No risk, no fun!
How to work successfully in inter- and transdisciplinary projects

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Working in a multidisciplinary environment: opportunities and pitfalls
October 24, 2016 - Budapest
Multidisciplinarity

1981 – 1986
PhD
Software Engineering

1987 – 1991
PostDoc
Information Systems

Model
Software

DB schema
Database

?
Multidisciplinarity

Software Engineering

Information Systems

Meta Model

Data Model

Model

DB schema

2 subdisciplines of Computer Science
2 different ontologies / methods
Multidisciplinarity

Several different disciplines with different (disjoint) ontologies / methods
1991 – 1997

Chair

Software Engineering and Information Systems
since 1997
Chair
Information Systems

Research Area: Software Engineering
Heinz Nixdorf (1925 – 1986)
German Computer Pioneer

Industry ↔ University

HEINZ NIXDORF INSTITUT
UNIVERSITÄT PADERBORN
• seven endowed chairs
  – interdisciplinary approach
    • computer science
    • mechanical engineering
    • electrical engineering
    • economics
    • (philosophy)
• seven endowed chairs
• corporate identity (board, marketing)
• high appreciation / reputation / success

Interdisciplinarity

Several different disciplines with aligned ontologies / methods
faculty structure

- Computer Science, Electrical Engineering & Mathematics
- Mechanical Engineering
- Business Administration & Economics
- Natural Sciences
- Arts & Humanities

Heinz Nixdorf Institute
Any organization that designs a system (defined broadly) will produce a design whose structure is a copy of the organization's communication structure.

-- Melvyn Conway, 1967
faculty structure

Silo faculty structure
- low coupling
- individual goals
- discipline-oriented quality assessment

Institute structure
- high coupling
- common goals
- goal-oriented quality assessment
4th industrial revolution: **Industry 4.0**

Cyber-Physical Social Systems (CPSS)

**Work 4.0**
4th industrial revolution: **Industry 4.0**

**Work 4.0**
- new role of employee
- impact on relationship between employer, unions, works council
4th industrial revolution: **Industry 4.0**

**Transdisciplinarity**

Ontologies / methods from one or several disciplines are transferred / applied in another discipline / domain

**Work 4.0**
- new role of employee
- impact on relationship between employer, unions, works council
Joint PhD School Work 4.0

- 10 professors
- 10 PhD students
- 1 coordinator
- 4 years
- external partners (unions, IT networks)

Mechanical Engineering
Product Development
Education
Computer Science
Software Engineering
Process Engineering

Sociology
Industrial Psychology
Computer Science
Sensorics
Robotics
Neuro informatics
• **Board** (4 professors, 2 PhD students, 2 external partners)

• **PhD supervision**
  – direct supervisor
  – PhD students in his/her research group
  – regular meetings of PhD students (coordinator or self-organized)
  – regular meetings of whole consortium
  – advisory board (3 professors)
  – interdisciplinary research question
  – feedback from external partners
  – access to works councils / employees
“In theory, theory and practice are the same. In practice, they are not.”

Anonymous
Pitfalls –

Professor

• „takes“ the money

• integrates PhD student as „regular“ PhD student in his/her team

• leaves university

• not open to interdisciplinary work (time, fear, no reputation)
Pitfalls –
PhD student

• „takes“ the money
  – wants only a PhD

• is isolated in the research team of his/her supervisor

• leaves university

• not open to interdisciplinary work (time, fear, hard to publish, additional time for discussion with other PhD students)
Pitfalls –

Interdisciplinary work

• discipline-specific research methods
  – analytical
  – constructive
  – empirical

• discipline-specific culture / publication methods
  – in-between, at-the-end
  – co-authors
  – journal, conference
Remedies

• careful selection of team
  – professors
  – PhD students

• strong leadership
  – discussions / meetings (individual, group)
  – distribute/assign responsibilities

• incentives for interdisciplinary work
  – new quality criteria
  – appropriate publication means
Heinz Nixdorf (1925 – 1986)
German Computer Pioneer

Industry  University

Technology Transfer  PhD School Work 4.0
Topics of modern ICT systems

- Software Engineering
- Digital Transformation
- Big Data Analytics
- Security
- Cloud Computing
- Mobile Applications
- Cyber-Physical Systems
- Embedded Systems Design
Software Innovation Campus Paderborn

SI-Lab

cooperation

on campus
or
in the company

Paderborn University

Faculties
- EIM
- WIWI
- MB
- ...

Institutes
- HNI
- PC²
- ...

Fraunhofer

SICP Partner

Atos
Fujitsu
resolto
UNITY
WINCOR
NIXDORF
REDKNEE
SIEMENS
## Competence Centers

- **no technology silos, but strong cooperation**
- **no static structure, but agile and competent teams**

<table>
<thead>
<tr>
<th>Competence Center</th>
<th>Director</th>
<th>Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cloud &amp; Mobile Systems</strong></td>
<td>Prof. Dr. Holger Karl</td>
<td>Dr. Simon Oberthür</td>
</tr>
<tr>
<td><strong>Cyber Physical Systems</strong></td>
<td>Prof. Dr. Falko Dressler</td>
<td>Dr. Bernd Kleinjohann</td>
</tr>
<tr>
<td><strong>Digital Business Innovation</strong></td>
<td>Prof. Dr. Dennis Kundisch</td>
<td>Dr. Stefan Sauer</td>
</tr>
<tr>
<td><strong>Smart Systems</strong></td>
<td>Prof. Dr. Eyke Hüllermeier</td>
<td>Dr. Gunnar Schomaker</td>
</tr>
<tr>
<td><strong>Software Engineering</strong></td>
<td>Prof. Dr. Gregor Engels</td>
<td>Dr. Stefan Sauer</td>
</tr>
</tbody>
</table>
Benefits of SICP

• single entry point for industry
  – in particular for SMEs
• adequate interdisciplinary team of researchers for each project
• centralized experience (proposals, contracts, IPR, budgets, employments)
• higher visibility of university
• knowledge exchange
Pitfalls

• **Professor**
  – doesn‘t understand the benefits
  – „can do everything“
  – afraid of loosing visibility / reputation / money

• **PhD student**
  – likes project work, forgets PhD

• **Research**
  – soft border between research and development
Remedies

• **Win-Win is the key!**
  – university, professor, Phd student
  – industry

• **long-standing relationships**
  – trust, appreciation
  – competence
Conclusions

• multi-, inter- and transdisciplinary work is needed to solve nowadays problems
• it needs additional effort and time
  – to cooperate in teams
  – to manage the people
• it is more risky
  – diverse backgrounds, expectations
  – unclear rewards
• it is more fun
  – broadens the horizon
  – greater impact

No risk, no fun!
Thanks
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