A Survey on Evaluation Factors for Business Process Management Technology

Bela Mutschler and Manfred Reichert

Information Systems Group, University of Twente, The Netherlands
bela@mutschler.info;m.u.reichert@utwente.nl

Abstract. Estimating the value of business process management (BPM) technology is a difficult task to accomplish. Computerized business processes have a strong impact on an organization, and BPM projects have a long-term cost amortization. To systematically analyze BPM technology from an economic-driven perspective, we are currently developing an evaluation framework in the EcoPOST project. In order to empirically validate the relevance of assumed evaluation factors (e.g., process knowledge, business process redesign, end user fears, and communication) we have conducted an online survey among 70 BPM experts from more than 50 industrial and academic organizations. This paper summarizes the results of this survey. Our results help both researchers and practitioners to better understand the evaluation factors that determine the value of BPM technology.

1 Introduction

The different stages of a business process can be described by means of the process life cycle [1] (cf. Fig. 1). First, a business process has to be (re)designed. Usually, business process modeling and analysis tools are used during this *design phase*. Second, the business process is implemented in the *implementation phase*.

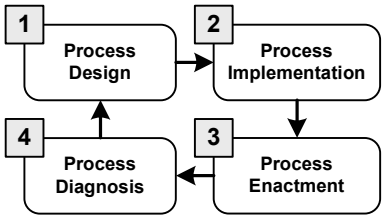


Fig. 1. The Business Process Lifecycle.

As a result of this phase we obtain one or several workflow-based applications that support the business process or at least fragments of it (e.g., enterprise resource planning (ERP) or product data management (PDM) systems). Third, multiple instances of the implemented business process can be created and executed in the *enactment phase*.

Finally, process enactment logs can be analyzed in the *diagnosis phase* to identify potentials for process optimizations.

Adequately handling all stages of this life cycle has become success-critical for enterprises. In response to this requirement, business process management (BPM) technology offers promising perspectives. In particular, BPM technology enables a new type of enterprise applications which do not only deal with business objects and functions, but with business process support as well [2]. For this purpose, BPM technology provides tools for designing, enacting, controlling, and analyzing business processes. On the one hand, build time components are provided which support the (graphical) modeling of ”as is” and ”to be” business processes and which enable comprehensive process analyses (e.g., based on simulations). On the other hand, run-time components provide support for the execution of business processes and the analysis of process performance based on logged execution data. Thereby, humans, organizations, applications, documents and other sources of information can be involved.

Technical issues related to BPM technology (e.g., enabling process flexibility by dynamic workflow changes, process mining, process patterns, process visualization, process meta models, etc.) have been intensively discussed in literature [1, 3–8]. However, what has been neglected so far is the systematic analysis of economic effects related to the use of BPM technology. Only few publications deal with this viewpoint [9, 10]. This is surprising as the introduction of BPM technology is associated with significant investments and efforts. In fact, introducing BPM technology is not only a matter of hardware and software costs. Major efforts related to the introduction of BPM technology are also caused by indirect issues. As examples consider the costs for business process (re)design activities prior to the introduction of BPM technology, or for the implementation of process-aware information systems based on BPM technology.

Consequently, policy makers often demand for a business case [11] that summarizes the costs, benefits, and risks related to the introduction of BPM technology. However, the preparation of such a BPM-specific business case is faced with many challenges like the identification of cost drivers, the quantification of benefits, or the aggregation of evaluation data into an overall investment recommendation.

In order to analyze the economics when introducing BPM technology, we are currently developing an evaluation framework in the EcoPOST project[1] [12]. One major topic addressed in this project is the identification of evaluation factors that have to be considered when dealing with BPM economics. To empirically validate the relevance of assumed evaluation factors (e.g., process knowledge, business process redesign, end user fears, and communication), we have conducted an online survey among 70 BPM experts from more than 50 industrial and academic organizations. The results of this survey are described in this paper. These results help both researchers and practitioners to better understand the evaluation factors that determine the value of BPM technology.

Section 2 describes the research methodology and research questions that have guided our empirical study. Section 3 discusses those survey results that allow for conclusions regarding the general understanding of BPM technology from an economic-driven viewpoint. In Section 4, we then focus on potential BPM evaluation factors. Section 5 addresses six of these evaluation factors we assume as being of particular

[1] This work has been funded by DaimlerChrysler Research.

importance. Section 6 discusses the major findings of our survey and Section 7 deals with related work. The paper concludes with a summary and an outlook in Section 8.

2 Research Methodology and Research Questions

The empirical study described in this paper has been conducted in the EcoPOST[2] project [12]. In this project we deal with the systematic evaluation of process-oriented software technologies and process-aware information systems from a value-based, i.e., economic-driven perspective. Preliminary work has been described in [13–15].

Our EcoPOST methodology is cost-driven, i.e., costs are the basic measure of evaluation. Thereby, it is one objective to quantify the lifecycle costs of BPM technologies and process-aware information systems. In order to achieve this, it is one prerequisite to identify, analyze and understand those factors that determine the costs of process-oriented software technologies and process-aware information systems. In order to empirically validate some of our assumptions regarding the relevance of alleged evaluation factors as well as to analyze their effectiveness, we have conducted an online survey among BPM experts.

Research Methodology. The survey described in this paper is a second survey after another survey in 2005 among 79 IT experts [13]. This first survey focused on an initial analysis of basic issues related to economic-driven IT evaluations in general. This implied the identification of factors aggravating the realization of adequate IS support for business processes. Altogether, this first survey has enabled us to derive an initial baseline of potential evaluation factors determining the economics of business process technology. In the following, we have extended this list of potential evaluation factors based on a profound literature study and an exploratory case study in the automotive domain; the results of this case study have been also described in [13] (cf. Fig. 2). In order to empirically validate this list of potential evaluation factors as well as to specifically analyze assumed effects related to selected factors we have conducted a second online survey (whose results are described in this paper).

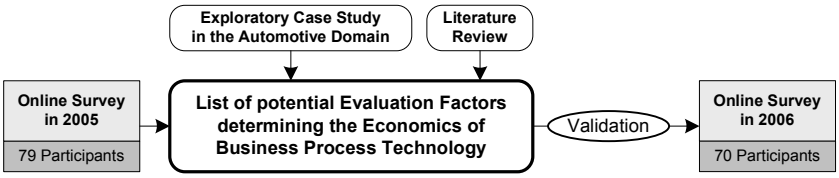


Fig. 2. Positioning this Survey in the EcoPOST Project.

Survey Background Information. This second survey was done over a period of two months in 2006. It was distributed via a web based survey delivery platform the

[2] **Eco**nomic-driven Evaluation of **P**rocess-**o**riented **S**oftware **T**echnologies

recipients were directed to. Due to the many benefits provided by commercial survey tools (e.g., automatic data collection, flexible questionnaire design, support of different question types, support of different analysis tools, etc.), we decided not to implement our own survey delivery platform. This decision was also supported by the fact that several studies (e.g., [16] and [17]) have described electronic surveys as advantageous when compared to traditional postal methods. Altogether, 70 BPM experts from more than 50 industrial and academic organizations participated. The number of 70 survey participants corresponds to a response rate[3] of 26.21%.

Figure 3 summarizes important background information about the survey participants. The questionnaire included 35 questions. Some questions allowed for the declaration of other answers than those provided in the basic set of answer possibilities.

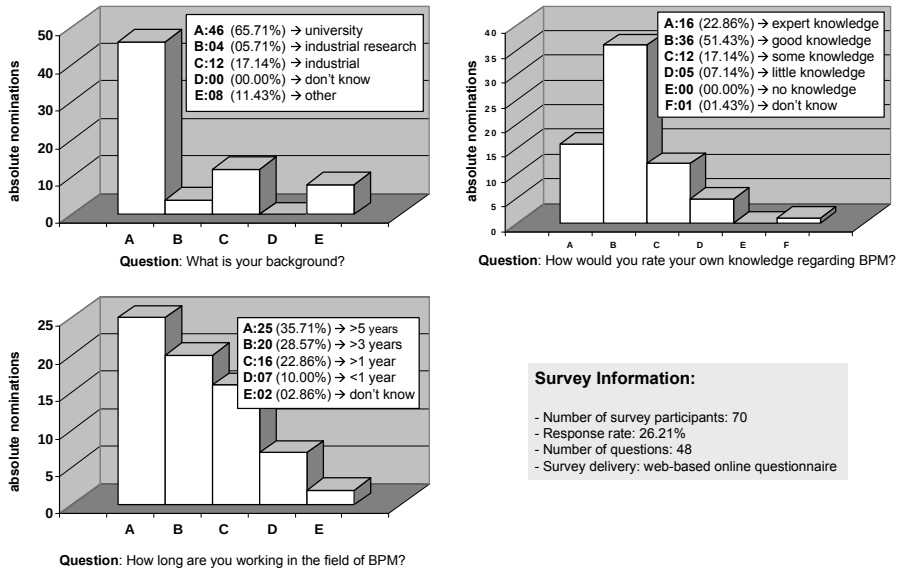


Fig. 3. Survey Background Information.

In order to convince people to participate in our survey we conducted several initiatives. First, and most important, email messages were sent over various international computer science mailing lists requesting participants to visit the survey site and to complete the questionnaire. Two weeks after sending out the initial mails we sent an additional reminder. The effect of this reminder was surprising. Within two days the number of participants raised from 25 to over 60. Secondly, we also used personal con-

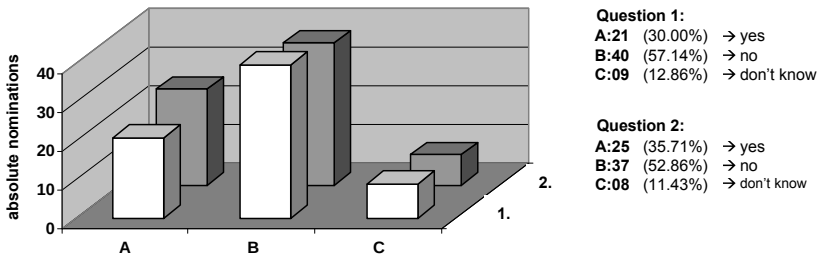
[3] Mehta and Sivadas [17] describe that response rates for electronic surveys ranged from 40% to 64%. Bachmann et. al [18] found response rates of 19% for email and 46% for mail surveys. Falconer and Hodgett [19] noted that reasonable response rates for IS research is likely to be in the range of 10% to 35%. Our response rate of our survey corresponds to this data.

tacts to raise awareness for the survey. In doing so, we convinced more than 15 people to participate in the survey.

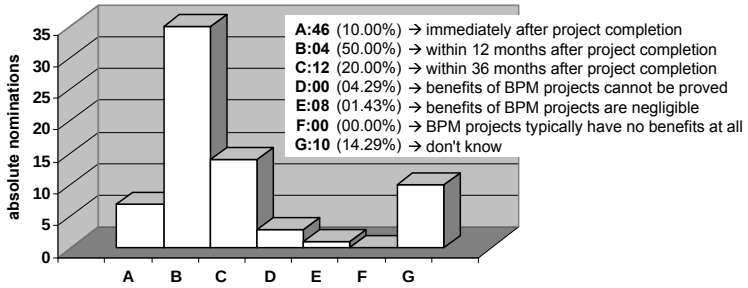
Research Question. Altogether, we can formulate the research question that has guided the empirical research described in this paper as follows: *Which evaluation factors determine the economics of BPM technology?* Thereby, we adopt the classification of evaluation factors as used in the EcoPOST project, i.e., we distinguish between organization-specific, project-specific, and technology-specific factors (see [20] for details). Thereby, we analyze six evaluation factors we consider as being of particular importance for a more detailed analysis. These factors comprise ”process knowledge”, ”domain knowledge”, ”business process redesign”, ”business process fragmentation”, ”end user fears”, and ”communication”.

3 Understanding the Economics of Business Process Management

Before discussing BPM evaluation factors in detail, this section shortly describes some findings of our survey regarding the general understanding of BPM economics.



Question 1: Is the economic impact of BPM projects/technologies sufficiently understood?
Question 2: Are financial business ratios such as the ROI suitable to cover the economic impact of a BPM project?



Question 3: Concerning benefits of a BPM project/investment: When can benefits typically be realized?

Fig. 4. Understanding of BPM Economics.

Our survey confirms, for example, that the economics of BPM is not sufficiently understood. Anyhow 57.14% of the survey participants share this opinion (see Question 1

in Fig. 4). By contrast, only 30% of them consider BPM economics as being sufficiently understood. This is a rather low value considering the increasing dissemination of BPM technology.

Altogether, 52.86% of the survey participants consider financial business ratios (such as the *return on investment*) as not suitable to quantify the economic effects of BPM (see Question 2 in Fig. 4). However, 35.71% of them acknowledge that such financial business ratios can be used in this respect. This seems to be a rather high number considering the difficulties reported in the practical BPM evaluation literature [9, 21–24].

Note that the results of Question 1 and Question 2 in Fig. 4 only vary slightly. It can be speculated that a survey participant who considers BPM economics as being only insufficiently understood also considers existing financial business ratios as not suitable to quantify the economics of BPM; i.e., most survey participants associate the general understanding of BPM economics with the applicability of financial business ratios.

We further asked the survey participants about the benefits provided by the introduction of BPM technology (without further dealing with the question what specific benefits exactly occur). According to our survey (see Question 3 in Fig. 4), every second participant expects benefits within the first year. This indicates that BPM technology is not only considered as a long-term investment but also as a short-term one.

20% of the survey participants expect benefits within 36 months after the introduction of BPM technology whereas 4.29% share the opinion that benefits of BPM technology cannot be proved at all. Finally, 1.43% of the participants consider the benefits of BPM technology as negligible. No participant states that a BPM project has no benefits at all. After all, 14.29% of the survey participants cannot answer this question. Altogether, this is another indicator for the acceptance BPM technology has achieved in the recent years.

4 Evaluation Factors

This section deals with evaluation factors that determine the economics of BPM technology. Thereby, we distinguish between organization-specific, project-specific, and technology-specific evaluation factors (see [20] for details). *Organization-specific evaluation factors* deal with organizational issues that bias the economics of BPM technology. As an example consider the impact of process knowledge on the ability to effectively redesign business processes. *Project-specific evaluation factors* deal with project-related issues such as domain knowledge. Another example concerns organizational barriers (e.g., between departments) that may cause process interceptions. Finally, *technology-specific evaluation factors* deal with technical capabilities of BPM technology. As a typical example consider the degree of flexibility provided by the BPM system (e.g., with respect to the support of dynamic changes). Besides, it was also possible for the survey participants to denote additional evaluation factors that have not been listed in the predefined set of answers. However, this possibility was only rarely used.

– **Organization-specific Evaluation Factors**. According to our survey (cf. Fig. 5), ”end user participation” (47.14%) and ”access to required information” (42.86%)

are those organization-specific evaluation factors that have aggregated most nominations as ”essential factor”. Many of the other factors have been considered as ”very important” with respect to the economics of BPM technology: reorganization of information, availability of process documentation, ability to redesign business processes, and organization’s ability to adapt its IT governance. In order to better understand the relevance of the analyzed evaluation factors, Fig. 6 shows the median of each evaluation factor.

– **Project-specific Evaluation Factors**. According to our survey (cf. Fig. 7), ”management commitment” (67.14%) and ”communication with end users” (45.71%) are those project-specific evaluation factors that aggregate most nominations as ”essential factors”. Besides, many of the other evaluation factors have been considered as ”very important” enablers for BPM technology, e.g., degree of job redesign, overview of existing processes, information and knowledge about existing processes, and motivation for the project. (cf. Fig. 8 for the median of each evaluation factor).

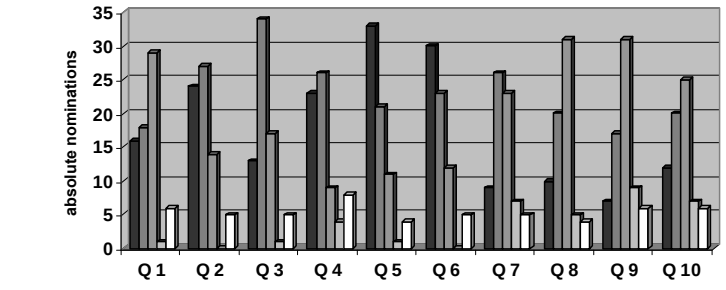
– **Technology-specific Evaluation Factors**. There are no technology-specific evaluation factors that have been considered as essential factors by a majority of the survey participants (cf. Fig. 9). In this context, ”good product documentation” (17.14%) and ”usability of a BPM system” (20%) have aggregated most nominations as ”essential factors” for the success of a BPM project. Moreover, these two factors have been considered as ”very important” by many participants (38.57% and 37.14%). Besides, there are many evaluation factors that are considered as ”very important” or ”important”, like ”available vendor support for a BPM system”, ”supported degree of process flexibility”, and ”availability of suitable development tools”. It is also an eye-catching result (cf. Fig. 9) that the number of participants who state ”don’t know” does only slightly vary along the prompted issues. This indicates that a certain amount of survey participants did not really know how to interpret the denoted technological factors (cf. Fig. 10 for the median of each evaluation factor).

5 Detailed Analysis of Selected Evaluation Factors

In this section we provide a more specific analysis regarding the effects of six selected evaluation factors[4] (cf. Fig. 11): process knowledge (cf. Section 5.1), domain knowledge (cf. Section 5.2), business process redesign (cf. Section 5.3), business process fragmentation (cf. Section 5.4), end user fears (cf. Section 5.5), and communication (cf. Section 5.6).

We applied a four-step sequence of questions (cf. Fig. 12) in order to analyze each of these six evaluation factors. First, we asked for the factor’s *relevance* with respect to BPM (Question 1). Second, we asked whether there is a *relationship* between the

[4] We have preselected these six factors based on the outcome of our first survey in the EcoPOST project and additional experiences we gathered in large information system projects in the automotive domain (cf. Section 2 for details).



	A	B	C	D	E	
Q 1	(22.86%)	(25.71%)	(41.43%)	(01.43%)	(08.57%)	**→ Experiences in using BPM technology**
Q 2	(34.29%)	(38.57%)	(20.00%)	(00.00%)	(07.14%)	**→ Ability to redesign business processes**
Q 3	(18.57%)	(48.57%)	(24.29%)	(01.43%)	(07.14%)	**→ Reorganization of information**
Q 4	(32.86%)	(37.14%)	(12.86%)	(05.71%)	(11.43%)	**→ Domain knowledge**
Q 5	(47.14%)	(30.00%)	(15.71%)	(01.43%)	(05.71%)	**→ End user participation**
Q 6	(42.86%)	(32.86%)	(17.14%)	(00.00%)	(07.14%)	**→ Access to required information**
Q 7	(12.86%)	(37.14%)	(32.86%)	(10.00%)	(07.14%)	**→ Organizational process maturity**
Q 8	(14.29%)	(28.57%)	(44.29%)	(07.14%)	(05.71%)	**→ Availability of process documentation**
Q 9	(10.00%)	(24.29%)	(44.29%)	(12.86%)	(08.57%)	**→ Mature technology infrastructure**
Q 10	(17.14%)	(28.57%)	(35.71%)	(10.00%)	(08.57%)	**→ Ability to adapt the IT governance**

Question: Please evaluate the following **ORGANIZATION-specific evaluation factors** towards their importance for the economics of BPM technology.

Fig. 5. Organization-specific Evaluation Factors.

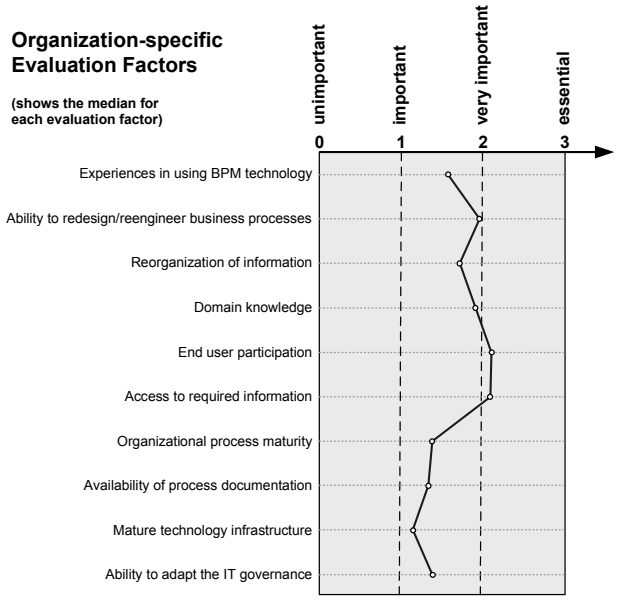
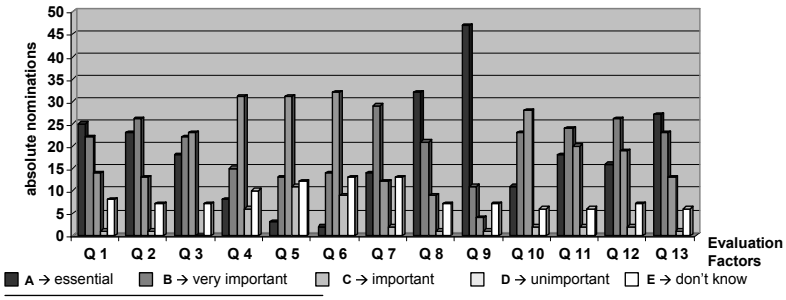


Fig. 6. Median Values of Organization-specific Evaluation Factors.



	A	B	C	D	E	
Q 1	(35.71%)	(31.43%)	(20.00%)	(01.43%)	(11.43%)	**→ Overview of existing processes**
Q 2	(32.86%)	(37.14%)	(18.57%)	(01.43%)	(10.00%)	**→ Knowledge about existing processes**
Q 3	(25.71%)	(31.43%)	(32.86%)	(00.00%)	(10.00%)	**→ Information about existing processes**
Q 4	(11.43%)	(21.43%)	(44.29%)	(08.57%)	(14.29%)	**→ Evolutionary process redesign**
Q 5	(04.29%)	(18.57%)	(44.29%)	(15.71%)	(17.14%)	**→ Revolutionary process redesign**
Q 6	(02.86%)	(20.00%)	(45.71%)	(12.86%)	(18.57%)	**→ Degree of job redesign**
Q 7	(20.00%)	(41.43%)	(17.14%)	(02.86%)	(18.57%)	**→ End user fears**
Q 8	(45.71%)	(30.00%)	(12.86%)	(01.43%)	(10.00%)	**→ Communication with end users**
Q 9	(67.14%)	(15.71%)	(05.71%)	(01.43%)	(10.00%)	**→ Management commitment**
Q 10	(15.71%)	(32.86%)	(40.00%)	(02.86%)	(08.57%)	**→ Use of process modeling tools**
Q 11	(25.71%)	(34.29%)	(28.57%)	(02.86%)	(08.57%)	**→ Adequate planning**
Q 12	(22.86%)	(37.14%)	(27.14%)	(02.86%)	(10.00%)	**→ Access to required skills**
Q 13	(38.57%)	(32.86%)	(18.57%)	(01.43%)	(08.57%)	**→ Motivation for the project**

Question: Please evaluate the following **PROJECT-specific evaluation factors** towards their importance for economics of BPM technology.

Fig. 7. Project-specific Evaluation Factors.

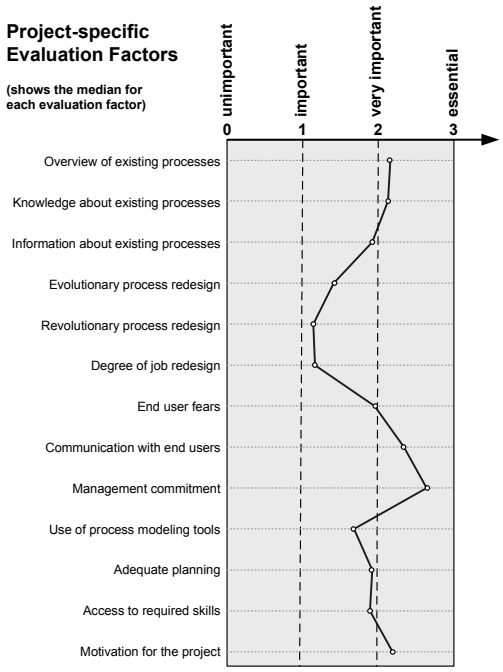
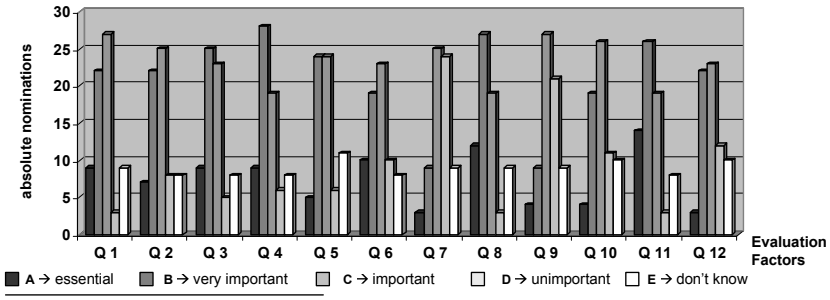


Fig. 8. Median Values of Project-specific Evaluation Factors.



	A	B	C	D	E	
Q 1	(12.86%)	(31.43%)	(38.57%)	(04.29%)	(12.86%)	**→ Technical maturity of the BPM platform**
Q 2	(10.00%)	(31.43%)	(35.71%)	(11.43%)	(11.43%)	**→ Experiences using the BPM platform**
Q 3	(12.86%)	(35.71%)	(32.86%)	(07.14%)	(11.43%)	**→ Available support for the BPM platform**
Q 4	(12.86%)	(40.00%)	(27.14%)	(08.57%)	(11.43%)	**→ Supported degree of process flexibility**
Q 5	(07.14%)	(34.29%)	(34.29%)	(08.57%)	(15.71%)	**→ Availability of developing tools**
Q 6	(14.29%)	(27.14%)	(32.86%)	(14.29%)	(11.43%)	**→ Support of standards and norms**
Q 7	(04.29%)	(12.86%)	(35.71%)	(34.29%)	(12.86%)	**→ Low license costs**
Q 8	(17.14%)	(38.57%)	(27.14%)	(04.29%)	(12.86%)	**→ Good documentation**
Q 9	(05.71%)	(12.86%)	(38.57%)	(30.00%)	(12.86%)	**→ Regular product updates**
Q 10	(05.71%)	(27.14%)	(37.14%)	(15.71%)	(14.29%)	**→ Model-driven application development**
Q 11	(20.00%)	(37.14%)	(27.14%)	(04.29%)	(11.43%)	**→ Usability of the BPM platform**
Q 12	(04.29%)	(31.43%)	(32.86%)	(17.14%)	(14.29%)	**→ Powerful application programming interface**

Question: Please evaluate the following **TECHNOLOGY-specific evaluation factors** towards their importance for the economics of BPM technology.

Fig. 9. Technology-specific Evaluation Factors

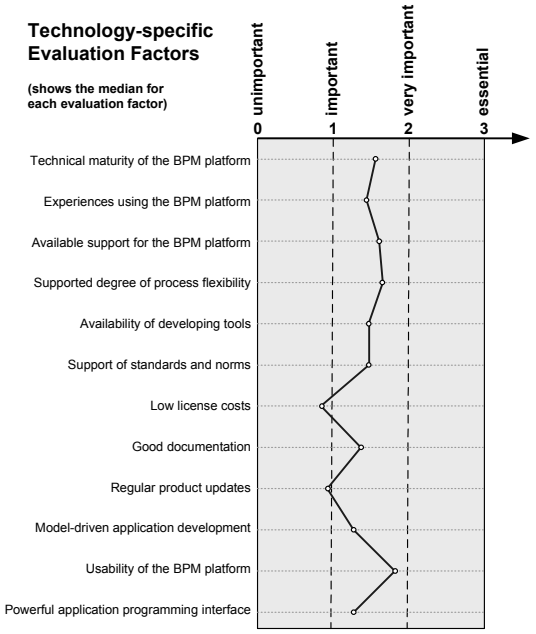


Fig. 10. Median Values of Technology-specific Evaluation Factors.

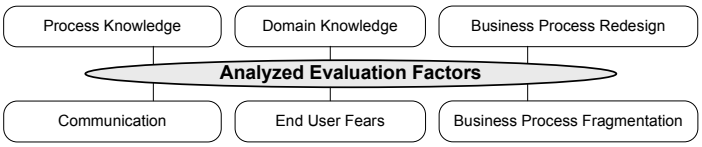


Fig. 11. Analyzed Evaluation Factors.

factor and the success/costs of a BPM project (Question 2). Only those survey participants - and this is important for the understanding of survey results - who answered this second question with ”yes” were directed to 2 additional questions. In particular, the first of the two additional questions addressed the *semantic specification of the relationship* (Question 3), whereas the second one addressed the *strength of the relationship* (Question 4).

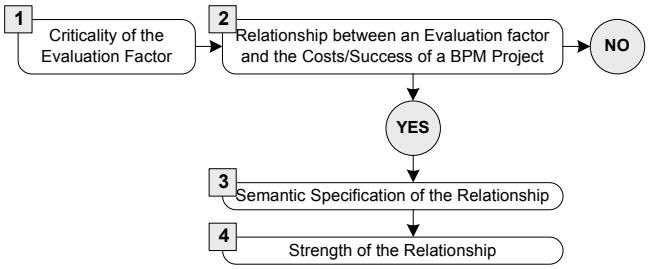


Fig. 12. 4-Step Sequence for Analyzing Assumed Dependencies.

5.1 Process Knowledge

Process knowledge represents knowledge about process activities and their dependencies. This includes, for example, knowledge about the different process participants and their role and knowledge about the flow of information between the process activities. It can be assumed that profound process knowledge enables more effective business process implementations and therewith results in decreasing costs of BPM projects.

The majority of 92.86% of the survey participants considers ”process knowledge” as an ”essential” (41.43%), ”very important” (37.14%) or ”important” (14.29%) factor for a BPM project (see Question 1 in Fig. 13). Furthermore, 61.43% of the survey participants confirm that there is a relationship between process knowledge and the costs of a BPM project (see Question 2 in Fig. 13). Out of these respondents, 72.09% share the opinion that a low (high) process knowledge results in increasing (decreasing) costs of a BPM project (see Question 3 in Fig. 13). Surprisingly, 18.6% of the survey participants believe that a low (high) process knowledge results in decreasing (increasing) costs of a

BPM project. It can be presumed here whether this figure corresponds to the real opinion of the respective survey participants, or whether some of them did not really read all possible answers. 6.98% of the respondents state that there is another, indirect relationship between process knowledge and the costs of a BPM project (without further specifying the kind of indirect relationship). Finally, 50% of these respondents point out (see Question 4 in Fig. 13) that the impact of process knowledge on the success of a BPM project either is ”very strong” (17.14%) or ”strong” (32.86%).

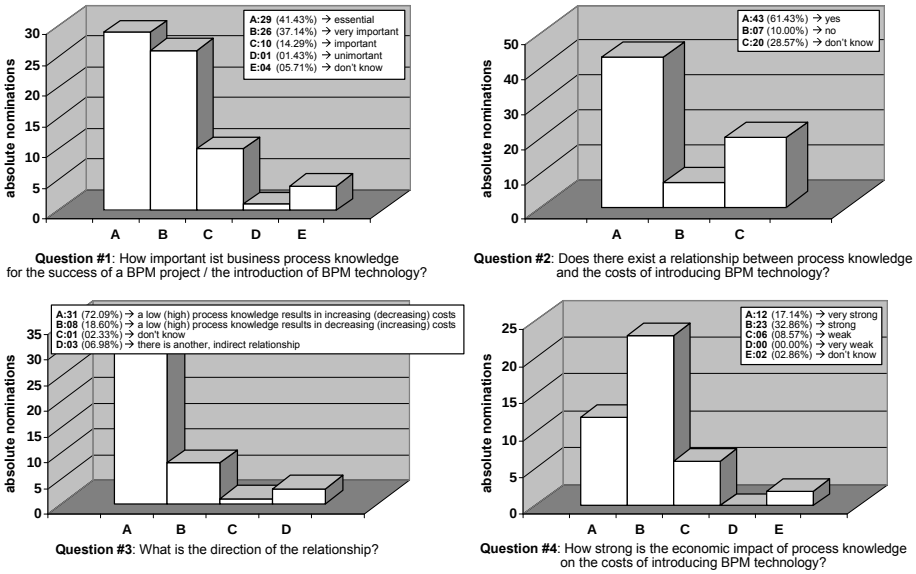


Fig. 13. Analyzing Process Knowledge.

5.2 Domain Knowledge

Domain knowledge is determined by the period a BPM expert has been working in a specific domain. Thus, domain knowledge is increasing over time. Generally, it can be assumed that high domain results in more effective business process implementations and therewith results in decreasing costs for BPM projects.

Domain knowledge is considered as an ”essential” (27.14%), ”very important” (38.57%) or ”important” (21.43%) factor for BPM projects by 87.14% of the survey participants (see Question 1 in Fig. 14). Moreover, 47.14% of the respondents acknowledge that there is a dependency between domain knowledge and the costs of a BPM project (see Question 2 in Fig. 14). When compared to process knowledge, this number is rather low and indicates that the impact of domain knowledge on the costs of a BPM project is at least considered as being of minor relevance. 69.7% of the respondents (out of the

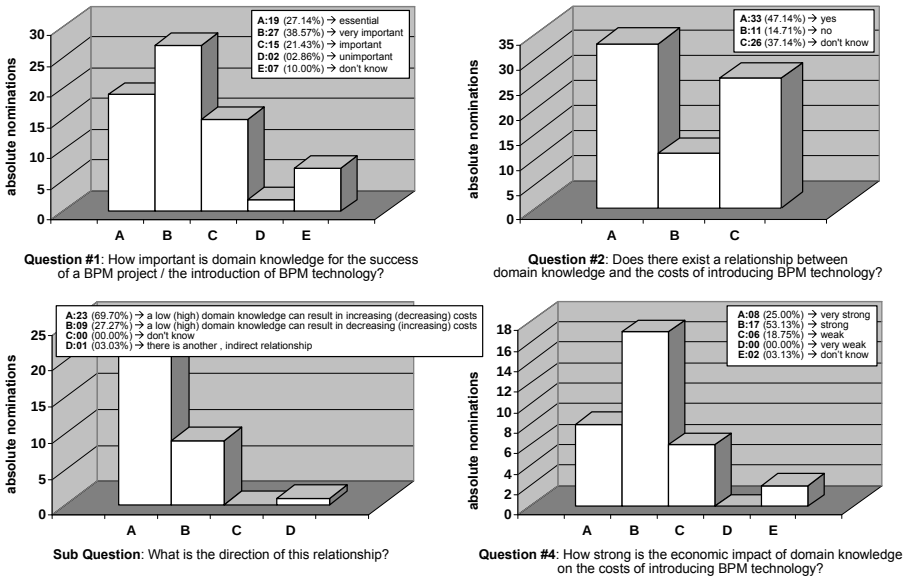


Fig. 14. Analyzing Domain Knowledge.

47.14%) share the opinion that a low (high) domain knowledge results in increasing (decreasing) costs of a BPM project (see Question 3 in Fig. 14). Anyhow, 27.27% of the respondents believe that a low (high) domain knowledge results in decreasing (increasing) costs of a BPM project. Finally, 78.13% of the survey participants state (see Question 4 in Fig. 14) that the impact of domain knowledge on the success of a BPM project either is ”very strong” (25%) or ”strong” (53.13%).

5.3 Business Process Redesign

The adequate redesign of business processes is another important success factor for BPM projects. Business process redesign deals with the evolutionary or revolutionary change of business processes prior to the introduction of BPM technology [25]. Such redesign activities can become necessary for several reasons. As examples consider the need to optimize the performance of an existing business process or the goal of realizing a higher degree of process automation. In doing so, business process redesign activities typically cause significant efforts and costs.

The redesign of business processes is regarded as ”essential” (18.57%), ”very important” (34.29%) or ”important” (31.43%) by 84.29% of the survey participants (cf. Question 1 in Fig. 15). More specifically, 68.57% of the survey participants confirm that there is a relationship between the ability to redesign business processes and the success of a BPM project (cf. Question 2 in Fig. 15). Out of these respondents, 83.33% consider the ability to redesign business processes as an enabler for the success of a BPM project (cf. Question 3 in Fig. 15). No participant thinks that the redesign of business processes

hampers the success of a BPM project. After all, 6.25% state that there is another, indirect relationship between the redesign of business processes and the success of a BPM project. Finally (and again out of these 68.57%), 83.36% of the respondents state (cf. Question 4 in Fig. 15) that the impact of business process redesign on the success of a BPM project either is ”very strong” (35.42%) or ”strong” (47.92%).

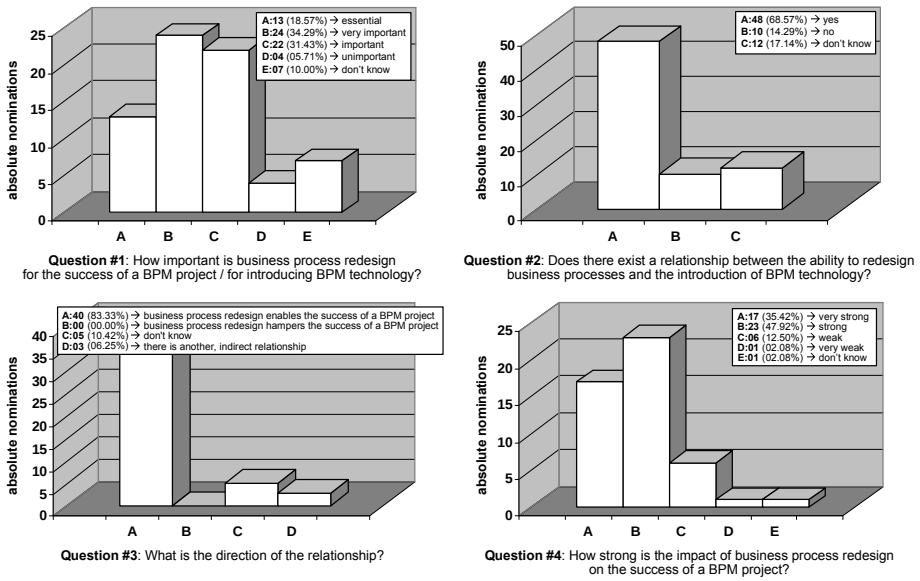


Fig. 15. Analyzing Business Process Redesign.

5.4 Business Process Fragmentation

Business process fragmentation means that the logic of a particular business process is scattered over several application systems (e.g., legacy systems or commercial systems). We assume that the costs of BPM technology are directly related to the degree of fragmentation of the business process to be supported. In particular, significant costs are caused by the integration of the underlying process-oriented applications.

According to our survey, a majority of 65.71% of the respondents considers business process fragmentation as ”very critical” (17.14%) or ”critical” (48.57%) with respect to the success of a BPM project (cf. Question 1 in Fig. 16). Hence, this factor is being considered as less important when compared to all aforementioned evaluation factors. Concerning the direction of this relationship, 58.57% of the survey participants acknowledge a relationship between business process fragmentation and the costs of a BPM project (cf. Question 2 in Fig. 16). Out of these respondents, 82.93% of the participants share the opinion that the more the implementation of a business process is

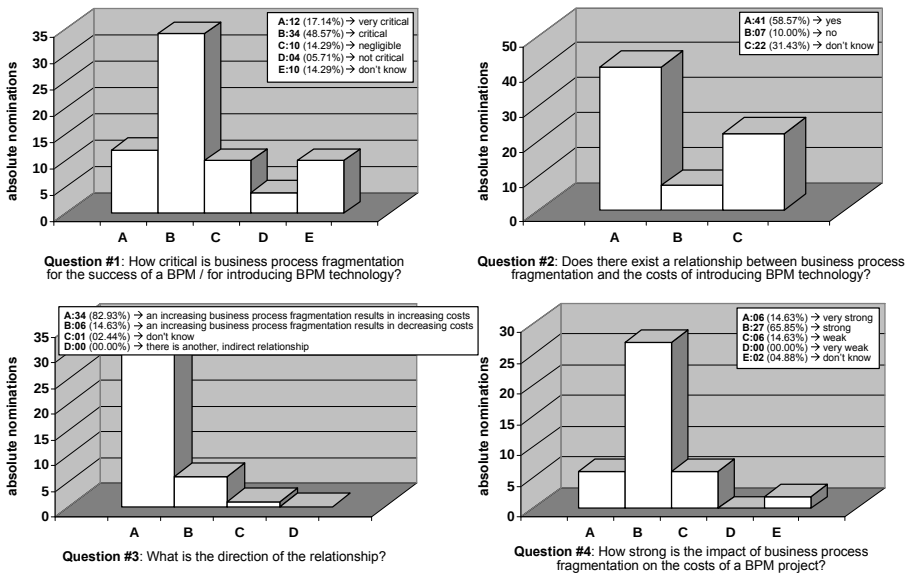


Fig. 16. Analyzing Business Process Fragmentation.

fragmented the higher are the costs of a BPM project (cf. Question 3 in Fig. 16). This is not surprising and confirms our aforementioned assumption that business process fragmentation is an important factor with respect to the costs of a BPM project. The other answers are negligible. Finally (and again out of these 58.57%), 80.48% of the respondents state (cf. Question 4 in Fig. 16) that the impact of business process fragmentation on the costs of a BPM project either is ”very strong” (14.63%) or ”strong” (65.85%).

5.5 End User Fears

The introduction of BPM technology may also cause end user fears, e.g., when changes in the employees’ work and task profiles occur and process activities become automated. This, in turn, can lead to an emotional resistance of end users, which makes it difficult to get useful information from users during a BPM project (e.g., regarding the optimization of the processes).

End user fears are considered as ”very critical” (28.57%) or ”critical” (45.71%) for the success of a BPM project by 74.28% of the survey participants (cf. Question 1 in Fig. 17). 70% of the survey participants additionally acknowledge that there is a dependency between this factor and the emotional resistance of end user against BPM technology (cf. Question 2 in Fig. 17). Out of these respondents, 83.67% share the opinion that increasing end user fears result in an increased emotional resistance (cf. Question 3 in Fig. 17). Other answers are negligible in this context. Finally, 89.8% of the respondents state (cf. Question 4 in Fig. 17) that the impact of end user fears on the emotional resistance of end users either is ”very strong” (42.86%) or ”strong” (46.94%).

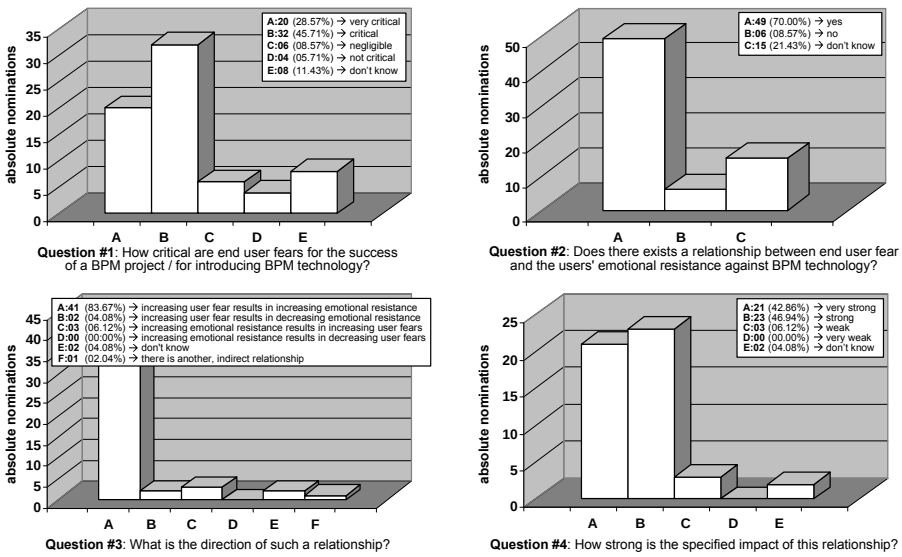


Fig. 17. Analyzing End User Fears.

5.6 Communication

Communication between all stakeholders of a BPM project (management, project staff, end users) seems to be important for the success of a BPM project, in particular, as it can decrease end user fears that are caused by the introduction of BPM technology. In doing so, communication can also increase the acceptance of BPM projects.

The majority of 92.86% of the survey participants consider communication as an ”essential” (47.14%), ”very important” (35.71%) or ”important” (10%) factor for the success of BPM projects (cf. Question 1 in Fig. 18). More specifically, 78.57% of the survey participants confirm that there is a relationship between communication and end user fears (cf. Question 2 in Fig. 18). Concerning the direction of this relationship, 74.55% out of these respondents think that an increasing communication results in decreasing end user fears (cf. Question 3 in Fig. 18). The other answers are negligible in this context. Finally, 85.45% of the respondents state (cf. Question 4 in Fig. 18) that the impact of communication on end user fears either is ”very strong” (29.09%) or ”strong” (56.36%).

6 Discussion

This section summarizes the major lessons learned from our survey. *First*, the survey results indicate that most survey participants associate the general understanding of BPM economics with the applicability of suitable financial business ratios. Consequently, it can be concluded that a survey participant who considers BPM economics as being insufficiently understood also considers existing financial business ratios as not suitable to

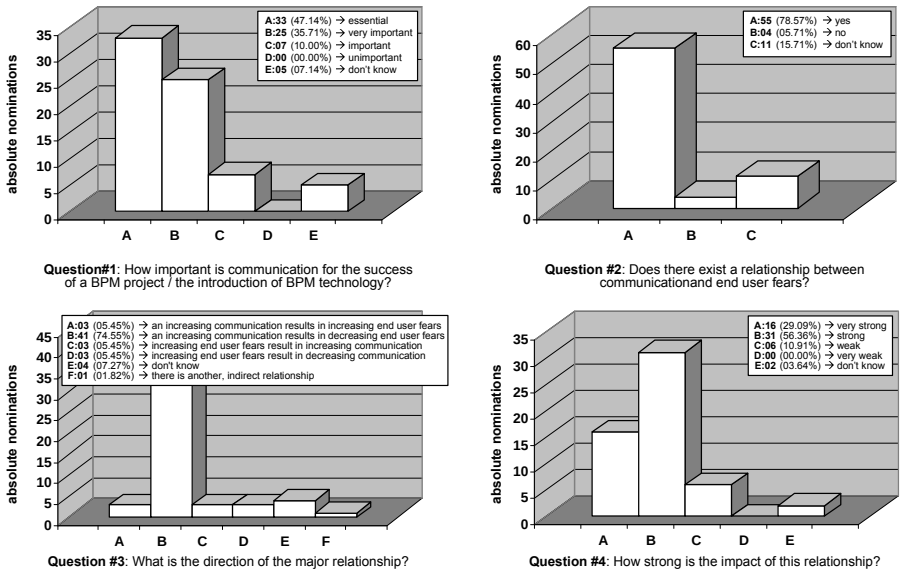


Fig. 18. Analyzing Communication.

quantify the economics of BPM. *Second*, our survey indicates that BPM technology is considered as a short-term investment. Every second respondent expects benefits within the first year after the introduction of BPM technology. Moreover, none of the respondents states that a BPM project has no benefits at all. Altogether, this is a strong indicator for the acceptance that BPM technology has achieved in the recent years. *Third*, it is difficult to identify evaluation factors that are really essential factors when dealing with the economics of BPM technology. By contrast, there are various organization-specific, project-specific, and technology-specific evaluation factors that are considered as ”very important” or ”important” factors. This allows for the conclusion that dealing with the economics of BPM technology is a complex issue as a large amount of different evaluation factors play a role in this respect. *Fourth*, our survey results clearly indicate (cf. Section 4) that technology-specific evaluation factors are considered being of minor relevance when compared to organization-specific and project-specific evaluation factors. This indicates that the economics of BPM technology is only partly determined by technological issues. By contrast, BPM economics especially seems to be a matter of organizational and project-specific issues. *Fifth*, the survey results also indicate that some of the evaluation factors that have been analyzed in more detail (cf. Section 5) are of significant relevance: process knowledge, domain knowledge, end user fears, and communication. Business process fragmentation and business process redesign, by contrast, can also be considered as important evaluation factors, but obviously decline in their relevance compared to the other four evaluation factors.

We will further use these survey results for our research in the EcoPOST project. The EcoPOST project deals with the development of a cost estimation methodology

that particularly allows for analyzing and estimating the costs of process-oriented software technologies and/or PAIS, i.e., costs are the basic measure of evaluation (including substantial empirical validation activities and the implementation of a tool to support cost estimations). In doing so, it is particularly the goal to estimate the costs of process-oriented software technologies and/or PAIS. These dependencies and dynamic interactions result in highly dynamic cost factors which makes their estimation a difficult task to accomplish. To systematically analyze the dynamics of cost factors (and therewith to get a substantial baseline for precise cost estimations), we use economic-driven evaluation models (that are formulated using the System Dynamics notation). The survey results presented in this paper particularly help us to understand and validate some of the assumptions underlying these evaluation models.

Altogether, our survey is a sound empirical proof that puts many assumptions underlying our research in the EcoPOST project on a more reliable basis. In particular, it allows for conclusions regarding the relevance of potential evaluation factors that have to be considered when dealing with BPM economics.

7 Related Work

There is only little work that deals with the economics of BPM and the economic effects of enabling technologies for BPM. Horwitz [9], for example, discusses the potential benefits of BPM. In particular, he concludes that only a detailed empirical validation of BPM business value convinces policy makers to support BPM projects - ”The proof will be in the numbers”.

Besides, there are a few publications dealing with the economics of workflow management technology which can be considered as conceptual predecessors of today’s BPM technology (or as their very core component). For example, there are several papers that address the impact of workflow technology on business process performance. Oba et al. [26] analyze the introduction of workflow technology and particularly focus on the identification of factors that influence work efficiency, processing time, and business process standardization. A mathematical model is provided for predicting the reduction rate of processing times. An extension is offered by the work of Reijers and van der Aalst [27] who use process simulation to compare pre- and post-implementations of information systems that rely on workflow management technology. Their focus is on analyzing business process performance based on criteria such as lead time, waiting time, service time, and utilization of resources. In most cases, the use of workflow management technology has resulted in a significant decrease of lead and service time. Choenni et al. [28] present a model to measure the added value of workflow management technology to business processes. This model builds upon different performance criteria such as speed, quality, flexibility, and reliability. A performance criterion is a parameter of a business process that is improved or compounded by the introduction of workflow management technology. The overall economic impact of workflow management technology is calculated from the costs related to these four performance criteria. Aiello [29] introduces a measurement framework for the evaluation of workflows. The framework is defined in an abstract setting to enable generality and ensure independence from existing workflow management technologies.

By contrast, only few approaches deal with other aspects related to the economic impact of workflow management technology on software development and software maintenance. Parkes, for example, analyzes critical success factors for workflow management technology implementations based on a survey [30] and a case study [31]. Three critical success factors are considered as being of particular importance: management commitment, communication, and participation by end users. Furthermore, empirical studies indicate that the effort for realizing process-oriented applications can be significantly reduced when using workflow management technology (see [32] for example).

There are other approaches that deal with other aspects related to the economics of workflow management technology. Becker et. al [33] have developed a framework to identify those processes that can be supported by workflow management technology in a ”profitable” way. Their framework can serve as guideline for evaluating processes during the selection and introduction of workflow management technology. It contains three groups of criteria: technical, organizational and economic. Designed as a scoring model, their approach enables users to systematically determine those business processes that can be automated using workflow management technology. A different approach is proposed by Abate et al. [34] who introduce a measurement approach to evaluate the performance of automated business processes: the ”workflow performance query language” (WPQL). This language allows to define and perform measurements independent from a specific workflow management technology implementation. It provides different mechanisms to select the workflow entities that are to be measured.

8 Summary and Outlook

Estimating the value of BPM technology is a complex task to accomplish. In order to empirically validate the relevance of assumed evaluation factors, we have conducted an online survey among 70 BPM experts. This paper summarizes the results of this survey. These results help both researchers and practitioners to understand the evaluation factors that determine the value of BPM technology.

As aforementioned, we will use the survey results for our research in the EcoPOST project. Next steps will include the design and analysis of economic-driven evaluation models using the evaluation factors described in this paper. Besides, it is our goal to identify further evaluation factors as well as to develop suitable metrics to quantify them.

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