Project types of business process management

Towards a scenario structure to enable situational method engineering for business process management

Tobias Bucher and Robert Winter
Institute of Information Management, University of St Gallen, St Gallen, Switzerland

Abstract

Purpose – The purpose of this paper is to explore project types (PTs) of business process management (BPM). PTs are a key concept to describe development situations in situational method engineering (SME). SME acts on the assumption that generic methods need to be adapted to the specifics of the development situation in which they are to be applied.

Design/methodology/approach – The paper draws on results from an empirical analysis directed at the identification of design factors of and realization approaches to BPM. It extends an earlier study through the inclusion of new data points that allow for the derivation and characterization of PTs. To this end, multivariate data analysis techniques such as regression analysis, factor analysis, and cluster analysis are applied. Albeit inherently behavioral, the research described in the paper constitutes an important foundation for subsequent design research (DR) activities, in particular for the engineering of situational methods.

Findings – The analysis suggests that there are three major and two minor PTs that characterize development situations of BPM. The common ground of the three major PTs is that they are characterized by a common target state, in this paper denoted as individualist realization approach to BPM. When compared to other realization approaches, this approach is characterized by high maturity and high customization requirements for process management.

Research limitations/implications – The gain in insight into the PTs of BPM is particularly useful for the engineering of situational methods aimed at the implementation and advancement of process-oriented management within real-world organizations. However, there are some research limitations/implications for further research: the empirical results are derived from a relatively small data set. The PTs identified in the present contribution therefore need further validation. In order to complete the proposed scenario structure for BPM, a taxonomy of complementary context types needs to be identified, too.

Practical implications – Many methods to support BPM or particular aspects thereof have been proposed and discussed. A major shortcoming of most of these methods is that they claim to be of universal validity. SME acts on the idea that there is no "one-size-fits-all" method. Instead, generic methods need to be adapted to the specifics of the development situation in which they are to be applied. The proposed PTs represent a starting point to enable the engineering of situation methods for BPM.

Originality/value – The research results of this paper are useful for the construction of methods in the field of BPM which can be adapted to specific development situations.

Keywords Business process re-engineering, Process management, Systems engineering

Paper type Research paper

Business Process Management Journal
Vol. 15 No. 4, 2009
pp. 548-568

1463-7154
DOI 10.1108/14637150910975534

The authors would like to thank the anonymous reviewers for their constructive feedback that helped to improve the work.

Introduction

"The story of the practical use of [b]usiness [p]rocess [m]anagement in different organizations is one of diversity and of effective outcomes" (Armistead *et al.*, 1999). This quotation highlights the fact there is no "one-size-fits-all" approach to business process management (BPM). Many authors argue that the progress towards organizational excellence through process-oriented management takes place in different stages, that different approaches or aspects thereof are predominant at different levels of organizational development, and that almost each and every organization has developed its own approach to BPM (Ho and Fung, 1994; Armistead *et al.*, 1999; Balzarova *et al.*, 2004).

The finding that generic solutions to practical problems (such as methods, models, or software) always need to be adapted in order to fit the characteristics of the problem situation at hand is not new. In fact, this finding has been argued for many years, especially in the field of situational method engineering (SME, Kumar and Welke, 1992; van Slooten and Brinkkemper, 1993; Harmsen *et al.*, 1994). Similar reasoning was made with respect to the application of reference models (Fettke and Loos, 2003; vom Brocke, 2007) and the selection and customization of Enterprise resource planning modules/systems (Kumar *et al.*, 2003; McGaughey and Gunasekaran, 2007; Parthasarathy and Anbazhagan, 2007; Muscatello and Chen, 2008). Irrespective of the type of solution, there is one common and essential precondition for the successful adaptation of the generic solution to a specific problem: the identification of attributes/qualities that may be used to characterize the specifics of the problem situation at hand. In this paper, we will focus on the identification of project types (PTs) that may – together with a complementary taxonomy of context types (CTs) – be used to differentiate multiple scenarios of BPM development. These findings serve as a foundation for the engineering of situational methods to support the implementation and advancement of BPM.

Based on the BPM body of literature (Davenport, 1993; Hammer and Champy, 1993; Harrington, 1995; Armistead and Machin, 1997; Zairi, 1997; Kueng and Krahn, 1999; Smith and Fingar, 2003; Melenovsky *et al.*, 2005; Hill *et al.*, 2006; Wang and Wang, 2006), four generic phases of BPM can be distinguished (Bucher and Winter, 2006):

(1) *Process identification, design, and modeling*. This stage includes the identification and thorough analysis of all activities and tasks within an organization. On this basis, processes (in terms of structured sequences of activities) have to be defined, designed, and modeled. If possible, all process stakeholders should participate in this stage. Particular attention should be paid to the coactions and mutual dependencies of the entirety of an organization's business processes.

(2) *Process implementation and execution*. The implementation of business processes includes the setup and/or adjustment of all activities, tasks, resources, and supporting information technology (IT) that are required for frictionless process execution. The training and ongoing support of process managers as well as process workers is also of key importance.

(3) *Process monitoring and controlling*. Irrespective of the degree of process automation, it is reasonable to monitor and control the execution of business

process in near-time or preferably real-time in order to be able to take corrective action in case of process exceptions and failures. Furthermore, process performance indicators can also be consulted to support managerial decisions and/or to guide process enhancements.

(4) *Process enhancements*. Already the first-time completion of stages one through three brings forth far-reaching changes for an organization. Nevertheless, the ongoing optimization of business processes and of the process landscape must not be forgotten. BPM must be understood as continuous approach to organizational optimization.

As stated before, there is sufficient evidence from both the body of literature as well as from our project experience with industry partners that real-world organizations adopt the BPM approach in many different ways. The findings of one of our previous empirical studies (Bucher and Winter, 2006, results sketched in section "Realization approaches of business process management" of this paper) support this assumption as well. Different organizations put different emphasis on one or multiple of the BPM stages mentioned above. However, research that is explicitly directed at gaining insight into and understanding the nature of these situational aspects of BPM as well as at identifying, categorizing, and describing different BPM approaches is scarce.

During the last two decades, a huge amount of methods to support BPM or particular stages thereof have been proposed. Business process modeling methods (stage 1: Scholz-Reiter *et al.*, 1999; List and Korherr, 2006; OMG, 2006) and business process reengineering methods (stage 4: Davenport and Short, 1990; Hammer, 1990; Harrington, 1991, 1995; Kaplan and Murdock, 1991; Davenport, 1993; Hammer and Champy, 1993; Hammer and Stanton, 1995; Imai and Heymans, 1999) are two well-known examples. However, those more or less generic methods that are aimed at supporting BPM or aspects thereof often do not take into account situational aspects – such as the maturity level of BPM within an organization or the nature of the underlying BPM approach. They rather claim to represent methods with almost universal validity.

To close this gap and to enable the engineering of situational methods, the paper at hand is aimed at identifying "project types" for the implementation and advancement of BPM within real-world organizations. PTs and CTs are the two key concepts to describe development situations in SME. As opposed to CTs, PTs are determined by factors/elements that both influence the applicability of a method and are at the same time transformed by the method's application. Consequently, the research presented in the paper at hand is aimed at answering the following two research questions:

RQ1. Which influencing variables are suited to characterize BPM PTs as an integral part of BPM development situations?

RQ2. What are the major BPM PTs to be observed in reality, and in what way are they different from each other?

As already mentioned before, the paper draws on results from our own previous work, in particular (Bucher and Winter, 2006). To address the above research questions, however, new data points are taken into account, the analysis is expanded considerably, and both new and continuative conclusions are drawn based on the empirical results. In doing so, we will focus explicitly on the identification and discussion of PTs while abstaining from contemplating CTs due to the nature of the underlying data set. In order to complete the proposed scenario structure for BPM, complementary CTs need to be specified, too. This will be subject to further research.

The remainder of this paper is structured as follows: the subsequent section, labeled "Situational method engineering," provides a short introduction to the principles of method construction and situational adaptation. The two sections that follow, entitled "Realization approaches of business process management" and "Derivation and characterization of project types," report on the results of an empirical analysis targeted at the identification of realization approaches and PTs of BPM. The concluding sections of the paper, headed "Discussion of research results" and "Conclusion and outlook," discuss the analysis results, summarize the main findings, and provide an outlook on further research.

Situational method engineering

ME can be attributed to the "design research" (DR) paradigm for information systems (ISs) development. DR, as opposed to behavioral research, is aimed at creating solutions to specific problems of practical relevance (March and Smith, 1995; Hevner *et al.*, 2004). Both design processes and design products play an important role in DR:

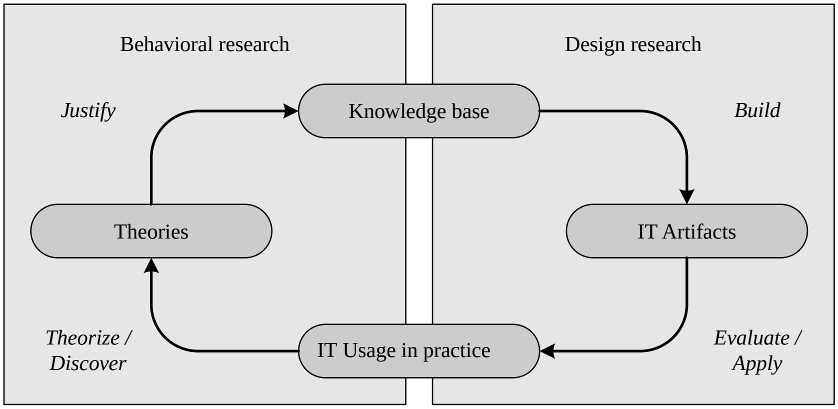
> As a product, a design is "a plan of something to be done or produced"; as a process, to design is "to so plan and proportion the parts of a machine or structure that all requirements will be satisfied" (Walls *et al.*, 1992).

As for the process aspect, the current body of DR literature proposes a variety of IS research processes that are closely related to each other. For example, March and Smith (1995) propose to distinguish between the four research activities "build," "evaluate," "theorize," and "justify." The "build" activity refers to the construction of artifacts whereas the "evaluate" activity addresses the formulation of evaluation criteria and the comparison of the design artifact with those criteria. The activities "theorize" and "justify" are concerned with the formulation and analysis of tentative explanations for why an artifact is valid or invalid in a given context. In accordance with this research process (Rossi and Sein, 2003) differentiate between "identify a need," "build," "evaluate," "learn," and "theorize." They particularly emphasize the necessity to identify an adequate research gap as an essential basis for the design of an artifact that is of practical relevance (Hevner *et al.*, 2004) stress the dualism of the two phases "develop/build" and "justify/evaluate" too. Niehaves (2006) summarizes these proposals and suggests the IS research cycle depicted in Figure 1.

The outcome of the design process – the design products – are commonly referred to as "artifacts,", i.e. as human-made objects of any kind (Simon, 1996). In the context of DR for IS, artifacts are typically of four types, namely constructs, models, methods, and implementations (Nunamaker *et al.*, 1990; March and Smith, 1995; Hevner *et al.*, 2004).

ME is concerned with the design, construction, adaptation, and evaluation of a particular DR artifact class – methods. A method is:

> [...] an approach to perform a systems development project, based on a specific way of thinking, consisting of directions and rules, structured in a systematic way in development activities with corresponding development products (Brinkkemper, 1996).



Source: Adapted from Niehaves (2006)

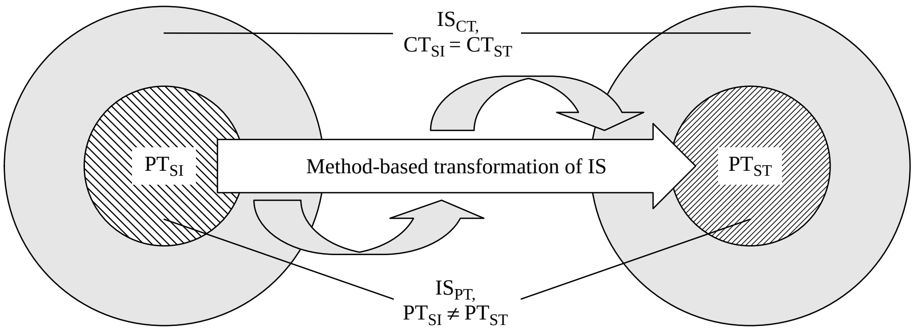
Figure 1.
IS research cycle

Generic methods need to be adapted to the specifics of the development situation in which they are to be applied. This approach is commonly referred to as SME (Kumar and Welke, 1992).

ME and SME are research disciplines that originate from software engineering. For that reason, a lot of ME/SME publications exhibit more or less explicit references to the domain of software engineering. In this paper, we will argue that most of the underlying principles of ME/SME can be applied to the business domain as well. The primary design objects of the business domain are socio-technical IS. Socio-technical IS are understood as the entirety of persons, business processes, software, and IT infrastructure that process data and information in an organization (Brookes *et al.*, 1982; Tatnall *et al.*, 1996; Bacon and Fitzgerald, 2001; Vessey *et al.*, 2002). The socio-technical understanding is similar to the definition of IT-reliant work systems. According to Alter (2003, 2006), a work system is defined as "system in which human participants and/or machines perform work using information, technology, and other resources to produce products and/or services for internal or external customers."

Consequently, methods pertaining to the business domain are targeted at the engineering and/or change (in the following summarized as transformation) of a socio-technical IS. Examples of such methods can be found in various publications (Kumar and Motwani, 1995; Zhang and Sharifi, 2000; Kremer *et al.*, 2003; Winter and Strauch, 2003; Tyler and Cathcart, 2006; Wortmann and Winter, 2006). A method represents a systematic procedure for the transformation of an IS from an initial state (SI) to a target state (ST) (Figure 2). The set of system elements of IS that are transformed by the application of the method is denoted as IS_{PT}. The combination of initial state of IS_{PT}, denoted as PT_{SI}, and target state of IS_{PT}, denoted as PT_{ST}, is referred to as PT (Bucher *et al.*, 2007).

Besides, PT, there are other – environmental – contingency factors that also have significant impact on the method application. It is a matter of fact that each IS_{PT} is part of a larger IS_{CT} (e.g. an IS is part of an IS landscape, the IS landscape is part of a company, and the company is part of a business network). We refer to this larger IS as environmental IS. This environment is outside of the transformation scope of a method;



Source: Bucher *et al.* (2007)

Figure 2. Method-based transformation of socio-technical information systems

it may comprise non-transformable system elements. The initial state CT_{SI} of IS_{CT} therefore does not differ from the target state CT_{ST}. The state of these environmental IS elements may nevertheless influence the applicability of the method's transformation procedures or techniques (e.g. in form of restrictions). The combination of CT_{SI} and CT_{ST} is denoted as CT (Bucher *et al.*, 2007). Aspects typically represented in CT are, for example, organizational size, the industry sector, or the organization's degree of centralization/decentralization.

As a matter of fact, both PT and CT are relevant parameters that have to be considered in SME. They are made up of project factors and context factors, respectively. PT and CT jointly constitute the so-called "development situation" or "scenario" (Figure 3) that may influence the applicability, effectiveness, and efficiency of method application. A scenario can relate to one or multiple PT as well as to one or multiple CT at the same time. Moreover, it is possible that certain combinations of PT and CT do not exist in reality and therefore do not constitute valid scenarios.

In spite of the differences between behavioral research and DR, it is essential to note that certain interactions between the two research paradigms do very well exist. Approaches and techniques that are commonly used in behavioral research (left-hand side of the IS research cycle depicted in Figure 1) can be applied to the DR activities (right-hand side of the IS research cycle depicted in Figure 1) in order to support the construction and evaluation of design artifacts (March and Smith, 1995; Cao *et al.*, 2006). Interactions between different research paradigms, their methods, and their techniques are especially important since they complement each other in creating solutions to specific problems. The combination or "triangulation" (Webb *et al.*, 1966)

<table>
<tr><th></th><th>Project type A</th><th>Project type B</th><th>Project type C</th><th>Project type …</th></tr>
<tr><td>Context type a</td><td rowspan="4">Situation 1</td><td colspan="2">Situation 2</td><td>Situation …</td></tr>
<tr><td>Context type b</td><td>Situation 3</td><td></td><td>Situation …</td></tr>
<tr><td>Context type c</td><td colspan="3">Situation 4</td></tr>
<tr><td>Context type …</td><td>Situation …</td><td></td><td>Situation …</td></tr>
</table>

Source: Bucher *et al.* (2007)

Figure 3. Exemplary matrix of development situations

of different methods and techniques will eventually lead to more enlightening and relevant research results.

In this paper we employ multivariate data analysis techniques that are commonly used in behavioral research (in particular regression analysis, factor analysis, and cluster analysis) for the identification of PTs in the BPM domain. Information about PTs of BPM is substantive for the design of situational methods in support of BPM. The research described in this paper, albeit inherently behavioral, therefore constitutes an important foundation for subsequent DR activities, in particular for the construction and evaluation of situational methods for the implementation and advancement of process-oriented management.

Realization approaches of business process management

An empirical analysis of exploratory character was conducted in order to identify current realization approaches of BPM and to infer future developments. As derived in the preceding section, the observable combinations of current state of BPM on the one hand and target state of BPM on the other hand can be referred to as PTs of BPM. In this section, we will describe the course of analysis and briefly report on current realization approaches of BPM. The main findings described in this section have already been published in Bucher and Winter (2006). In the subsequent section, we will extend the analysis to the investigation of target states, i.e. target realization approaches, in order to derive and characterize PTs of BPM.

The data for the exploratory analysis was collected by means of a questionnaire distributed at two BPM forums. The forum participants were specialists and executive staff, primarily working in IT or operating departments concerned with organizational issues and process management. The questionnaire was designed to assess both the current and the target state of BPM within the interviewed organizations. For this purpose, appropriate statements were formulated and the respondents were asked to indicate current and target realization degrees of each item on a five-tiered Likert scale. Thirty-eight properly completed questionnaires entered the analysis. Comprehensive information on the underlying data set can be found in Bucher and Winter (2006).

Eighteen items were selected to be included in the analysis. For each of those items, both the as-is item value and the to-be item value were sampled:

$$\begin{aligned} &\text{as-is item value } v_{ij}^{t_0} && \text{item value } v, v \in \{1, \ldots, 5\} \text{ (Likert scale)} \\ &\text{to-be item value } v_{ij}^{t_1} && \text{observation } i, i \in \{1, \ldots, n_i\}, n_i = 38 \\ & && \text{item } j, j \in \{1, \ldots, n_j\}, n_j = 18 \\ & && \text{time } t, t_0 = \text{as-is}, t_1 = \text{to-be}. \end{aligned}$$

First, a factor analysis was conducted in order to gain insight into the dominant design factors of BPM (using the as-is item values). Principal component analysis (PCA) was chosen as extraction method. PCA is a technique for extracting a small number of mutually independent factors from a multiplicity of items. It is aimed at answering the question of how to summarize the items that load on a particular factor by the use of a collective term (Härdle and Simar, 2003).

According to Dziuban and Shirkey (1974), a data set is appropriate for PCA if and only if the items' anti-image covariance, i.e. the share of an item's variance that is independent of the other items, turns out as small as possible. Consequently, a set of items qualifies for PCA if the proportion of non-diagonal elements in the anti-image covariance matrix that are different from zero accounts for 25 percent at the most. In the case at hand, this parameter value is about 17.6 percent. The measure of sampling adequacy (MSA, "Kaiser-Meyer-Olkin criterion") is about 0.753. The MSA indicates whether or not a factor analysis can reasonably be performed on a given data set (Kaiser and Rice, 1974) appraise a value of 0.7 and more as "middling,", i.e. the data set is considered to be appropriate for applying PCA.

Four factors that jointly explain about 69.1 percent of the total variance were extracted by means of PCA. The component matrix was rotated using the Varimax method with Kaiser normalization in order to improve the interpretability of the items' assignment to factors (left-hand side of Table I). Normally, an item is assigned to a factor if its factor loading amounts to a value of at least 0.5 and/or to the factor on which it loads highest (Härdle and Simar, 2003). Contrary to this rule, four items were assigned to another factor (with similarly high factor loadings) due to logical reasons. The assignment of items to factors can be learned from the italicized values in Table I.

Factor scores were calculated for each factor and each observation using the regression method:

as-is factor score $f_{ik}^{t_0}$ factor score f

factor $k, k \in \{1, \ldots, n_k\}, n_k = 4$

function F_k calculates factor scores f_{ik} for each observation i and each factor k based on the item values v_{ij} of all items $j = 1, \ldots, n_j$ for that particular observation i:

	Rotated component matrix				Standardized means of item values			
Item	Factor 1	Factor 2	Factor 3	Factor 4	Cluster 1	Cluster 2	Cluster 3	Cluster 4
1	*0.614*	0.352	−0.102	0.375	0.427	−0.834	−0.807	1.213
2	*0.498*	0.128	−0.031	0.657	1.189	−0.515	−1.077	0.403
3	*0.843*	0.140	0.132	−0.024	0.109	−0.171	−1.185	1.247
4	*0.717*	0.060	0.365	0.399	0.718	−0.687	−1.019	0.987
5	*0.678*	0.058	0.191	0.377	0.547	−0.696	−0.975	1.125
6	*0.748*	0.078	0.255	−0.001	0.539	−0.846	−0.833	1.140
7	0.105	*0.917*	−0.017	0.088	−0.540	−1.131	0.966	0.704
8	0.250	*0.860*	−0.011	0.179	−0.430	−1.190	0.599	1.020
9	−0.115	*0.524*	0.630	0.067	0.562	−1.425	0.806	0.058
10	0.146	*0.780*	0.295	0.035	−0.257	−1.289	0.576	0.970
11	0.187	0.353	*0.626*	0.260	1.118	−1.160	−0.428	0.471
12	0.140	0.024	*0.712*	0.287	1.418	−0.560	−0.822	−0.036
13	0.565	0.077	*0.611*	−0.151	0.289	−0.479	−1.060	1.250
14	0.358	−0.119	*0.663*	0.074	1.002	−0.794	−0.924	0.716
15	0.542	0.362	0.245	*0.456*	0.655	−1.093	−0.580	1.019
16	0.662	0.224	0.081	*0.480*	0.655	−0.696	−1.001	1.041
17	0.101	0.140	0.362	*0.545*	1.373	−1.016	−0.279	−0.078
18	0.043	0.046	0.161	*0.844*	1.347	−1.036	0.025	−0.335

Table I.
Results of the factor analysis (rotated component matrix) and of the hierarchical cluster analysis (standardized means of item values)

$$
\begin{aligned}
f_{ik}^{t_0} &= F_k\left(v_{ij}^{t_0} \,\middle|\, j = 1, \ldots, n_j\right), \quad \forall i \in \{1, \ldots, n_i\}, \quad \forall k \in \{1, \ldots, n_k\} \\
f_{ik}^{t_0} &\overset{!}{=} F_k^*\left(v_{ij}^{t_0}\right) = b_0^k + \sum_{j=1}^{n_j} b_j^k v_{ij}^{t_0}, \quad \forall i \in \{1, \ldots, n_i\}, \quad \forall k \in \{1, \ldots, n_k\}.
\end{aligned} \tag{1}
$$

Multiple linear regression yields:

$$
f_{ik}^{t_0} = F_k^*\left(v_{ij}^{t_0}\right) = \beta_0^k + \sum_{j=1}^{n_j} \beta_j^k v_{ij}^{t_0}, \quad \forall i \in \{1, \ldots, n_i\}, \quad \forall k \in \{1, \ldots, n_k\}, \tag{2}
$$

regression coefficients $\beta_0^k, \beta_1^k, \ldots, \beta_{n_j}^k$.

The four design factors of BPM can be interpreted as follows:

(1) *Design factor 1: degree of performance measurement*. A total of six items were found to have significant impact on the first factor. Our analysis results indicate that a high degree of performance measurement is characterized by (item 1) the usage of simulations for process design (item 2) the usage of surveys to assess the process customers' satisfaction with the processes (item 3) the measurement of process cycle times (item 4) the measurement of process outputs and performances (item 5) the fact that performance measures are available without undesirable time lags, and (item 6) the fact that performance measurement is supported by a workflow management system.

(2) *Design factor 2: professionalism of process management*. Four items exhibit high loadings on the second factor. According to our analysis results, professional BPM is characterized by (item 7) the fact that the documentation of process performances and goals is common knowledge (item 8) the fact that the documentation of non-financial measures is available to all employees without any restrictions (item 9) the existence of an organizational unit for strategic process management, and (item 10) the existence of a dedicated education for process managers.

(3) *Design factor 3: impact of process managers*. Likewise, four items were found to have significant impact on the third factor. Our analysis results show that the impact of process managers is positively influenced by (item 11) the fact that process management is located at a sufficiently high level in organizational hierarchy (item 12) the fact that process managers enjoy high prestige in the organization (item 13) the fact that process managers have sufficient decision-making power in order to influence process design and execution, and (item 14) the fact that process managers are actively engaged in change projects.

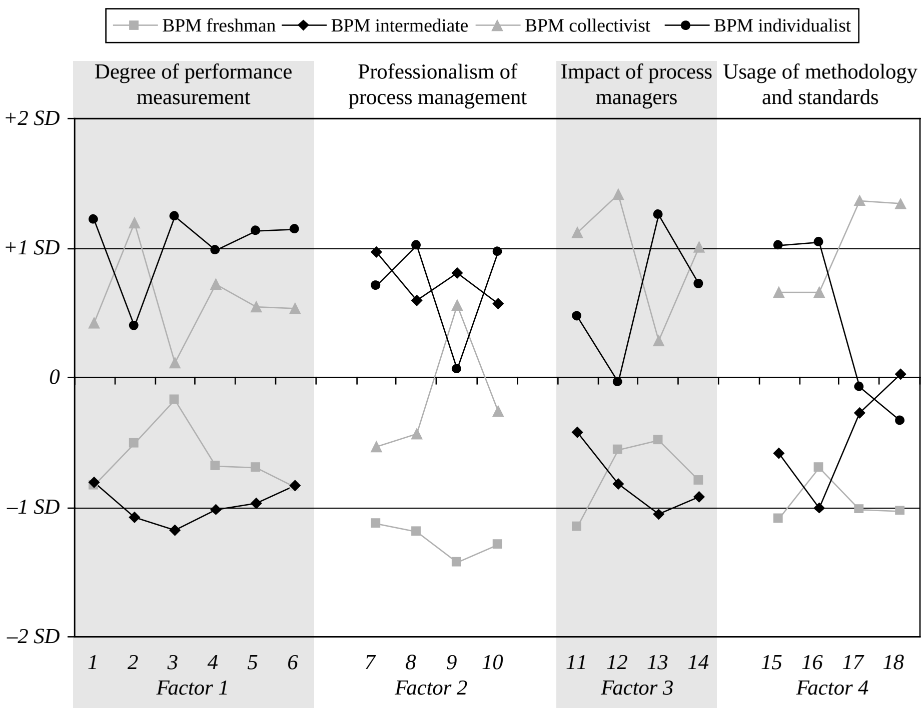
(4) *Design factor 4: usage of methodology and standards*. Finally, the fourth factor is made up by four items as well. Corresponding to our analysis results, usage of methodology and standards is characterized by (item 15) the usage of procedure models for the design of performance management systems (item 16) the usage of reference process models for process analysis and design (item 17) the fact that the organization is ISO-certified, and (item 18) the fact that the organization uses the EFQM approach to quality management.

Second, observations were classified by means of a hierarchical cluster analysis algorithm, building upon the calculated factor scores. The Ward algorithm and the squared Euclidean distance have been used as fusion algorithm and distance measure, respectively. The so-called dendrogram provides a graphical representation of the clustering process. It can be used to identify the number of clusters that should be built for a given clustering problem. In the context of the present analysis, this heuristic suggests that the construction of four clusters (representing four distinct realization approaches of BPM) is the most reasonable solution:

$$\{f_{ik}^{t_0} | k = 1, \ldots, n_k\} = \left\{f_{i1}^{t_0}, \ldots, f_{in_k}^{t_0}\right\} \rightarrow c_l \quad \text{cluster } c_l, \quad l \in \{1, \ldots, n_l\}, \quad n_l = 4. \tag{3}$$

The right-hand side of Table I shows the standardized arithmetic means of each of the 18 items' values for each of the four clusters. The same information is represented graphically in Figure 4.

The profile lines of the four BPM realization approaches illustrate an obvious partitioning between two BPM approaches on the one hand side, in the following referred to as "BPM freshman" (cluster 2, composed of 11 observations, i.e. 11 organizations) and "BPM intermediate" (cluster 3, seven observations), and the remaining two clusters on the other hand, subsequently labeled as "BPM



Source: Bucher and Winter (2006)

Figure 4.
Profile lines of the four current realization approaches of business process management

collectivist" (cluster 1, nine observations) and "BPM individualist" (cluster 4, 11 observations).

The former group is characterized by rather low realization degrees with respect to performance measurement, arrangements supporting the work of process managers, and usage of methodology and standards (factors 1, 3, and 4) whereas organizations clustered into the last-mentioned group show significantly higher implementation degrees in terms of these factors. Thus, both the BPM collectivist and the BPM individualist approach can be characterized as mature approaches to process management. Accordingly, our findings suggest that the maturity level of BPM is determined by the items summarized in factors 1, 3, and 4.

The BPM freshman approach is branded by exceptionally low professionalism of process management (factor 2). For that reason, the BPM freshman approach contrasts with the BPM intermediate stage. Although rather immature as well, organizations in the BPM intermediate stage have at least started to pay a certain amount of attention to the implementation of BPM, e.g. by establishing an organizational unit for strategic process management and a dedicated education for process managers.

In contrast to this classification, the differentiation between the BPM collectivist and the BPM individualist approach is residing at the design level. The former approach is characterized by reliance on established standards as well as on procedure and reference models whereas organizations having adopted the last-mentioned approach to process management strive to implement a more tailor-made type of BPM. Thus, the main differences between these two highly mature realization approaches of BPM do exist with respect to the professionalism of process management and the usage of methodology and standards (factors 2 and 4).

Derivation and characterization of project types

In the previous section, we have reported on the identification of four design factors as well as of four as-is realization approaches of BPM. In order to make statements about BPM PTs, it is necessary to identify target realization approaches for each and every organization and to examine their correspondence with the respective as-is approaches.

To that end, we made use of the previously described to-be item values. Since the cluster analysis (for the identification of realization approaches) is based on the results of the factor analysis (for the identification of design factors), it is necessary to calculate to-be factor scores for each observation and each factor by means of multiple linear regression in the first instance. The regression coefficients originate from equation (2).

Calculation of to-be factor scores $f_{ik}^{t_1}$ by means of multiple linear regression:

$$f_{ik}^{t_1} = F_k^*\left(v_{ij}^{t_1}\right) = \beta_0^k + \sum_{j=1}^{n_j} \beta_j^k v_{ij}^{t_1}, \quad \forall i \in \{1, \ldots, n_i\}, \quad \forall k \in \{1, \ldots n_k\}. \qquad (4)$$

Subsequently, the to-be observations (each one represented by four to-be factor scores calculated according to equation (4)) need to be grouped into one of the four clusters, i.e. they are assigned to one particular to-be realization approach. Equation (6) represents the algorithm for the calculation of the Euclidean distance. Each to-be observation is grouped into that one cluster that minimizes this distance. As a prerequisite, as-is cluster means need to calculated according to equation (5).

Calculation of as-is cluster means $m_{c_l}^{t_0}$ with respect to factor k:

$$m_{c_l}^{t_0}\left(f_{\bullet k}^{t_0}\right) = \frac{1}{n_i}\sum_{i=1}^{n_i} f_{ik}^{t_0}, \quad \forall k \in \{1, \ldots, n_k\}, \quad \forall l \in \{1, \ldots, n_l\}. \tag{5}$$

Group to-be observations $v_{i\bullet}^{t_1}$ into that one cluster c_l that minimizes the Euclidean distance d_i:

$$d_i = \left\{ \sqrt{\sum_{k=1}^{n_k} \left(f_{ik}^{t_1} - m_{c_l}^{t_0}\left(f_{\bullet k}^{t_0}\right) \right)^2} \, | l = 1, \ldots, n_l \right\} \to \text{MIN!} \tag{6}$$

The results of these calculations are summarized in Table II. The vertical axis represents as-is realization approaches whereas the horizontal axis depicts to-be realization approaches. The numerical data in the matrix shows the number of organizations that were grouped into each particular combination of as-is and to-be realization approaches. For example, there are seven organizations that currently reside in the BPM collectivist approach (cluster 1) but that are planning to adopt a more individual approach to BPM (BPM individualist, cluster 4) in the future. In this way, it is possible to identify different development tracks from current state to target state. Furthermore, one particular observation is striking: more that 86 percent of the interviewed organizations are planning to adopt an individualistic approach to BPM in the future whereas a mere 14 percent tend to remain or develop into BPM collectivists. The fact that the BPM freshman and BPM intermediate clusters (clusters 2 and 3) will be vacant in the future is less astonishing.

Correspondingly, a total of five PTs for the engineering of situational methods to support BPM can be identified. Based on the number of relevant observations (Table II), these PTs can be further subdivided into three of major importance (PTs 1-3) and two of minor importance (PTs 4 and 5):

- *PT 1*. BPM collectivist (cluster 1) turning into BPM individualist (cluster 4). Seven organizations that have currently adopted the BPM collectivist approach were found to pursue the BPM individualist approach. Both approaches are characterized by high maturity but differ with respect to the design type of process management.
- *PT 2*. BPM freshman (cluster 2) turning into BPM individualist (cluster 4). A total of ten organizations that have not yet begun or are at most about to deal with

	To-be				
	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Total
As-is					
Cluster 1	2	0	0	7	9
Cluster 2	1	0	0	10	11
Cluster 3	2	0	0	5	7
Cluster 4	0	0	0	11	11
Total	5	0	0	33	38

Table II. Development tracks from current state (as-is cluster membership) to target state (to-be cluster membership)

BPM were found to pursue the BPM individualist approach in the long run. This implies that those organizations need to improve the maturity of their BPM approach significantly and develop individual practices.

- *PT 3*. BPM intermediate (cluster 3) turning into BPM individualist (cluster 4). Five organizations that currently reside on the BPM intermediate stage, i.e. that have started to pay a certain amount of attention to the implementation of BPM, were found to pursue the BPM individualist approach. Similar to PT 2, these organizations need to both improve the maturity of their BPM approach and develop independent procedures for BPM at the same time.
- *PT 4*. BPM freshman (cluster 2) turning into BPM collectivist (cluster 1). Just one organization that is branded with exceptionally poor professionalism of BPM was found to pursue the BPM collectivist approach in the long run. Owing to the marginal number of relevant observations, this PT is considered to be of minor importance. We will therefore refrain from discussing this PT in the remainder of this paper.
- *PT 5*. BPM intermediate (cluster 3) turning into BPM collectivist (cluster 1). Similarly, a mere two organizations that have currently adopted the BPM intermediate approach were found to purse the BPM collectivist approach. For the same reason as with PT 4, we will refrain from discussing PT 5 in the following.

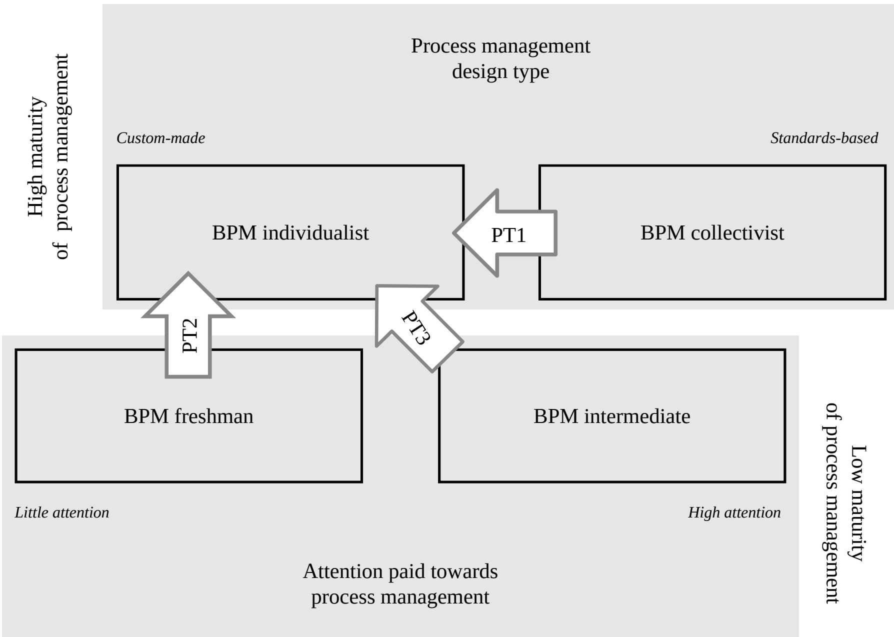
Discussion of research results

In our previous work on the classification of BPM realization approaches (Bucher and Winter, 2006), we have proposed to arrange the four approaches in matrix format and classify them according to three dimensions (Figure 5):

(1) Maturity level of process management: the classification of the four approaches depends on the BPM maturity level within the organization. This differentiation is in accordance with the obvious partitioning between the two bottom clusters (clusters 2 and 3, BPM freshman and BPM intermediate) on the one hand and the two top clusters (clusters 1 and 4, BPM collectivist and BPM individualist) on the other hand.

(2) Attention paid towards process management: if the maturity level is rather low, it is assumed that BPM has not played any significant role within the organization in the past. However, the BPM freshman (cluster 2) and the BPM intermediate (cluster 3) approach can be differentiated with respect to the amount of attention that is currently paid towards process management.

(3) Process management design type: on the contrary, if the maturity level of BPM is rather high (i.e. if the organization has dealt with the BPM concept for quite a long time), one can distinguish between two design types of process management. The BPM collectivist (cluster 1) relies on established standards as well as on procedure models and reference models whereas the BPM individualist (cluster 4) focuses on the adoption of a more tailor-made approach to BPM. For this purpose, the BPM individualist provides process managers with excellent education and far-reaching authority for decision-making with respect to process design and execution.



Source: Adapted from Bucher and Winter (2006)

Figure 5.
BPM typology matrix with major project types

The BPM typology matrix as derived in Bucher and Winter (2006) is depicted in Figure 5. We have added three arrows representing the three major PTs of BPM as identified in the present contribution.

We have argued in our previous work (Bucher and Winter, 2006) that the BPM intermediate approach might be characterized as transitional stage in an organization's shift towards process-oriented thinking. According to the analysis results presented in the paper at hand, this assumption does not hold completely true. PT 2 is made up of ten observations that develop directly from the BPM freshman approach to the BPM individualist approach.

The common ground of the three major PTs of BPM is that the target state in all cases is the BPM individualist approach. When compared to the other realization approaches, this particular approach is characterized by the highest implementation level with respect to ten out of 18 items that have been sampled and included into the analysis (Table I and Figure 4). This fact indicates areas that need to be explicitly addressed in BPM transformation projects. The assessment of relative distances of the BPM collectivist, BPM freshman, and BPM intermediate implementation levels from the BPM individualist implementation level with respect to the 18 items covered in our analysis points towards the topics that are of particular importance in each one of the three PTs.

To make an example, we will regard items 7 (the documentation of process performances and goals is available to all employees without any restriction) and 14 (process managers are actively engaged in change projects; Table I and Figure 4). As for item 7, the BPM intermediate approach exhibits an implementation level that is approximately equal to the BPM individualist implementation level. The respective implementation levels of the BPM collectivist and the BPM freshman approach are significantly lower. On the contrary, as regards item 14, the BPM collectivist and the BPM individualist approach exhibit implementation levels that are approximately equal to each other and significantly higher than the respective implementation levels of the BPM freshman and the BPM intermediate approach. Consequently, PT 1 needs to focus on the improvement of the implementation level with respect to item 7, PT 3 on the improvement of item 14, and PT 2 on the improvement of both items 7 and 14.

Conclusion and outlook

Our analysis has shown that at least four different realization approaches of BPM can be observed in real-world organizations. The BPM freshman and BPM intermediate approaches are characterized by low maturity whereas the BPM collectivist and the BPM individualist approaches feature high maturity levels. When asked about the future design of their BPM activities, most organizations were found to strive for the BPM individualist approach in the long run. Based on these analysis results, three major PTs could be extracted: BPM collectivist turning into BPM individualist, BPM freshman turning into BPM individualist, and BPM intermediate turning into BPM individualist. The gain of insight into these PTs of BPM is particularly useful for the engineering of situational methods aimed at the implementation and advancement of the BPM concept within real-world organizations.

There are, however, several limitations to the research results presented in this paper:

(1) The empirical results were derived from a relatively small data set. A careful and thorough examination, discussion, and evaluation of the here identified/described PTs are needed in order to validate our findings.

(2) The scope of the empirical study on which this paper draws was limited to the extent that it only surveyed variables from five selected domains/topics:

- the communication of process management;
- the role of process managers;
- process design;
- process performance measurement; and
- other initiatives pertaining to BPM (Bucher and Winter, 2006).

The study did not survey other attributes that might be used to characterize/differentiate BPM projects (e.g. the objects that are subject to redesign in the context of business process reengineering) as well as the environment/context of those BPM projects (e.g. characteristics of the process/processes, of the organizational unit that is responsible for the process/processes, and of the organization itself):

- The present contribution therefore focuses on the identification of BPM PTs. In order to complete the discussion of BPM development situations, complementary CTs of BPM have to be identified. A BPM scenario structure could then be established which represents all valid development situations for the engineering of situational BPM methods.

- The research results do not allow for drawing conclusions on the point of reference (e.g. one single process, one particular unit within an organization, one organization as a whole) that underlies the scenario structure. The determination of the reference point's adequate level of granularity, i.e. the identification of the scope of the selected BPM realization approach, therefore remains subject to further research.

Based on the research results presented in this paper, a major research opportunity can be seen in the engineering (i.e. design and/or adaptation and/or evaluation) of situational BPM methods that are suitable for a particular PT. These situational methods must account for the characteristics of one or multiple PT(s) that have been identified in this paper. To illustrate this point, we will revert to the exemplary BPM method classes that have been mentioned in the introductory section of this paper, i.e. business process modeling methods and business process reengineering methods.

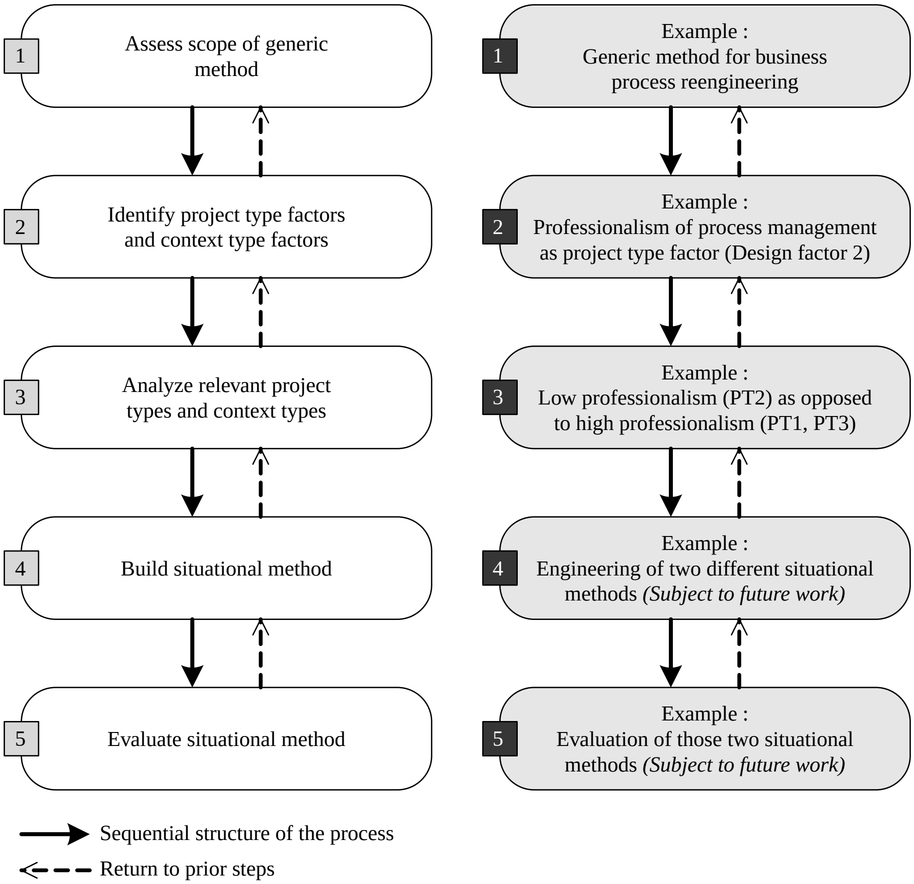
It is quite obvious that process modeling methods must take into account the BPM maturity level. As an example, PT 2 (which addresses the transformation of a BPM freshman into a BPM individualist) must address process governance issues in a more fundamental way than PT 1 (addressing the transformation of a BPM collectivist into a BPM individualist).

On the contrary, PTs 1 and 3 (BPM collectivist/BPM intermediate turning into BPM individualist) need to explicitly address the documentation and the assessment of the as-is process landscape in the context of the application of business process reengineering methods. The as-is process landscape represents the starting point for process improvement. By contrast, the as-is process landscape might be of minor importance in the context of PT 2 (BPM freshman turning into BPM individualist). In this regard, the brainstorming of to-be design alternatives might be dealt with independently of the as-is process landscape due to the low maturity of processes and process management.

Figure 6 depicts an exemplary process for the engineering of situational methods. The above example was incorporated into the process description for the purpose of illustration (Bucher *et al.*, 2007) distinguish between four major steps in SME:

(1) assessing the scope of a generic method or a set of connatural methods;
(2) identifying PT factors and CT factors;
(3) consolidating PT factors/CT factors and analyzing the resulting PTs/CTs; as well as
(4) engineering and evaluating the resultant situational method or methods.

These methods are either specific to one or multiple development situations, or generic but configurable to meet the characteristics of particular development situations (Bucher *et al.*, 2007). In accordance with the differentiation between the two major activities of the DR paradigm (Figure 1), we opted to split the fourth step into two disjoint activities – "build situational method" and "evaluate situational method." Despite of the sequential structure of the process, it is always possible to move backwards to prior steps in case unforeseen changes have to be incorporated.



Source: Adapted from Bucher *et al.* (2007)

Figure 6.
Exemplary process for the engineering of situational methods

References

Alter, S. (2003), "18 Reasons why IT-reliant work systems should replace 'The IT Artifact' as the core subject matter of the IS field", *Communications of the Association for Information Systems*, Vol. 12 No. 23, pp. 366-95.

Alter, S. (2006), "Work systems and IT artifacts – does the definition matter?", *Communications of the Association for Information Systems*, Vol. 17 No. 14, pp. 299-313.

Armistead, C. and Machin, S. (1997), "Implications of business process management for operations management", *International Journal of Operations & Production Management*, Vol. 17 No. 9, pp. 886-98.

Armistead, C., Pritchard, J.-P. and Machin, S. (1999), "Strategic business process management for organizational effectiveness", *Long Range Planning*, Vol. 32 No. 1, pp. 96-106.

Bacon, C.J. and Fitzgerald, B. (2001), "A systemic framework for the field of information systems", *ACM SIGMIS Database*, Vol. 32 No. 2, pp. 46-67.

Balzarova, M.A., Bamber, C.J., McCambridge, S. and Sharp, J.M. (2004), "Key success factors in implementation of process-based management – a UK housing association experience", *Business Process Management Journal*, Vol. 10 No. 4, pp. 387-99.

Brinkkemper, S. (1996), "Method engineering – engineering of information systems development methods and tools", *Information and Software Technology*, Vol. 38 No. 4, pp. 275-80.

Brookes, C.H.P., Grouse, P.J., Jeffrey, D.R. and Lawrence, M.J. (1982), *Information Systems Design*, Prentice-Hall, Sydney.

Bucher, T. and Winter, R. (2006), "Classification of business process management approaches – an exploratory analysis", *BIT – Banking and Information Technology*, Vol. 7 No. 3, pp. 9-20.

Bucher, T., Klesse, M. and Kurpjuweit, S.R. (2007), "Situational method engineering – on the differentiation of 'Context' and 'Project Type'", in Ralyté, J., Brinkkemper, S. and Henderson-Sellers, B. (Eds), *Situational Method Engineering – Fundamentals and Experiences*, Vol. 244, Springer, Boston, MA, pp. 33-48.

Cao, J., Crews, J.M., Lin, M., Deokar, A., Burgoon, J.K. and Nunamaker, J.F. Jr (2006), "Interactions between system evaluation and theory testing – a demonstration of the power of a multifaceted approach to information systems research", *Journal of Management Information Systems*, Vol. 22 No. 4, pp. 207-35.

Davenport, T.H. (1993), *Process Innovation – Reengineering Work through Information Technology*, Harvard Business School Press, Boston, MA.

Davenport, T.H. and Short, J.E. (1990), "The new industrial engineering – information technology and business process redesign", *Sloan Management Review*, Vol. 31 No. 4, pp. 11-27.

Dziuban, C.D. and Shirkey, E.C. (1974), "When is a correlation matrix appropriate for factor analysis?", *Psychological Bulletin*, Vol. 81 No. 6, pp. 358-61.

Fettke, P. and Loos, P. (2003), "Classification of reference models – a methodology and its applications", *Information Systems and e-Business Management*, Vol. 1 No. 1, pp. 35-53.

Hammer, M. (1990), "Reengineering work – don't automate, obliterate", *Harvard Business Review*, Vol. 68 No. 4, pp. 104-12.

Hammer, M. and Champy, J. (1993), *Reengineering the Corporation – A Manifest for Business Revolution*, Harper Collins, New York, NY.

Hammer, M. and Stanton, S.A. (1995), *The Reengineering Revolution – A Handbook*, Harper Business, New York, NY.

Härdle, W. and Simar, L. (2003), *Applied Multivariate Statistical Analysis*, Springer, Berlin.

Harmsen, A.F., Brinkkemper, S. and Oei, H. (1994), "Situational method engineering for information system project approaches", in Verrijn-Stuart, A.A. and Olle, T.W. (Eds), *Methods and Associated Tools for the Information Systems Life Cycle, Proceedings of the IFIP 8.1 Working Conference on Methods and Associated Tools for the Information Systems Life Cycle, North-Holland, Amsterdam, The Netherlands*, pp. 169-94.

Harrington, H.J. (1991), *Business Process Improvement – The Breakthrough Strategy for Total Quality Productivity, and Competitiveness*, McGraw-Hill, New York, NY.

Harrington, H.J. (1995), *Total Improvement Management – The Next Generation in Performance Improvement*, McGraw-Hill, New York, NY.

Hevner, A.R., March, S.T., Park, J. and Ram, S. (2004), "Design science in information systems research", *MIS Quarterly*, Vol. 28 No. 1, pp. 75-105.

Hill, J.B., Sinur, J., Flint, D. and Melenovsky, M.J. (2006), "Gartner's position on business process management", available at: www.gartner.com/ (accessed July 6, 2006).

Ho, S.K.M. and Fung, C.K.H. (1994), "Developing a TQM excellence model", *The TQM Magazine*, Vol. 6 No. 6, pp. 24-30.

Imai, M. and Heymans, B. (1999), *Gemba Kaizen*, Berrett-Koehler Communications, San Francisco, CA.

Kaiser, H.F. and Rice, J. (1974), "Little Jiffy, Mark IV", *Educational and Psychological Measurement*, Vol. 34 No. 1, pp. 111-7.

Kaplan, R.B. and Murdock, L. (1991), "Rethinking the corporation – core process redesign", *The McKinsey Quarterly*, Vol. 27 No. 2, pp. 27-43.

Kremer, S., Kolbe, L.M. and Brenner, W. (2003), "Do you know your terms? – A procedure model for terminology management", *Proceedings of the Eleventh European Conference on Information Systems (ECIS), Naples, Italy, June 16-21*.

Kueng, P. and Krahn, A. (1999), "Building a process performance measurement system – some early experiences", *Journal of Scientific and Industrial Research*, Vol. 58 Nos 3/4, pp. 149-59.

Kumar, A. and Motwani, J.A. (1995), "Methodology for assessing time-based competitive advantage of manufacturing firms", *International Journal of Operations & Production Management*, Vol. 15 No. 2, pp. 36-53.

Kumar, K. and Welke, R.J. (1992), "Methodology engineering – a proposal for situation-specific methodology construction", in Cotterman, W.W. and Senn, J.A. (Eds), *Challenges and Strategies for Research in Systems Development*, Wiley, Chichester, pp. 257-69.

Kumar, V., Maheshwari, B. and Kumar, U. (2003), "An investigation of critical management issues in ERP implementation – empirical evidence from Canadian organizations", *Technovation*, Vol. 23 No. 10, pp. 793-807.

List, B. and Korherr, B. (2006), "An evaluation of conceptual business process modelling languages", in Liebrock, L.M. (Ed.), *Proceedings of the 21st Annual ACM Symposium on Applied Computing (SAC2006), ACM Press, New York, NY, USA*, pp. 1532-9.

McGaughey, R.E. and Gunasekaran, A. (2007), "Enterprise resource planning (ERP) – past, present and future", *International Journal of Enterprise Information Systems*, Vol. 3 No. 3, pp. 23-35.

March, S.T. and Smith, G.F. (1995), "Design and natural science research on information technology", *Decision Support Systems*, Vol. 15 No. 4, pp. 251-66.

Melenovsky, M.J., Sinur, J., Hill, J.B. and McCoy, D.W. (2005), "Business process management: preparing for the process-managed organization", available at: www.gartner.com/ (accessed July 6, 2006).

Muscatello, J.R. and Chen, I.J. (2008), "Enterprise resource planning (ERP) implementations – theory and practice", *International Journal of Enterprise Information Systems*, Vol. 4 No. 1, pp. 63-78.

Niehaves, B. (2006), "Reflective designer – designing IT-consulting processes", *Dissertation*, University of Münster, Münster.

Nunamaker, J.F. Jr, Chen, M. and Purdin, T.D.M. (1990), "Systems development in information systems research", *Journal of Management Information Systems*, Vol. 7 No. 3, pp. 89-106.

OMG (2006), "Business process modeling notation specification", available at: www.omg.org/docs/dtc/06-02-01.pdf (accessed November 2, 2007).

Parthasarathy, S. and Anbazhagan, N. (2007), “Evaluating ERP implementation choices using AHP”, *International Journal of Enterprise Information Systems*, Vol. 3 No. 3, pp. 52-65.

Rossi, M. and Sein, M.K. (2003), “Design research workshop – a proactive research approach”, available at: www.cis.gsu.edu/~emonod/epistemology/Sein%20and%20Rossi%20-%20design%20research%20-%20IRIS.pdf (accessed March 19, 2008).

Scholz-Reiter, B., Stahlmann, H.-D. and Nethe, A. (1999), *Process Modelling*, Springer, Berlin.

Simon, H.A. (1996), *The Sciences of the Artificial*, MIT Press, Cambridge, MA.

Smith, H. and Fingar, P. (2003), *Business Process Management – The Third Wave*, Meghan-Kiffer Press, Tampa, FL.

Tatnall, A., Davey, B. and McConville, D. (1996), *Information Systems – Design and Implementation*, Data Publishing, Melbourne.

Tyler, D.F. and Cathcart, T.P. (2006), “A structured method for developing agile enterprise architectures”, in Verma, A.K. (Ed.), *Proceedings of the International Conference on Agile Manufacturing (ICAM)*, pp. 1-8.

van Slooten, K. and Brinkkemper, S. (1993), “A method engineering approach to information systems development”, in Prakash, N., Rolland, C. and Pernici, B. (Eds), *Information System Development Process, Proceedings of the IFIP WG8.1 Working Conference on Information System Development Process, North-Holland, Amsterdam*, pp. 167-86.

Vessey, I., Ramesh, V. and Glass, R.L. (2002), “Research in information systems – an empirical study of diversity in the discipline and its journals”, *Journal of Management Information Systems*, Vol. 19 No. 2, pp. 129-74.

vom Brocke, J. (2007), “Design principles for reference modeling – reusing information models by means of aggregation, specialization, instantiation, and analogy”, in Fettke, P. and Loos, P. (Eds), *Reference Modeling for Business Systems Analysis*, Idea Group, Hershey, pp. 47-75.

Walls, J.G., Widmeyer, G.R. and El Sawy, O.A. (1992), “Building an information system design theory for vigilant EIS”, *Information Systems Research*, Vol. 3 No. 1, pp. 36-59.

Wang, M. and Wang, H. (2006), “From process logic to business logic – a cognitive approach to business process management”, *Information & Management*, Vol. 43, pp. 179-93.

Webb, E.J., Campbell, D.T., Schwartz, R.D., Sechrest, L. and Grove, J.B. (1966), *Unobtrusive Measures – Nonreactive Research in the Social Sciences*, Rand McNally, Chicago, IL.

Winter, R. and Strauch, B. (2003), “A method for demand-driven information requirements analysis in data warehousing projects”, *Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS-36), IEEE Computer Society, Los Alamitos, CA, USA*.

Wortmann, F. and Winter, R. (2006), “A procedure model for enterprise-wide authorization architecture”, *Proceedings of the Twelfth Americas Conference on Information Systems (AMCIS 2006), Association for Information Systems, Acapulco, Mexico*, pp. 2423-32.

Zairi, M. (1997), “Business process management – a boundaryless approach to modern competitiveness”, *Business Process Management*, Vol. 3 No. 1, pp. 64-80.

Zhang, Z. and Sharifi, H. (2000), “A methodology for achieving agility in manufacturing organisations”, *International Journal of Operations & Production Management*, Vol. 20 No. 4, pp. 496-512.

About the authors

Tobias Bucher is a Research Assistant and doctoral student at the Institute of Information Management, University of St Gallen (HSG), Switzerland. He holds a Master degree in economics (concentration in information systems and econometrics) from the University of Freiburg,

Germany. His research interests include business engineering methods and models, data warehousing, business intelligence, and business process management. Tobias Bucher is the corresponding author and can be contacted at: tobias.bucher@unisg.ch

Robert Winter is a Director of the Institute of Information Management, University of St Gallen (HSG), Switzerland, and academic director of HSG's Executive Master of Business Engineering program. He received Master degrees in business administration and business education as well as a doctorate in social sciences from Goethe University, Frankfurt, Germany. After 11 years as a researcher and deputy chair in information systems, he was appointed full professor of information management at HSG in 1996. His research areas include business engineering methods and models, information systems architectures/architecture management, and integration technologies/integration management.