Enhancing Competence and Industry Integration

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Abstract

Systems Engineering education and research requires a close relation with a context. This is a case study of the way that USN-SE runs a program that enhances competence and integrates with industry.

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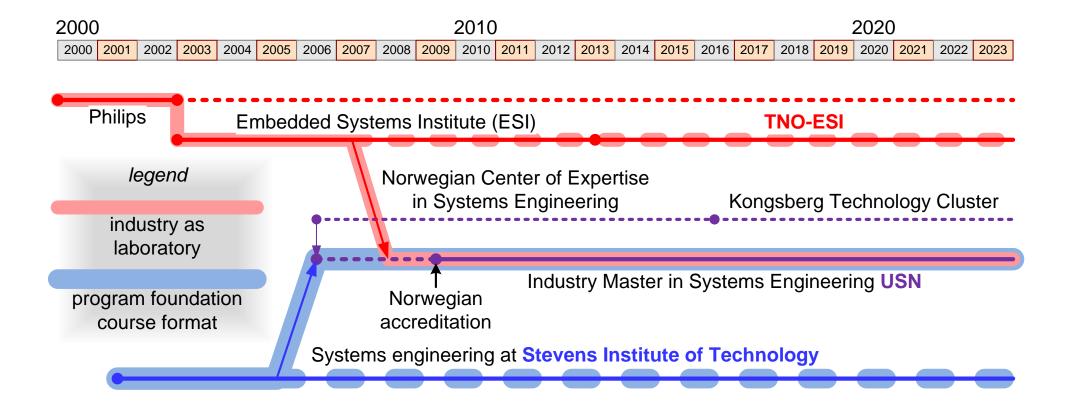
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September 16, 2023 status: planned

version: 0

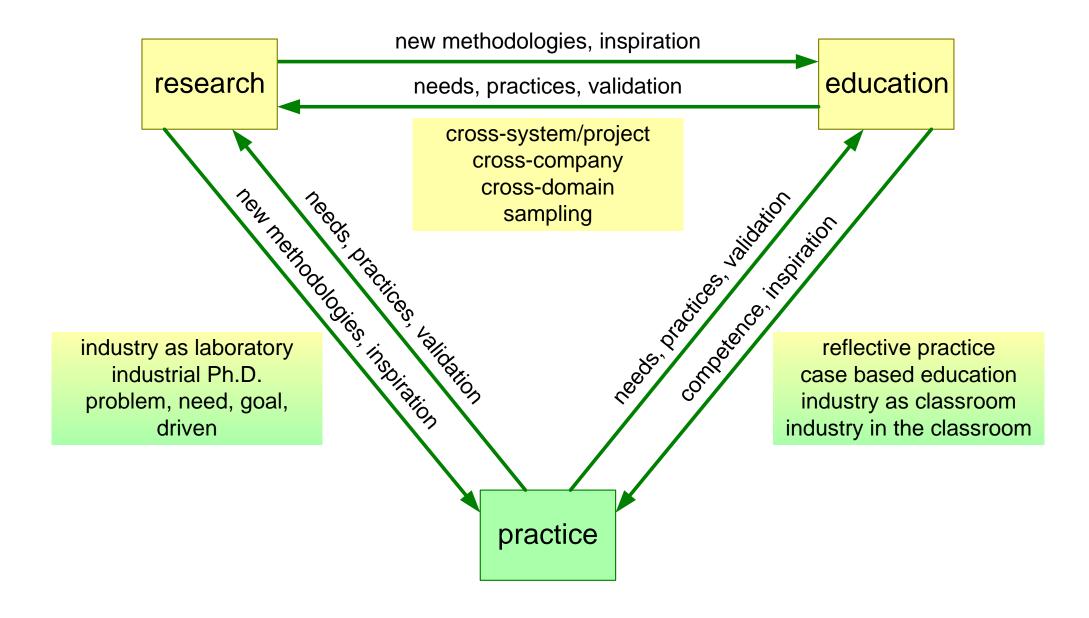


Genealogy of the Industrial Driven Approach





Evolve Research Education, and Practice Together





Systems Architecture Forum: Best Practices

One of several *prerequisites* for *architecture creative synthesis* is the definition of *5-7 specific key drivers* that are *critical for success*, along with the *rationale* behind the selection of these items

The essence of a system can be captured in about 10 models/views

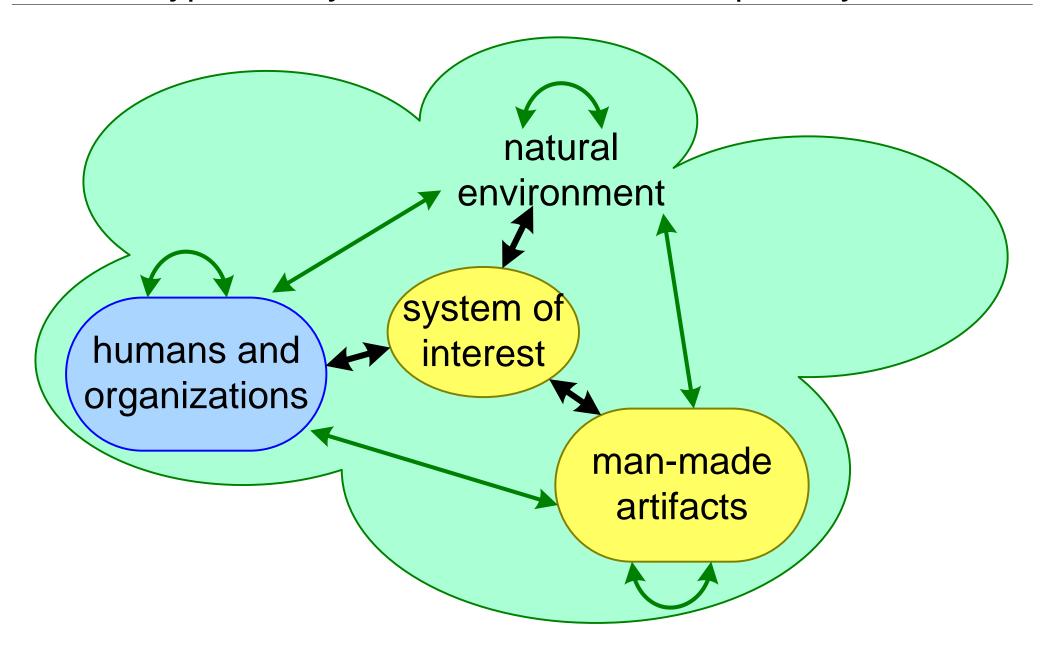
A *diversity* of *architecture descriptions* and *models* is needed: languages, schemata and the degree of formalism.

The level of formality increases as we move closer to the implementation level.

Architecting education must be framework and standard agnostic, but architects must have seen or used multiple frameworks and standards.

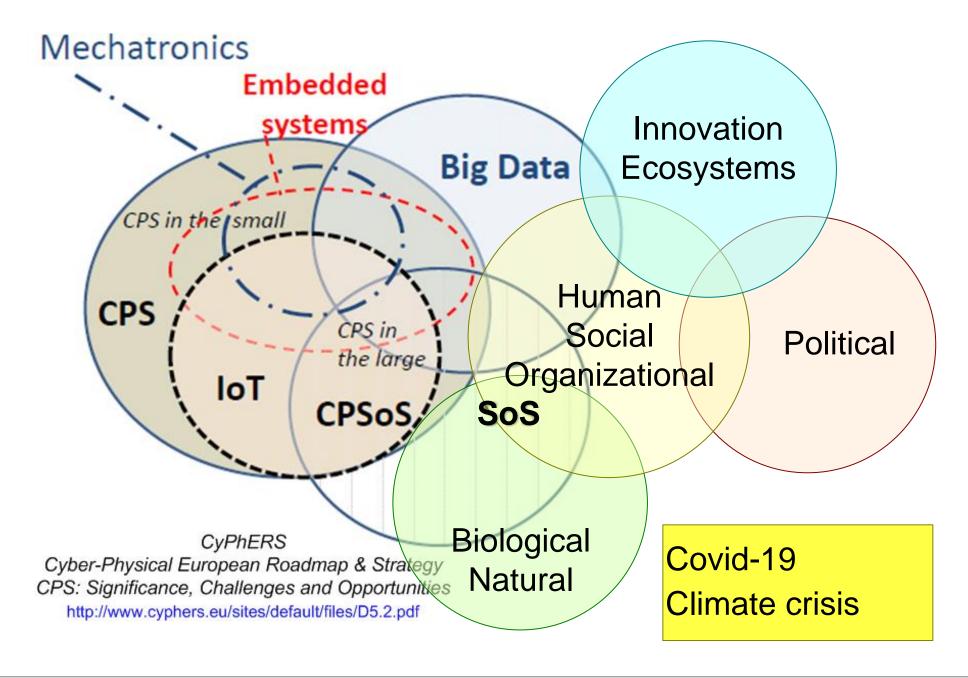


Various Types of Systems Form More Complex Systems





How Far Do We Expand Our Scope?





Relevant Social, Political, and Legal Perspectives

Political

Economic

Social

Technical

Environmental

Legal

Political

Economic

CAPEX

OPEX

time to deployment

life time

risks

viable business model Social

affordable for all

participation by all

disruption of deployment

side effects (e.g.noise)

Technical

readiness level

complexity

competence level

 effectiveness/ performance

robustness

Environmental

foot print

impact on flora and fauna

RFSBpestel

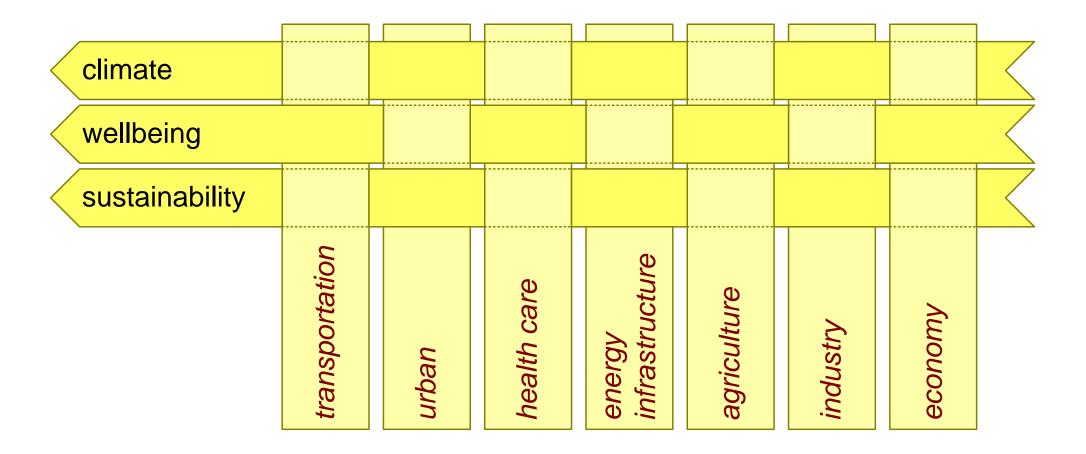
Legal

 fits in current legislation



Especially in Society's Major Challenges

Transdisciplinary competence integrates many disciplines to achieve objectives with desired quality attributes





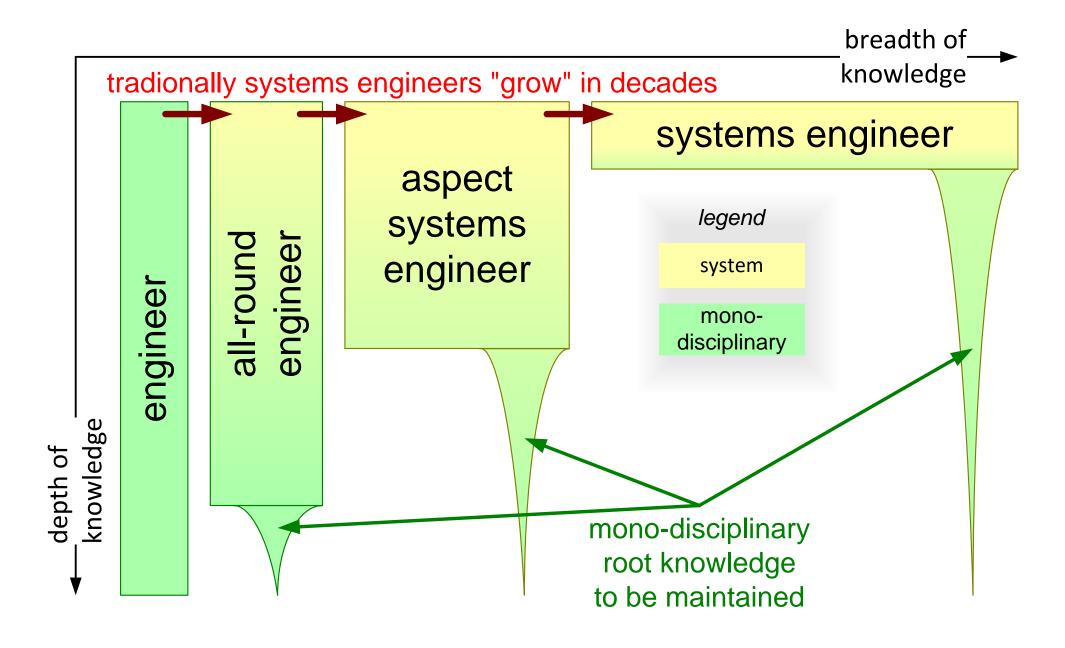
Vision behind the Industry Master

The objective of the industry master in systems engineering is to accelerate the competence development of new systems engineers, from e.g. 10..20 years in the past to 5..10 years.

Core of the acceleration is experiential learning, where offering theory and building up experience happens concurrently and is used to reinforce learning.

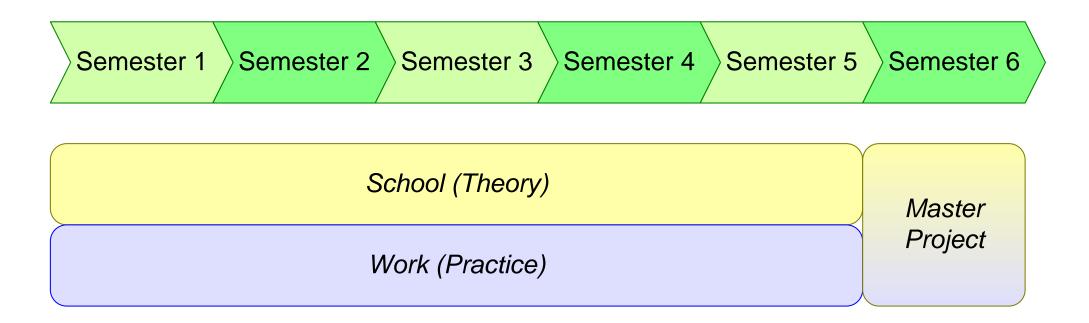


Historical: Growing Systems Engineers Takes Decades



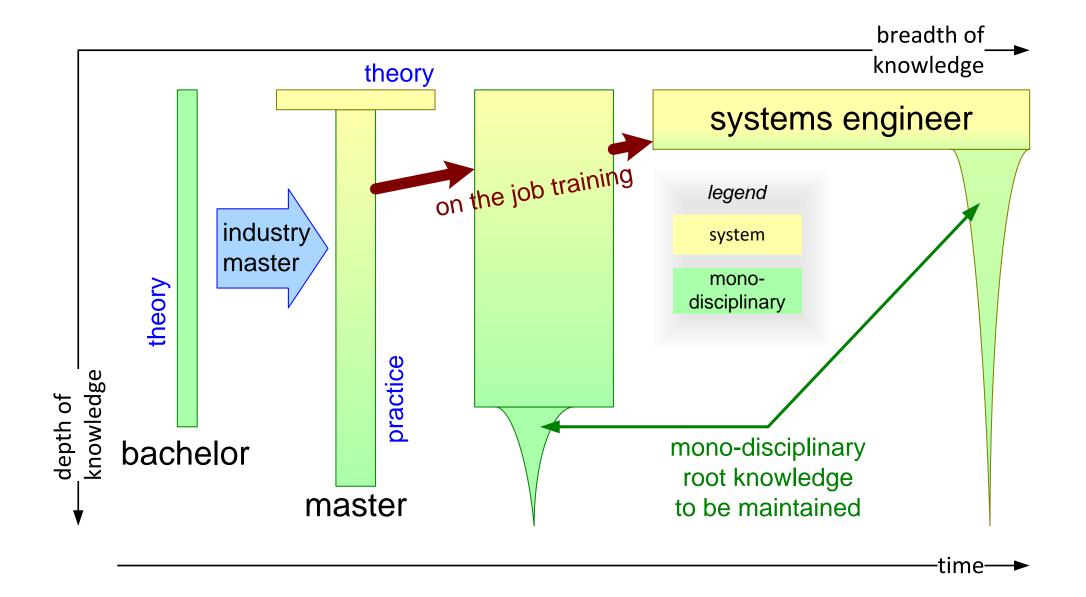


Work and Study Concurrently



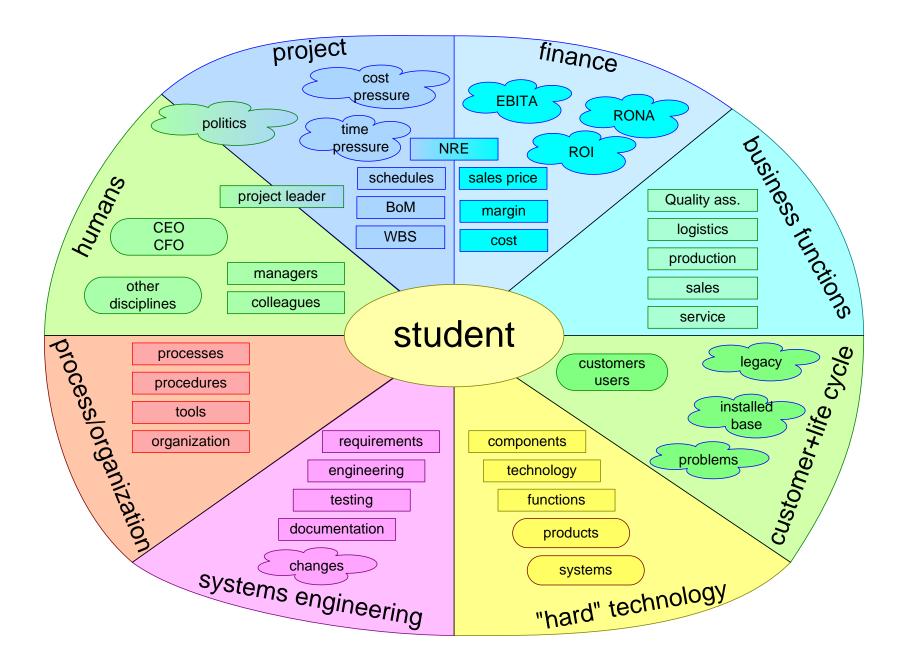


Intended Growth of Industry Master students





Overload of Impressions for Fresh Bachelors





What is Competence?

Attitude (perseverance, faith, critical, constructive, etc.)

train

Ability (know when to use what skill and knowledge)

apply/use often, experience

Skills (calculate missing angle, calculate hypothenusa)

exercise

Knowledge (triangle has 3 corners, sum of angles is 180 degrees, Pythagoras $c^2 = a^2 + b^2$)

learn

Competence = Knowledge + Skills + Ability + Attitude



Various Ways to Develop Competence

what how who participant coaching reflection **Attitude** assignments **Ability** practice teacher/coach lecturing exercises Skills Knowledge



Course Format and Pedagogic

Prepare

e.g. reading or online

0 to 20 hrs.

Intense course

lecturing, discussion, and in-class group work 40 hrs.

10 week homework assignment

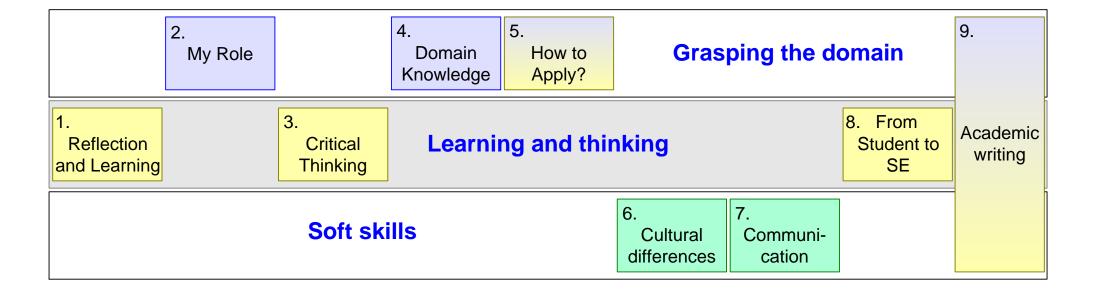
case-based, individual or group work, with supervision

140 to 160 hrs.

- Students travel 4 times per year
- Study and work planning is flexible
- Active learning, case-based
- Actual industry cases are possible (depends on course)

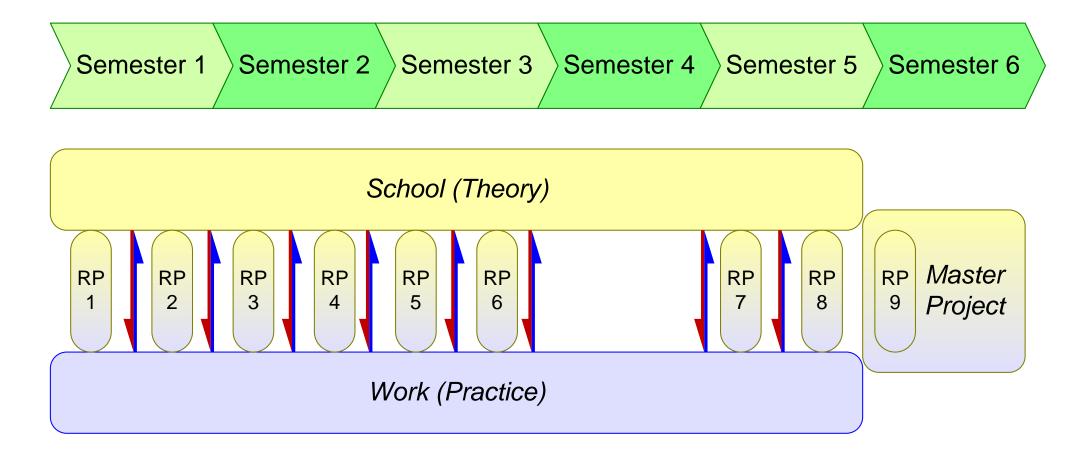


Reflective Practice; 9 Workshops in 3 Years



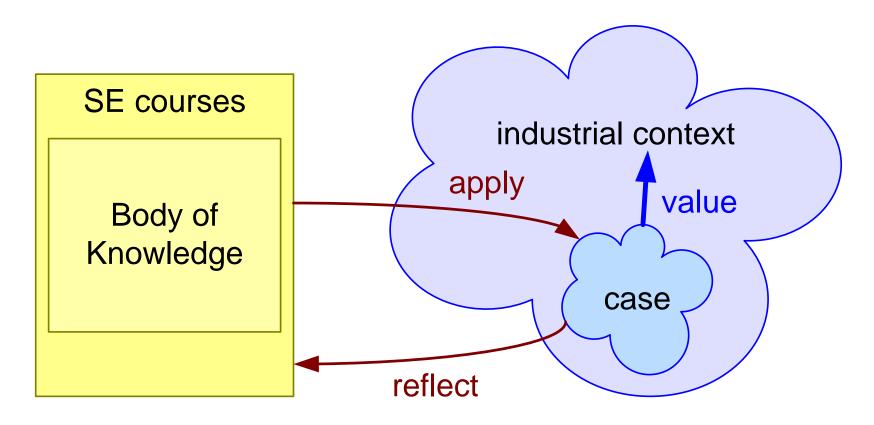


Reflective Practice Connects Study and Work





Objectives of Master Project



Apply part of the SE body of knowledge in practice and evaluate and reflect on its application, while providing value to the industrial sponsor



Industrial Networking

formal boards

strategic decision makers

Industrial Advisory
Board

tactical subject matter experts

Reference group

operational HRM

HR forum

KSEE
June

SESG
November, February

Xmas party

in-company courses
research

and a large amount of informal contacts

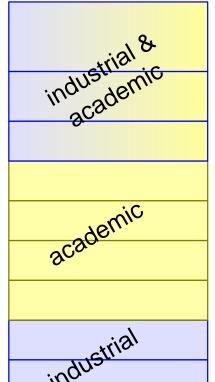


Challenge: Recruiting Industrial and Academic Staff

full-time academic staff

>10 years industry pp

PhD

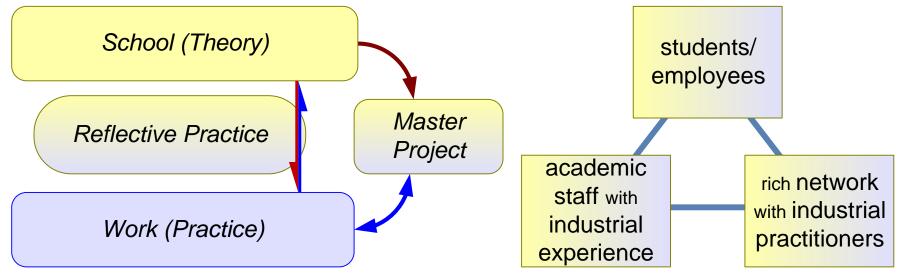


part-time academic staff

- highly experienced
- recognized
- broad coverage



Summary



Studying and working concurrently

Format and pedagogic of courses fits industry

Reflective Practice connects study and work

The master project is the closure

Continuous investment in industrial relations
Offering an inspiring environment and network
for practitioners, students, and staff

