

WAT-E1010 Context Session on
SCIENCE + DISCIPLINES

3courses, 24.10.2016 – Marko Keskinen

SYNTHESIS WEEK

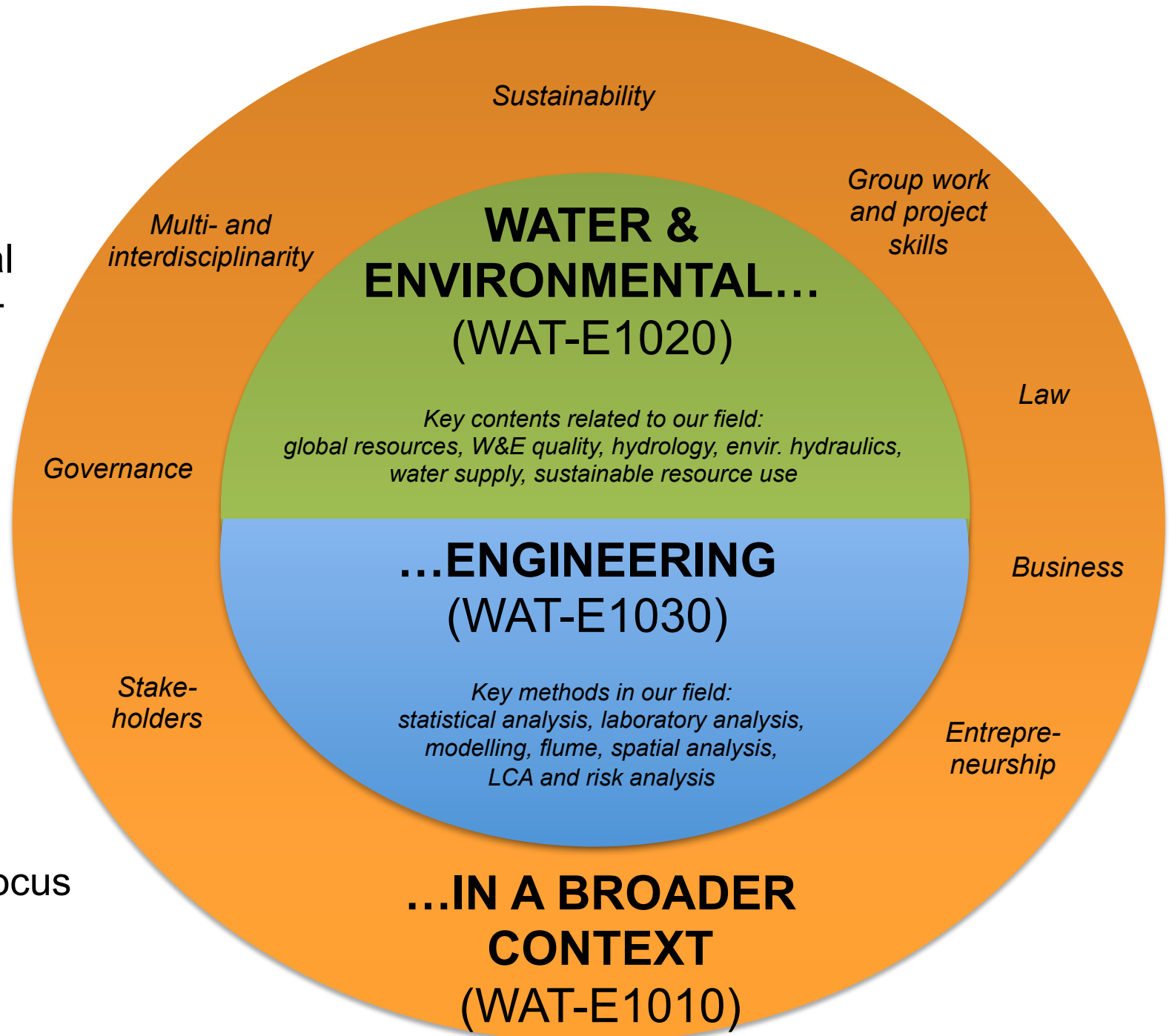
- Jee! This is the 7th and last week of our 3 courses
 - Aim is to reflect and synthesise what we have learned during the past six weeks

TIMETABLE

- Monday afternoon: final WAT-E1010 Context Session on science + multi- and interdisciplinarity
- Tue-Wed: independent work in groups (AaltoWAT students also having mentor meetings)
- Thursday: Synthesis Day
 - Each group runs a Synthesis Session
- Friday morning: Feedback & Reflection

Thu afternoon
also possible
video session
→ interested?

3 courses provide an in-depth introduction to water and environmental engineering + its context



Each course has its own focus – and related color!

AIMS FOR TODAY

- Learn and discuss what is science and disciplines
- Understand the key differences between different 'disciplinaritys'
 - Cross-, multi-, inter-, trans- etc.
 - Link to common drive for integration
- Use all this to reflect what we have learned during the 3 courses, and the way we define water & environmental engineering
 - Link to your synthesis work, to be done during this week

1. SCIENCE + DISCIPLINES



WHAT IS SCIENCE?

“A **systematically** organised body of knowledge on a particular subject”

“The intellectual and practical activity

- encompassing the **systematic study**
- of the structure and behaviour
- of the physical and natural world
- through observation and experiment (empirical and measurable evidence)”

Oxford Dictionary

→ “A systematic way to study world”

Marko Keskinen

SCIENTIFIC METHOD

- Science is highly variable and creative process, yet some common elements can be recognised
- ‘Scientific method’: general phases
 - Hypothesis generation
 - Hypothesis testing through experiment
 - Creating new knowledge through analysis (based e.g. on deductive or inductive logic)
- The phases build on common principles
 - Parsimony (simplicity: match method with data)
 - Reproducibility and falsifiability
 - Presuppositions, domain & limits

SCIENTIFIC METHOD

- 'Method' has an important role in scientific study
 - Allows the study of phenomena that are too complex to understand just by thinking
 - Foundation for systematic inquiry and reproducibility
 - Reduces human biases
 - e.g. fallacious logic and confirmation bias
- We have used variety of methods during 3 courses, both during WAT-E1030 and other courses

SCIENTIFIC THEORY

- Large number of scientific experiments and related analyses lead to an (re-)establishment of a ‘scientific theory’
 - Well-substantiated and comprehensive **explanation** of some aspect of the **natural world** that is supported by a vast body of **evidence** Wikipedia, US-National Academy of Sciences
- “One of the most useful properties of scientific theories = can be used to make predictions about natural events or phenomena that have not yet been observed” US-National Academy of Sciences (2008) <https://www.nap.edu/read/11876/chapter/1>
 - e.g. gravitation, particle physics / Higgs bosom

DISCIPLINE

Your view?

- What is a discipline?
 - 'a specific field of study that creates its own branch of scientific knowledge'
 - A discipline thus provides a scientist with an identity: maintains an institutional order and has own professional standards and publication + education procedures
- Yet, the division of research into separate disciplines is due to historical development rather than to genuine scientific necessity
 - Challenge: leading to overspecialisation and too narrowly defined research questions

'Society has problems,
universities have disciplines'

Adapted from Scholz & Marks (2001)

QUESTIONS?
COMMENTS?



2. 'DISCIPLINARITIES'



'DISCIPLINARITIES'

- An increasing drive to find ways to link different disciplines more closely together
 - Different kinds of 'multi-disciplinarity'
- Links to our society's rive for 'integration'
 - The buzzword of the day: almost everything should be 'integrated' (more in additional slides)
- Also research seeing drive towards integration
 - Reasons are also similar:
 - Defragmentation to separate disciplines
 - Sustainable development

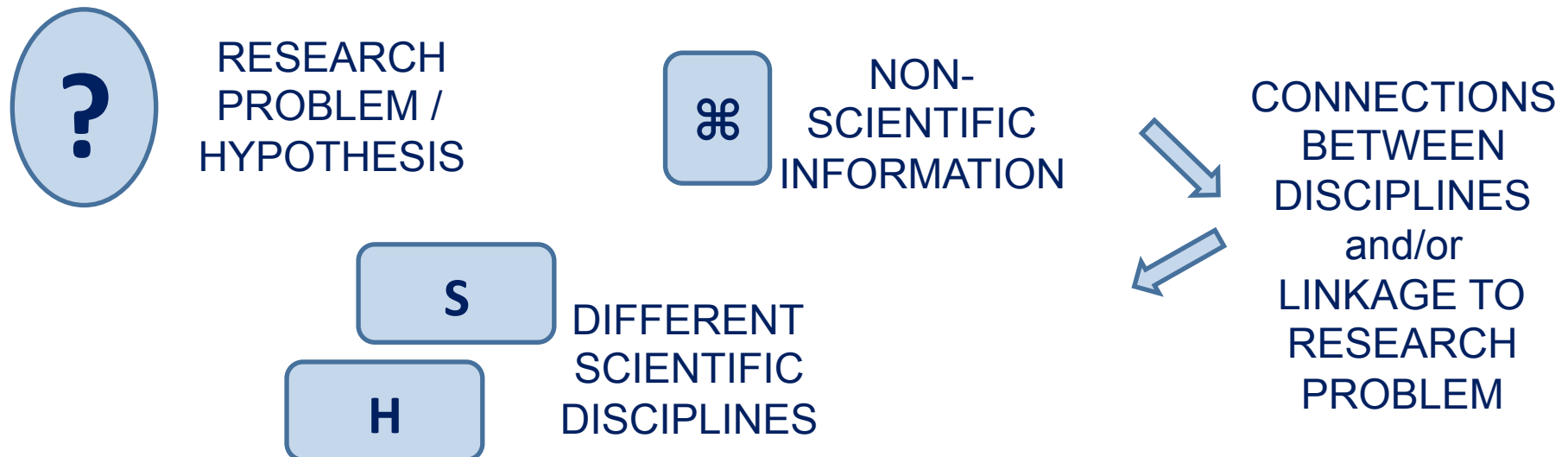
Already Agenda 21 of Rio 1992 called for research that would be interdisciplinary and integrated

'MULTI-DISCIPLINARITIES'

- Disciplines can naturally be connected in different ways: different kinds of 'multi-disciplinarity'
 - Multidisciplinarity ('monitieteisyys')
 - Crossdisciplinarity ('poikkitieteisyys')
 - Interdisciplinarity ('tieteiden välisyys')
 - Transdisciplinarity ('tieteiden ylisyyys')
 - Others, too (mono-, pluri-, post-)
- But how these differ?

TASK: VISUALISING MULTI-DISCIPLINARITIES

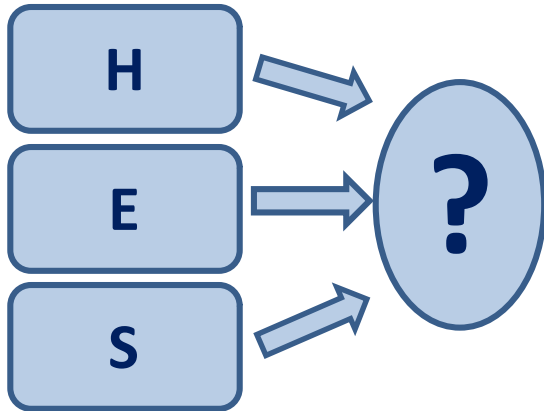
- Draw a visualisation for four multi-disciplinaritys (multi-, cross-, inter- & transdisciplinarity)
- You may use the following shapes (add your owns, if needed)



TASK: VISUALISING MULTI-DISCIPLINARITIES

What did you find out?

- Are there differences?
- How they can be described?
- Does this make sense?

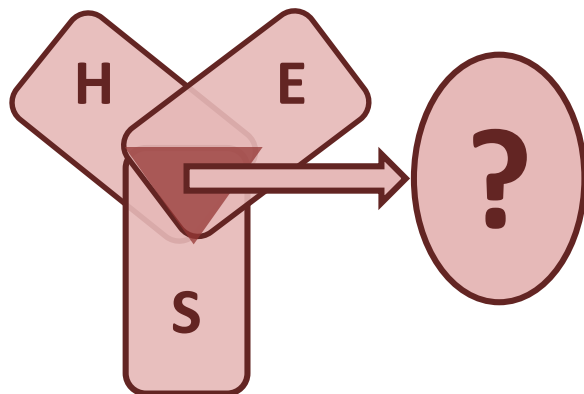
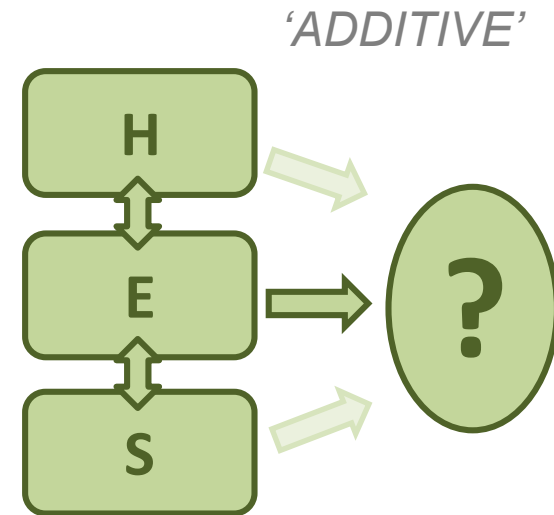


MULTIDISCIPLINARITY

Problem analysed through different disciplines, with experts working as one team but still using their own disciplinary methods

CROSSDISCIPLINARITY (NON-EGALITARIAN)

Problem analysed by the team mainly through one discipline, but adapting and using methods and expertise from different disciplines

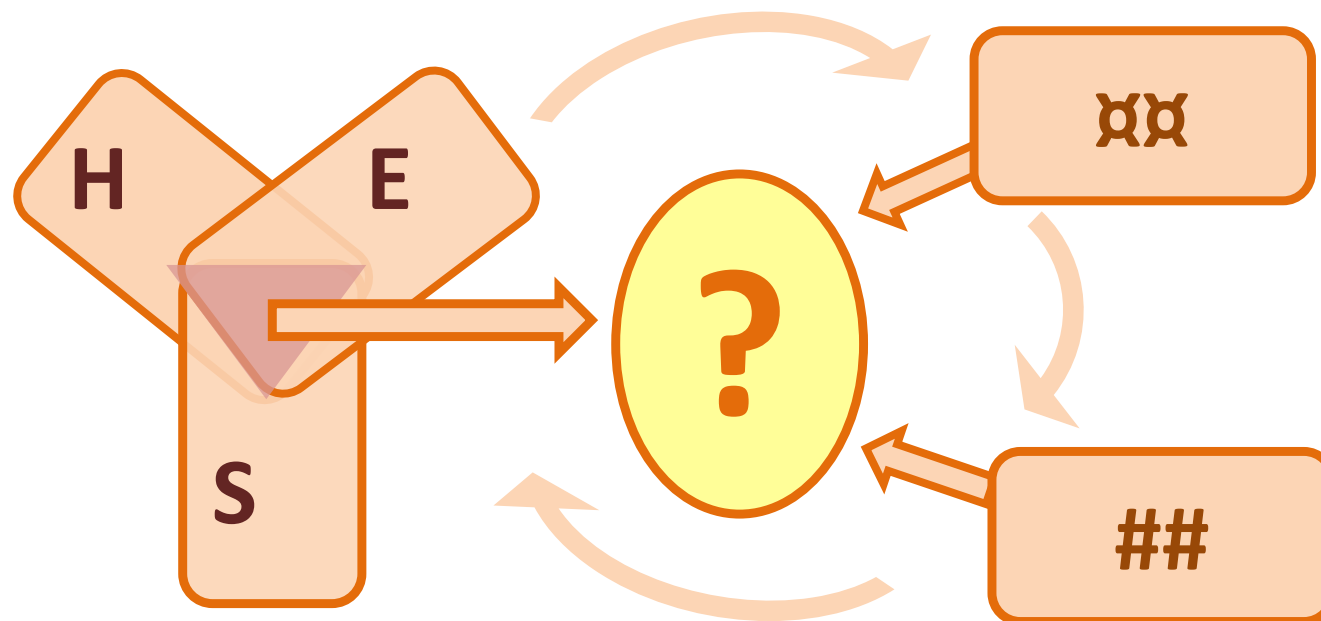


INTERDISCIPLINARITY

Problem analysed with the help of methods developed by the team for this particular problem, integrating knowledge, theories and methods from different disciplines *'INTERACTIVE'*

TRANSDISCIPLINARITY:

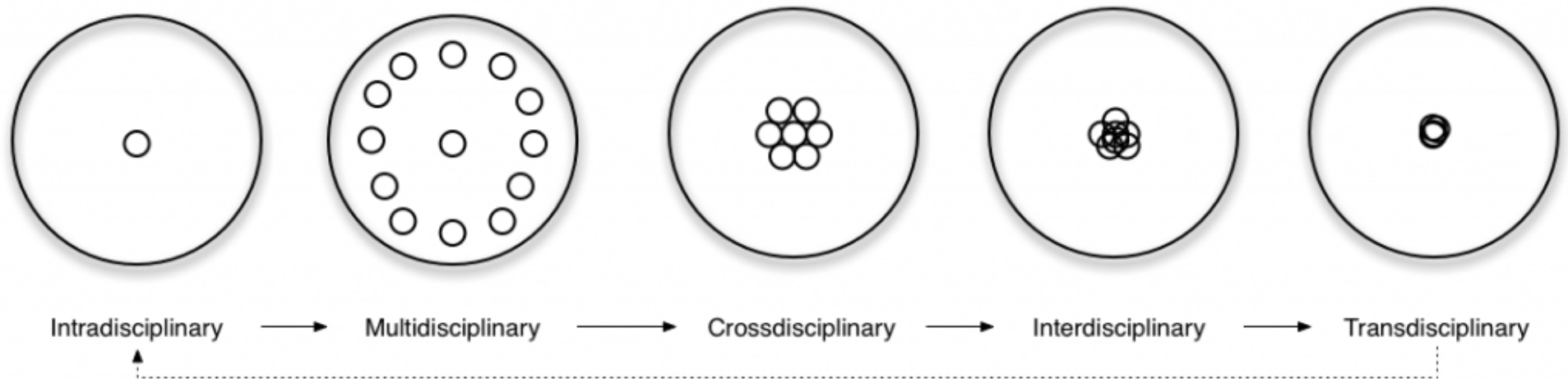
Collaborative, dynamic problem solving approach crossing both disciplinary boundaries & different forms of knowledge production



'HOLISTIC'

TASK: VISUALISING MULTI-DISCIPLINARITIES

Many different ways to do this, of course.



<http://www.arj.no/2012/03/12/disciplinarity-2/>

QUESTIONS?
COMMENTS?



3. SOME CONCLUSIONS



WAT RESEARCH

- Water and environmental research going towards increasing inter- and even transdisciplinarity
 - INTER: not only bringing different disciplines together, but taking a problem-specific view with (new) methods suitable for that specific purpose
 - TRANS: considering also other, non-scientific forms of knowledge (particularly local/traditional knowledge), and hence engaging different stakeholders
- These same trends visible in our field more generally (i.e. also beyond research)

LINK TO 3 COURSES' GROUPS

- The discussion about multi-disciplinarity is very similar to cooperation between different sectors – and teams with different experts (like yours!)
- Some common elements for both
 - The importance of finding the common ground
 - Research context / collective problem
 - Generalism ('the easy one') vs. holism ('the important one')
 - Generalism: multiple views i.e. multidisciplinary
 - Using existing expertise & methods
 - Holism: comprehensive i.e. interdisciplinary
 - Using new methods and creating new expertise

Which one you used?
Why?

WAY FORWARD

- Need for multidisciplinary / -sectoral teams with interdisciplinary / -sectoral approaches
 - Team interaction more & more important
- ‘Doing more with less’: successful work in our field may actually require less sectoral studies & expertise and much more interaction
 - Slow, long process
- Integration works as mindset, but not always as actual approach
 - Also ‘fragmentation’ is good in some cases

HEY YOU T-PEOPLE!

- Close links to water and environmental education
→ T-shaped people needed!

Combination of:

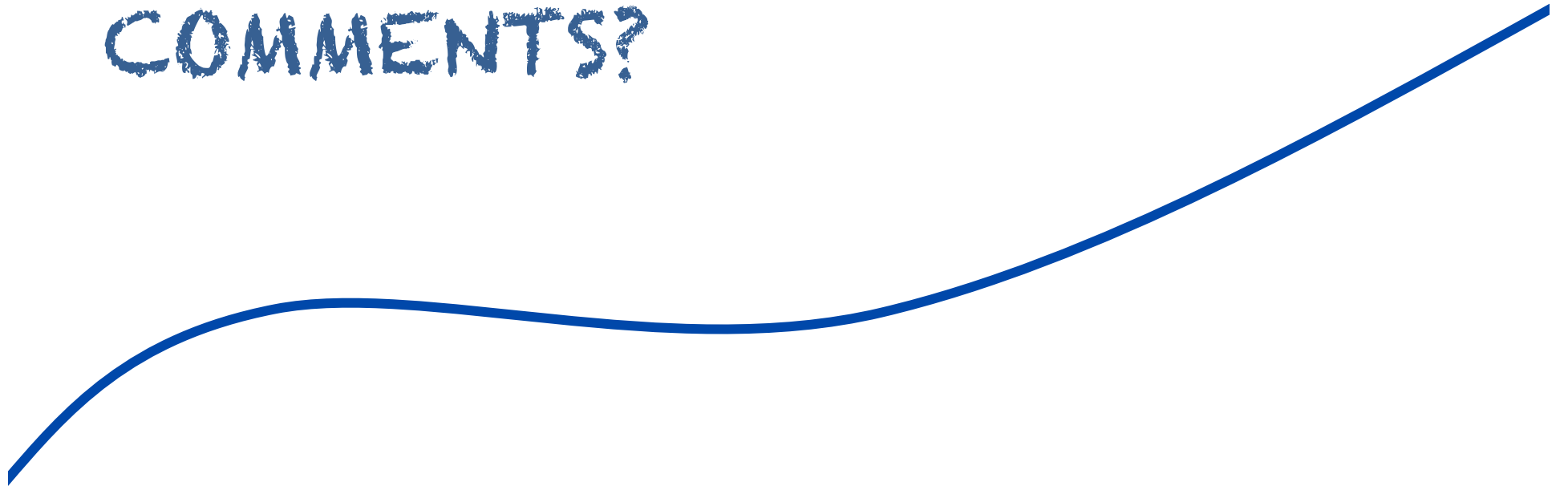
- In-depth expertise on some specific field/method (*‘the legs that you standing on’*)
- Capability and willingness to cooperate with experts from other disciplines and fields (*‘arms wide open’*)

→ This is also what 3courses and our Master’s Programme is about!



THANK YOU!

QUESTIONS?
COMMENTS?



ADDITIONAL SLIDES:
INTEGRATION



Integration =

a process of combining different items and issues together

to form a whole,

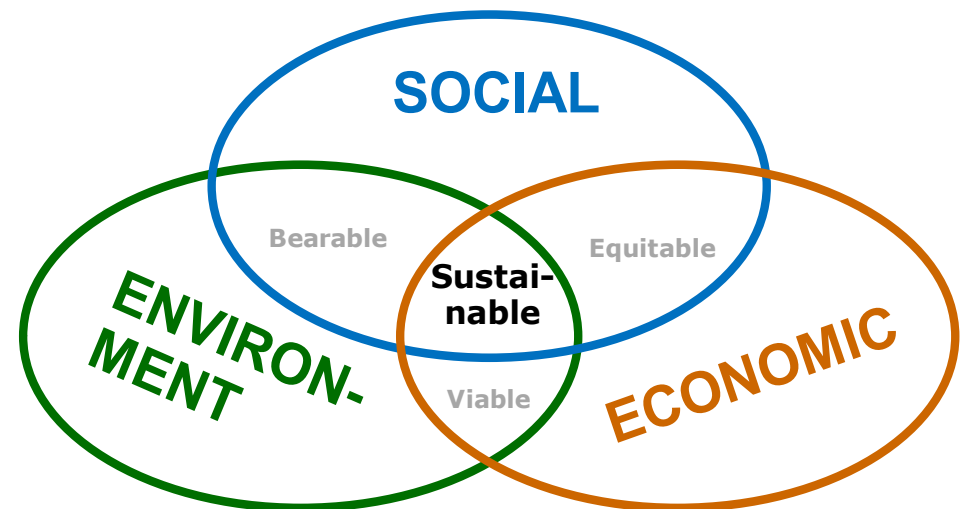
usually with an aim to gain a comprehensive, systemic view.

INTEGRATION

- The buzzword of the day:
almost everything should be ‘integrated’
 - Different fields:
 - Management, impact assessment, policies
 - Also research (‘multi-disciplinarity’)
 - Different sectors & areas:
 - Water, forests, land, rural development, urban planning, coastal zones...
 - Plethora of approaches (and acronyms):
IWRM, IRBM, IWM, ICZM, TWM, ILUP, IESM, IRD, IFM...

BACKGROUND

- Long, sporadic history (e.g. Egyptian farmers, the US in 1908)
- Present-day integrated approaches emerged in the 1970s as a response to **sectoral approaches**
 - Failure to consider environment + compartmentalisation
- The concept of **sustainable development** in 1980s
 - Brought in also people and their livelihoods (not just about protecting environment)



CHARACTERISTICS

- Integration means bit different thing in different contexts, but some general characteristics:
 - **Comprehensive** (understanding the context)
 - **Interconnected** (intricate interconnections within the context)
 - **Participative** (considering differing views)
 - **Goal-orientated** (what we actually want to achieve)
 - **Strategic** (long-term view + focus on key aspects)

DEFINING INTEGRATION

- Hence: integrated \neq comprehensive
 - Why not?
- The beauty of integration: accepts that we cannot cover everything in every management context, as it would become too complex & messy
 - Need to find the most relevant things to focus on
- Based on comprehensive view, yet focusing on the most relevant things in a specific context
 - Challenging, almost absurd task
 - 'Context-specific focusing' / 'strategic selection'

DIFFERENT DIMENSIONS

- Usually things to be integrated are themes or sectors, such as water, land use and forests
 - But several other things can be integrated, too: policy levels, institutions, tools etc.
- Three general dimensions *(Kidd & Shaw 2007)*
 - Sectoral integration
 - Territorial integration (vertically and horizontally)
 - Organisational integration (strategic & operational)

INTEGRATION IN WATER MGT

- Several integrated approaches in water field
 - *Integrated Water Resources Management (IWRM)*
 - *Integrated River Basin Management (IRBM)*
 - *Integrated Catchment Management (ICM)*
 - *Integrated Watershed Management (IWM)*
 - *Integrated Coastal Zone Management (ICZM)*
 - *Integrated Water Management (IWM)*
 - *Integrated Water Resource Systems (IWRS)*
 - *Total Water Management (TWM)*
- Out of these, IWRM most influential as it has been embraced by the UN & several key actors

IN SUMMARY...

- Various things to be integrated:
themes, sectors, institutions, scales...
- Broadly, integration is about
 - Sustainable development + defragmentation
- Essentially integration is about
comprehensive views with a focus,
to link different items more closely together
 - Ultimate aim should be:
equal & sustainable water management