Supporting PSS innovation processes by an integrating model grid

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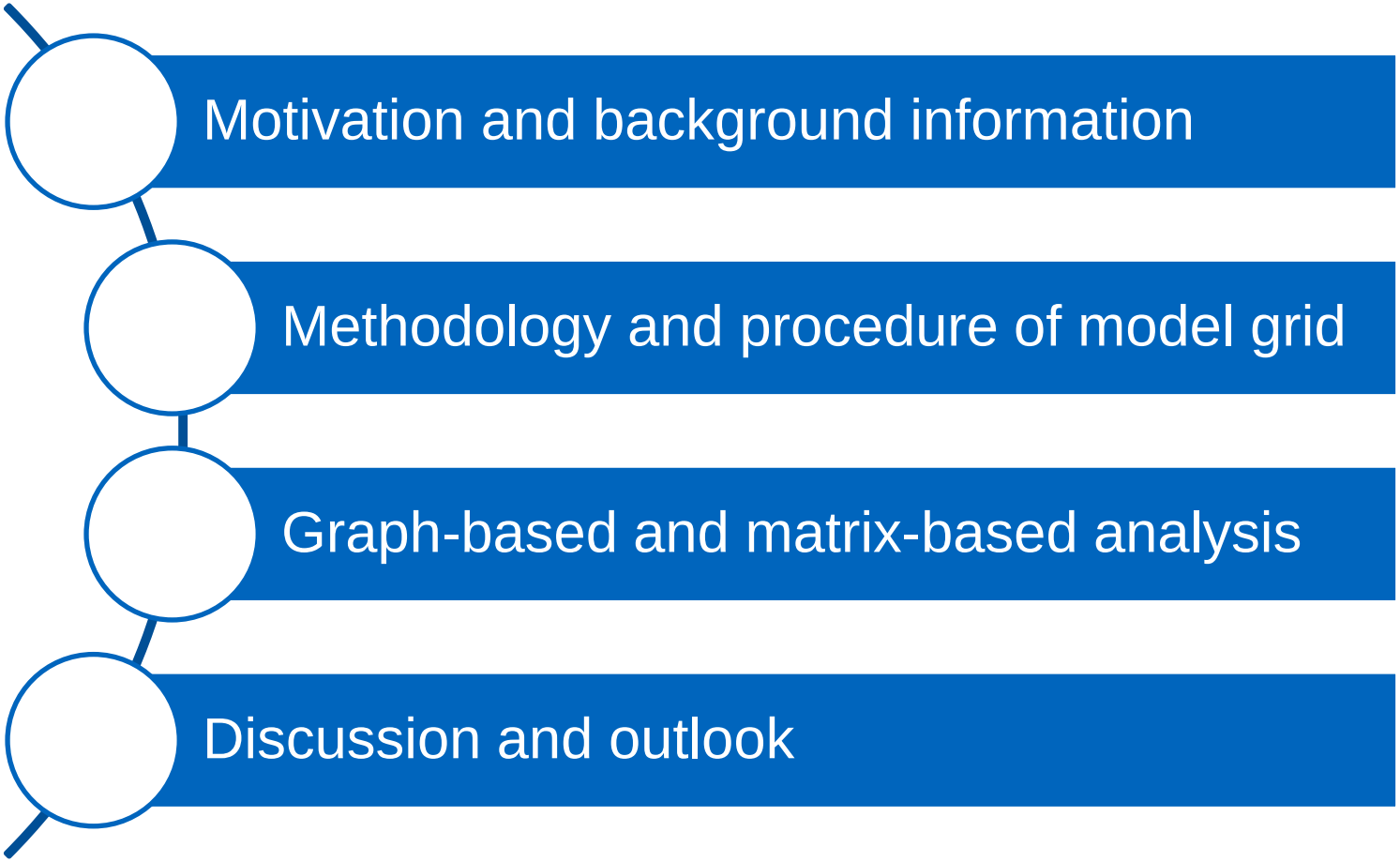
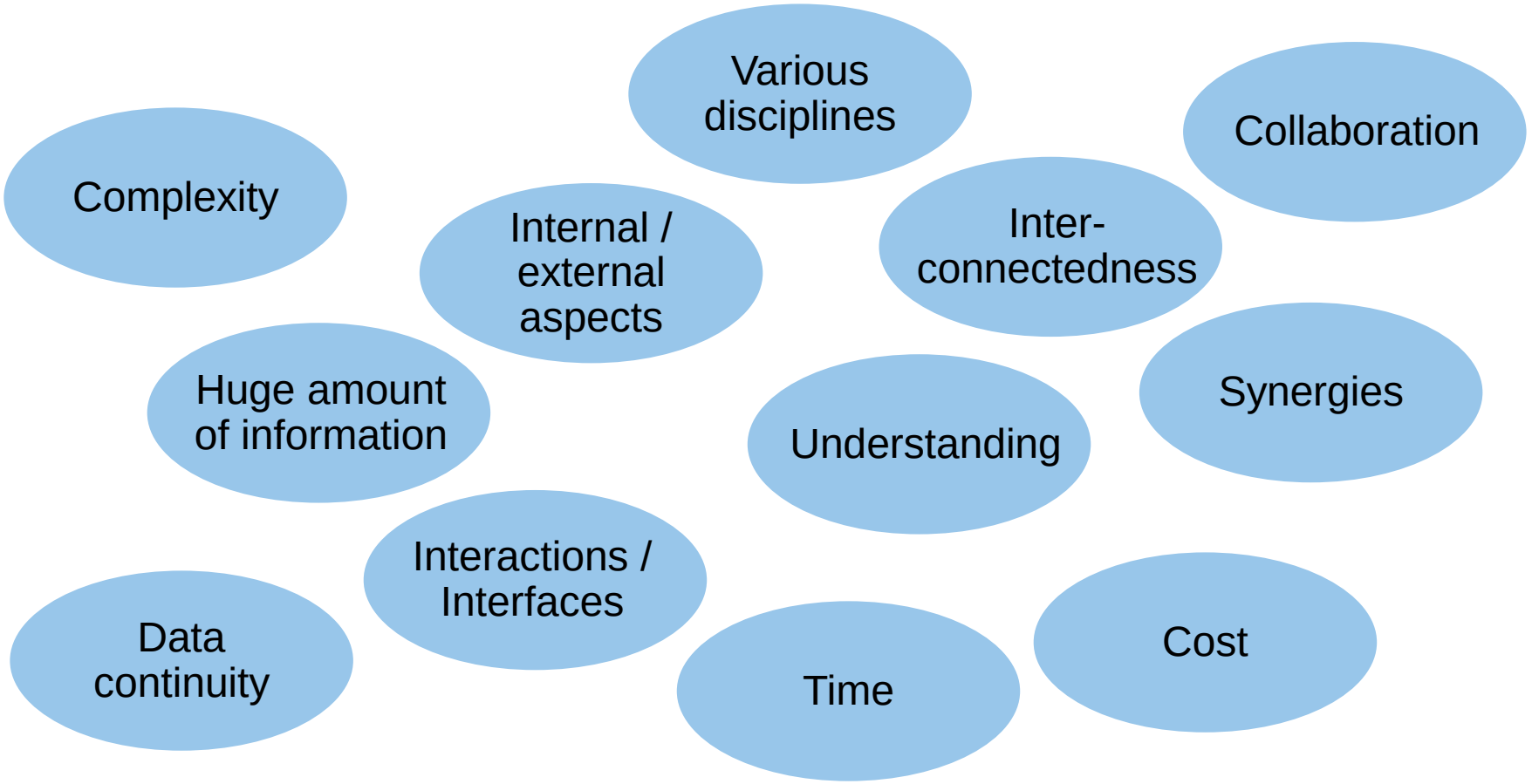
Agenda



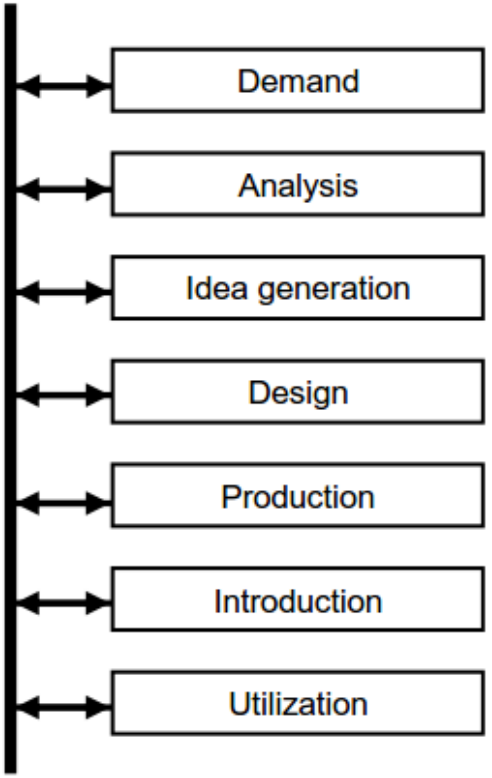
Motivation

Numerous influencing factors on product-service systems:



Background Information

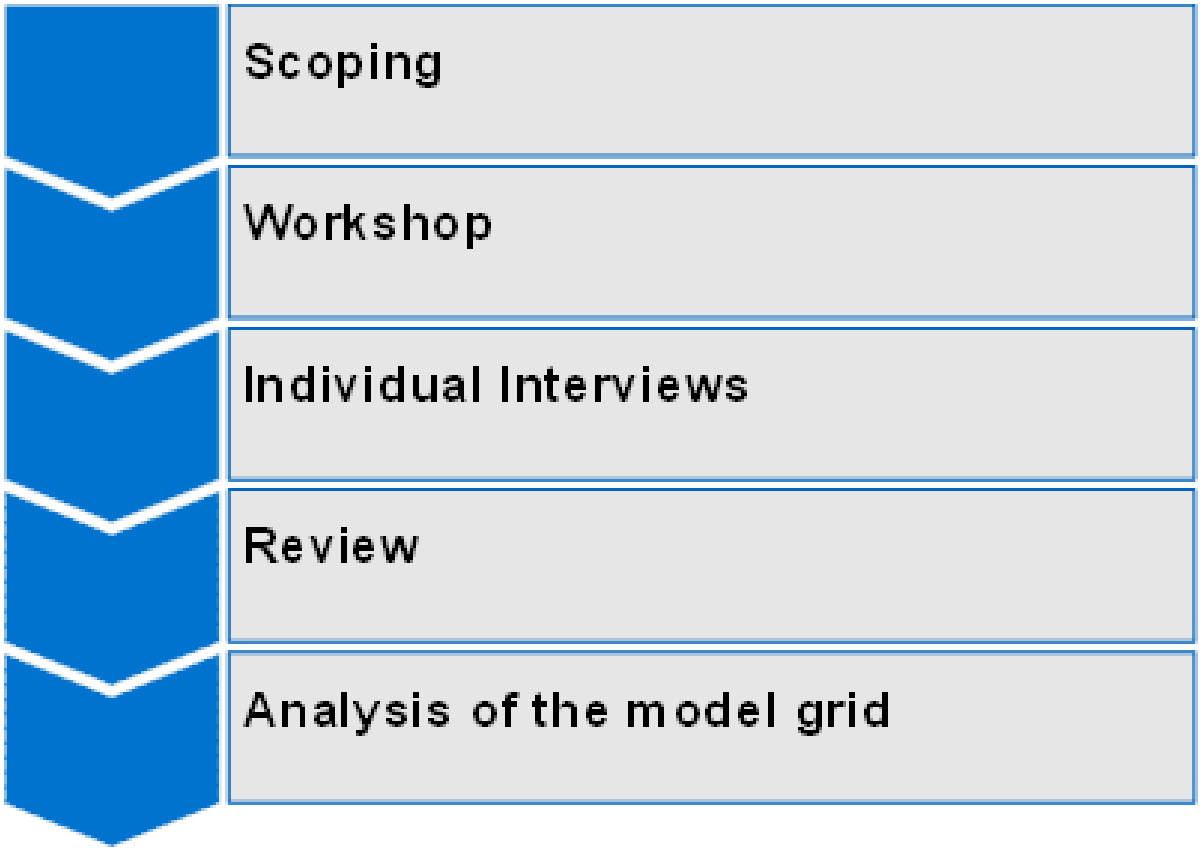
- **Collaborative Research Centre** for managing cycles in innovation process of PSS in Munich, Germany
- **Innovation Processes of Product-Service Systems**: Complete process from demand, design, and utilization of PSS
- **Model Grid**: network of models that integrates models covering the socio-technical, economic, and patent situation at the environment of the innovation process as well as customer behavior



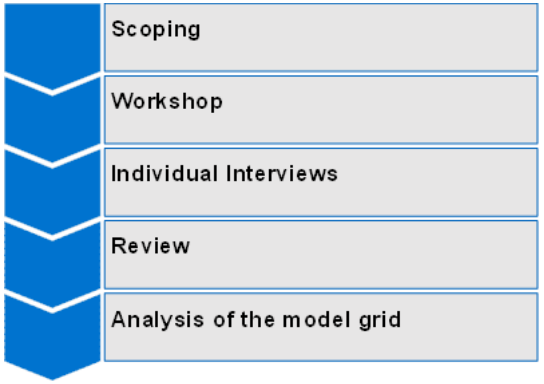
Phases of the innovation process of PSS

Methodology

Procedure for developing the model grid in the context of PSS innovation processes



Procedure (1of4)



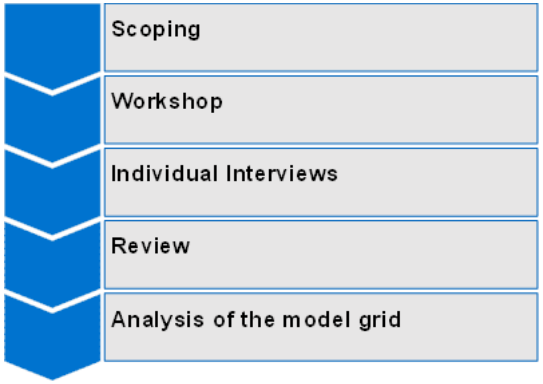
Scoping

- Common understanding
- Supporting collaboration
- Specifications of procedures, models, interfaces, relations
- Definition of interfaces

Workshop

- Collection of data
- Estimation of scope
- Nomenclature and degree of abstraction
- Identification and classification of models, interfaces and relations

Procedure (2of4)



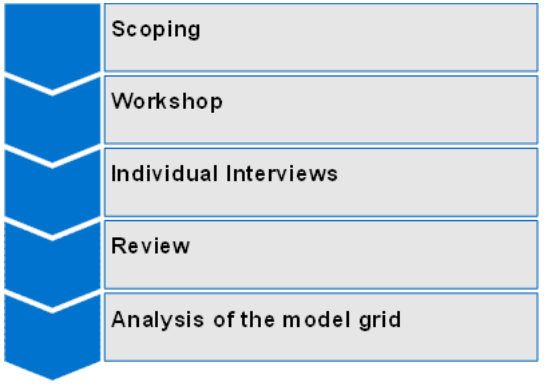
Individual Interviews

- Extensive rethinking of previoud decisions
- Refinement of data
- Significant changes
- Recognition of influences of other models
- Identification of synergies
- Increase of understanding

Review

- Group discussion of models, interfaces, relations
- Verification
- Refinement
- Minor iterative loops

Procedure (3of4)



Analysis of the model grid

Documentation Sheet for each model

- Proper documentation
- Assessing model's quality and scope
- Transparency
- Reproducibility
- Easy to understand
- Adequate detailing
- Categories:
  - Name
  - Description
  - Aim of model
  - Representation by
  - Ability of experimentation
  - Illustration

Structural model of PSSycle

SFB 768

Description:

The model itself consists of several structural models in different stages of the development of the PSSycle project and represents the behavior of development processes in its entirety. It constitutes an extension of classical structural models by the component of time in order to represent the dynamics of development processes. Relationships between development, requirements and development of components in software, hardware and service depicted.

Aim:

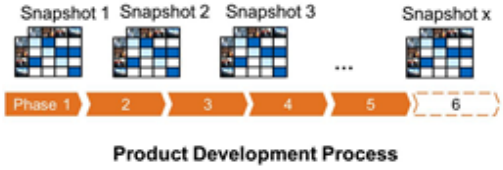
Analysis of the temporal development of the PSSycle project and identification of influencing factors. The model forms the base for the development of a System Dynamics model of PSSycle development process in order to test various scenarios.

Representation by:

Multiple-Domain-Matrices

Ability of experimentation:

Relations between elements (development, requirements and development of components in software, hardware and service) as well as the elements themselves can be modified to see what affects the development process. This allows the identification of critical elements.

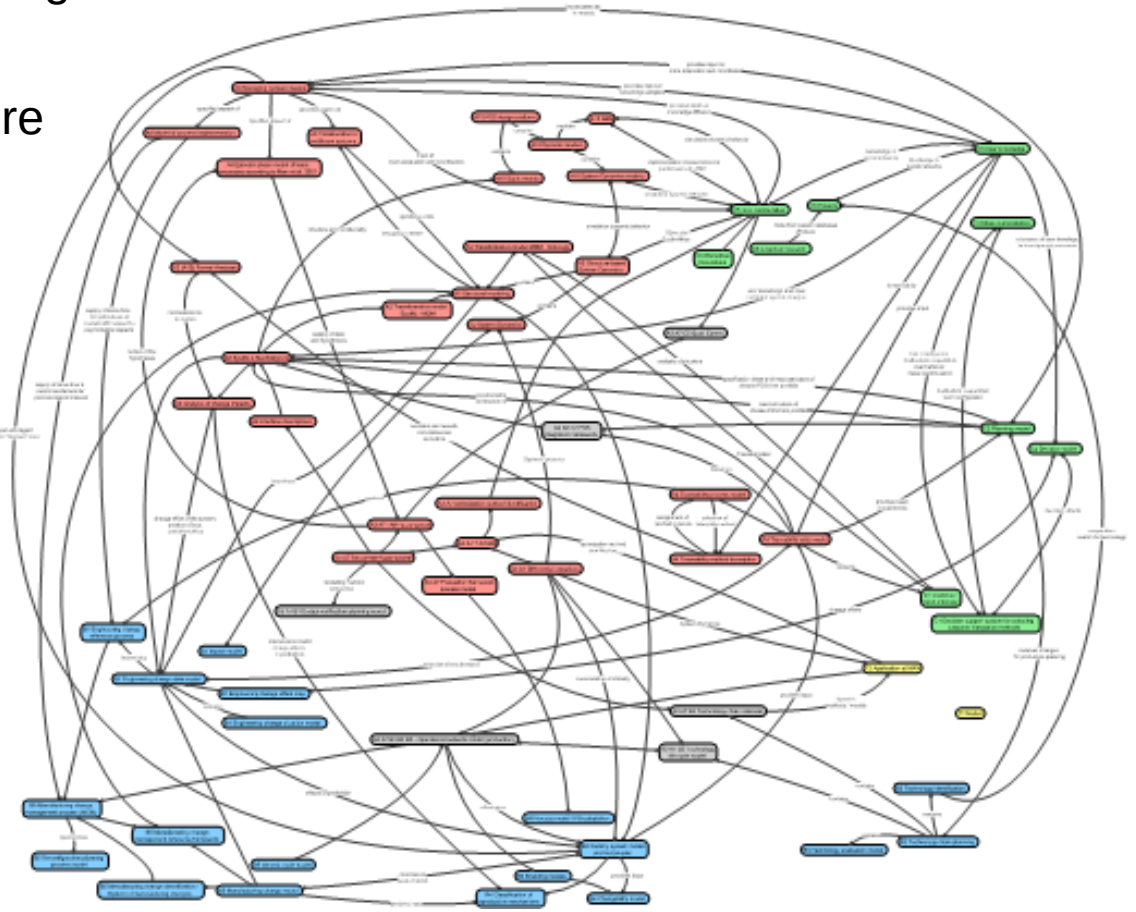


Product Development Process

Procedure (4of4)

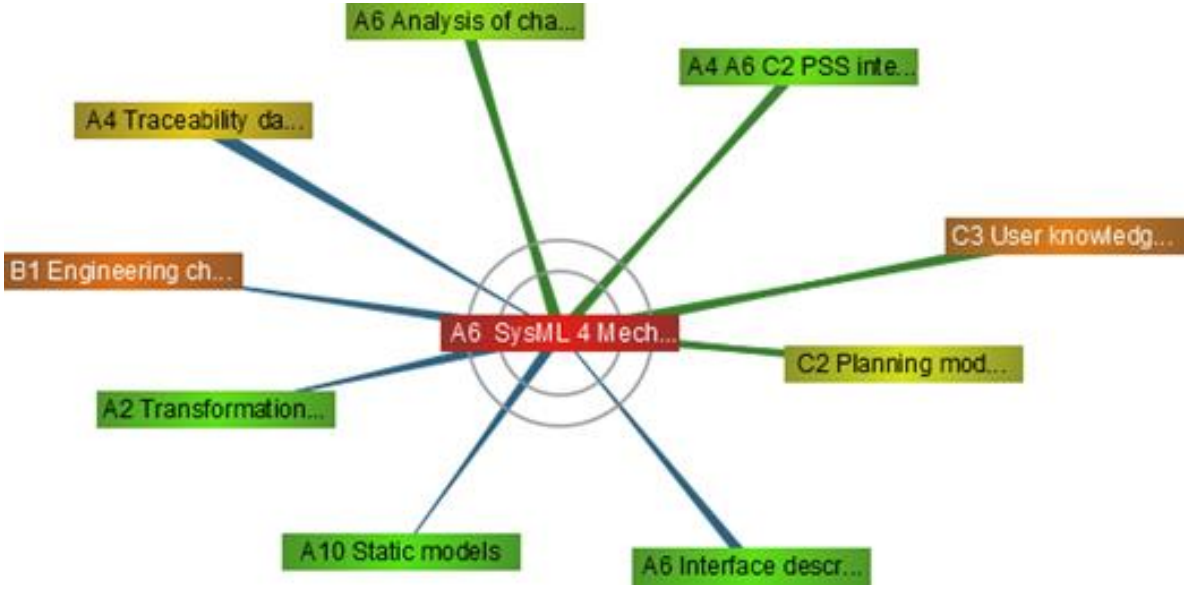
Analysis of the model grid

- Creation of the complete model grid with 64 individual models
- Illustration and overview
- Classification of model structure in different project areas:
  - Process Foundations (red)
  - Creating Solutions (blue)
  - Market Orientation (green)
  - Transfer projects (yellow)
  - Shared models (grey)
- Labelling of relations



Analysis of the model grid: Graph-based analysis

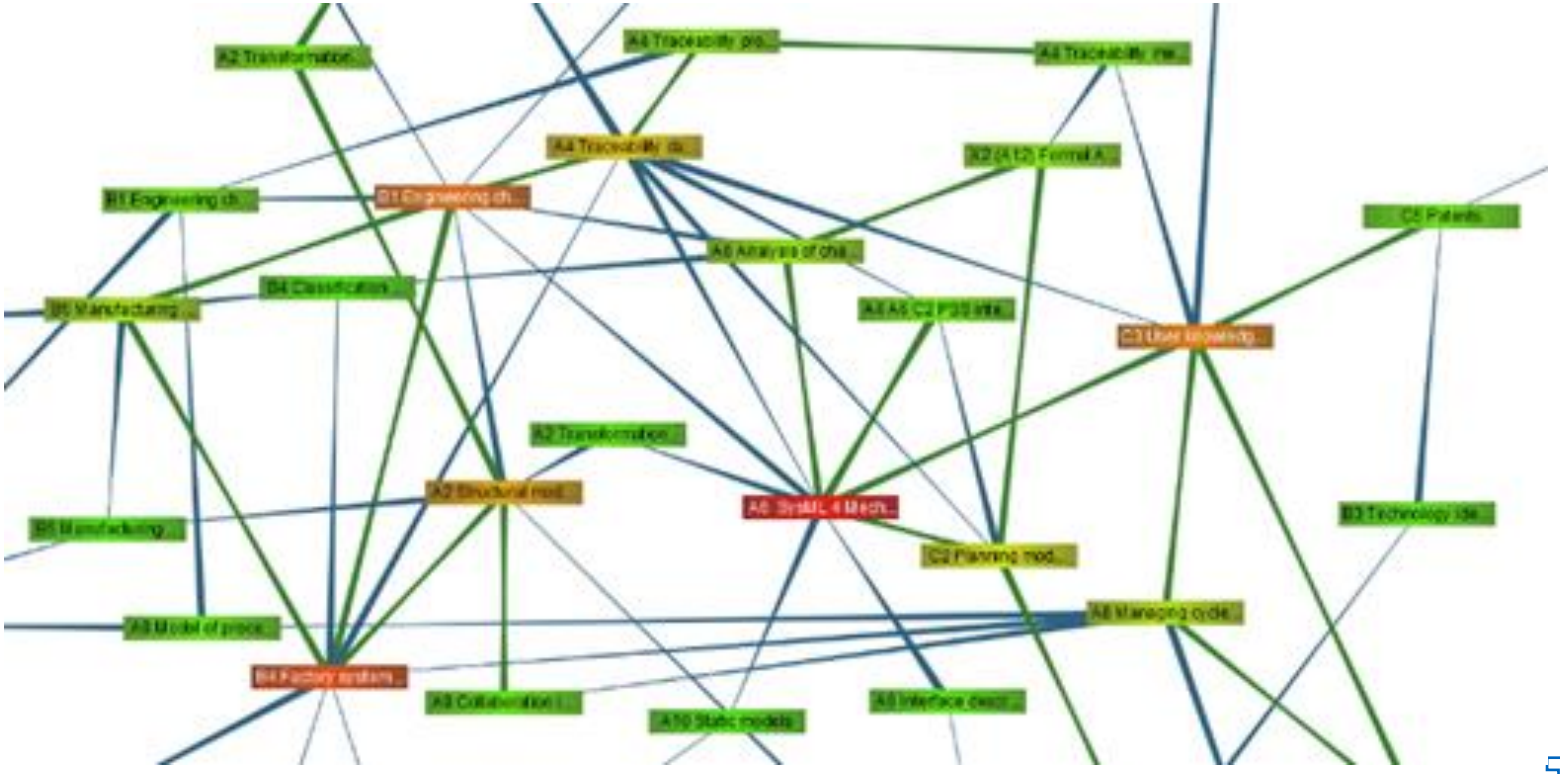
- Product of incoming and outgoing relation is considered as **criticality**
  → the higher criticality the higher the importance for the network
- **Reallocation** based on their criticality
  → the higher criticality the more central location within the model grid
- Identification of **areas of interest** for PSS-innovation
- Coloration from red (very critical) to green (not so critical)



Analysis of the model grid: Zoom-in

New form of the model grid serves as possibility for identification of:

- Overlaps
- Interfaces
- Shared models or resources
- Potential synergies



Analysis of the model grid: Matrix-based analysis

Additional analysis metrics:

- **Clustering algorithms** → identification of clusters of models
  (clusters are groups of models that are largely independent from other areas)
- Sorting of elements by **activity** or **passivity**
- Identification of particular **network constructs** such as leaf elements
- Further indication of:
  - Dependencies
  - Intensities and directions of connections
  - Interferences and overlaps which might not have been considered so far

→ Allows for additional collaborations and synergies

Discussion and Outlook

- Tool for creating an **integrated model understanding**
- Illustration and **management of complexity** in interdisciplinary model networks
- **Integration of models** covering the specific customer behaviour, socio-technical, economic and patent situation in PSS innovation processes
- **Improvement of interconnectedness** of models
- Identification of specific types of models, such as highly interconnected or critical models
- **Support of data sharing and data continuity** between individual models and persons in charge as well as whole domains
- Explicit **representation of knowledge** within and for the innovation process
- Iteration because of a lot of different views on models, interfaces and relations → assimilation of these different points of view
- Common understanding and agreed definitions as key prerequisite for collaboration in academic as well as industrial environments
- Further attention on data continuity, data redundancy and effort to benefit ratio

Thank you for your attention!

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