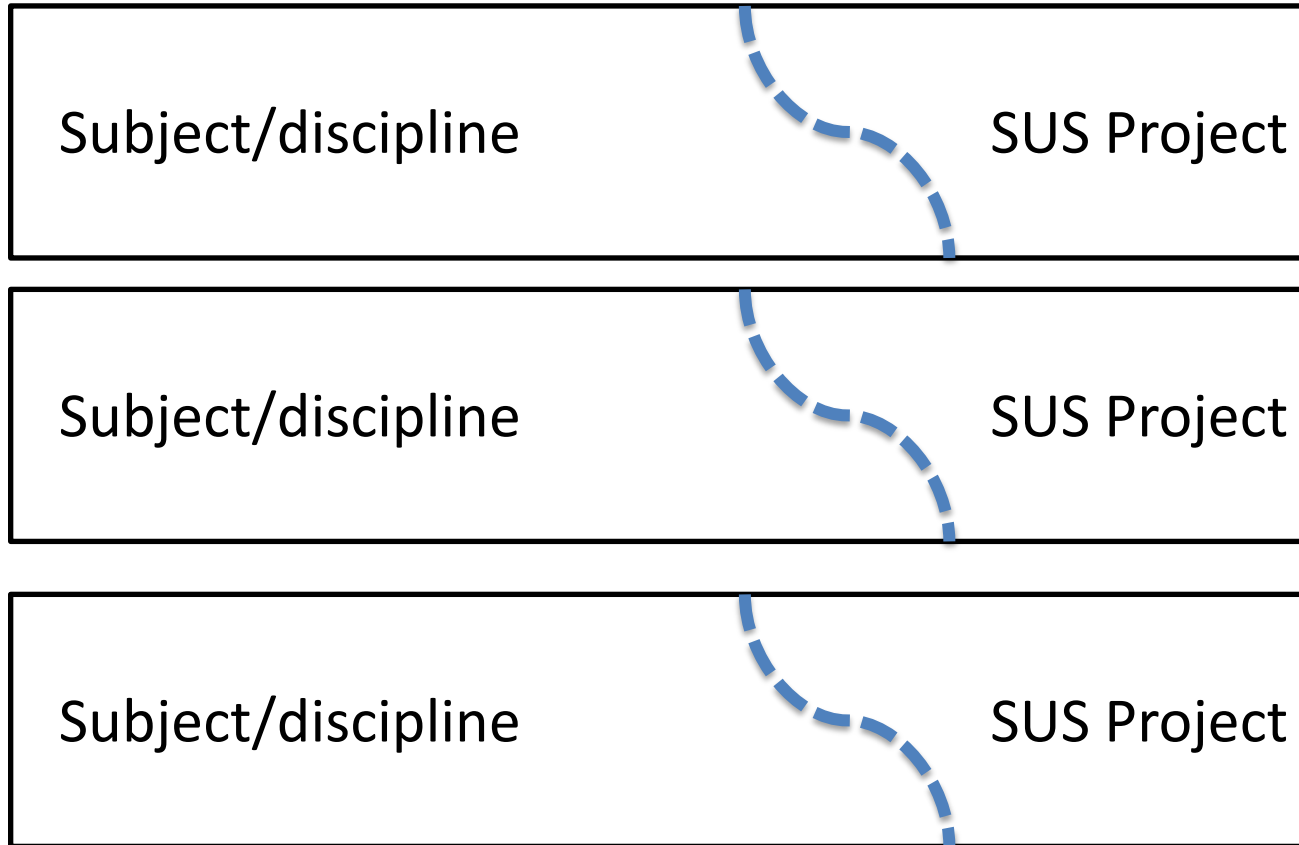


# Single course strategy for change – *“I change my own course”*

Semester 4	Traditional lecture class	Traditional lecture class	Traditional lecture class	Traditional lecture class
Semester 3	<b><i>PBL/active learning/Sus</i></b>	Traditional lecture class	<b><i>PBL/active learning</i></b>	Traditional lecture class
Semester 2	Traditional lecture class	Traditional lecture class	Traditional lecture class	Traditional lecture class
Semester 1	Traditional lecture class	Traditional lecture class	Traditional lecture class	<b><i>PBL and sustainability</i></b>

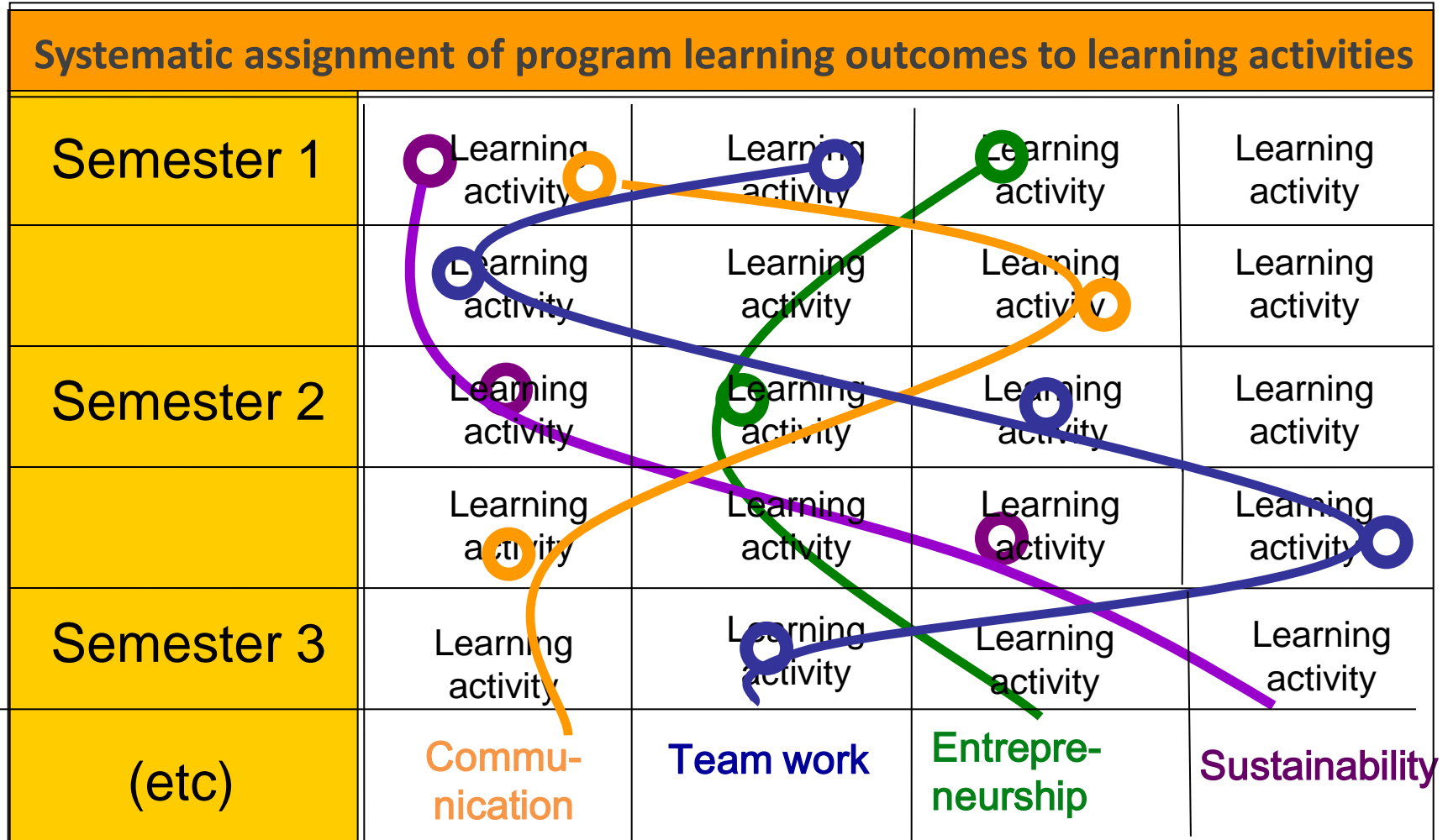
Disadvantages with this strategy: uncoordinated, non stable,

# Single course add-on sustainability and PBL

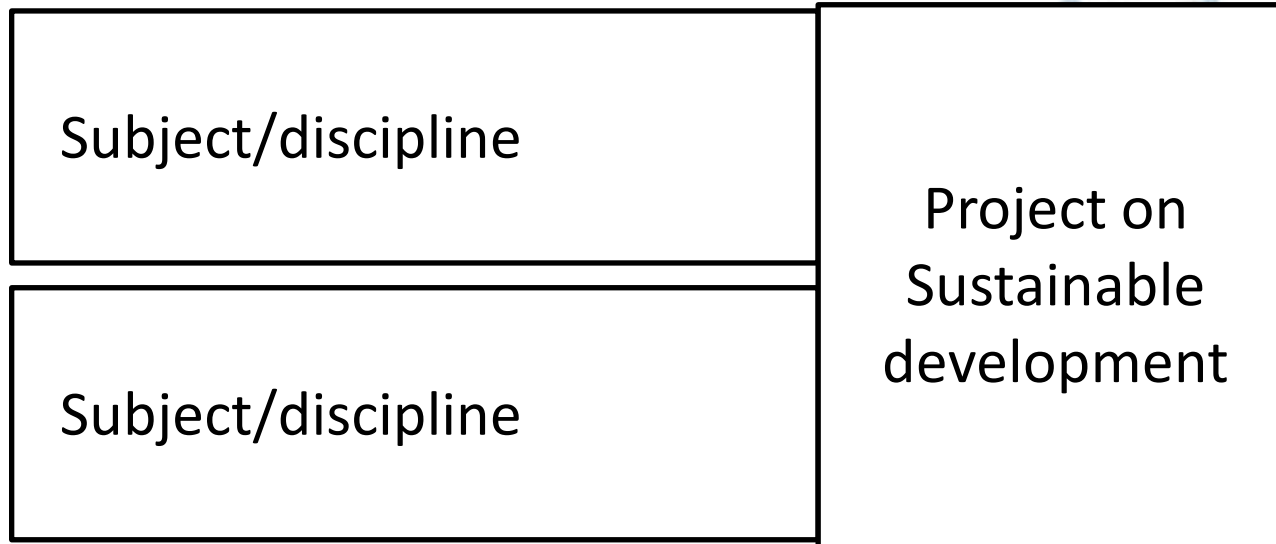


# Integration strategy – Mode 2

## Mapping the courses and integrate new skills(CDIO)



# Integration of SUS by PBL



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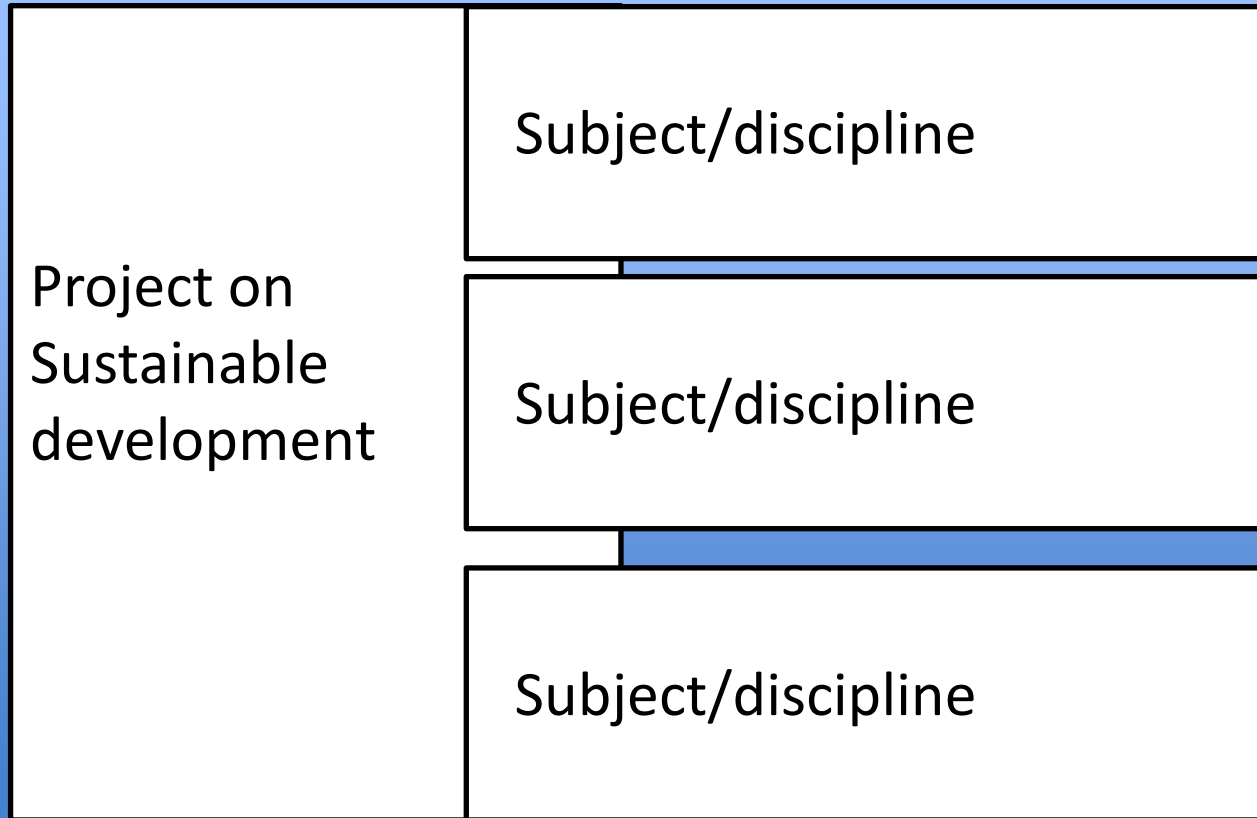
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Moesby, E. 2004. "Reflections on making a change towards Project Oriented and Problem-Based Learning (POPBL)", World Transactions on Engineering Technology Education (WTE&TE), UICEE, Monash University, Australia. Volume 3, No. 2, December 2004.

# Re-building with PBL – direction mode 3

Theme: e.g. sustainable and smart cities



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# We need to work on the discipline boundaries in science in the science ecosystem

Theme	Year 1	Year 2	Year 3	Year 4
Social, Environmental Economic	Engineering, Society, Sustainability and Self	User-Centred Engineering	Engineering Entrepreneurship	Engineering for Business
Modelling	Mathematical Modelling	Modelling Failure (including Statistics)	Green Building Design	Electric Vehicle Design
Structures and Machines	Design of Structures and Machines	Design and Control of Machines	Manufacturing for Sustainability	Social Responsibility and Engineering
Thermo-Fluids	Design of Thermo-Fluid Systems	Design of Renewable Energy Systems	Energy Efficiency for Industry	Industrial Design for Sustainability and ethics

# All strategies are management strategies

- Add on strategy is aligned with academic freedom
- Integration strategy is aligned with requirements for new competences
- Re-building strategy is aligned with requirements for new competences, societal values and sustainable development goals



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<http://www.ucpbl.net>

# Thank you



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