Concept for the Research Seminar "Systematic Innovation Methodology"

Hans-Gert Gräbe, Ken Pierre Kleemann, Simon Johanning,
Nadine Schumann (Uni Leipzig), Ralf Laue (WH Zwickau)

April 11, 2022

1 Aim and Methodology of the Seminar

The concept of a *system* plays a prominent role in computer science when it comes to database systems, software systems, hardware systems, accounting systems, access systems, etc. In general, computer science is regarded by a majority as the "science of the *systematic* representation, storage, processing and transmission of information, especially their automatic processing using digital computers" (German Wikipedia). Also certain relevant professions such as the *system architect* are in high esteem by IT users.

However, the significance of the concept of system extends far beyond the field of computer science – it is fundamental for all engineering sciences and as *Systems Engineering* with the ISO/IEC/IEEE-15288 standard "Systems and Software Engineering", it is also the subject of international standardisation processes. Even more, the concept of systems also plays an important role in the description of complex natural and cultural processes.

In contrast to an *artefactual* dimension of computers and software running on them, Systems Engineering is more concerned with the *design and use* of such systems as a result of *cooperative action*. The English Wikipedia emphasises

> "Systems Engineering is an interdisciplinary field of engineering and engineering management that focuses on how to design, integrate, and manage complex systems over their life cycles. At its core, systems engineering utilises systems thinking principles to organise this body of knowledge. The individual outcome of such efforts, an engineered system, can be defined as a combination of components that work in synergy to collectively perform a useful function."

Ian Sommerville takes a similar view when he identifies the design and operation of socio-technical systems as the focus of his textbook *Software Engineering*.

> *Socio-technical systems* contain one or more technical systems, but beyond that – and this is crucial – the knowledge of how the system should be used to achieve a broader purpose. This means that these systems have *defined work processes*, *human operators* as integral part of the system, are *governed by organisational policies* and are affected by *external constraints* such as national laws and regulations. [4, p. 48]

Systematic Innovation Methodology takes these concepts of organisational computer science[1] and combines them with questions of Business Process Modelling. In such practices, the worlds of experience of the engineer and the manager meet, at least insofar as the latter applies *scientifically based methodologies* to organise his work. However, structured approaches on the basis of systemic modelling is increasingly shaping managerial action as well, making the latter an *engineer of social relations* who has to solve essential tasks in the design of more comprehensive socio-technical systems such as organising companies or inter-company supply chain structures.

In the seminar, we want to learn more about such modern management appoaches in which *common conceptualisations* and *consensus-oriented decision-making processes* are central and of crucial importance for the success and ways of formation and consolidation of new systemic structures. We are particularly interested in the connection between the dialectical resolution of contradictory requirement situations in the sense of *TRIZ methodology*, the transition of such approaches to *Business TRIZ*, and the emergence of common conceptual and notational worlds as a result of the application of suitable Semantic Web technologies.

2 Thematic Orientation of the Seminar in S22

TRIZ as a systematic innovation methodology has its roots in the field of engineering, especially in mechanical engineering. Even when applied, for example, in the field of chemical technologies (see the books by Dietmar Zobel), some special features arise, since chemical technologies are more oriented towards *processes* and less towards designing equipment.

TRIZ methodologies are applied

- to sharpen intended effects in functional modelling as an Ideal Final Result or Ideal Machine,
- to identify negative (harmful) effects occurring during implementation,
- to localise such problems as contradictory behaviour in a delimitable "operational zone",
- and finally to resolve such contradictions by transforming a "system as it is" into a "system as required".

Such ideas and approaches can be transferred to non-technical areas in which *systemic thinking*, *planning-based* cooperative action and thus *scientifically based practices* are established.

In the last 20 years, in particular the field of *organisational management* has developed in this direction. This domain includes the modelling of *business processes* in smaller-scale internal BP landscapes and more compact *business models* in larger-scale inter-organisational contexts. Today scientifically based methods are used more widely beside experience-based control methods such as those described in "Mintzberg on Management" [3]. Data-supported methods of recording and evaluating real-world processes, which require common terminologies and the use of Semantic Web technologies of data management, are gaining particular importance in that area.

This idea of transferring basic TRIZ approaches to the management field is taken up in *Business TRIZ*. A schematic transfer is not very helpful, as is the schematic application of

[1] The subject of computer science is not only hardware and software, but also orgware.

TRIZ to concrete engineering problems, too. Even in applications of classical TRIZ to concrete problems, *domain specifics* with its own terminology and established procedures must always be taken into account. If such engineering problem-solving processes are embedded in internal company contexts, economic analyses and thus approaches of Business TRIZ have always been applied. In this respect, the idea of *systematising* such experiences is evident.

In TRIZ as an *application-oriented methodology*, "use cases" as successful solutions to problems are an important driver for the further theoretical development. In this specificity, Business TRIZ meets with other management theories, which also have to prove their effectiveness above all in *practical* applications. For this purpose, specific consulting structures have emerged in the management sector, in which such experiences *converge* on an inter-company level, are *systematised*, *consolidated* and *disseminated* via both consulting and training structures. Business TRIZ is only one building block in this larger methodological context.

In the seminar we want to explore various aspects of Business TRIZ from such a more general perspective. M. Bindel [1] has compiled an initial overview in her seminar paper in W21. On the basis of [2], particular Business TRIZ concepts in their relation to business processes are to be presented in more detail in this semester's seminar.

3 Embedding of the Seminar

The seminar is designed as a permanent *Research Seminar* in which developments on the topic outlined above have been studied in more detail since 2019 with different focuses. A summary of findings and discussions is available as *Seminar Notes:*

- Seminar on System Theory. Winter Term 2019/20.
  `https://nbn-resolving.org/urn:nbn:de:bsz:15-qucosa2-748430`
- Management Theories. Summer Term 2021.
  `http://www.informatik.uni-leipzig.de/~graebe/skripte/Notes-S21.pdf`
- Sustainability, Environment, Management. Winter Term 2021/22.
  `http://www.informatik.uni-leipzig.de/~graebe/skripte/Notes-W21.pdf`

The course offered by the working group *Systematic Innovation Methodologies* at the InfAI is part of the WUMM project[2] aims at a better understanding of such management processes. Our starting point was TRIZ as a systematic innovation methodology derived from engineering experience in contradictory requirement situations. With the field of *Business TRIZ*, which has been unfolding for about 20 years, a transfer of experience is being actively promoted, embedded in older management cultures and theories. A better understanding of such approaches to management issues and their connection to systemic concepts and approaches remains in the focus of our seminar.

In recent years, co-operative action by differently specialised experts has become increasingly important. In such interdisciplinary work contexts, the development of *common conceptual systems* of sufficient performance proves to be a difficult problem that can be supported by digital semantic technologies. Parallel to these challenges *agile approaches* play a major role,

[2] WUMM stands in German for *Widersprüche und Managementmethoden* (Contradictions and Management Methods).

not only in the field of management, but also increasingly in the solution of socio-technical and engineering problems concerning ongoing co-operative actions in multi-stakeholder contexts – for example with the concept of *technical ecosystems*.

4 Organisation of the Course

In the **seminar** we jointly explore different aspects of systematic innovation methodologies. With this seminar, we are approaching comprehensive topics that are new to us, which offers the opportunity to participate in a joint academic explorative process on a basis of equals. This bears opportunities, but also challenges. The students are expected to actively participate in the seminar through seminar discussions, presentations and last but not least by reading the relevant materials. For the successful completion of the seminar, a topic has to be presented as discussion leader and a handout of 2–3 pages on the topic has to be submitted in advance.

The seminar is accompanied by a **lecture** *Modelling Sustainable Systems and Semantic Web* (Thursday 9-11 a.m.) in which important concepts of our interdisciplinary course programme such as

- technology as combination of globally available procedural knowledge, institutionalised procedures and private procedural skills,
- sustainability requirements and systemic concepts,
- digital change and concepts of Semantic Web technologies,
- concept and knowledge formation processes,
- cooperative action, network economies and Open Culture

are developed in more detail. The lecture and the seminar are not directly related to each other, but conceptual frameworks developed in the lecture will be heavily present in the seminar. There is a slide stack[3] available from the lecture in the previous semester.

All materials and seminar reports that can be made publicly available, will be published in the github repository `https://github.com/wumm-project/Seminar-S22`.

5 Seminar Organisation

The seminar will be held weekly on Tuesdays 9-11 a.m. synchronously online. Prior to each appointment participants have to study the assigned reading to be in a position to discuss the problems in the seminar. The seminar is moderated by a *discussion leader*, who prepares a short workout of 2–3 pages and makes it available to the participants in advance *before the seminar* (by Sunday evening).

Students find more about the seminar in the Saxonian e-learning platform OPAL[4]. The platform will be used for organisational purposes only. The **primary source for the seminar plan** is the (actual version of the) file `Seminarplan.md` in the github repository *Seminar-S22*.

[3] `http://www.informatik.uni-leipzig.de/~graebe/skripte/Folien-W21.zip`

[4] `https://bildungsportal.sachsen.de/opal/` – Course S22.BIS.SIM.

6 Examination. Topics for Seminar Work

In order to successfully complete the seminar module, one of the seminars has to be moderated as discussion leader, for this seminar a short workout has to be prepared and made available to the participants and a Seminar Paper (about 20 pages) has to be written.

The seminar is graded from the evaluation of this Seminar Paper, which has to be completed until the end of the semester on September 30, 2022.

7 Privacy

We follow an Open Culture approach not only theoretically, but also practically and make course materials publicly available. This also applies to the course materials you have to produce (presentations, seminar papers) as well as to (annotated) chat sessions of the seminar discussions, in which your names are also mentioned. We assume your consent to this procedure if you do not explicitly object. The seminar discussions themselves are **not** recorded.

To simplify the further use of the materials and texts, the papers are asked to be compiled in English using LaTeX. Also the LaTeX source should be provided under the terms of the CC-BY[5] license in order to create a corresponding corpus of texts that can be used to accompany similar efforts in the OpenDiscovery project. Of course, this cannot be "decreed". **Please inform the seminar instructor if you do not wish to make your work available for exchange under these conditions**.

8 Seminar plan

The seminar starts on April 19, 2022 with a kick-off meeting. The exact topics and themes will be published at the beginning of the seminar, when the number of participants can be estimated more precisely.

A non-exhaustive list of possible topics for student presentations is compiled in the *Seminar Plan*.

References

[1] Michelle Bindel (2022). *System Model Innovation with Business TRIZ*. Seminar Paper. `https://github.com/wumm-project/Seminar-W21/blob/master/SeminarPapers/MichelleBindel.pdf`

[2] Darrell Mann (2007). *Hands-On Systematic Innovation for Business and Management*. IFR Press.

[3] Henry Mintzberg (1989). *Mintzberg on Management*.

[4] Ian Sommerville (2007). *Software Engineering*. Cited by the German 8th edition. Pearson Studium.

[5] `https://creativecommons.org/licenses/by/4.0/`