International Perspective on Collaborative Research and Education

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Position of Denmark
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Collaboration

Incentives-needs

Mechanisms

Partners
Collaboration: Incentives - Needs

Externally sponsored (EU, UN, …)

EU-ERASMUS (encourage mobility of students)

EU-Research projects (ITN, NMP-big, NMP-small, …)

Bilateral

Country level

University – Department level

Research center/group/faculty level
Collaboration: Partners

Countries

Universities/departments

Research centers/groups

Individuals
Collaboration: Mechanisms

Education

Summer schools, workshops, courses …

Research

Visiting researchers (informal)

Exchange of visits (formal)

Faculty/postdoc

PhD students

MSc students
Model based framework

\[ \log P_i = A_i + \frac{B_i}{(C_i + T)} \]

**Property models**

**Process models**

\[ \frac{dm_i}{dt} = f_{in,i} - f_{out,i} - r(m, T, P)V; i = 1, NC \]

### Models for environmental impact
- Operation models
  - Process models
    - Property-kinetics models
  - Cost models

### Models for sustainability metrics
- Product manufacturing model
- Product evaluation model
Models and relationships

Models:
Process/product
\[ \frac{dx}{dt} = f(f, u, d, \theta, x) \]
\[ y = g(x) - y^* \]
\[ \beta = \beta(C, f, x) - \beta^* \]

Sustainability Metrics
\[ S_e = S_e(f, u, x, y, d, \theta) \]
\[ S_i = S_i(C, f, x, y, \theta) \]
\[ S_s = S_s(\text{size, profit, } ?) \]

Safety & Hazards
\[ H_c = H_c(C, f, x, y, d, \theta) \]
\[ H_p = H_p(u, f, x, d, \theta) \]

To solve problem: supply \( \beta^*, \theta, C, f, d, u^*, y^* \)
Managing the complexity through collaboration

**Issues**

- System boundaries
- Models (of different types, sources, ....)
- Data (from different sources, )
- Multi-objective & multi-discipline
- ........

**Collaboration** = systematic solution of problems by efficient management of the complexity
CAPEC collaboration activities 2012

4  Number of faculty members
30-36  Total number of personnel
16  Number of current PhD students
12  Number of visitors (students, postdocs, ....)
13  Number of countries representing CAPEC personnel
3  Number of active EU-funded projects
10  Number of international active collaborations within academia
31  Number of active collaboration agreements with companies
> 70  Number of academic licenses for ICAS (CAPEC software)
7  Number of workshops, summer schools, short courses, ..
14  Countries represented in the CAPEC industrial consortium