

What is Subject-Orientation? - a compact introduction

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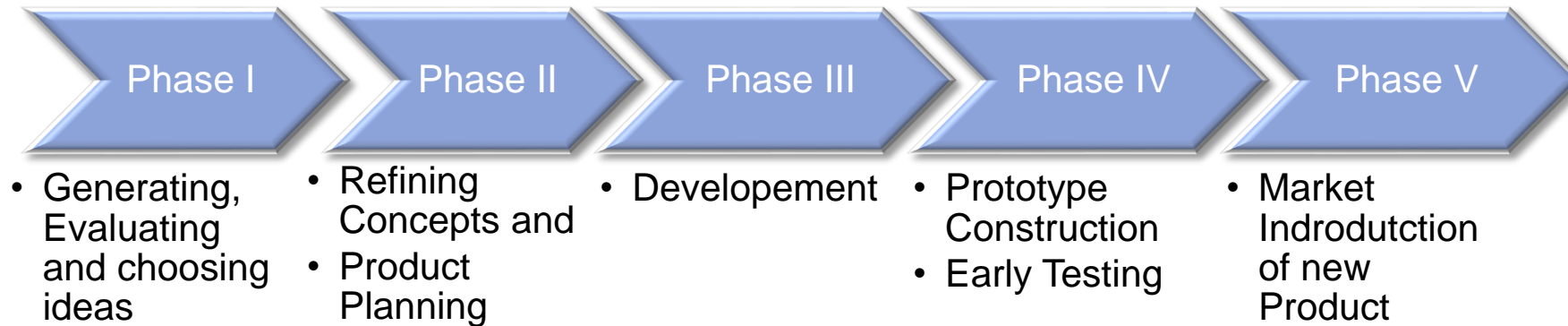
IMI Research Unit PM²EA*: Introduction

- Dr.-Ing. Dipl. Wi.-Ing. Matthes Elstermann
- Researcher, Lecturer, and Research Unit Lead for “Process Modeling and Management Applications in Engineering” at
- Institute for Information Management in Engineering
- Research topics:
 - **agile development approaches** for cross-domain product and service development
 - strategic + early stage **product development**
 - suitable **applications for the subject-oriented business process management and modeling (S-BPM) paradigm** in engineering
- Lectures:
 - Computer Science for Engineers (incl. OO-Programming)
 - Technical Information Systems
 - Information Engineering
 - Product Lifecycle Management
- Projects: intwertL, Delfine, DRIMPAK, dimenSion, Adistra,

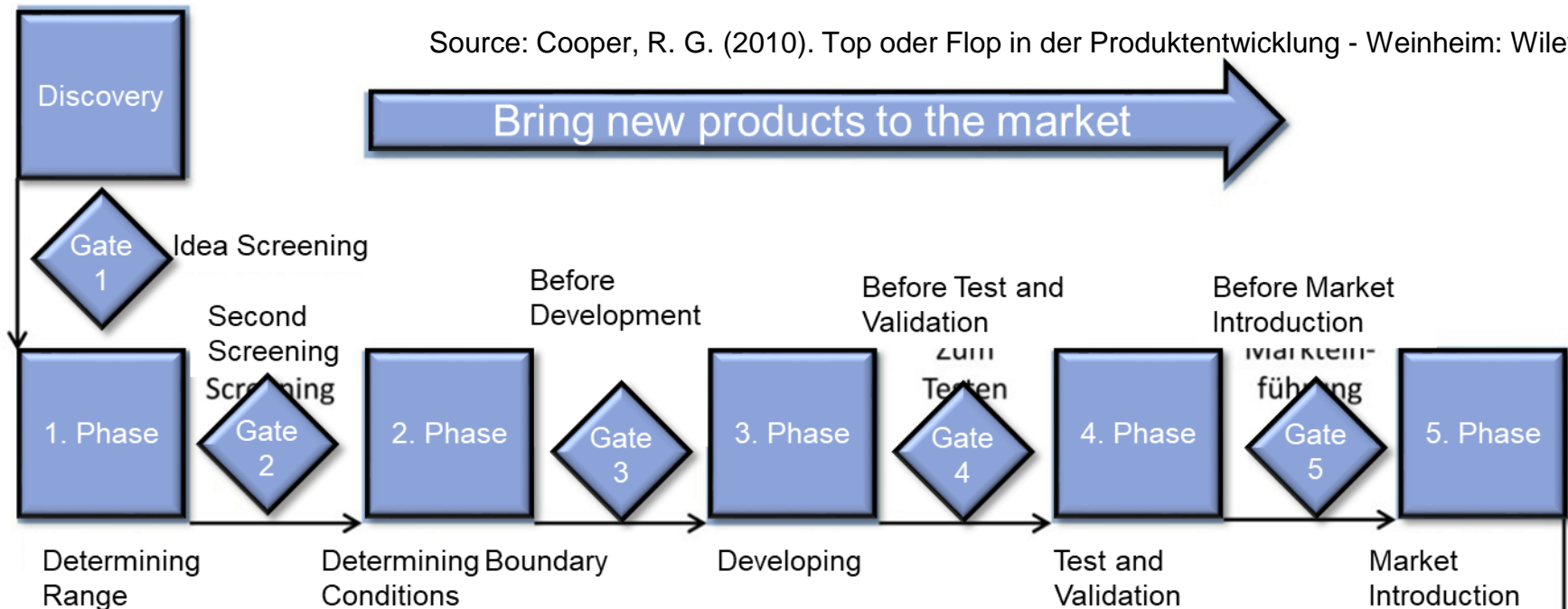


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Typical Phase Based Process Concepts (Innovation Management)

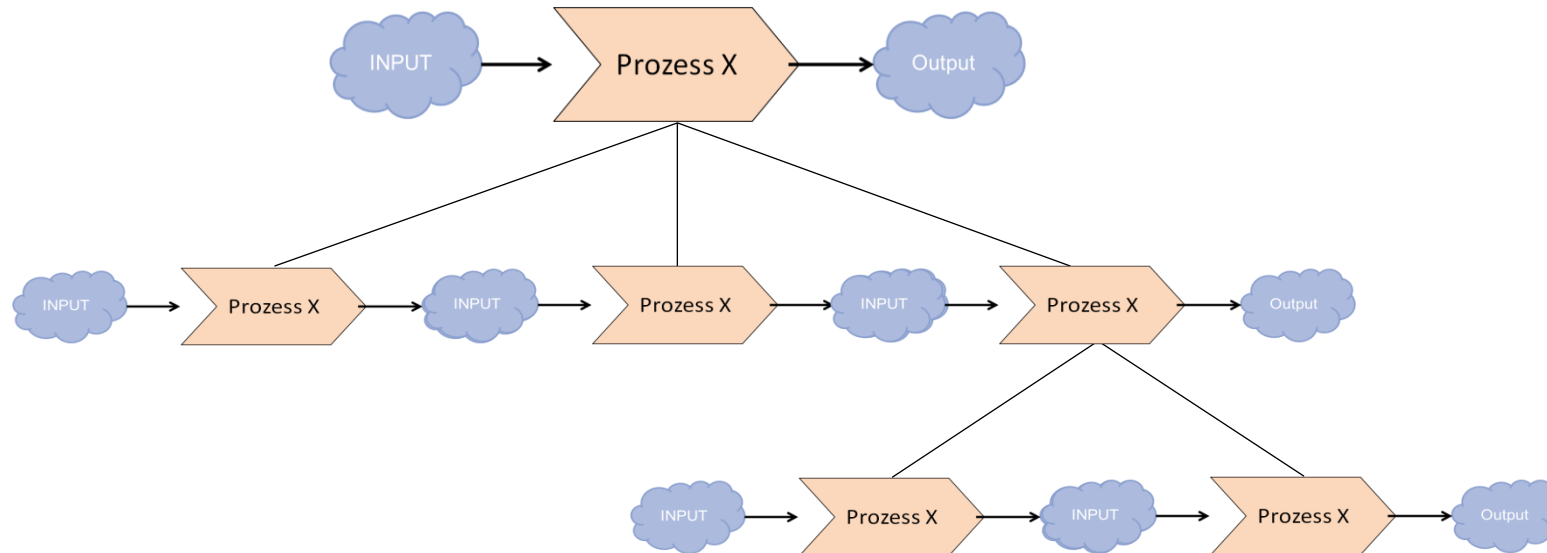


Source: Herstatt, C., & Verworn, B. (2007). *Management der frühen Innovationsphasen*



Source: Herstatt, C., & Verworn, B. (2007). *Management der frühen Innovationsphasen: Grundlagen - Methoden - Neue Ansätze.*

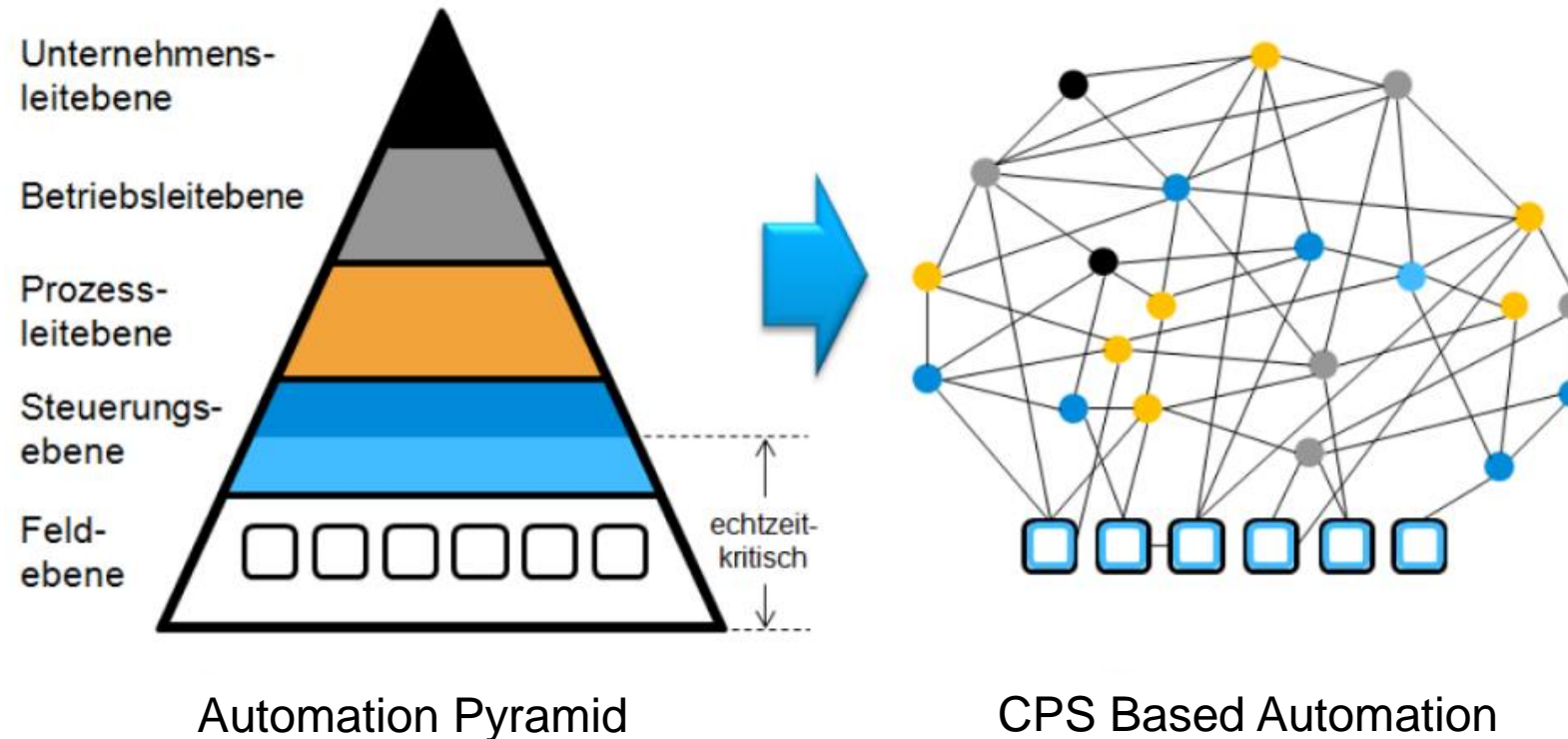
Typical Idea/thinking Concept for Processes



- + Very **simple** and intuitive
- + good for physical, **linear** production processes
- (sub) **task/activity** as the only **abstraction** mechanism
- Tracking of variants infeasible (see procedural programming)
- Complex if **more than one type of in/output** is involved (temporal vs. causal logic → equivalent to “spaghetti code”)
- **Cycles** and iterations break description logic

Not a new Realization: Changing Concepts for Cyber Physical System (CPS)

- Especially in the context of Industry 4.0 Modern Manufacturing Execution Systems (MES) can and **should not be described and understood as a hierarchical structure.**



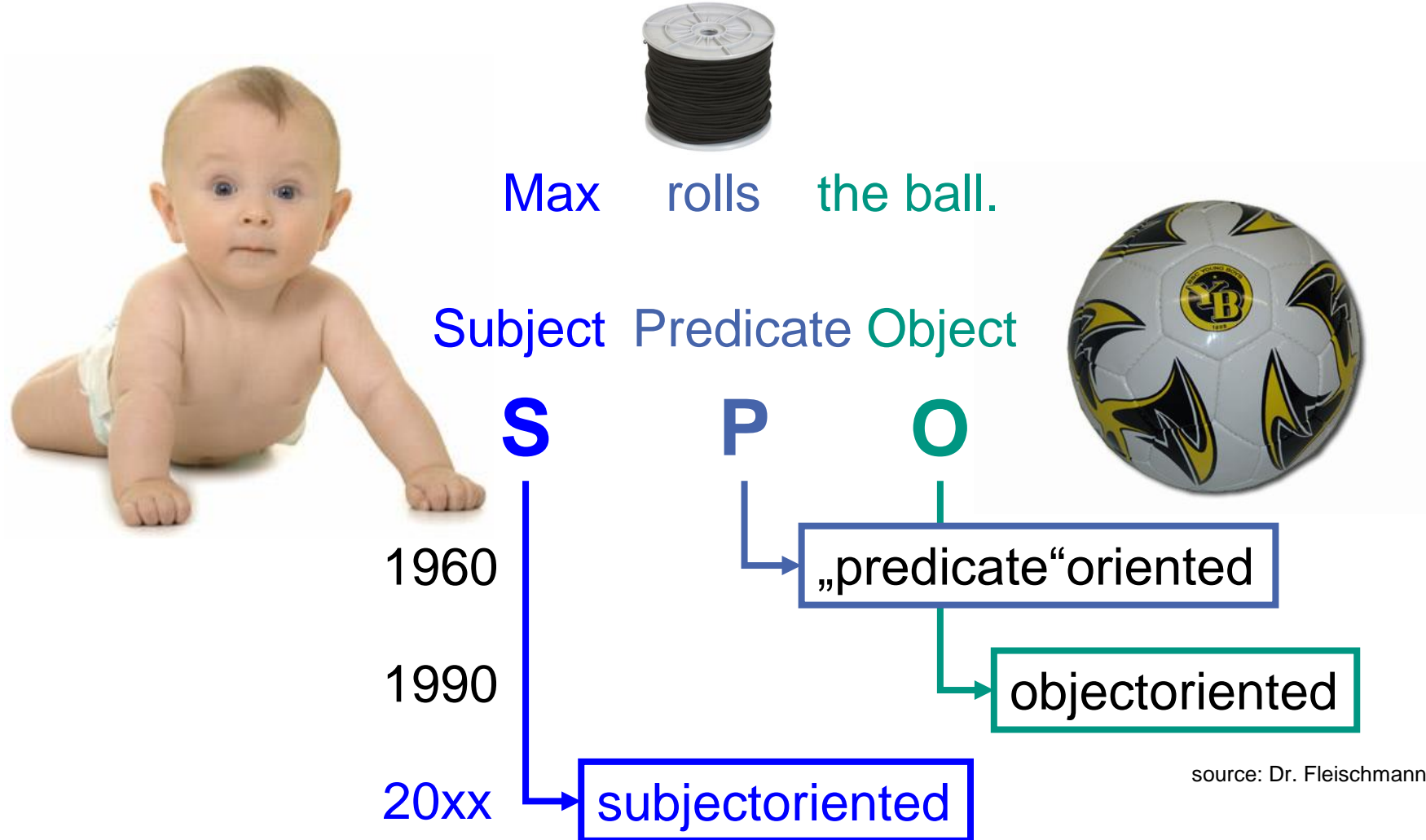
Source: VDI 2013

So what is amiss?

What could be an alternative?

→ Take a look at natural languages and how humans describe what is happening

Natural language description of process requires SPO – classical description paradigms do not cover all



Core Aspects of Subject-Orientation

Conceptually continuous consideration and differentiation during modeling between:

- **Active** units or elements in a Process
 - Subjects (abstract process-specific actors/roles) and
- **Passive** (Data-) Objects that are used by Subjects
 - Messages
- With all activities required to belong to a Subject.
- With special consideration of interaction between subjects (interaction must explicitly be described)

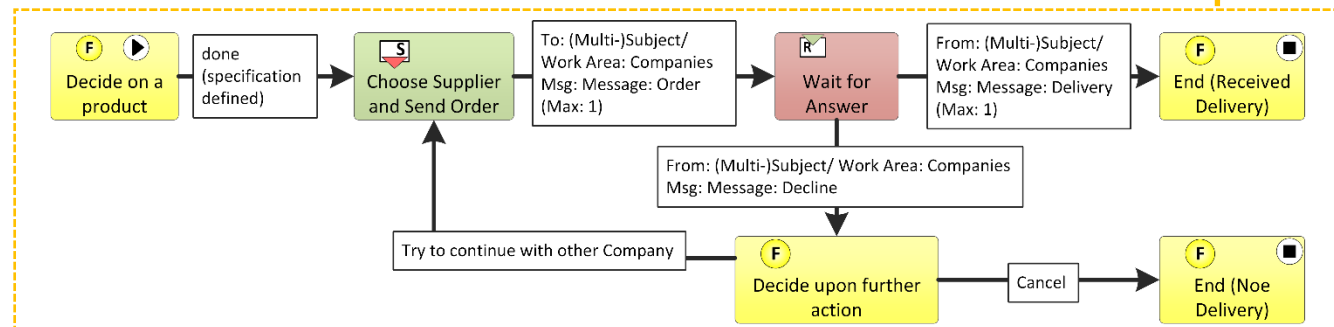
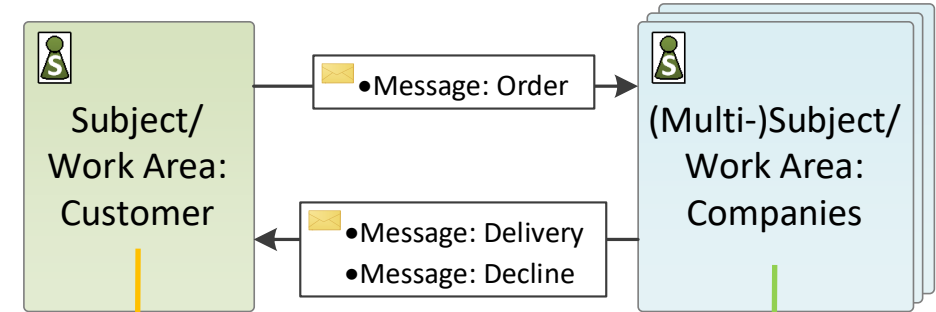
Conceptually **close to human languages**, where subject, predicate and object are required to convey information completely.

Conceptual and Terminological World of Subject-Orientation

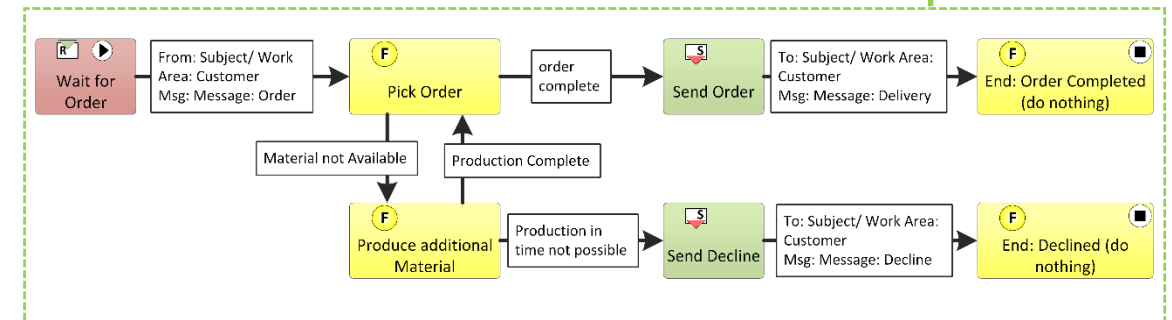
- **Subject-orientation** is a principle modelling or formal description paradigm for processes.
- It is foundation and integral part of a Process Management concept with strong roots in IT/process automation
→ Subject-Oriented Business Process Managements
(**S-BPM**)
- There is at least one specialized formal process modelling language for subject-oriented process descriptions:
→ **Parallel Activity Specification Schema (PASS)**
(theoretically it is possible to model subject-oriented with a limited set of BPMN or employ it in freestyle)

Subject-Oriented Process Modelling Language PASS

Subject Interaction Diagram (SID)
(abstract) actors and their means of interaction in form of „messages“

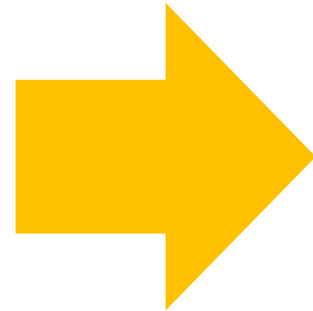


Each Subject is associated with an individual : **Subject Behavior Diagram (SBD)** describing internal actions as well as the order and conditions of sending and receiving of “messages”

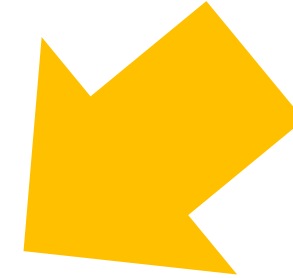
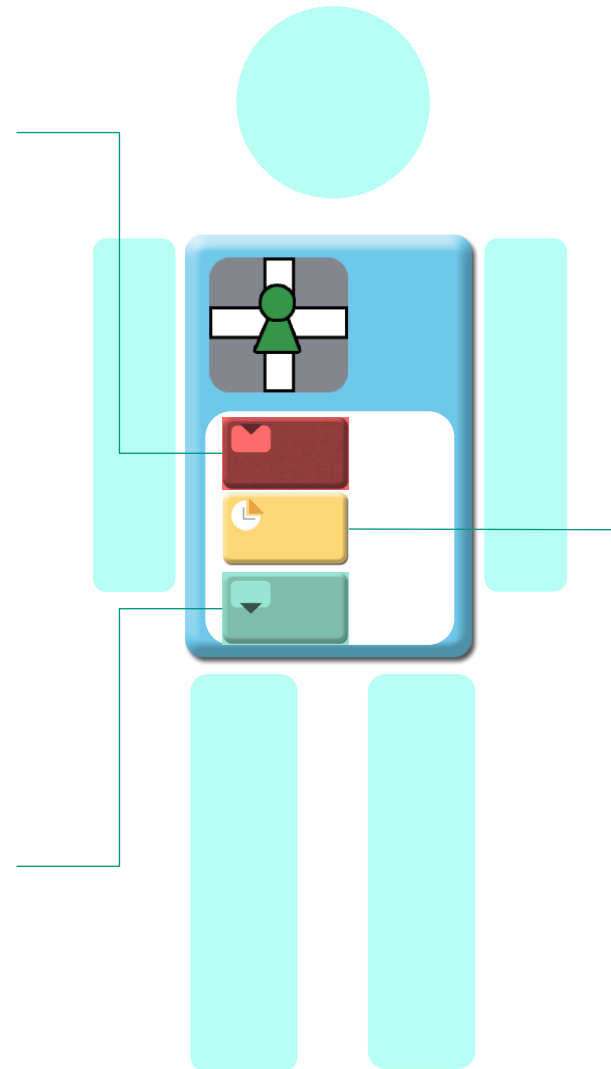


A Different but Simple Decentralised Perspective

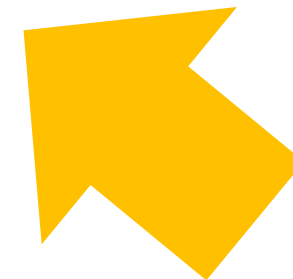
What inputs do I get
and from whom?



What outputs do I
produce and who is
waiting for them?

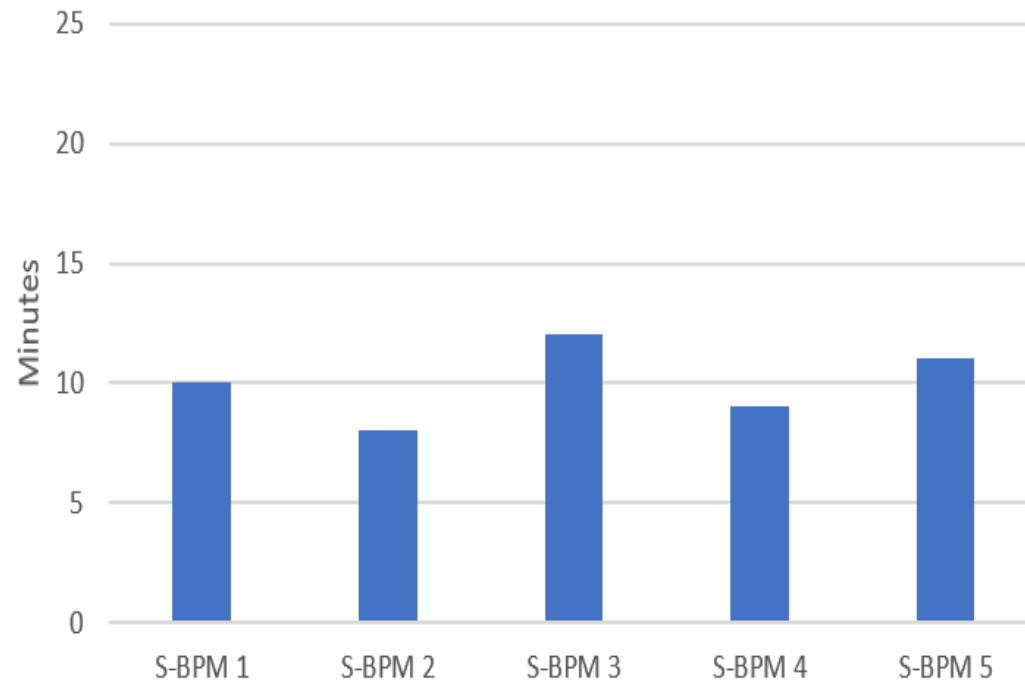


How do I transform my
inputs into my outputs
and how do I do it most
efficiently?

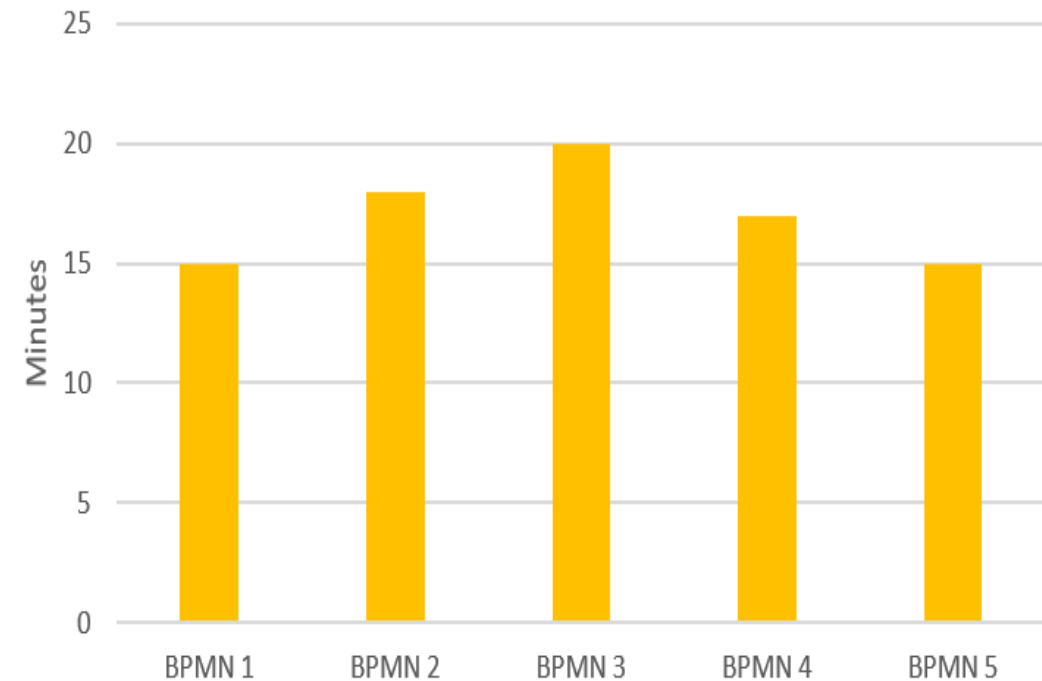


Faster modelling than using control-flow languages

Modelling times for S-BPM groups



Modelling times for BPMN groups



S-BPM: 40% reduction in modelling time on average
(Moattar, Bandara, Kannengiesser & Rosemann, to appear)

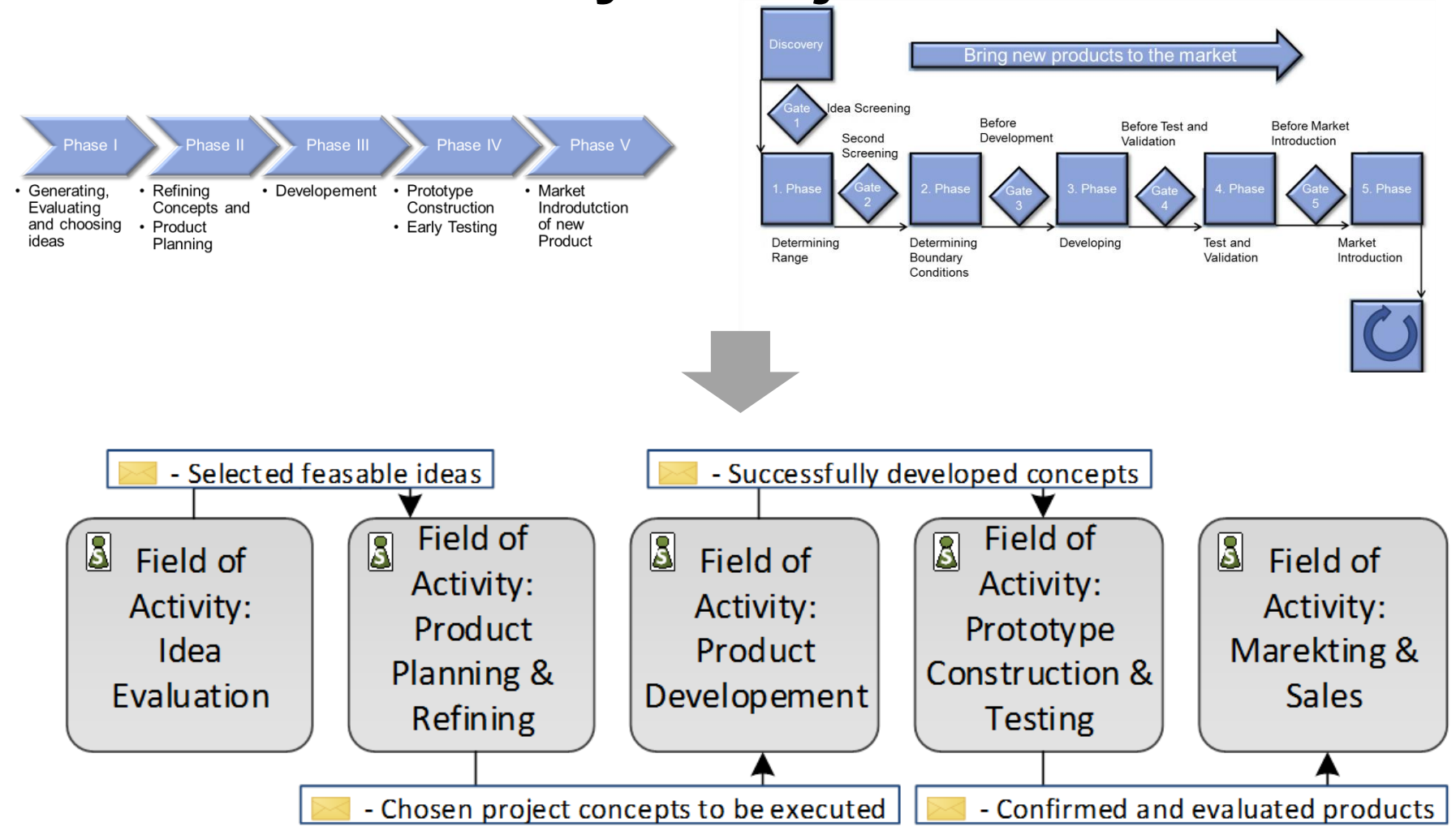
Executability

- Under the hood: executable definition based on Abstract State Machines (ASM) formalism
- Instant validation & execution of process models by the users

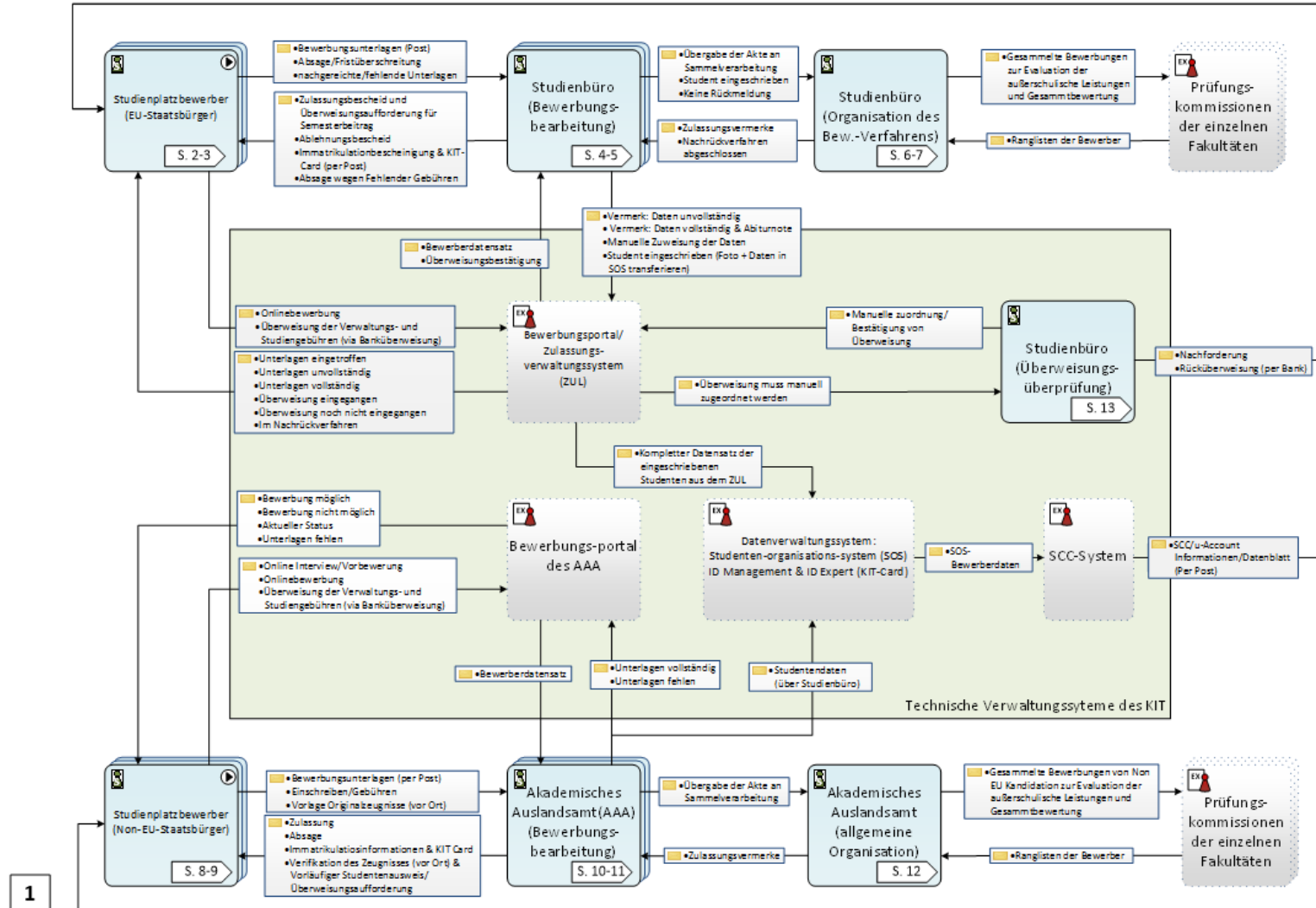


Example Process Models:

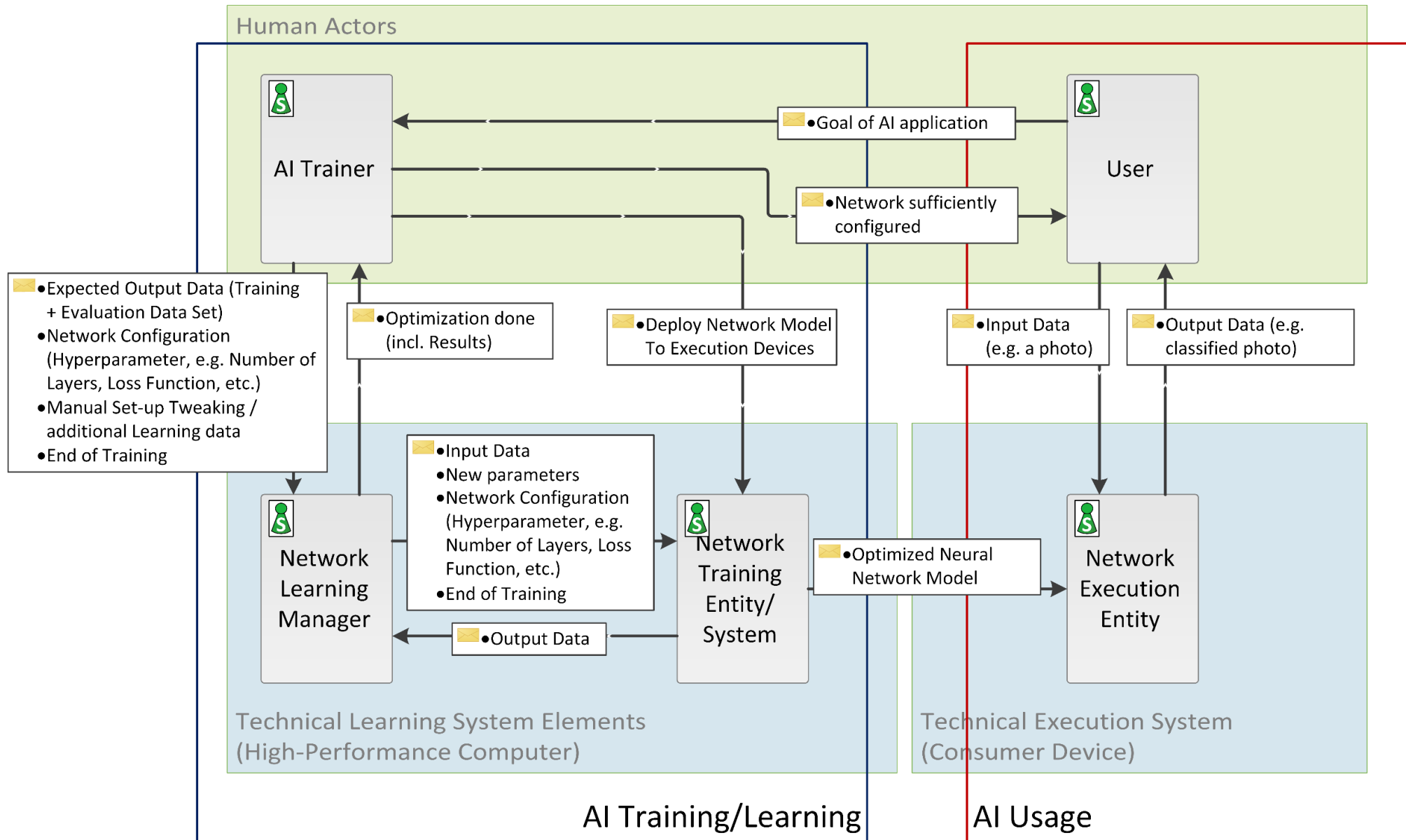
Changing the point of View – There are no “Phases” only “Subjects”



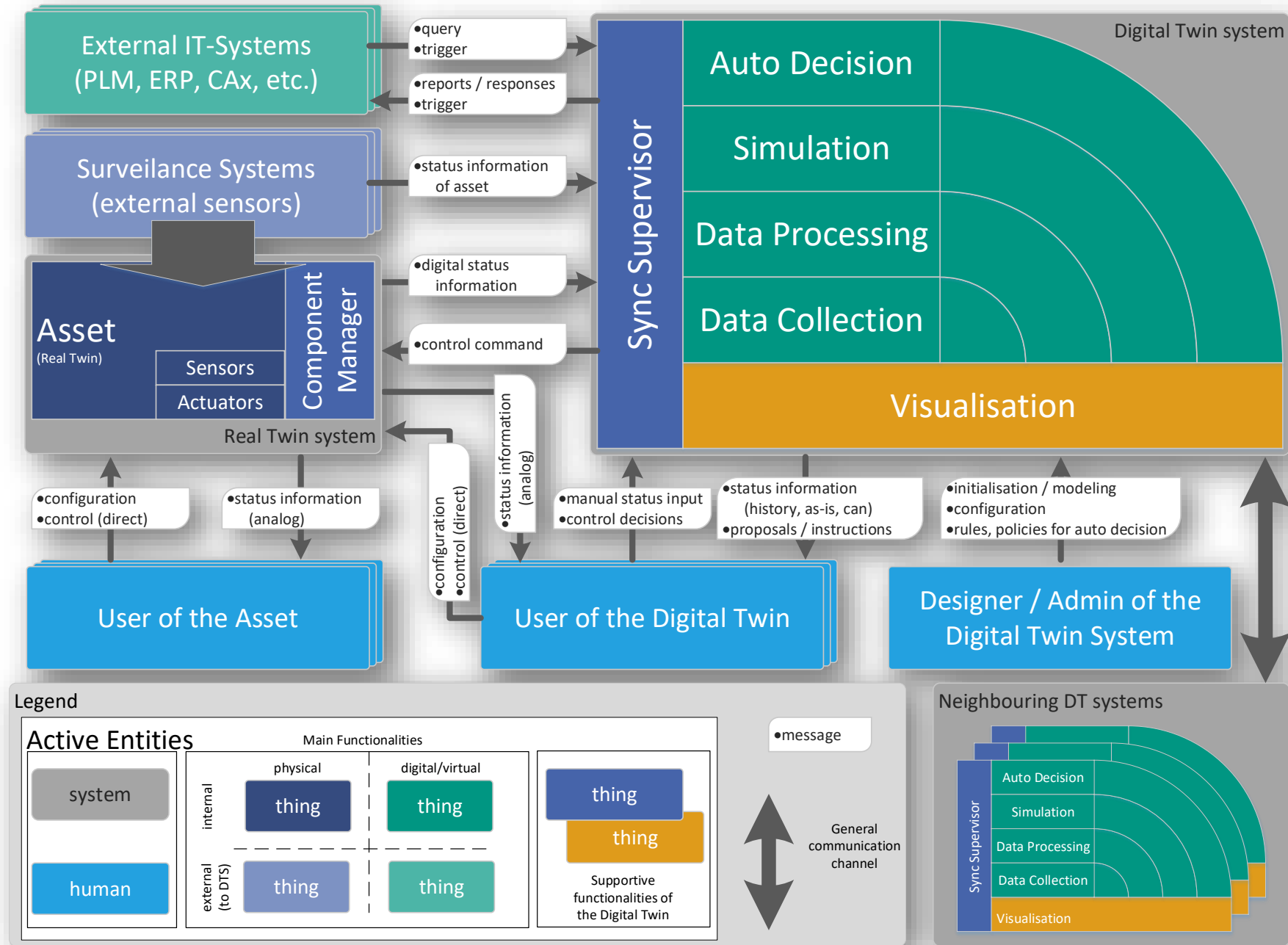
Example: Application and Registration Process of the KIT (SID only – German)



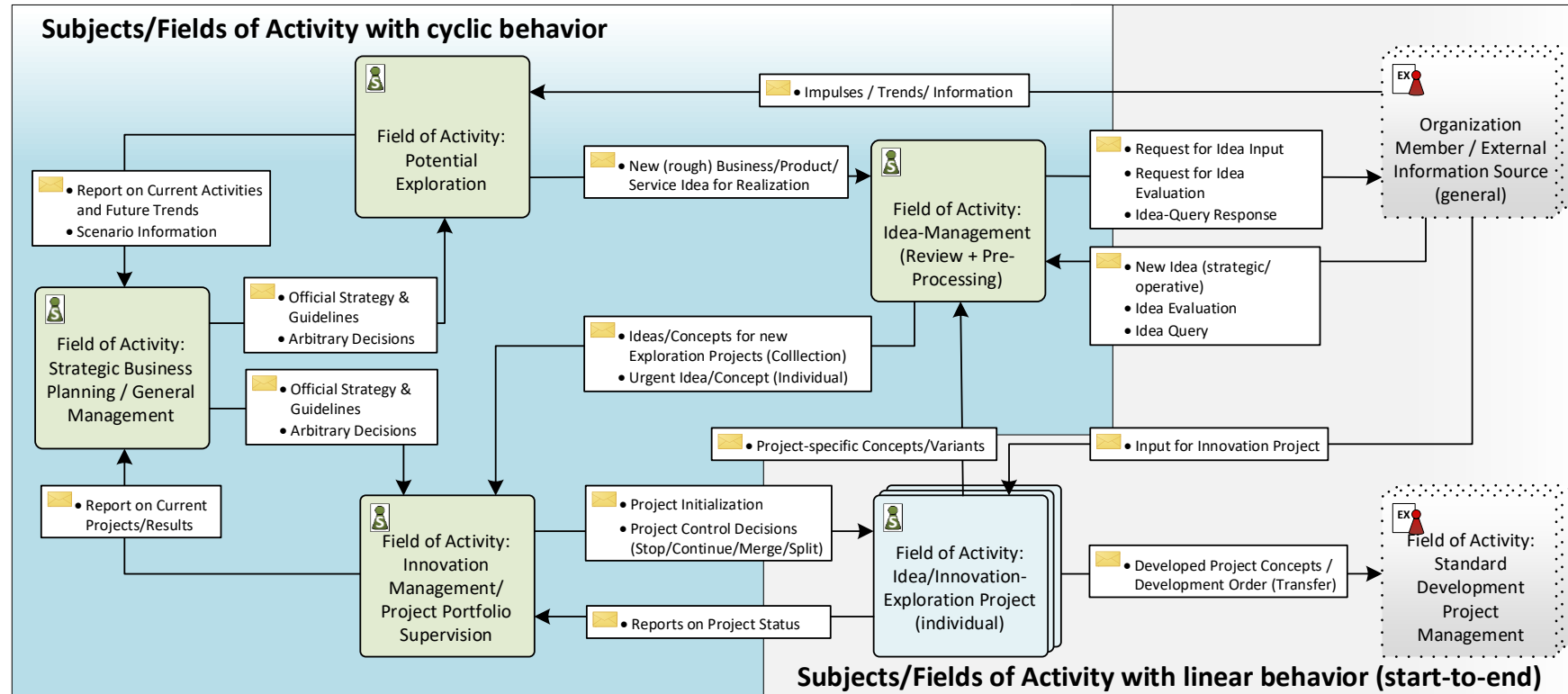
Subject-Oriented Referential Process Model for Learning and Deployment of Neural Network Applications



Subject-Oriented Reference Model for Digital Twins



Subject-oriented Referential Process Model for Strategic Product Planning

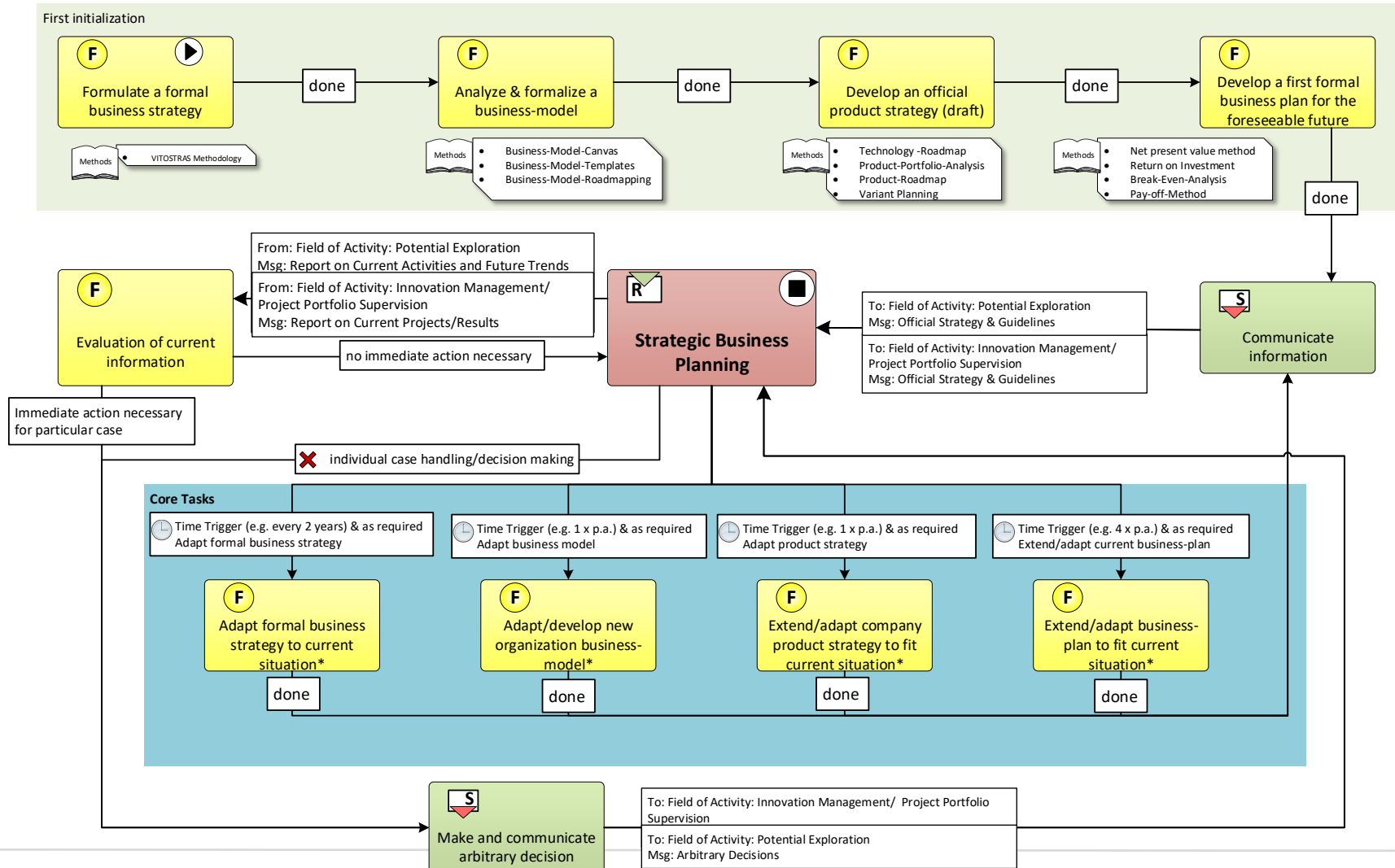


(Subject Behavior Diagrams on the following slides)

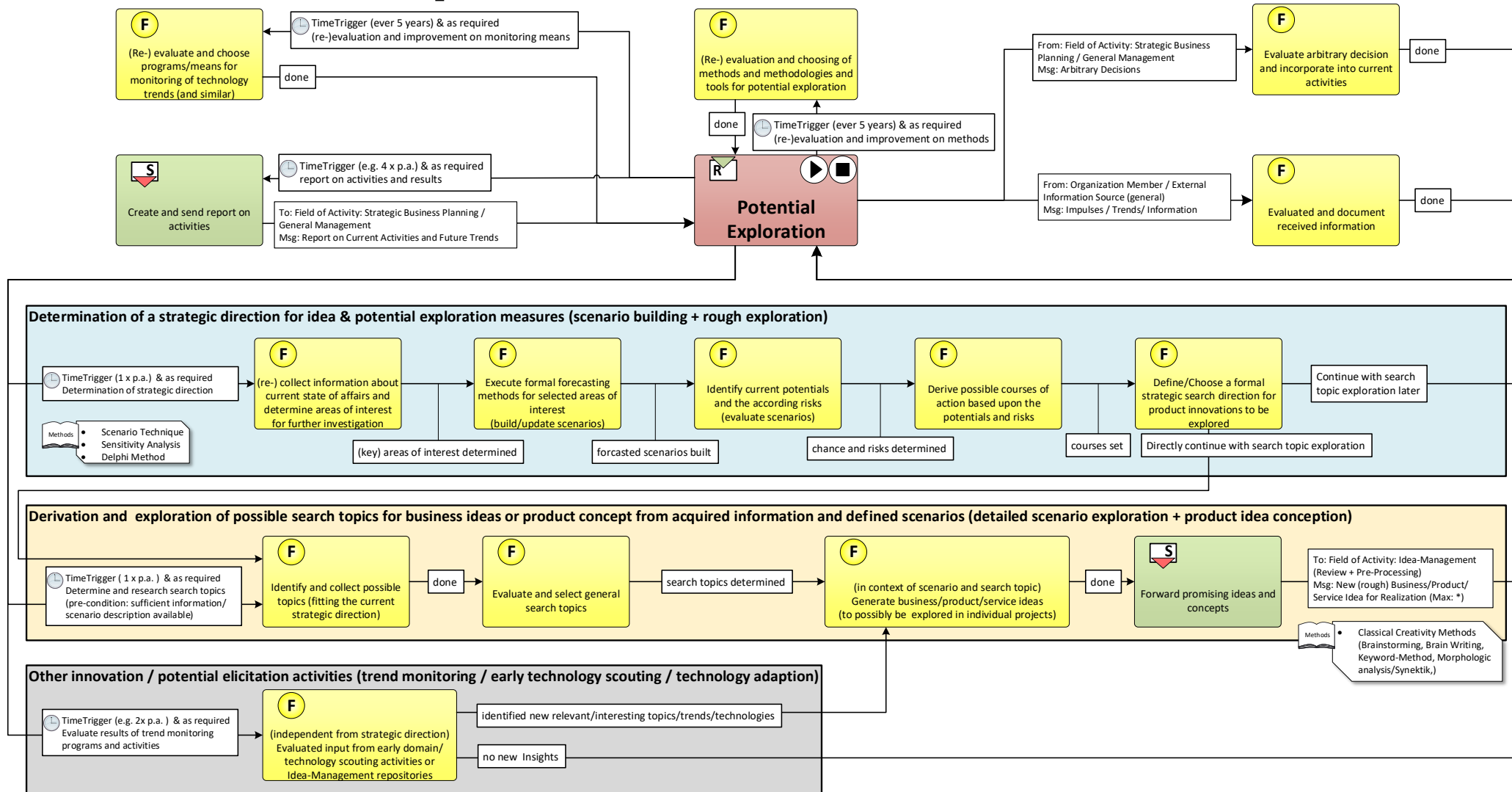
■ Dissertation result of Matthes Elstermann

- Combination/Integration of several processual concepts from the domains of innovation/idea management and strategic product planning
- Formal correct combination of cyclical and linear aspect
- Accurate integration of "Phase 0" concepts → towards agile development methodologies

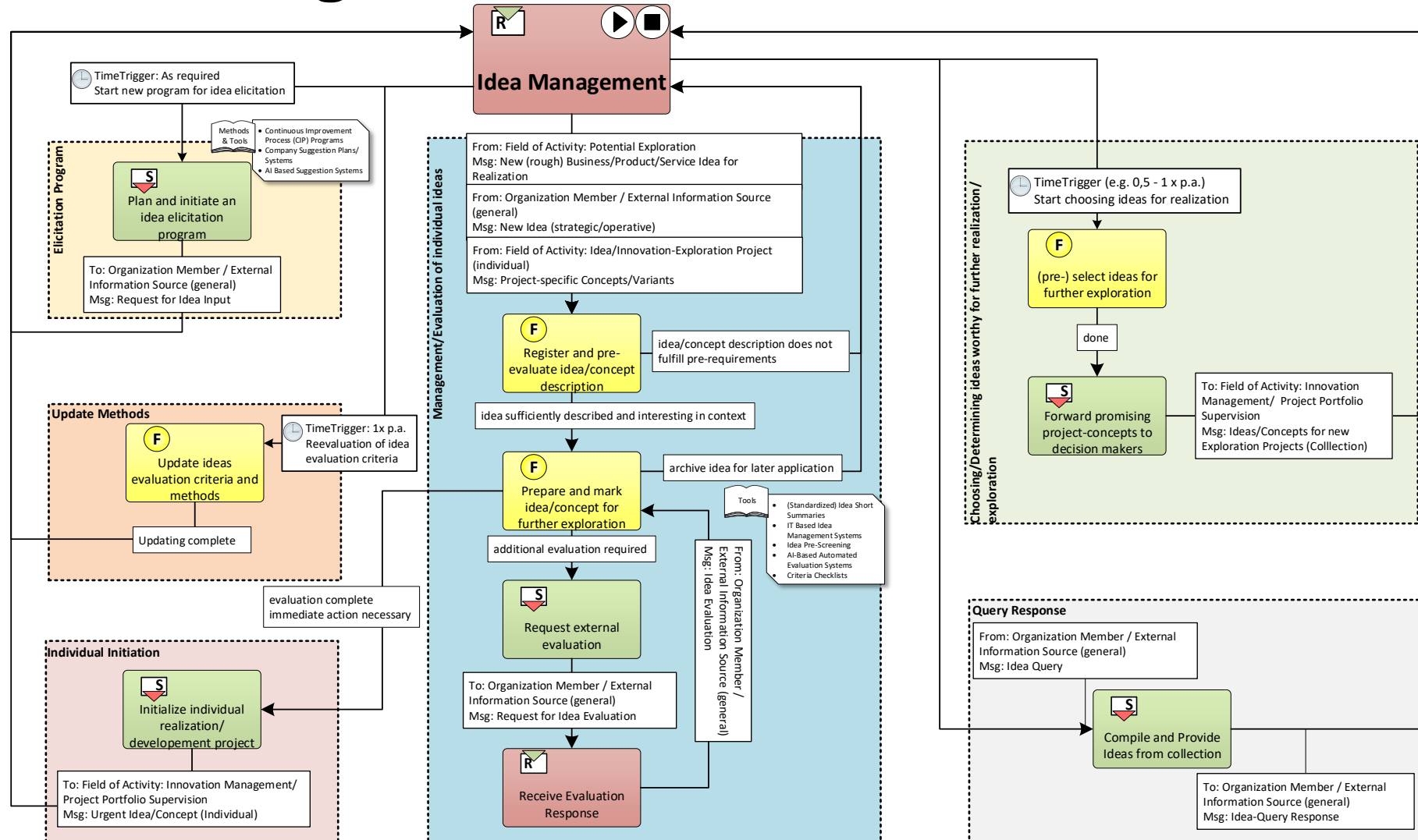
SBD: Strategic Business Planning



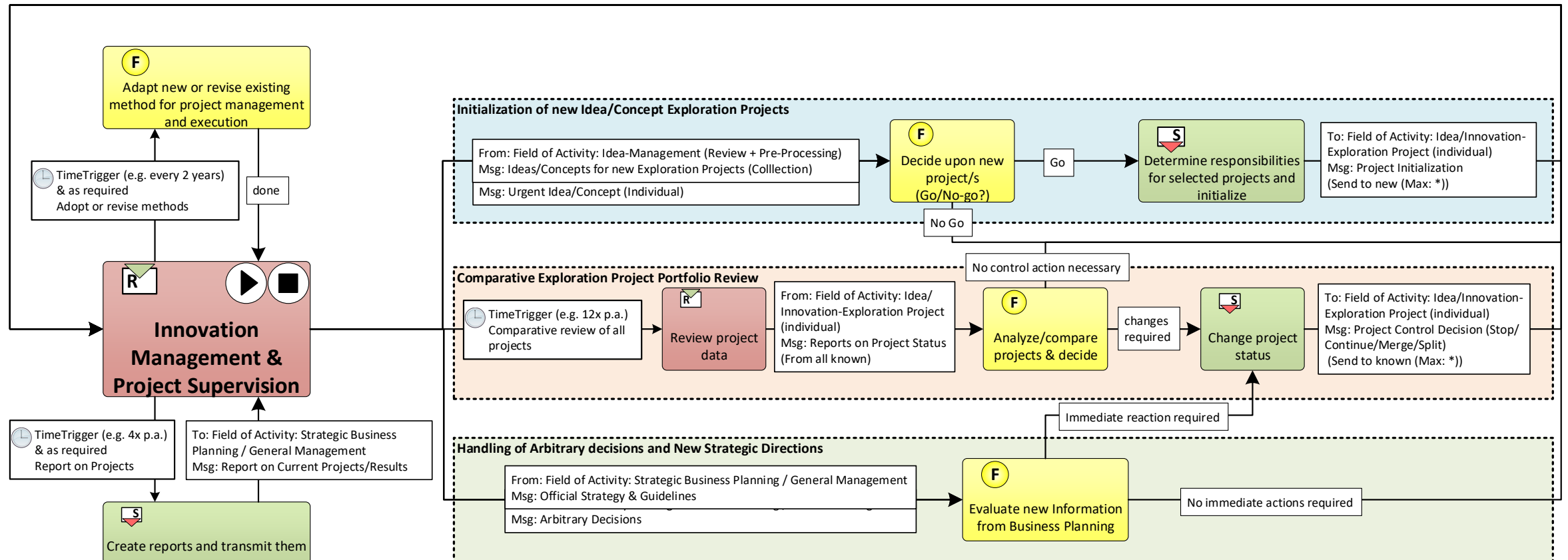
SBD: Potential Exploration



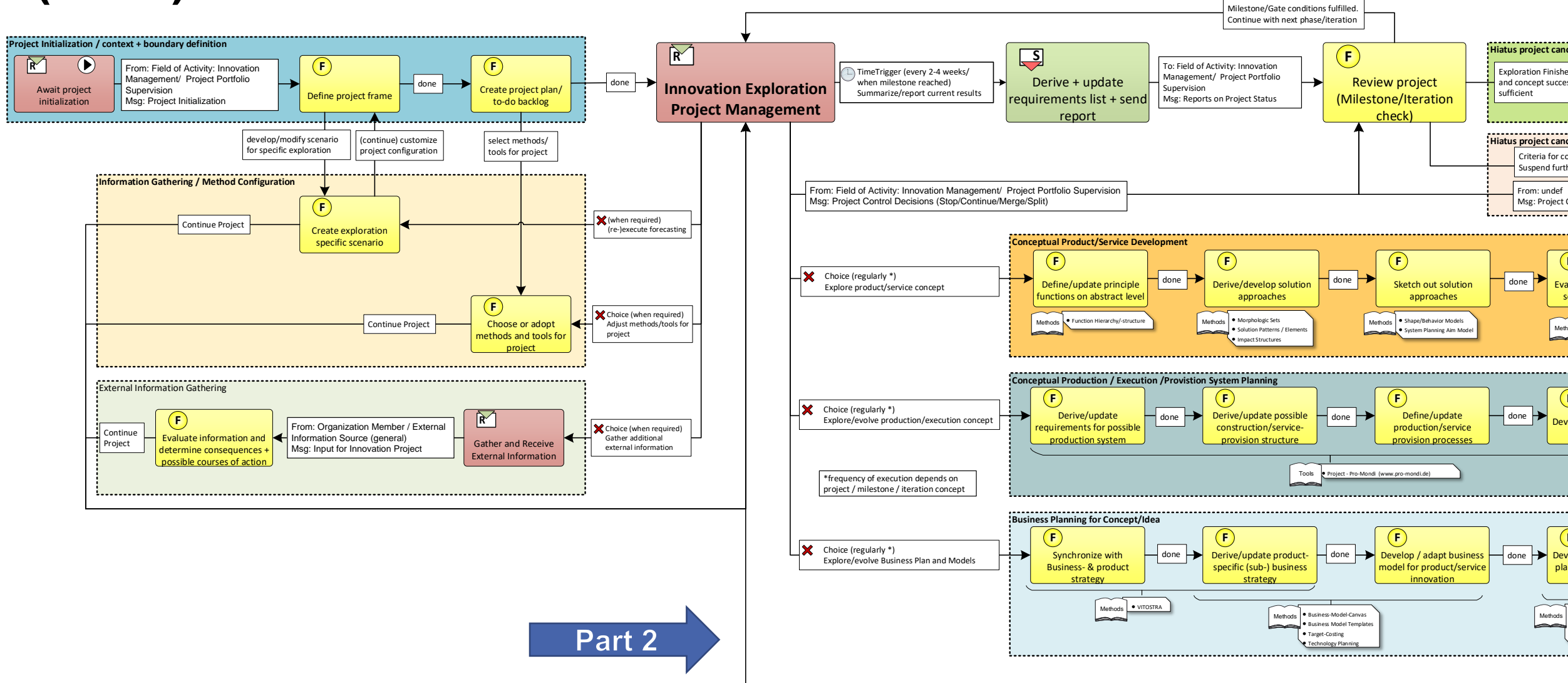
SBD: Idea Management



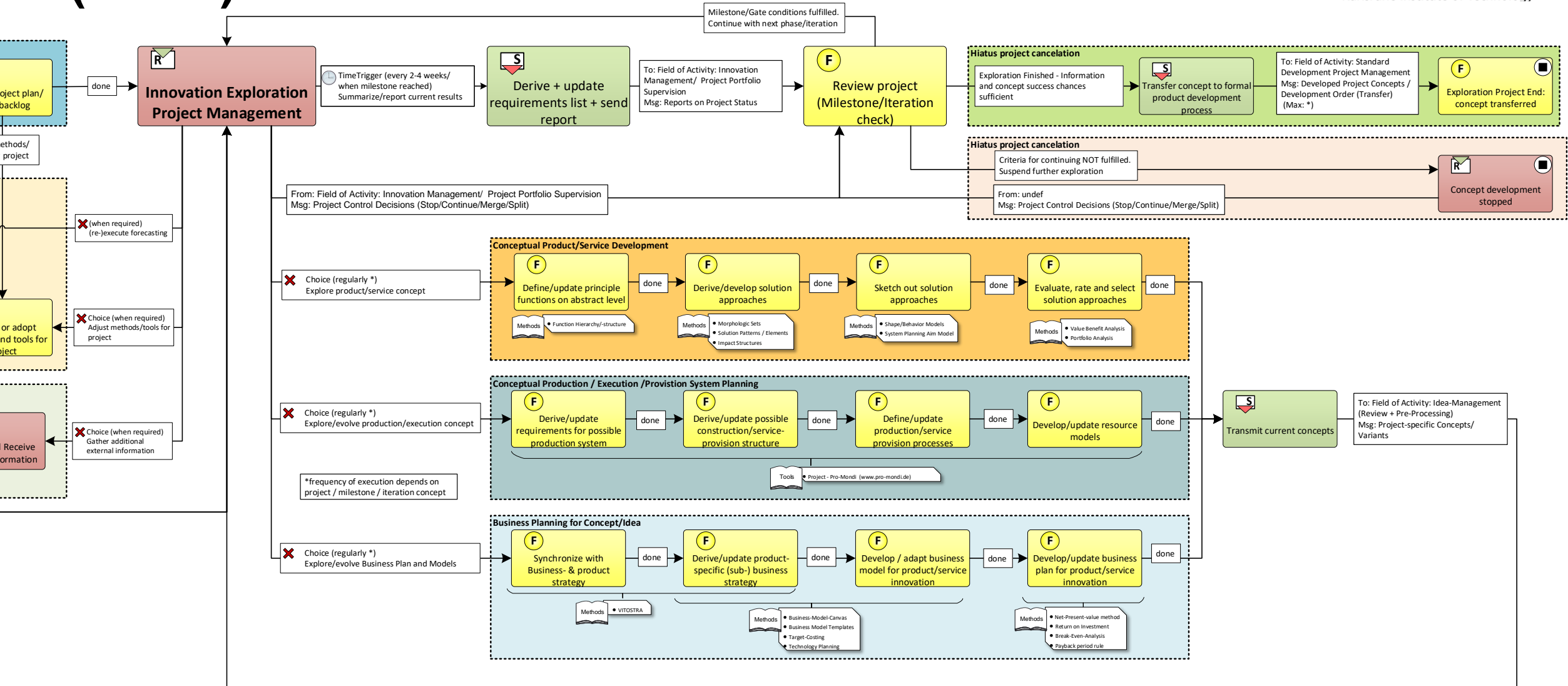
SBD: Innovation Management & Project Supervision



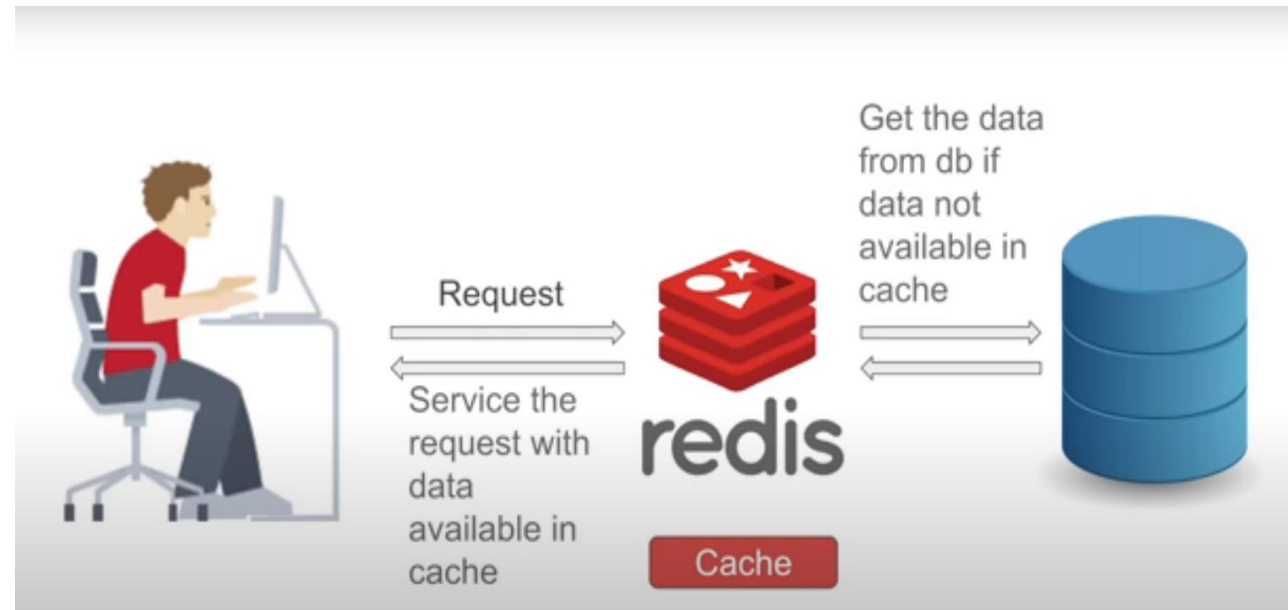
SBD: Innovation Exploration Project Management (Part I)



SBD: Innovation Exploration Project Management (Part II)



SO Models in Principle exist all the time



Simple modelling language & tools



Disadvantages of Subject-Orientation/PASS

- **Uncommon** modeling concept
 - Possible **misunderstandings** and confusion when attempting to interpret models as classical limited linear understanding
 - Especially the SID is often misunderstood
- **Extra effort necessary for linear processes without interactions**
 - Split-ups in SID and SBDs are complex for inexperienced users or viewers.
- **More complexity for Small Processes Models**
 - **Forced explicit communication** modeling increases model sizes in contrast to classical approaches
- Complex to model **trilateral communication** if execution is required
- No official technical ISO or OMG standard (yet)

Advantages when using SO/PASS (1)

- **Powerful yet compact**
 - Only five basic conceptual symbols
 - Possible to model all workflow patterns
- Possibility to model **linear and cyclic concept** simply and formally correct within the same process model
- **Formally Executable** (not only pictures)
- Simpler (re-)mapping of **subjects and users** in an execution system
- **Aligned with human information gathering and thinking structures**
 - Based on natural language structure
 - Follows the order of five “W-questions”
 - Easy to understand
- **Natural Context Separation**
 - Automatic splitting of complex models into naturally comprehensible parts
 - Sub-Parts (SBDs) are not intervening with one another directly

Advantages when using SO/PASS (2)

- Facilitates **process exploration**
 - Stakeholder Information can usually be modeled individually
- Allows for **distributed, decentralized and parallel modeling**
 - parallel creation of different model parts that can be integrated
- **Explicit modeling of communication** → increased chances for better process models
 - Requires to ask more detailed questions about the content of messages
 - Fosters identification of inconsistencies in communication (neuralgic)
 - Better comprehensibility for larger processes (when understood)
- **Ideal for training and teaching** through separation of concerns
 - Individual SBD already are structured to be used as training material for new personnel going to be responsible for single areas of activity
 - Process parts relevant or for individual trainee can be revealed without the need to create additional and/or reduced model excerpts
- **Three Different Abstraction Mechanism Available**

Conclusion

- SO is a **different approach to think about and consider processes** (it is much more than just another modeling language)
- Changes viewpoints and perspectives of involved people
- Considered advantages far outweigh drawbacks
- However: quantitative evaluation of the effects is not easily measured. Qualitative indicators speak for the advantages
- At the very least is an interesting but still very usable approach
- Possibly, it is a necessary option or visualization approach for design and analysis of modern IT Systems.

Further Resources

- Original Paper „What is S-BPM“ (2010)
https://link.springer.com/chapter/10.1007/978-3-642-15915-2_7
- Wikipedia: https://en.wikipedia.org/wiki/Subject-oriented_business_process_management
- Open Community Book: <https://github.com/I2PM/PASS-Standard-Book-TeX-Project/releases/tag/2021-08>

Foundation Book:

- **Subject-Oriented Business Process Management (2012 – Open Access Book)**
<http://www.springer.com/de/book/9783642323911#otherversion=9783642440953>

Supplementing Books:

- „S-BPM Illustrated“ (2013 – Open Access Book)
<https://link.springer.com/book/10.1007%2F978-3-642-36904-9>
- S-BPM in the Production Industry (2017 – Open Access Book) <http://www.springer.com/de/book/9783319484655>

Other Research: Conference Series “**S-BPM ONE**” (2009 – ongoing)

- <http://www.s-bpm-one.org/home/>
- Conference 2009-2014 → Springer
- Conferences 2014-2017 → ACM
- Conferences 2018-... → Springer

Other Resources

- <https://i2pm.net/> - Institute for Innovative Process Management
- <https://github.com/I2PM> - Online resources regarding SO/S-BPM of the I2PM

Modeling Tools

Free for Academic and Private Usage

- Shapes for Microsoft Office Visio
 - <https://subjective-me.jimdo.com/downloads/>
 - Google: subjective me S-BPM
- Installation guide:
<https://www.youtube.com/watch?v=RH40P8ITyLQ>
- Handling Tutorial:
<https://www.youtube.com/watch?v=GD2VjV9NILE>