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Exposé

Benefits and Challenges of Problem Structuring Approaches at the Front-End of IT Projects

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Content

Abstract

Despite significant progress in software engineering, still too many IT-Projects fail or are compromised. This thesis explores in which ways problem structuring methods, applied at the very beginning of IT-projects, could lead to a better understanding of a project's purpose and thereby contribute to higher success rates and considerable economical savings.

This expose explains the motivation, planned steps, and professional basis of the dissertation project. Research gaps, research methods, an implementation plan, and means of quality assurance of the dissertation results are listed. The function of problem structuring methods (PSM), as the main object of consideration are explained in more detail. They support the investigation of wicked problems. For this type of problems, it is essential to achieve a shared understanding of the stakeholders. Based on a first rough literature research questions were formulated. Answering them will lead to a better understanding of the challenges of the front-end phase of IT projects, and why we should focus on a shared understanding of the underlying real-world problems.

Introduction and Motivation

Clear requirements and a sufficiently defined objective are in themselves an essential prerequisite for any type of undertaking. Otherwise, how should one determine whether one has completed a task or not.

This is especially true for IT Projects. However, IT project should start nowadays with a proven concept as a result at the front-end phase.

The front-end phase is the first well-documented phase of IT projects. For example, Samset (Samset 2010) describes the methods of this phase very well in his book "Early project appraisal"

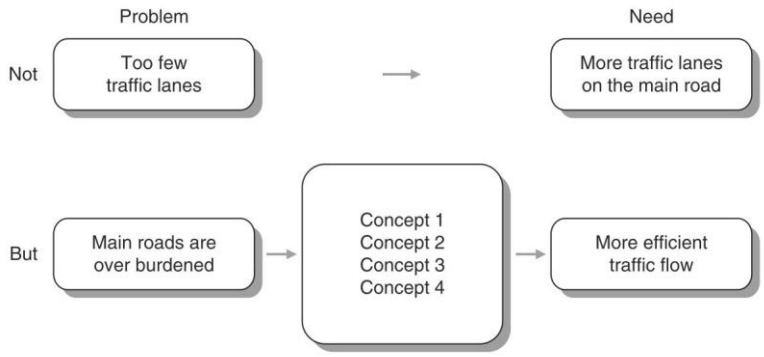


Figure 1: Samset 2010 - Early project appraisal.jpg (Samset 2010, S. 98)

But what about the entry in the front-end phase? To develop different concepts, which means suggested ways to possible solutions, the stakeholders must have a shared understanding of the real world problem to be improved.

To emphasize it, in order to successfully complete IT projects for the order giving organization, there should be no doubt at the kickoff of an IT project about what needs to be done, it is only a question of how the project should proceed. It is state-of-the-art to engage in stakeholder management. Again and again, create various stakeholders different purposes late in the course of the project determined. Significant changes in project objectives are the result. This is prevented with the PSM approach, as a common problem view is already available before the project starts. The "why" of the project is beyond question.

The following diagram illustrates that – purpose is not in the focus of the projectmanager. While the project manager is responsible for the goals (objectives) of the project, the organization, ordering the project is responsible for ensuring that the project goals support the desired effects in the organization.

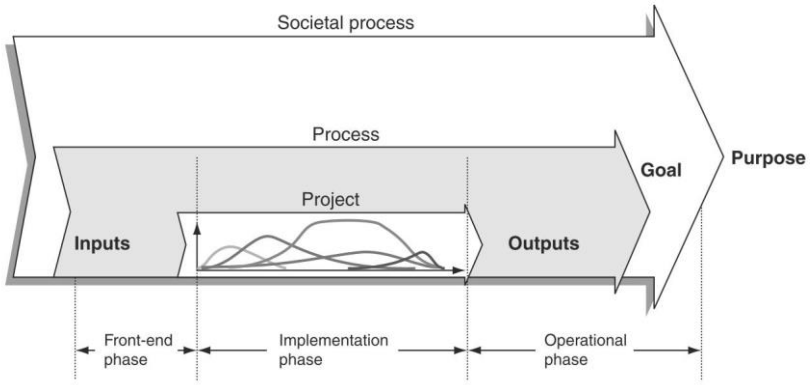


Figure 2 Purpose vs. Goals

The dissertation thesis will deal with the conditions, problems, and improvement potentials of the pre-project phase, i.e., the time dedicated describing the problem situation.

Therefore, a process or method is needed to transform the undescribed real-world situation into a well-structured problem description. We find this in the form of the Problem Structuring Approach and Problem Structuring Methods. Technical terms and assumptions:

Problem structuring methods (PSMs) are a broad group of model-based problem handling approaches whose purpose is to assist in the structuring of problems rather than directly to derive a solution. (Rosenhead 2013)

A good example is the Soft System Methodology (SSM) created by Checkland.

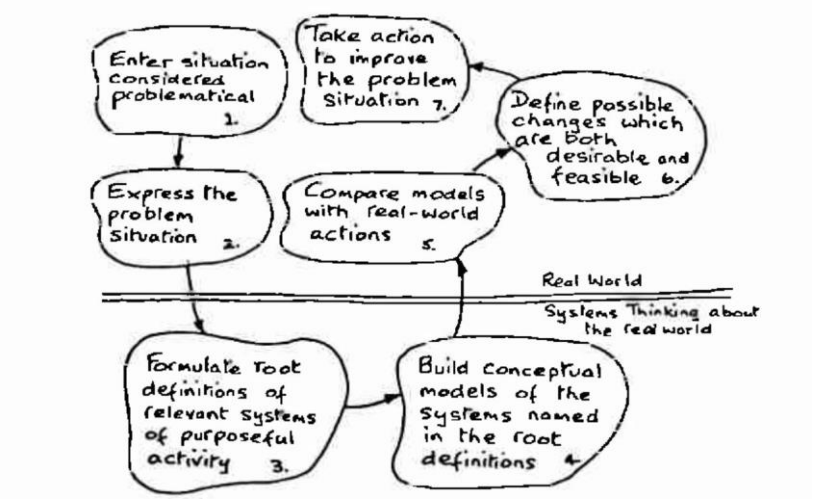


Figure 3: Checkland 2008 - Soft System Methodology.jpg (Checkland 2008, S. 71)

The following graphic explains SSM. Relevant for the dissertation is that the Root Definition is a well-structured problem description.

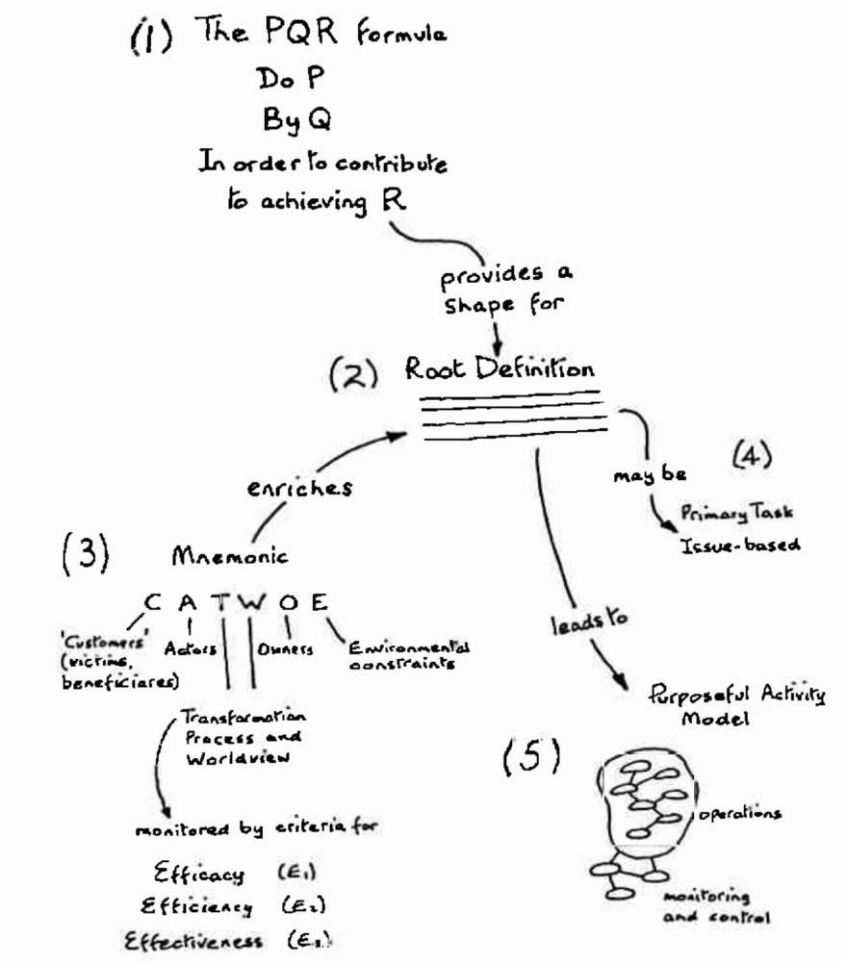


Figure 4: Checkland, Poulter 2006 - Learning for action.jpg (Checkland und Poulter 2006)

A shared understanding of the situation is the goal. A structured problem description the result. The structured problem description is achieved by using PSMs. "Wicked Problems" are the subject of consideration.

Technical terms

To get to the front end project phase, which evaluates the various concepts for solving the problem, one must extract from the unstructured and chaotic problem situation a structured problem definition which is shared by the stakeholders. In general, PSMs or the problem structuring approach (PSA) deal with wicked problems, gaining a well-structured problem definition.

Briefly explained Wicked problems are ill-structured problems with the additional dimension of different views from the additional worldviews of the problem stakeholders

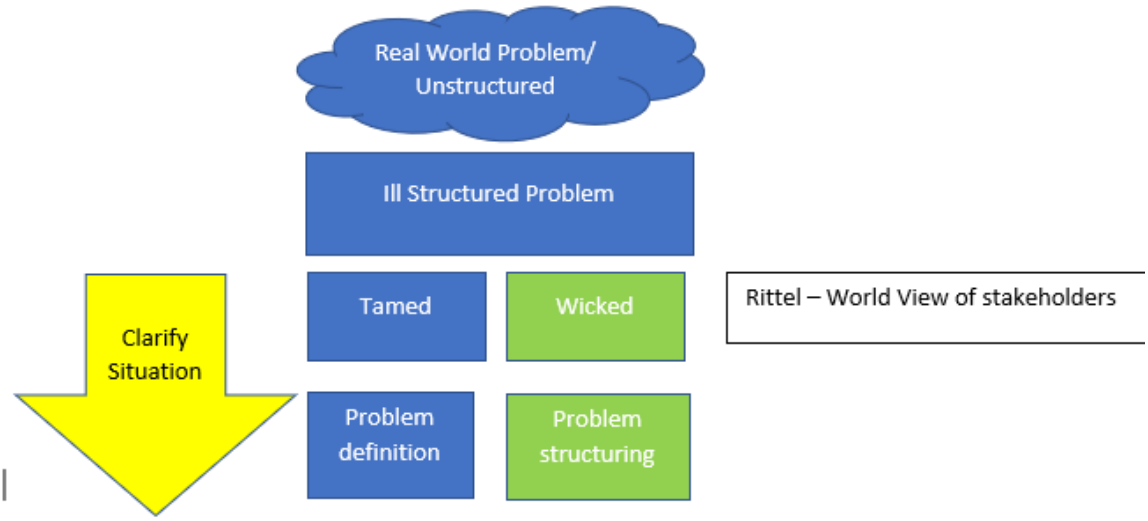


Figure 5 Real World Situation to structured problem definition

Rittel (Rittel und Webber 1973),one of the earliest scientists who looks at this type of problem (HU: wicked problems) define them as following (adapted by the HU)

Wicked problems:

I. cannot be easily defined so that all stakeholders agree on the problem to solve
II. require complex judgements about the level of abstraction at which to define the problem
III. have no clear stopping rules
IV. have better or worse solutions, not right and wrongs ones
V. have no objective measure of success
VI. require iterations - every attempt to build a solution changes the problem
VII. often have strong moral, political or professional dimensions, particularly for failure

Note HU: Points IV and V. are not sufficiently explained. Because "without measurement (see V.)" there is no objective distinction between "better or worse solution (see IV)" Rittel and Weber refer here to the stakeholders involved. They evaluate the proposed solutions. See “Closure (Hu: of the problem) is often forced by pragmatic constraints. (e.g. managerial or political) rather than "rational Scientific) (2003, S. 12)”

Rittel and Webber, made two testable claims of direct relevance to review first, that many design problems are "wicked" problems are in contrast to "tame" or "benign" problems, which can be modeled computationally and secondly, that an "argumentative process was the most effective way to tackle such problems (ebrary, Inc 2003, S. 12) (adapted by HU)

To begin the dissertation following definition of PSMs is good enough as a starting point. The definition of PSMs will evolve during the dissertation:

Problem structuring methods (PSMs) are a broad group of model-based problem handling approaches whose purpose is to assist in the structuring of problems rather than directly to derive a solution. (Rosenhead 2013)

Relevant is what PSMs ares supposed to do for us:

What each PSM offers is a way of representing the situation (that is, a model or models) that will enable participants to clarify their predicament, converge on a potentially actionable mutual problem or issue within it, and agree commitments that will at least partially resolve it. To do this a PSM must:

• enable several alternative perspectives to be brought into conjunction with each other,

• be cognitively accessible to actors with a range of backgrounds and without specialist training, so that the developing representation can inform a participative process of problem structuring,

• operate iteratively, so that the problem representation adjusts to reflect the state and stage of discussion among the actors, as well as vice versa, (Note HU: Consideration of the problem representation has a learning effect and promotes shared understanding)

• permit partial or local improvements to be identified and committed to, rather than requiring a global solution, which would imply a merging of the various interests (Mingers und Rosenhead 2004, S. 531)

State of research:

In the preliminary research, only a few papers were found that deal with PSMs in the IT environment. The excerpt Figure 6: Mingers, Rosenhead 2004 - Problem structuring methods in action.jpg (Mingers und Rosenhead 2004) shows not even 20% of the specialist articles are related to It environment.

Developing business strategy	System dynamics + soft systems	Wilson (1995)
Information systems		
Accounting information system	SSM	Ledington (1992)
Analysis of CD-ROM network	SSM	Knowles (1993)
Information systems strategy	VSM	Schuhman (1990)
Capturing process knowledge	SSM + process models	Boardman and Cole (1996)
Building process models	SSM + grounded theory	Platt (1996)
Developing information systems strategy	Interactive planning + SSM + VSM + strategic choice	Ormerod (1996a,b, 1998)
Technology, resources, planning		
New technology and culture conflict	SSM	Kartowisastro and Kijima (1994)
Planning livestock management in Nepal	SSM	Macadam et al. (1995)

Figure 6: Mingers, Rosenhead 2004 - Problem structuring methods in action.jpg (Mingers und Rosenhead 2004, S. 541)

Some researches deal with PSMs, the structure of PSMs, and suggestions for evaluating the problem structuring approach. As an example “Towards a new framework for evaluating systemic problem structuring methods. (Midgley et al. 2013)” or “ The characteristics of problem Structuring Methods. (Smith und Shaw 2019)

At the beginning of the first reflections on the dissertation objectives, three issues arose. The first is there is not just only one PSM. Second, there is no dedicated method used during the prephase of IT projects. Thirdly, some publications point out that the PSMs are developed for specific problem fields, e.g., traffic infrastructure.

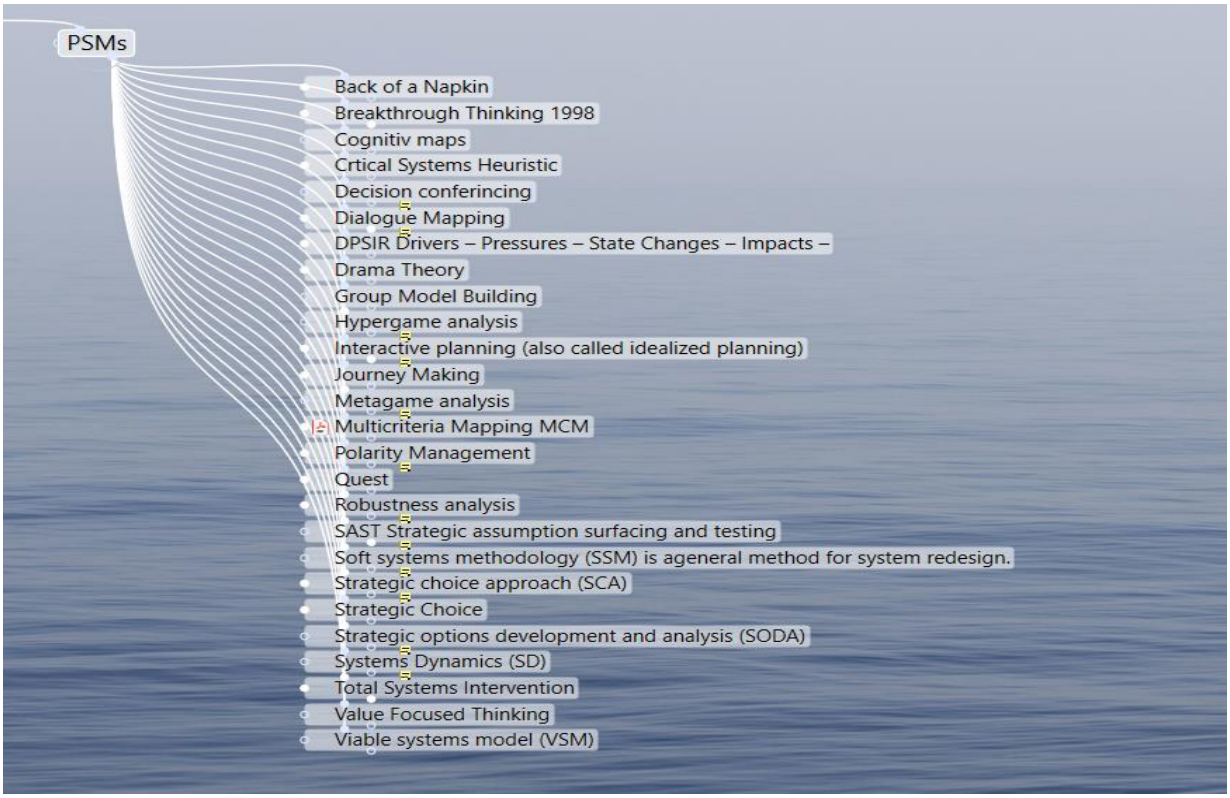
A lot of application enables the necessary information and data in companies to be available at the right time in the right place, i.e., in a wide variety of specialist departments. As already mentioned, available PPPs have been developed for particular problem areas. Therefore, a PSM suitable for the IT project's pre-project phase will combine parts of different PSMs and specific extensions.

Aleander Bock et al., worked in similar research in the paper “Towards More Expressive Problem Structuring” in the domain of enterprise modeling, states.

“The idea of the desired modeling method is to combine general problem structuring concepts, inspired by theoretical problem solving research and work in the field of PSMs, with the meta modeling

mechanisms and the portfolio of domain-specific modeling languages from the field of enterprise modeling. (Bock et al. 2018)“

The number of methods is on the rise. A short pre-literature research reveals more than 20 methods.



The search for common software support has yielded low results. As an example, IBIS Issue-Based Information System or Banxia Decision Explorer. In the course of the dissertation, it is important to find more research on the one hand, but on the other hand to develop proposals in the direction of development, precisely for the PSMs which are evaluated as suitable for IT projects. Ideally, they should dock to the concept phase methods.

Research Gaps:

Researches and papers found until now do not address the following aspects:

1. Evaluation of the different PSM approaches for the front-end phase of IT projects
2. Evaluation of software support using PSM methods
3. Extension of the RUP process into the pre-project phase with PSMs
4. Which PSM would best serve which type of IT project?

There are a lot of papers that will be used as a basis for the dissertation. Here are a few examples. This proves the fundamental interest in the topic in the scientific environment.

Terry Williams, Hang Vo, Knut Samset, Andrew Edkins. (2019) The front-end of projects: a systematic literature review and structuring. Production Planning & Control 30:14, pages 1137-1169.

Richard Ormerod. (2017) Writing practitioner case studies to help behavioral OR researchers ground their theories: application of the mangle perspective. Journal of the Operational Research Society 68:5, pages 507-520.

Champion, J M Wilson. (2010) The impact of contingency factors on validation of problem structuring methods. Journal of the Operational Research Society 61:9, pages 1420-1431.

J Davis, A MacDonald, L White. (2010) Problem-structuring methods and project management: an example of stakeholder involvement using Hierarchical Process Modelling methodology. Journal of the Operational Research Society 61:6, pages 893-904.

G A Hindle, L A Franco. (2009) Combining problem structuring methods to conduct applied research: a mixed methods approach to studying fitness-to-drive in the UK. Journal of the Operational Research Society 60:12, pages 1637-1648.

White, L. (2006): Evaluating problem-structuring methods: developing an approach to show the value and effectiveness of PSMs. In: Journal of the Operational Research Society 57 (7), S. 842–855. DOI: 10.1057/palgrave.jors.2602149.

Research Questions

Answering the following research questions will close the specified gaps

- (R1) What criteria should a PSM meet in order to support problem analysis in an IT environment?
- (R2) Which criteria have to be taken into account to assign certain types of IT projects to certain PSMs?
    - (R2.1) Which categorization of IT projects is necessary for the selection of the most suitable PSM?
    - (R2.12 Which requirements are relevant for IT projects?
- (R3) Which of the many PSMs are suitable for use in the front end of IT projects?
    - (R3.1) Which PSM takes into account which necessity?
    - (R3.2.) Which of these PSMs are supported by software, and how can you improve this support?
    - (R3.3) If none of the existing PSMs are suitable for IT projects, which combination of different PSMs is a suitable approach? (Multimethodology approach)
- (R4) How can the results of the problem structuring approach be transferred to the conventional front end phase of project management methods?
    - (R4.1) Transformation and integration into RUP process for conventional projects?
    - (R4.2) Transformation and integration in the Agile project processes? (Building Vision)?

Applied research methods:

- Literature research to identify
  - the most relevant PSMs
  - adequate Case Studies
  - existing categorizations of IT projects and environments
- Interviews and surveys
  - It is planned to use surveys by email to find a higher number of contacts. The aim is to find experts and practitioners. Structured expert interviews through with cases studies will be used in later phases of the dissertation.
- Case Studies
  - Structuring interviews and joint sessions
  - Existing case studies are to be taken over from the literature or extended. Some adoption leads case studies useful for interviews and quasi-experiments.
- Quasi-experiments for Proof of Concept
  - The term "experiment" usually implies a controlled experiment, but controlled experiments are prohibitively difficult or impossible regarding the research questions. So natural experiments or quasi-experiments are the best choice.
  - The case studies are tested in laboratory experiments (student groups) for their suitability for structured interviews. The application of the quasi-experiments is trained.
  - Due to the assumed small number of experts, it is impossible to randomly select participants in the experiment.

The documentation of interviews and quasi-experiments is carried out or supported with the help of tools for computer-supported argumentations visualization.: (ebrary, Inc 2003). The advantage here is that a central technique of problem structuring approach is used. It is necessary to represent the different models and argumentations during the developping of a shared understanding of the real-world situation in joint sessions. Bruggen stated the need of presenting the problem.

“To solve an ill-structured problem, problem solvers will have to represent the problem, define constraints, apply operators and evaluate proposed solutions, but since none of these are given, they first have to draw upon other knowledge sources to determine relevant or beneficial representations, constraints, operators and criteria (problem structuring). (Bruggen van et al. 2003, S. 28)”.

Proof of Concept:

The results of the dissertation will be checked for their suitability in a second round with improved case studies while interviewing practitioners

Analysis of existing research papers containing case studies with the help of the developed processes, methods, categorization of PSMs in relation to IT environments.

Conduct a quasi-experiment with a control group. Preferably in an IT department of one or more companies.

Target Journals and Conferences:

- International Journal of Information Technology Project Management
- International Journal of Project Management – (https://www.elsevier.com/journals/international-journal-of-project-management/)
- International Conference on Conceptual Modelling (http://er2017.pros.webs.upv.es/)
- International Conference on Advanced Information Systems Engineering (CAiSE)
- Information Visualisation Journal
- International Journal of Information Systems and Project Management http://www.sciencesphere.org/ijispm/index.php
- Journal of Management Information Systems
- Information Systems Journal

Main Tasks:

1. Literaturresearch to find
   1.1. all relevant PSMs
   1.2. IT environments/IT projects taxonomy
   1.3. suggested existing categorizations of PSMs
   1.4. existing case studies in literature
2. Dissertation topic related work
   2.1. PSMs suitability to IT projects
   2.2. PSMs taxonomy
   2.3. PSMs support software analysis and improvement
   2.4. Assignment PSMs taxonomy to IT taxonomy
   2.5. Build up of own PSM (O-PSM)
   2.6. Build up of case studies for proof of O-PSMs, categorization,..
   2.7. O PSM connection to conventional front end phase of project management
      2.7.1.Rup Integration
      2.7.2.Agil integration
3. Identify Peer groups, Experts, Practitioners doing
   3.1. Surveys with the help of professional associations (e.g.)IPMA, PMA
   3.2. Enterprise Surveys
4. Write Papers (suggestions)
   4.1. PSMs – list of PSMs, the status of PSMs, taxonimation, categorization, Demarcation from subject areas, and location in subject areas
   4.2. PSMs - Categorization It environments &project - linking with PSM taxonomies
   4.3. Further Papers
5. Interviews of peer groups, experts, and practitioners
   5.1. First Round – Begin of dissertation expansion of literature research with state of the art practice experience
   5.2. Middle Round - Securing the development of methods and results of dissertation work
6. End Round Part of Proof f Concept
7. Monographie based on papers and enhancements

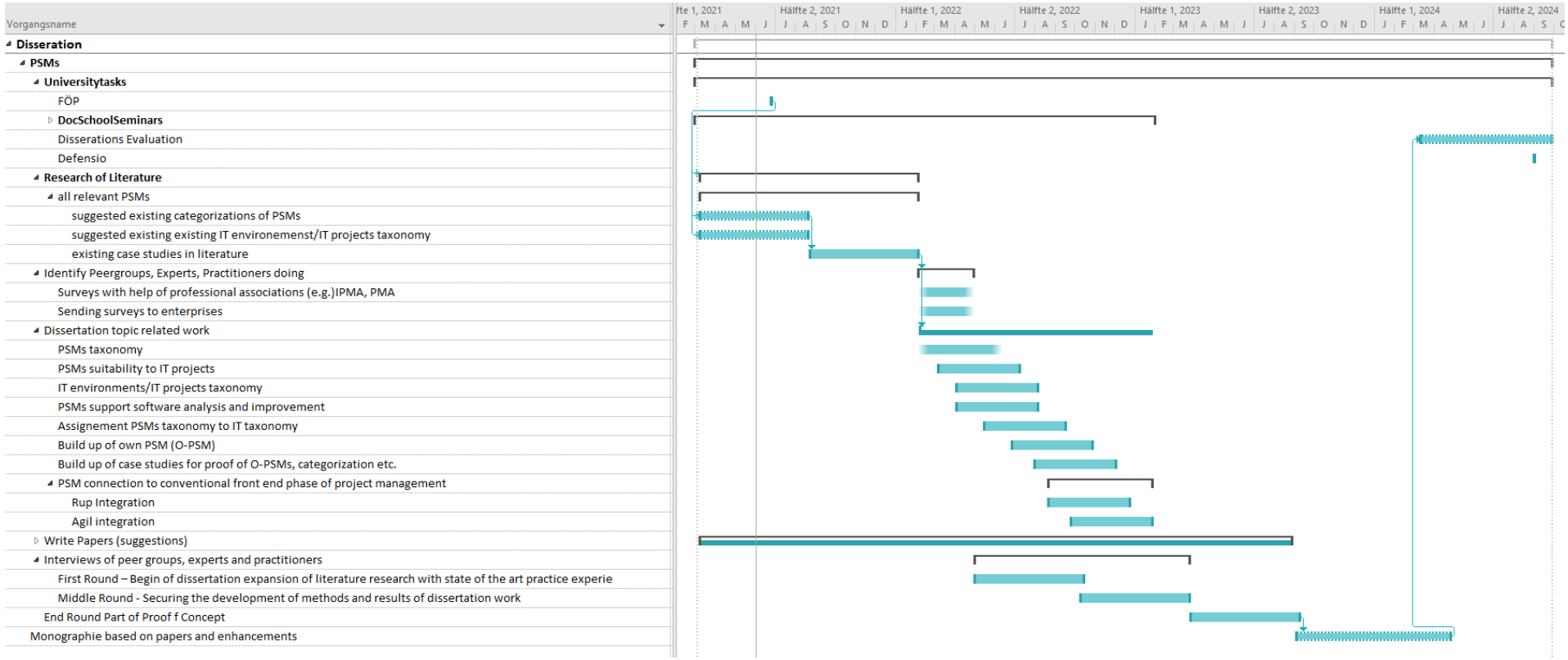
Conclusion:

IT applications should help to solve real-world problems or at least make them manageable. For this, it is necessary to map parts of reality into computer models. To do this, structured problem descriptions are required.

With PSMs, which have been in use for decades, we have sophisticated methods that achieve this transformation, unstructured situation into structured problem description.

This work will increase the benefit of the PSMs for the field of computer science and ultimately make successful IT projects more likely. Due to the strong connection with the real problem situation, better applicability of the results of the IT projects can be expected.

Timeline: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Research of Literature
all relevant PSMs
suggested existing categorizations of PSMs
suggested existing existing IT environemenst/IT projects taxonomy
existing case studies in literature
Identify Peergroups, Experts, Practitioners doing
Surveys with help of professional associations (e.g.)IPMA, PMA
Sending surveys to enterprises
Dissertation topic related work
PSMs taxonomy
PSMs suitability to IT projects
IT environments/IT projects taxonomy
PSMs support software analysis and improvement
Assignement PSMs taxonomy to IT taxonomy
Build up of own PSM (O-PSM)
Build up of case studies for proof of O-PSMs, categorization etc.
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