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Method construction - a core approach to organizational engineering

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Method Construction – A Core Approach to Organizational Engineering

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ABSTRACT
This paper discusses whether method construction can serve as a core approach to organizational engineering. Based on a discussion of fundamental scientific positions in general and approaches to information systems research in particular, appropriate conceptualizations of 'method' and 'method construction' are presented. These conceptualizations are then discussed regarding their capability of supporting organizational engineering.

Categories and Subject Descriptors
D.2.10 [Design]: Methodologies

General Terms
Documentation, Design, Theory, Verification.

Keywords
Organizational Engineering , Method Engineering, Method

1. Introduction
Organizational engineering aggregates multi-disciplinary concepts, methods and technology to model, develop and analyze various aspects of changing organizations [38]. Hence organizational engineering can be regarded as a 'design science' approach as specified by HEFNER ET AL. [15] for information systems research (ISR). Generally, all scientific methodologies should appropriately reflect the particular research questions, the validity of results and the actual discourse environment [24] [42]. For the 'design science' ISR approach, epistemological issues have been discussed e.g. in [9] [11] [33]. According to GREIFFENBERG, methods can be regarded as design science 'theories' if appropriately constructed and validated [11].

This paper discusses whether, as a consequence of GREIFFENBERG's proposal, the systematic construction of methods can serve as a core scientific methodology for organizational engineering. Based on a discussion of fundamental scientific positions in general (section 2) and ISR positions in particular (section 3), appropriate conceptualizations of 'method' and 'method construction' are presented in section 4, and literature contributions are classified according to these conceptualizations. Method construction is then classified regarding its scientific positioning in section 5. Based on this analysis, the concluding section 6 discusses the potential of method construction as a core methodology for organizational engineering. Due to the importance of the 'design science' ISR approach in the German-speaking countries, many citations reference work in German language. International authors and publications in English however have been considered wherever available and appropriate.

2. Epistemological Process
In order to be able to assess the potential of method construction as a scientific approach, an overview of the main aspects of epistemology and the philosophy of science is given below. In research practice, a clear positioning in terms of epistemology and philosophy of science is often difficult. Although extreme positions are rare, this section discusses these extremes for reasons of clarity.

2.1 Epistemological Positions
Different epistemological opinions exist regarding (a) the source of knowledge and (b) the subject's relationship with the outside world, including the implications which result from it.

a) According to MUSGRAVE AND SEIFFERT [25], empiricism and rationalism can be regarded as the basic epistemological positions in respect of the source of knowledge.

b) Where the relationship with the outside world is concerned, the central debate is between the advocates of realism and idealism. Despite the fact that this pairing of concepts stems from metaphysics, it is also applied in epistemology. Whereas metaphysical realism objectivisticallly takes the viewpoint that the real world exists independently of the knowing or perceiving subject, for metaphysical idealism there is subjectivistically no objective reality independent of the human spirit. Thus, when applied to epistemology, the truth or falsehood of a belief is seen by the objectivist as a decisive objective characteristic which has to be defined in terms of its consistency with objective facts. For the subjectivist, on the other hand, a belief is true if it is self-evident from the perspective of the subject [26].

2.2 Philosophy of Science Positions
In its narrower sense, the term philosophy of science is used nowadays to encompass logical empiricism, which primarily aims to solve problems by means of formal logic and semiotics, and POPPER'S critical rationalism [34]. The approaches can be roughly characterized on the basis of the attributes (a) scientific legitimacy, (b) scientific procedure and (c) research approach.

a) Two different approaches exist to validate the scientific legitimacy of a proposition: verification and falsification. The former, which is pursued by the advocates of logical empiricism in particular [34], assumes that a proposition is scien-

tific if the observation of a spatially and temporally determined event can be formulated for it. The decision rule states: a proposition is true if it is confirmed by observation. Conversely, POPPER, as founder of critical rationalism, claims that a proposition in the context of a theory or a theoretical system should be recognized as scientific if the proposition or the system is falsifiable [1]. This means that an observation can be formulated which contradicts the proposition or the system [30].

b) Furthermore, scientific approaches can be distinguished according to their procedures. Whereas deduction is based on the laws of logic, under which it is sometimes subsumed, and on the basis of laws and theories derives different conclusions which can serve as explanations and predictions [7], induction in its naïve form assumes that the epistemological process is based on observation and generalization. While critical rationalism rejects induction to explain the truth or probability of hypotheses, the proponents of induction assume that inductively obtained conclusions are the main sources of knowledge [2].

c) As the last attribute for differentiating scientific positions, it is possible to distinguish between the quantitative and qualitative research approach. While the former attempts to establish a contradiction-free connection between the elements of a theory and reality by means of large random samples, the qualitative approach sets out to understand and interpret observable aspects of reality [24].

3. The Epistemological Process in Information Systems Research

In order to position method construction in ISR, an overview of the goals and methods of ISR is provided below.

3.1 Goals of Information Systems Research

BECKER ET AL. deduce four research goals for ISR [5]. In relation to the objects of ISR, i.e. information systems and their environment, they distinguish on the one hand between the behavioral science approach and the design science approach:

- Behavioral science approach: The goal of this approach is to comprehend reality.
- Design science approach: The goal of this approach is to design and/or change reality. Here, it is possible to draw on the results from behavioral research.

On the other hand, BECKER ET AL. differentiate between method-oriented research goals (i.e. which aim to understand and develop methods and techniques for information systems analysis, design and utilization) and artifact-oriented research goals (i.e. which aim to understand actual information systems utilization and to develop actual information systems).

3.2 Methods of Information Systems Research

KÖNIG ET AL. identified the most important research methods in the German-speaking ISR community as part of a Delphi study [22]. If these research methods are extended to include the dominant methods in the Anglo-American community [14], this results in Table 1:

Table 1. Methods of information systems research

Empirical Methods	Observation (e.g. of user or system behavior)
	Document analysis
	Ethnography
	Exploration by means of case studies and field studies
	Ex-post descriptions and interpretations of real facts
	Research through development
	Grounded theory
	Reference models as a quasi-empirical (semi-formal) approach
	Surveys, interviews
Constructive Methods	Action research
	Argumentative research
	Deduction
	Development and testing of prototypes
	Creativity techniques
	Modeling
	Simulation
	Futurology

Consolidation is performed by merging research methods with the same content. The categories "Empirical Methods" and "Constructive Methods" are based on the classification in [22].

4. Methods

Before going on to take a closer look at the construction of methods below, the method concepts of ISR should be examined.

4.1 General Method Concept

LORENZ defines a method as a process which is planned and systematic in terms of its means and purpose, and which leads to technical skill in resolving theoretical and practical tasks [23]. Characteristic features of the concept of method are goal orientation and a systematic ('engineering') approach. Someone who acts methodically can explain the means and procedures they selected to achieve specific goals. In science, method concepts vary slightly according to the respective universe of discourse. If these different concepts are consolidated around a common core, a method is a process for systematically acquiring, representing and imparting knowledge.

Table 2. Fundamental attributes of methods

	BALZERT [3]	BECKER [4]	BRINKKEMPER [6]	CRONHOLM [8]	FERSTL/SINZ [9]	GREIFFENBERG [11]	GUTZWILLER [13]	KARLSSON [20]	KETTINGER [21]	PRAKASH [28]	PUNTER [29]	SCHEER [32]
Goal orientation	X	X		X	X	X			X	X	X	
Systematic approach	X	X	X	X	X	X	X		X		X	
Principles	X	X	X	X	X				X			X
Repeatability	X											X

4.2 Method Concept in Information Systems Research

The design of information systems necessitates an engineering-based procedure as it needs to be plannable and repeatable. It thus calls for a systematic approach to design. There is broad agreement in the literature that the use of methods constitutes the basis for engineering-based procedure. Nonetheless, a large number of different definitions and opinions exist regarding the concept of method.

When it comes to defining the concept of method, the emphasis is placed on different attributes in the literature:

- Goal orientation: Methods are goal-oriented. They stipulate rules on how to proceed or act in order to achieve defined goals or solve problems.
- Systematic approach: If methods are to deliver rules on how to act and instructions on how to solve problems or achieve goals, then they must possess a systematic structure in order to enable the deduction of concrete work steps or tasks for achieving goals.
- Principles: Many method specifications are closely related to design principles, i.e. general construction guidelines and/or strategies.
- Repeatability: In the literature, some authors call for methods to be intersubjectively repeatable.

Table 2 provides an overview of the fundamental defining attributes of a method used in the literature.

Table 3. Fundamental elements of methods

	Balzert [3]	Becker [4]	Brinkkemper [6]	Cronholm [8]	Ferstl/Sinz [9]	Greiffenberg [11]	Gutzwiller [12]	Karlsson [20]	Kettinger [21]	Prakash [28]	Punter [29]	Scheer [32]
Specification document		X	X				X	X		X	X	
Meta model		X			X		X	X		X		
Role				X			X					
Technique		X	X				X		X		X	
Activity / Procedure model	X	X	X	X	X	X	X	X	X	X	X	X
Tool		X	X				X		X			

4.3 Constituent Elements of a Method

The foundation for the development and description of methods is provided by method engineering. Gutzwiller has analyzed numerous approaches to method engineering and derived generally applicable elements of method description in [13]. According to Gutzwiller, a method is described on the basis of the elements "activity", "role", "specification document", "meta model" and "technique". Activities are construction tasks which create certain results, i.e. which create certain specification documents. A procedure model is created by virtue of the fact that activities are performed in a specific order. Activities are performed by roles (e.g. people, job descriptions or organization units). Results are recorded in previously defined and structured specification documents. Techniques are understood to mean detailed instructions for the development of a certain type of specification documents. Tools can be used to support the application of one or more techniques. The meta model specifies the conceptual data model of the results, thereby guaranteeing the consistency of the entire method.

Table 3 shows an overview of the fundamental elements of a method proposed in the literature.

4.4 Research Methods for Method Construction

In the literature considered by the authors (see Table 2 and Table 3), no advice is given as to which research approaches are primarily suited to the construction of methods. For this reason, the authors have analyzed a series of scientific articles which set out to construct a method. The research approaches adopted in the articles considered are shown in Table 4 and differentiated according to the research method used and their orientation toward practice or literature.

Table 4. Research methods in scientific articles

Author	Research Methods	Focus
Grant [10]	Action research	Practice
Grünauer [12]	Action research	Practice
Heinrich [16]	Deduction, case study research	Literature
Herden [17]	Deduction, development and testing of prototypes, modeling	Literature
Hinrichs [18]	Deduction, development and testing of prototypes, modeling	Literature
Kaiser [19]	Creativity technique, action research	Practice
Park [27]	Case study research, deduction	Literature
Riempp [31]	Action research, case study research, ethnographic research, deduction, creativity technique	Practice
Steffen [35]	Deduction, case study research	Literature
Strauch [36]	Deduction, case study research	Practice
Thiesse [37]	Action research, deduction, case study research	Practice
Vidgen [40]	Action research	Practice
Wolf [41]	Deduction, case study research	Practice

5. Scientific Classification of Method Construction

In this section, method construction is classified according to epistemological and philosophy of science positions as well as ISR goals and methods.

The approaches to method construction cited in section 4.4 can be split into two categories according to whether they are primarily

derived from actual cases or from literature, which are reflected in Table 5 (column 'Cases' and column 'Lit.').

For the classification of method construction from the epistemological perspective, Table 5 shows that it is first and foremost practice-oriented method constructions which are primarily empirical in their argumentation core, whereas methods derived from literature can be classed as rationalistic in respect of their *knowledge source*. In the case of method construction, the *relationship with the outside world* can be classed as oriented toward an existing reality and therefore objectivistic.

Table 5. Classification of method construction

			Cases	Lit.
Epistemology	Knowledge source	Senses (empiricism)	X	
		Reason (rationalism)		X
	Relationship with Outside World	Objectivistic/realistic	X	X
		Subjectivistic/idealistic		
Philosophy of Science	Validation	Falsification		
		Verification	X	X
	Scientific Procedure	Deductive		X
		Inductive	X	
	Research Approach	Qualitative	X	X
		Quantitative		
Research Goals	Basic Approach	Comprehension		
		Design	X	X
	Research Goals	Method-oriented	X	X
		Artifact-oriented		
Research Methodology	Empirical Methods	Exploration through case studies	X	
		Surveys, interviews	X	
		Document analysis	X	X
	Constructive Methods	Action research	X	
		Deduction		X

From the point of view of science theory, the *validation* of constructed methods is performed as a rule by means of verification. The *scientific procedure* of method construction is to be characterized as primarily inductive or primarily deductive depending on whether it is oriented toward practice or literature respectively, although HEINRICH [16] claims to proceed inductively in his literature-oriented work. Since case studies in ISR are also intended to contribute to solving problems which are weakly structured in terms of theory, qualitative *research approaches* are generally suitable.

Regarding the *basic research approach*, method construction is clearly part of design science. As expected, method-oriented research goals dominate clearly.

Where *research methods* are concerned, method construction based on interaction with practice relies in particular on "action research", "surveys and interviews", "document analysis" and "exploration by means of case studies and field studies". Method construction based on literature, on the other hand, uses first and foremost document analysis and deduction.

Overall, Table 5 shows that both the method construction which stems from practice and that which stems from literature can be characterized from an epistemological and from a philosophy of science viewpoint, and are embedded in ISR in terms of their research methodologies.

6. Potential of Method Construction as a Core Methodology for Organizational Engineering

Since organizational engineering is intended to create and keep the alignment between (models of) business strategy, business processes and business support systems [39], it can be classified as a design science, method-oriented approach to ISR. It was shown in this paper that all analyzed approaches to method construction do exactly match this classification and hence constitute a strong candidate for a core methodology for organizational engineering. Since method construction approaches based on cases and those based on literature still significantly differ with regard to knowledge source, scientific procedure and research methodology, however, the organizational engineering research community has to consolidate a generalized concept (or set of concepts) for method construction and a set of requirements for acceptable method construction formats.

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