Association for Information Systems
AIS Electronic Library (AISeL)

AMCIS 2010 Proceedings

Americas Conference on Information Systems (AMCIS)

8-2010

How Many Methods Do We Need? – A Multiple Case Study Exploration into the Use of Business Process Modeling Methods in Industry

Prof. Dr. Jörg Becker
University of Münster, joerg.becker@ercis.uni-muenster.de

Dr. Björn Niehaves
Universität Münster, bjoern.niehaves@ercis.uni-muenster.de

Irina Thome
University of Münster, irina.thome@ercis.uni-muenster.de

How Many Methods Do We Need? – A Multiple Case Study Exploration into the Use of Business Process Modeling Methods in Industry

Prof. Dr. Jörg Becker
University of Münster
joerg.becker@ercis.uni-muenster.de

Dr. Dr. Björn Niehaves
University of Münster
bjoern.niehaves@ercis.uni-muenster.de

Irina Thome
University of Münster
irina.thome@ercis.uni-muenster.de

ABSTRACT

Business process models have been researched for decades and process modeling methods exist in abundance. They satisfy different purposes and are applied in numerous Business Process Management (BPM) projects. Organizations apply different methods for their specific needs, often using several different modeling methods at the same time. BPM activities are supported either by specialized modeling software, or by standard software tools. However, no conception of the actual handling of purpose and method plurality in organizations has been achieved so far. We aim to close this gap by conceptualizing and empirically investigating different types of method plurality based on four in-depth case studies of industrial organizations. Furthermore, we provide a framework for studying method plurality, and identify contextual parameters which influence the emergence of modeling method plurality.

Keywords

business process management, process modeling, grounded theory, modeling method plurality

INTRODUCTION

A plurality of business process modeling methods exists in research and in practice. Since the 1980's new modeling methods have been proposed continuously, covering a wide range of applications. Several attempts at deriving reference frameworks for process modeling methods have been made (e.g., Kettinger, Teng, Guha (1997). Research in this area so far focused on supporting the selection of appropriate modeling methods. However, little research has been done on the way in which organizations deal with the abundance of process modeling methods in their Business Process Management (BPM) activities.

Therefore, the aim of this paper is to investigate into how industry organizations deal with business process modeling method plurality. We seek to answer the following research questions:

- What different types of method plurality can be identified empirically? (Method Assessment)
- What factors contribute to explaining different types of method plurality (Context Assessment)

The conceptualization of method plurality is our first step towards an understanding of the problem field. We seek to grasp the relevant characteristics of method plurality in order to structure our subsequent research. Based on the conceptualization, we seek to empirically identify different types of method plurality in data from four case studies in different industrial organizations. The identified types are matched to the previous conceptualization. Furthermore, we search for factors, which can contribute to an explanation as to how different method plurality types emerge in real-life scenarios.

Adopting an explorative qualitative approach, the paper is organized as follows. After a review of the relevant literature on business process modeling, we conceptualize modeling method plurality. Afterwards, we set out methods and data of a multiple case study analysis. The analysis involves four settings and is based on 24 expert interviews and multiple further sources of evidence. We discuss the findings from our exploration and strive to explain variations in the data based on the conceptualization of method plurality. Subsequently, we reflect on the implications our results provide, as well as the limitations of our research. The final section draws a conclusion and proposes perspectives for further research.

BACKGROUND

Business Process Management (BPM) defines the purpose of business process modeling. The approach has its roots in Business Process Reengineering (BPR) and Total Quality Management (TQM). The concept of BPR emerged within a Massachusetts Institute of Technology's management research program that examined the role that IT would play in organizations in the 1990s (Peppard & Fitzgerald (1997)). Early publications (Davenport & Short (1990); Hammer (1990)) emphasized that BPR projects are radical, revolutionary, and a one-time undertaking (Hung (2006); Zairi & Sinclair (1995)). While both BPR and TQM have in common the focus on improving organizational processes, TQM on the other hand is considered a rather incremental, evolutionary approach aiming at continuous improvement (Hung (2006); Zairi & Sinclair (1995)). However, most literature in business process research recognizes that both concepts have to be viewed as complementary integral parts of a process-oriented strategic management system (Davenport (1993); De Bruyn & Gelders (1997); Harrison & Pratt (1992); Hung (2006); Martinsons & Hempel (1998); Zairi & Sinclair (1995)). For example, Kettinger et al. (1997, p. 56) argue on BPR that "[r]ather than a 'quick fix', BPR is increasingly recognized as a form of organizational change characterized by strategic transformation of interrelated organizational subsystems". Against this background, we view BPM as a management approach that applies concepts of both punctuated and incremental change. This perspective is supported, for instance, by Armistead & Machin (1997) who argue that BPM is "concerned with how to manage processes on an ongoing basis, and not just with the one-off radical changes associated with BPR". Accordingly, BPM can be considered a holistic approach to the way in which organizations are managed (Armistead & Machin, (1998); Pritchard & Armistead 1999; Rosemann et al. (2006)). Within this paper, we therefore understand BPM as a set of recurring projects that aim at the continuous change of organizational procedures (for focus on change aspects see, for instance, Kettinger et al. (1997); Lyytinen & Newman (2008); Sarker et al. (2006)). For that reason, BPM projects should be considered as being embedded in a relatively stable structural organizational setting and do not imply, for instance, business process re-definition in the move of company mergers. The focus of BPM projects can range from purely organizational to more technical perspectives (Rosemann et al. 2006; Sun et al. (2006)), the latter especially in the course of information systems implementations (for an overview on the relationship between information systems and the innovation of business processes see Tarafdar & Gordon (2007)).

BPM activities cover a wide range of application areas, e.g. workflow specification (Ellis, Nutt (1993); Eder, Liebhart (1995)), organizational re-engineering (Davenport & Short (1990); Hammer (1990); Blyth (1995)), software development purposes (Rumbaugh et al. (1991)), or certification and continuous improvement (e.g., Balzarova et al. (2004)). Against the background of the multiple contexts of BPM, process modeling methods need to serve multiple purposes as well. Possible application areas of process modeling are various and have been defined repeatedly (e.g., Kettinger et al. (1997).. Over time, efforts were made to apply process models for new contexts, to introduce new modeling methods, or to combine existing methods for new purposes (for example, Recker et al. (2006)). Research also pointed out the limited application scope of given modeling techniques (e.g., Kettinger et al. (1997)).

Modeling methods used for aforementioned BPM purposes need to have different properties. No one single modeling method can fulfill all possible BPM requirements of an organization. This leads to four conceivable stages of modeling method usage: stage 1, where a single BPM purpose is pursued using several modeling methods. This stage can evolve into stage 2a, where additional purposes are introduced, each covered by multiple modeling methods (unstructured pluralization). The other possible development path leads towards stage 2b, where the number of modeling methods used is reduced to one single method suitable for the given purpose (unification). Stage 3 can either emerge from stage 2a via unification, i.e. the reduction of modeling methods per purpose, or from stage 2b via structured pluralization, i.e. the addition of further modeling purposes, each supported by one designated modeling method (see Figure 1). If more than one process modeling method is used per purpose, we speak of a multiple method approach (stages 1 and 2a).As far as one single process modeling method is used per purpose, a single method approach is the case (stages 2b and 3).

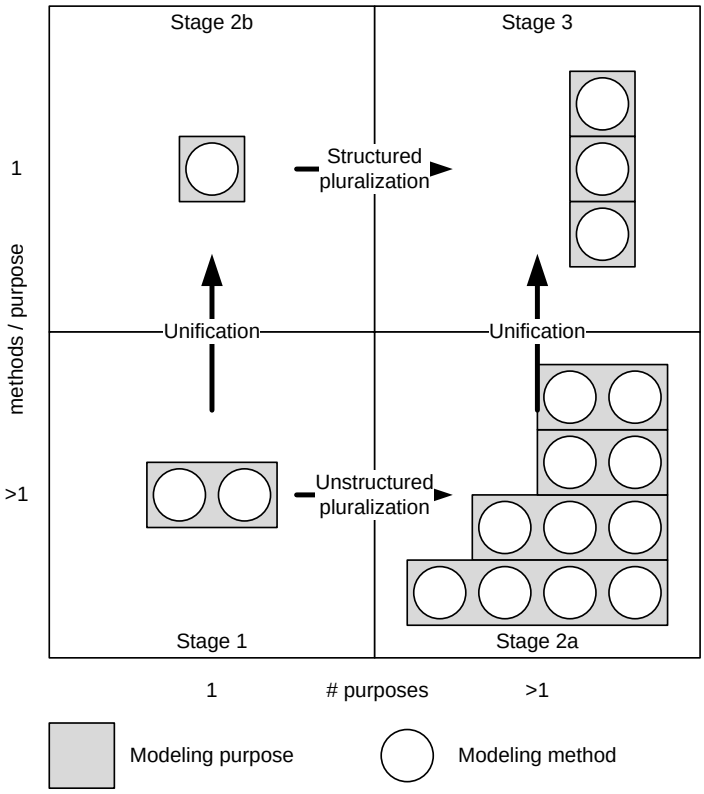

Figure 1. Conceptualization of modeling purpose and method plurality

RESEARCH METHOD

In order to answer our given research question, we chose to conduct and cross-analyze four in-depth qualitative case studies. Here, our intent is to explore the phenomenon under investigation rather than to statistically test specific hypotheses. We seek to tie in with the rich tradition of qualitative IS research (for instance, Kern & Willcocks 2002; Mingers 2003; Remenyi & Williams 1998; Silverman 1998) and will first summarize the case study settings and, then, discuss the process of data collection and analysis in detail. The data analysis phase yields several data codes, which are presented and explained lastly.

Case Selection

Four qualitative case studies were conducted in order to explore the context of BPM method and tool usage. The cases selected had to fit our given research purpose and had to allow for a meaningful cross-case analysis (Yin 2003). Against this background, criteria for case selection included the firm size, here, minimum annual turnover of 100 Million € and number of employees greater than 500 (see Table 2). While operating in different private sector industry branches, for reasons of access convenience, all TELCO, PRODUCTION, BANKING, and CHEMICAL, are European companies and thus have to be viewed in relation to this context.

	TELCO	PRODUCTION	BANKING	CHEMICAL
Industry	Telecommunication	Office supplies	Banking	Fertilizer
Annual Turnover	1,200 Million €	110 Million €	8,000 Million €	550 Million €
Number Employees	2300	750	800	1300

Table 1. Overview Case Settings

Data Collection

The period of intensive data collection lasted from September 2008 to January 2009, with a prior wave serving the purpose of selecting adequate cases studies with regard to the research question (January 2008 to September 2008). We employed multiple data collection methods in order to exploit the synergetic effects of combining them via triangulation (Capaldo

2007; Jick 1979; Yin 2003). Three sources of evidence are included in our analysis: focused individual interviews (primary method), direct observations, and documentary information.

- Focused Individual Interviews. The primary sources of evidence are interviews with the key actors in a firm's BPM efforts. Ranks of interview partners included, for instance, head BPM unit, head IT department, head organization department, head controlling, and head quality management. Regarding the interviewee selection, we followed a purpose-driven snowball sampling approach (Salganik & Heckathorn 2004). As a result, five to nine interviews were conducted per case (nine at TELCO, each five at PRODUCTION, BANKING, and CHEMICAL) leading to a total of 24 interviews, 1,500 minutes of interview time, and 95,000 words of transcript. An interview thus lasted more than 1 hour in average (see Table 3).
- Documentary Information. Several materials produced by or about the firms were incorporated as supplementary source of evidence. For instance, business process documentations, organization charts, business press articles, internet sources, research reports, project documentations, minutes of project meetings, or company reports helped us to reconstruct each case study setting in great detail.
- Direct Observations. We were able to directly observe the settings and relevant events throughout a total of 13 site visits. This included, for instance, observing the working procedures and analyses of BPM tools applied. These direct observations yielded additional understanding of each case study setting.

	TELCO	PRODUCTION	BANKING	CHEMICAL
Number of Site Visits	6	2	3	2
Number of Interviews	9	5	5	5
Total Minutes of Interviews Time	625 minutes	310 minutes	320 minutes	245 minutes
Total Number of Words Transcribed	54,402 words	18,905 words	13,104 words	9,185 words
Period of Data Collection	September 2008 to January 2009	October 2008 to February 2009	August 2008 to February 2009	October 2008 to January 2009
Departments & Functions	IT, Quality Management, Organization, Business Process Management, Sales, Controlling, Finance	IT, Quality Management, Controlling, Human Resource Management, Logistic	IT, Organization, Controlling, Finance, Internal Audit	IT, Quality Management, Marketing, Controlling, Logistic

Table 2. Data Collection Fact Sheet

Data Analysis

A total of 25 hours of interviews, equating to 95,000 words of transcript, were included in the analysis. As initial step, two authors (open) coded the data individually, while all interview data was reviewed in the light of available documentary information and of direct case observations. Afterwards, the resulting codes and coded data were contrasted among the two authors' perspectives. In case of unresolved differences, a third party was consulted. Then, the codes were interpreted and structured. Here again, if no consensus was achieved among the first and the second author, a third party was involved for conciliation. The interpretation of data and refinement of theory elements were highly recursive and formed a continuous interplay (Myers 2008). Such approach yielded the advantage that, both, the authors' understanding of the case findings as well as the refinement of (grounded) theory gradually improved. As a consequence, relevant variables were derived that related to prior theory elements while others clearly expanded it. Hence, it can be regarded as a proof of openness in the data analysis procedure that, too, novel aspects were discovered. As prior theory knowledge was applied and refined in a continuous interplay with the data, we followed a procedure closely related to a "Straussian" approach to grounded analysis (Corbin & Strauss 2007) which is most frequently applied in IS research (Matavire & Brown 2008). This approach is increasingly common in the IS research literature because the method has proven "extremely useful in developing context-based descriptions and explanations […] of phenomen[a]" (Myers 2008, see also Orlikowski 1993).

Data Codes

The coding resulted in a number of concepts relevant for the given research question. The 13 concepts were grouped in six clusters: organizational context, practical application, BPM context, modeling purpose, modeling tool, and modeling method (see Table 4). The organizational context consists of the issues of modeling conventions, BPM responsibilities, BPM

coverage, and BPM strategy. Modeling conventions are defined by external requirements, specified by the company itself, or absent. BPM responsibilities are assigned to certain persons or departments, or are left undefined. BPM coverage describes the scope and the continuity of BPM activities in the organization. BPM strategy summarizes the way in which BPM is incorporated in the business strategy of the organization. Practical application covers the problems of BPM know-how, model usage, and model availability. Know-how regarding BPM modeling methods can vary strongly throughout the employees in different departments. Model usage describes the way in which employees use process descriptions. Model availability covers technical aspects of access to process models provided to the employees. BPM context consists of internal actors, external contacts, and used satisfaction. Internal actors comprise company employees involved in creating or using process models. Furthermore, different external contacts can be involved in BPM activities. User satisfaction refers to the acceptance and level of content of involved stakeholders with BPM activities in general and process models in particular. Modeling purpose describes the application areas process models are used for in the particular organization. Modeling tool refers to the software tools used to support process modeling projects, including specific BPM tools as well as generic office software as far as it is used to create or use process descriptions. Modeling method refers to the organization's means of documenting processes, including both BPM specific modeling methods and generic methods like textual descriptions.

		TELCO	PRODUCT-ION	BANKING	CHEMICAL	SUM
Organizational context	Modeling conventions	16	9	2	4	31
	BPM responsibilities	24	16	6	4	50
	BPM coverage	16	19	11	8	54
	BPM strategy	6	11	2	6	25
Practical application	BPM know-how	13	9	2	3	27
	Model usage	10	15	4	8	37
	Model availability	5	7	2	2	16
BPM context	Internal actors	20	5	17	12	54
	External contacts	42	22	24	18	106
	User satisfaction	6	4	5	6	21
Modeling purpose		35	22	17	12	86
Modeling tool		28	6	5	11	50
Modeling method		31	18	16	11	76
Total		252	163	113	105	633

Table 3. Data Code Fact Sheet

FINDINGS

Case Study TELCO

Method Assessment

At TELCO, process models are used to serve six different purposes: certification, system integration, training, knowledge management, process optimization, and process documentation. For most of the purposes, event-driven process chains (EPC) are used, supported by the ARIS toolset (III-1). For process documentation, some textual process descriptions are employed additionally (I-1). In the IT department, special IT requirement documents (II-1) are used to aid system integration needs. TELCO reached stage 3 for the majority of its BPM purposes; two purposes (process optimization and process documentation) are at stage 2a (see Figure 2).

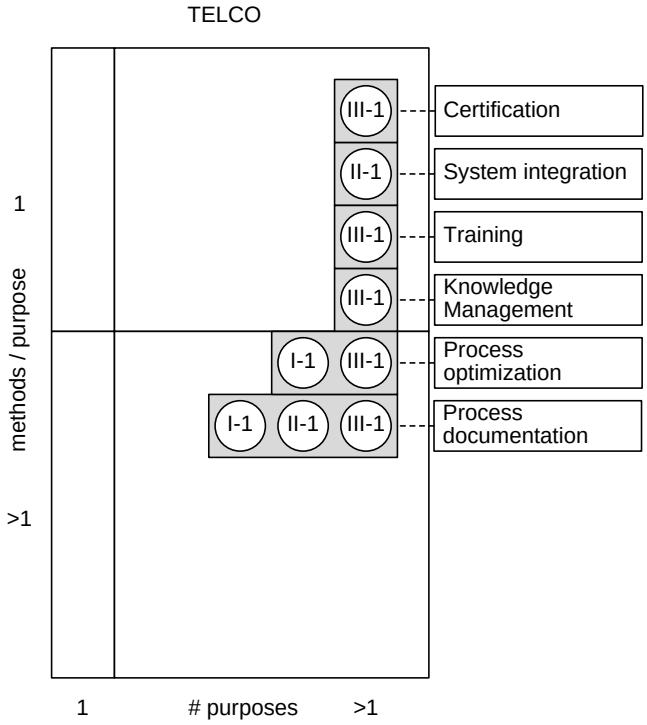

Figure 2. Overview of Case Study Findings TELCO

Context Assessment

The management at TELCO commits itself to BPM and incorporates it in the company strategy. Two designated departments are responsible for strategic and operational BPM, respectively. BPM responsibilities are defined on several levels: resort-wise, process-wise (functional process experts), and in the BPM departments (methodical process managers). BPM conventions are set by the BPM department and applied to the whole company. As of today, about 50%-70% of all processes are documented, focusing on core processes. Specific BPM method knowledge can only be found in the BPM department; functional experts are not proficient in BPM methods. Process models are seldom used in the day-to-day business outside the BPM department. Models are provided when asked for, but are not otherwise accessible to other department heads or employees. Internal stakeholders include employees of nearly every department. The processes are deeply intertwined with supplier processes and outsourcing partners, involving them directly in BPM activities. Furthermore, consultants take part in some BPM projects. Throughout the company BPM is well accepted and perceived as useful.

Case Study PRODUCTION

Method Assessment

At PRODUCTION, we identified five BPM purposes and a number of different specific and non-specific modeling methods. The purposes cover the areas of certification, system integration, organizational re-engineering, process documentation and process optimization. Modeling methods include process landscapes (I-1), flowcharts (I-2), textual descriptions (I-1) and process instructions (I-2). No specific tool is used to assist process modeling; instead, non-specific tools like MS Visio, MS PowerPoint, MS Word, or MS Excel are employed. Regarding certification and system integration, PRODUCTION belongs in the 3rd development stage, while the remaining purposes are at stage 2a (see Figure 3).

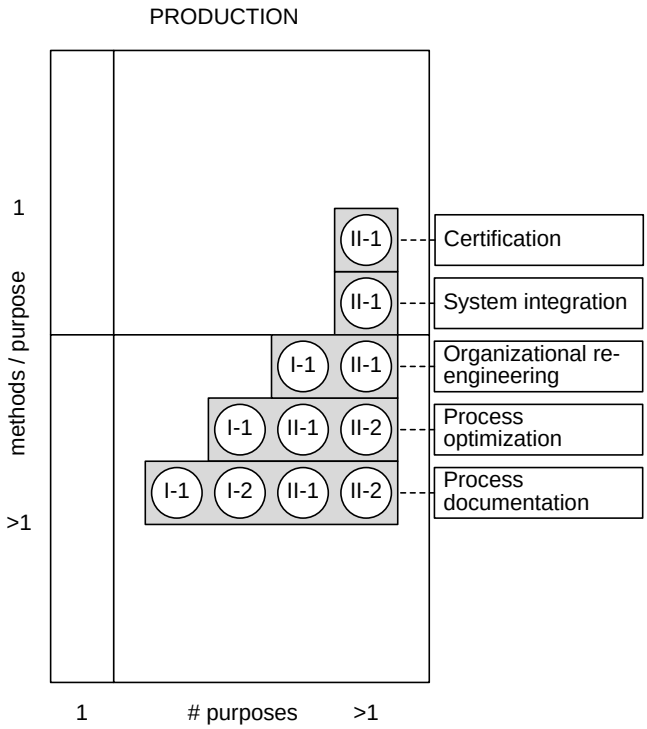

Figure 3. Overview of Case Study Findings PRODUCTION

Context Assessment

At PRODUCTION, neither an established BPM strategy nor a central organizational unit responsible for BPM can be found. Modeling responsibilities lie in the functional departments where the respective process is executed. For cross-departmental processes (ca. 20%), no clear responsibilities are defined. The process landscape is created by the Quality Management department for certification means and includes most of the processes at PRODUCTION. Still, other departments create own process models for their needs. Modeling conventions stem from external certification guidelines and are only used with regard to process models created for certification. Aside from the scope of the certificate audition, no guidelines are followed. Moreover, no continuous updating or optimization of processes is undertaken. Most employees do neither have a clear understanding of BPM, nor are they proficient in BPM methods. The models can be accessed through the intranet, but are rarely used. Internal stakeholders are mostly practitioners from the company divisions. As there is no clear perception of BPM benefits among the employees, their involvement is often hindered by acceptance problems. External actors are limited to consultants in process optimization projects and auditors for certification according to ISO 9001 guidelines.

Case Study BANKING

Method Assessment

BANKING has six different BPM purposes: certification, process optimization, internal benchmarking, training, system integration and process documentation. A wide range of modeling methods is used, including non-specific methods like work instructions (I-1) and textual process descriptions (I-2), as well as specific methods like action charts (II-1), process landscapes (III-1) and EPC (III-2). Specific tools like the ARIS toolset or ibo Prometheus are sporadically used in optimization projects. Most modeling activities are supported by standard office software. BPM activities at BANKING are at stage 2a, with certification purpose extending to stage 3 (see Figure 4).

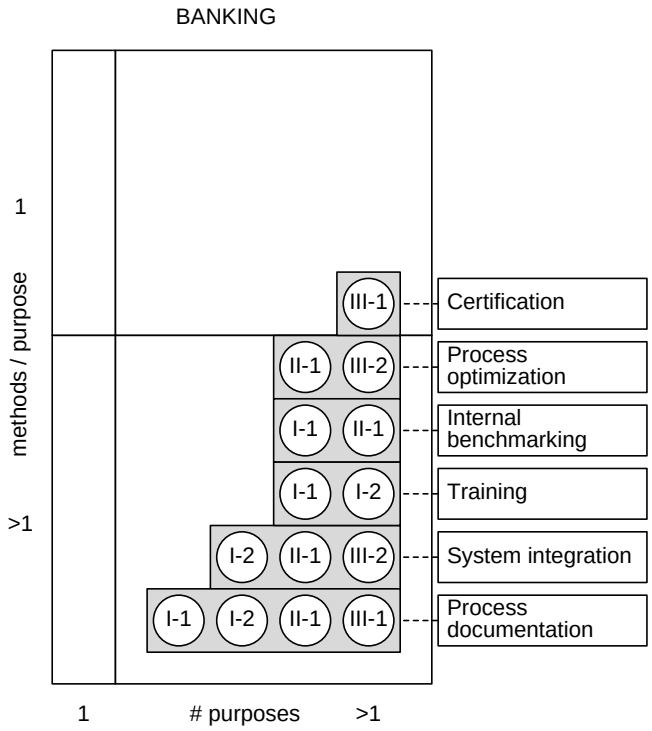

Figure 4. Overview of Case Study Findings BANKING

Context Assessment

BPM activities at BANKING began in the 1980s. Today, process responsibility is located centrally in the organization department. Core processes are documented in a standardized way, but this does not apply to all processes. Furthermore, particular processes are modeled and analyzed "on demand" within optimization projects. Employees in functional departments do not have specific know-how concerning BPM methods. Existing models are hardly ever used in the day-to-day activities, although they are accessible via intranet and in printed form. The benefit of isolated BPM projects is seen critically, as BANKING employees perceive their processes as nearly optimal, so that further optimization would not be cost-efficient. The most important internal actors are the organizational department (responsible for BPM activities) and the internal revision (responsible for auditing). Functional departments are involved in optimization projects from time to time. External contacts exist with consultants and sister companies.

Case Study CHEMICAL

Method Assessment

BPM activities at CHEMICAL cover the areas of certification, training, system integration and process documentation. The methods used are mostly non-specific, such as textual descriptions in the quality management guide (I-1) and various textual or matrix representations in other departments (I-2). The IT department employs EPC as a specific method (II-1). Aside from certification, BPM activities at CHEMICAL are located at stage 2a; in the area of certification stage 3 was reached (see Figure 5).

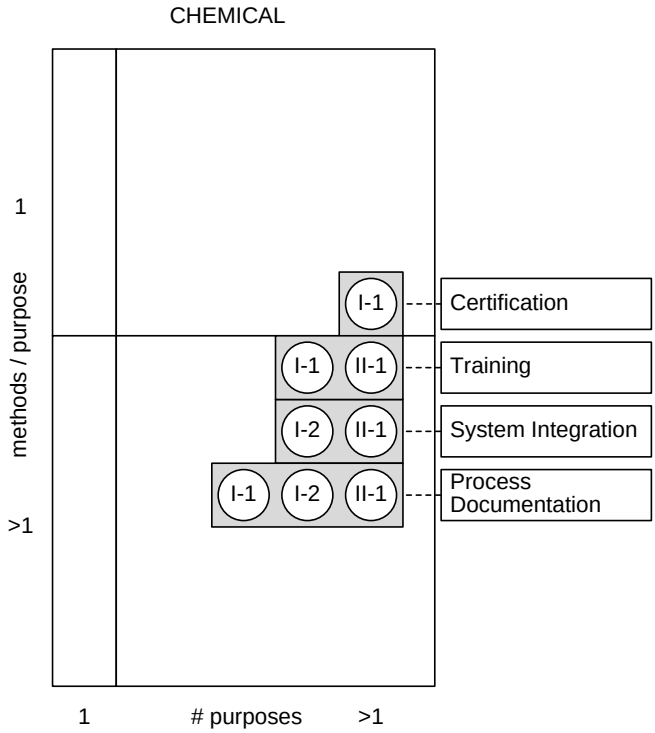

Figure 5. Overview of Case Study Findings CHEMICAL

Context Assessment

The management identified process oriented QM as part of the business strategy. The responsibilities for the BPM strategy are divided between the QM department head and the IT department head. Furthermore, there is a process owner for each process. Conventions for process definitions were provided by the parent company. No specifications regarding the use of a modeling tool were made by the management. Many processes have been modeled, albeit partly on a quite high abstraction level. Employees and executives outside the QM and IT department are not proficient in BPM methods. The IT department requirements differ from the QM (certification) requirements, so the process descriptions in the QM guide are not used for IT purposes. There is no easy way for employees to access specific process models. The internal actors most concerned with BPM activities are the QM department and the IT department. Functional departments only use process models, if either the QM department (audits) or the IT department (software requirement analysis) is involved. Some employees do not see any benefit in using the BPM models, while other name training purposes as a potential application area.

DISCUSSION

Implications

The data show a prevalence of modeling method and purpose plurality in the investigated cases. All companies show several different application areas for process models, ranging from certification and system integration to trainings and process optimization. Although some purposes are fulfilled using one single modeling method, each case shows purposes where several modeling methods are used to meet the specific needs of the organization. Therefore, all four case studies can be placed between stage 2a and stage 3. This indicates a primary unstructured pluralization of BPM purposes, and a subsequent unification of modeling methods. However, two main kinds of plurality can be identified with regard to their effectiveness concerning BPM efforts. The first stage is that of a chaotic plurality, typical of an organization in an early BPM maturity stage. This can be seen in all the investigated case studies, as none of them completely overcame this stage of maturity. In all organizations different modeling methods are applied, often without adequate process modeling proficiency. The same processes are modeled by different persons parallel to each other using a mix of specific and non-specific modeling methods. The second stage is that of a structured plurality in more mature organizations, when multiple methods are used for means of effectiveness in distinct areas. Only rudimentary evidence for this stage can be found in the data.

Method use differs significantly depending on BPM purpose. Certain purposes are usually pursued through the single method approach, while others tend to be served by multiple methods. Several background variables play a role in explaining these differences. We limit the discussion to purposes which occurred in at least two organizations, leaving out internal benchmarking, organizational reengineering, and knowledge management, since little general implications can be deducted from one specific case.

- Certification: One single modeling method is used to answer this purpose in all four case studies. This method is specific in three of the cases, with only CHEMICAL using a non-specific modeling method for certification purposes. At both TELCO and BANKING, the use of a specific modeling method is complemented by a specific software tool. This high degree of maturity in the area of certification stems from the existence of clearly defined requirements and guidelines for process descriptions, which have to be met in order to achieve a certification. Furthermore, the group of model users is usually formed by employees of the Quality Management department (PRODUCTION, CHEMICAL) or the designated BPM department (TELCO), who are skilled in the respective modeling method ant software tool.
- System integration: This purpose is answered by a single modeling method at TELCO and PRODUCTION, while BANKING and CHEMICAL present a multi method approach in this area. In all cases, at least one specific modeling method is applied. Usually, the models created for system integration purposes are maintained by the IT department and are rarely used outside of this limited application area. For example, at TELCO, method II-1 is only used for system integration purposes, and at CHEMICAL, the same holds true for method I-2. An explanation can be found in the specifics of the particular problems posed by system integration needs, which require highly structured modeling methods and specific information. This renders the models unsuitable for use by other stakeholders due to limited proficiency with the chosen formal modeling method.
- Process documentation: This purpose is served by a multi method approach in all four cases. Moreover, it usually comprises most, if not all modeling methods used in the organization. Therefore, it seems to differ structurally from other purposes. Documentation often is stated as a sub-purpose of other BPM applications, and every process model created for some purpose automatically documents a process, contributing to the documentation goal. Therefore, process documentation should be viewed as a special BPM purpose, running orthogonally to other purposes.
- Process optimization: The purpose of optimization is served by a multi method approach focusing on specific modeling methods. Sometimes, these methods are aided by non-specific methods like textual process descriptions, e. g. at TELCO and PRODUCTION. Specific modeling methods are used by the Quality Management or BPM department to analyze processes, while the non-specific methods are mainly used for communication with non-proficient stakeholders.
- Training: This purpose is usually supported by a multi method approach focusing on non-specific methods. At BANKING, training purposes are aided by non-specific methods I-1 and I-2, and at CHEMICAL, I-1 and II-1 are used for the same purpose. The focus on non-specific methods can be explained by the specific user group of the models, which is usually composed of employees without special modeling method knowledge.

Exploring Contextual Factors

Contextual factors contributing to purpose and method plurality mainly stem from one of three categories: organizational, personal, or technical factors. Organizational factors are described by data codes from the group "organization context" (cp. Table 4). The existence of modeling conventions, clearly defined BPM responsibilities, and BPM strategy proved to be most important for the organizational integration of BPM in a company, which fosters the unification process and promotes the use of specific modeling methods and tools. The effects of a high level of BPM integration can be seen at TELCO, where the transition to stage 3 is nearly completed. The other three cases show lower levels of BPM integration, along with a less unified state of modeling purposes and methods. Another organizational factor from the "BPM context" data code group is the existence of external contacts. The integration of external stakeholders (e.g. consultants or auditors) in BPM activities leads to a higher number of usually specific modeling methods used in the company. Quite often, these modeling methods are used in addition to existing process models, thus creating model plurality (e. g. at BANKING or PRODUCTION). Personal factors are derived from data codes for BPM know-how, model usage, and user satisfaction. They focus on the lack of modeling proficiency, acceptance problems, and individual preferences and conflicts. The absence of modeling know-how in employees as well as a low acceptance of specific models creates the need for easy-to-understand textual process descriptions, complementing specific methods already in use for a certain purpose, and fosters method plurality. This effect can be found in all cases, often in combination with the purpose of training or other purposes where processes need to be communicated to non-proficient users. Personal conflicts (e. g. conflicts of competence between department heads) can also

lower the acceptance of specific models and lead to the introduction of additional modeling methods. Technical aspects consist of model availability and usability. If deliberately created process models cannot be easily accessed by employees, or are complicated to use due to properties of the chosen software tool, employees will begin to use additional modeling methods, leading to method plurality. Evidence for this can be found at CHEMICAL.

Limitations

In our study, we examined four in-depth qualitative case studies in a European private sector context. The period of intensive data collection lasted from September 2008 to January 2009 and supported a point in time analysis. Against this background, we see potentially fruitful avenues for future research with regard to sample size and focus. Extending the number of case studies could improve the robustness of our findings, while longitudinal studies in the same four settings could reveal potential changes over time. This would support the assumed progress through the four process modeling method plurality stages. Too, we see value in further investigating into contextual factors, for example by more extensively studying the impact of industry branches, comparing private and public sector findings, or comparatively analyzing the impact of national contextual variables in non-European settings. Above all, our qualitative multiple case exploration of method plurality scenarios is intended to build a foundation for subsequent quantitative research endeavors and for further efforts to understand process modeling method plurality.

SUMMARY

The aim of our study was to investigate the way in which organizations deal with existing modeling method plurality. We conducted four in-depth case studies, involving 24 expert interviews and multiple other information sources. Our analysis yielded the following key contributions: 1) Conceptualizing process modeling method plurality, which can be regarded as a useful framework for further research. Our framework distinguishes four different stages of modeling purpose and method plurality, delineates possible paths of development between these stages, and devises a structured view on possible combinations of modeling methods and modeling purposes. 2) We empirically identified several types of process modeling method plurality in industrial organizations, providing practical evidence for our framework. 3) Based on our case studies, we identified key factors influencing the occurrence of one of the stages of method plurality. Future research should strive to verify our findings in a greater context. Furthermore, the relation between BPM purpose and the number and properties of adequate modeling methods should be investigated in depth.

ACKNOWLEDGEMENTS

We would like to thank the reviewers for their extraordinarily helpful and constructive suggestions. They not only helped us to further improve our paper, but also provided valuable impulses for our future work.

REFERENCES

1. Armistead, C. & Machin, S. (1997), Implications of business process management for operations management, *International Journal of Operations & Production Management*, 17, 9, 886-898.
2. Armistead, C. & Machin, S. (1998), Business Process Management: Implications for Productivity in Multi-Stage Service Networks, *International Journal of Service Industry Management*, 9, 4, 323-336.
3. Balzarova, M. A., Bamber, C. J., McCambridge, S., & Sharp J. M. "Key success factors in implementation of process-based management - A UK housing association experience." *Business Process Management Journal* (10:4), 2004, pp. 387-399.Blyth, A. (1995) Modeling the Business Process to Derive Organisational Requirements for Information Technology. SIGOIS Bulletin 16 (1), 25-33.
4. Capaldo, A. (2007) Network Structure and Innovation: The Leveraging of a Dual Network as a Distinct Relational Capability, *Strategic Management Journal*, 28, 6, 585-608.
5. Corbin, J. M., & Strauss, A. L. (2007), Basics of qualitative research: Techniques and procedures for developing grounded theory, Sage, Thousand Oaks, CA, USA.
6. Davenport, T. H., & Short, J. (1990), The New Industrial Engineering: Information Technology and Business Process Redesign, *Sloan Management Review*, 31, 4, 11-27.
7. Davenport, T. H. (1993), Need radical innovation and continuous improvement? Integrate process reengineering and TQM, *Planning Review*, 21, 3, 6-12.
8. De Bruyn, B., & Gelders, L. (1997), From TQM to BPR – Two case studies in personnel administration, *International Journal of Production Economics*, 50, 2-3, 169-181.

9. Eder, J. & Liebhart, W. (1995), The Workflow Activity Model WAMO, *Proceedings of 3rd Intl Conference on Cooperative Information Systems*, Vienna, Austria.
10. Ellis, C. A. & Nutt, G. J. (1993), Modeling and Enactment of Workflow Systems, *Application and Theory of Petri Nets*, in: *Lecture Notes on Computer Science*, 691, 1-16.
11. Hammer, M. (1990), Reengineering Work: Don't Automate, Obliterate, *Harvard Business Review*, 68, 4, 104-112.
12. Harrison, D. B., & Pratt, M. D. (1992), A methodology for reengineering businesses, *Planning Review*, 21, 2 , 6-11.
13. Hung, R. Y.-Y. (2006), Business Process Management as Competitive Advantage: A Review and Empirical Study, *Total Quality Management*, 17, 1, 006, 21-40.
14. Jick, T. D. (1979), Mixing Qualitative and Quantitative Methods: Triangulation in Action, *Administrative Science Quarterly*, 24, 4, 602-611.
15. Kern, T., & Willcocks, L. (2002), Exploring relationships in information technology outsourcing: the interaction approach, *European Journal of Information Systems*, 11, 1, pp. 3-19.
16. Kettinger, W. J., Teng, J. T. C., & Guha, S. (1997), Business Process Change – A Study of Methodologies, Techniques, and Tools, *MIS Quarterly*, 21, 1, 55-80.
17. Lyytinen, K., & Newman, M. (2008), Explaining Information Systems Change: A Punctuated Socio-Technical Change Model, *European Journal of Information Systems*, 17, 4, 589-613.
18. Martinsons, M. G., & Hempel, P. S. (1998), Chinese business process re-engineering, *International Journal of Information Management*, 18, 6, 393-407.
19. Matavire, R., & Brown, I. (2008), Investigating the use of "Grounded Theory" in information systems research, Proceedings of the research conference of the South African Institute of Computer Scientists and Information Technologists on IT research in developing countries, Wilderness, South Africa.
20. Mingers, J. (2003), The paucity of multimethod research: a review of the information systems literature, *Information Systems Journal*, 13, 3, 233-249.
21. Myers, M. D. (2008), Qualitative Research in Information Systems, *MIS Quarterly*, 21, 2, (1997), 241-242. *MISQ Discovery*, updated version, last modified: November 5, 2008 www.qual.auckland.ac.nz.
22. Orlikowski, W. J. (1993), CASE tools as organizational change Investigating incremental and radical changes in systems development, *MIS Quarterly*, 17, 3, 309-340.
23. Peppard, J., & Fitzgerald, D. (1997), The transfer of culturally-grounded management techniques: the case of business process reengineering in Germany, *European Management Journal*, 15, 4, 446-460.
24. Pritchard, J.-P., & Armistead, C. (1999), Business process management - lessons from European business, *Business Process Management Journal*, 5, 1, 10-32.
25. Remenyi, D., & Williams, B. (1998), The nature of research: Qualitative or quantitative, narrative or paradigmatic?, *Information Systems Journal* 6, 2, 131-146.
26. Rosemann, M., de Bruin, T., & Power, B. (2006), A Model to Measure Business Process Management Maturity and Improve Performance, in *Business process management: practical guidelines to successful implementations* Jeston, J., Nelis, J. (Eds.), Butterworth-Heinemann, London, England, pp. 299-315.
27. Rumbaugh, J., Blaha, M., Premerlani, W., Eddy, F. & Lorensen, W. (1991), Object-Oriented Modeling and Design. *Prentice-Hall International Editions*. Prentice-Hall.
28. Salganik, M. J., & Heckathorn, D. D. (2004), Sampling and Estimation in Hidden Populations Using Respondent-Driven Sampling, *Sociological Methodology*, 34, 1, 193-240.
29. Sarker, S., Sarker S., & Sidorova, A. (2006), Understanding business process change failure: An actor-network perspective, *Journal of Management Information Systems*, 23, 1, 51-86.
30. Silverman, D. (1998), Qualitative research: meanings or practices?, *Information Systems Journal*, 8, 1, 3-20.
31. Sun, S. X., Zhao, J. L., Nunamaker, J. F., & Sheng, O. R. L. (2006), Formulating the Data Flow Perspective for Business Process Management, *Information Systems Research*, 17, 4, 374-391.
32. Tarafdar, M., & Gordon, S. R. (2007), Understanding the Influence of Information Systems Competencies on Process Innovation: A Resource-Based View, *Journal of Strategic Information Systems*, 16, 4, 353-392.

33. Yin, R. K. (2003), *Case Study Research: Design and Methods*, Sage Publications, London, England.
34. Zairi, M., & Sinclair, D. (1995), Business process re-engineering and process management – a survey of current practice and future trends in integrated management, *Management Decision*, 33, 3, 3-16.