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## **Value-oriented Process Modeling: Integrating Financial Perspectives into Business Process Re-design**

### **Abstract**

**Purpose** – Financial information about *costs* and *return on investments* are of key importance to strategic decision-making but also in the context of process improvement or business engineering. In this paper we propose a value-oriented approach to business process modeling based on key concepts and metrics from operations and financial management, to aid decision making in process re-design projects on the basis of process models.

**Design/methodology/approach** – We suggest a theoretically founded extension to current process modeling approaches, and delineate a framework as well as methodical support to incorporate financial information into process re-design. We use two case studies to evaluate the suggested approach.

**Findings** – Based on two case studies, we show that the value-oriented process modeling approach facilitates and improves managerial decision-making in the context of process re-design.

**Research limitations / implications** – We present design work and two case studies. More research is needed to more thoroughly evaluate the presented approach in a variety of real-life process modeling settings.

**Practical implications** – We show how our approach enables decision makers to make investment decisions in process re-design projects, and also how other decisions, for instance in the context of enterprise architecture design, can be facilitated.

**Originality/value** – This study reports on an attempt to integrate financial considerations into the act of process modeling, in order to provide more comprehensive decision making support in process re-design projects.

**Keywords** – Process Modeling, Financial Planning, Re-engineering, Return on Investment, Total Cost of Ownership, Capital Budgeting

**Paper type** – Research paper

## 1. Introduction

Over recent decades, business process management (BPM) has emerged as a popular management approach in information systems and business management practice. BPM has over the last five years continuously been identified as a top business priority and building business process capability continues to be a major challenge for senior executives in the coming years (Gartner Group, 2009).

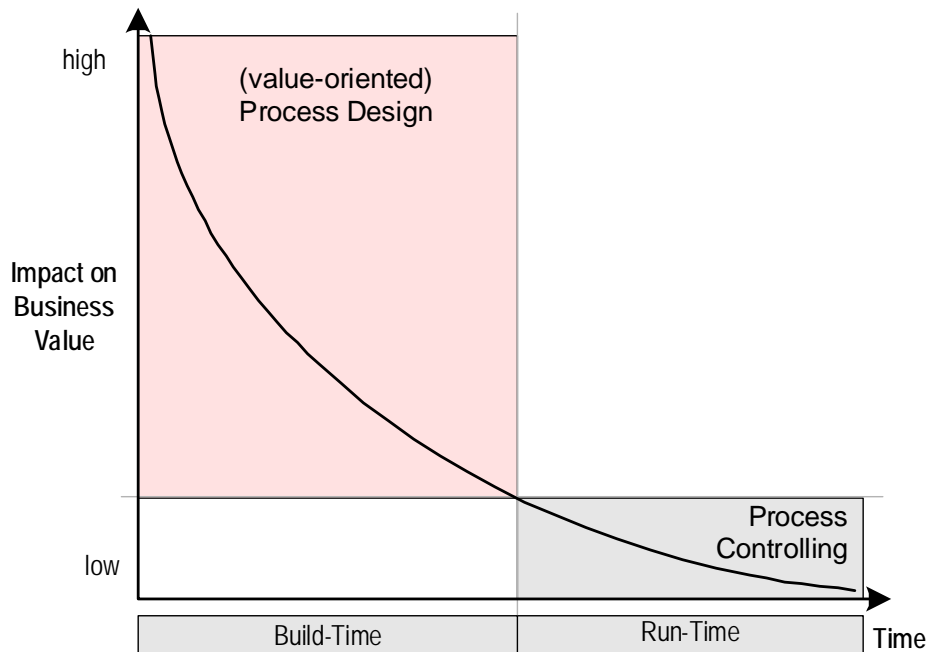
Business Process Management is mostly employed to improve, re-design or re-engineer existing business operations so as to improve overall effectiveness or efficiency of an enterprise. In fact, a recent survey on BPM initiatives confirmed that 75% of active BPM projects are concerned with process improvement (Palmer, 2007). A key challenge in such process improvement projects is the initial discovery and description of the business operations in a manner that is conducive to process improvement (Indulska et al., 2006). In this context, process modeling as an approach to graphically articulate the activities, events or states, and control flow logic that constitute a business process is typically employed to discover existing processes, and document them in a way that helps managers making improvement or change decisions (Recker, 2007).

However, the graphical description of events, tasks, control flow logic and the like does actually little in helping managers making improvement or re-design decisions. Whilst process modeling supports developing an understanding of current or future business operations, and to increase transparency about suggested process changes, key information is missing about the fundamental decision whether or not to engage in the process change. Relevant information would include, amongst others, details about the tangible and intangible benefits of the suggested change, the estimated timeframe for the change, or the related cost investment required to conduct the process change.

Most notably, what is missing in process modeling practice is a focus on business value considerations that would guide the decision-making process in a process change project. While popular process modeling approaches, such as ARIS (Scheer, 2000) provide a reasonably good understanding of what is happening in the current or future process, the approaches reveal only little about the financial consequences of the operations, and how changes to these operations would contribute – or not – to corporate success. Likewise, existing approaches in process simulation (e.g., Gregoriades and Sutcliffe, 2008), or process mining (e.g., van der Aalst, 2005) hardly consider financial information.

In order to further highlight the focus of research we refer to the diagram shown in Figure 1. The diagram illustrates the business value impact over the course of a process management project. It specifically shows that the degree of influence on business value typically aligns with the design phase of processes – the so-called build-time (Rosemann and van der Aalst, 2007) – whereas it is decreasing the more the process is moving to run-time, i.e., towards implementation and continuous execution time. The rationale behind this illustration is that during build-time major decisions can be taken (e.g.,

regarding the control flow of a process, or regarding involved technologies or organizational resources) which restrict future measures and thus defines the level for the potential value contribution of a process (vom Brocke, 2007).



**Figure 1. Analyzing the Value-Impact of Business Process Management**

While the significance of build-time to business value impact is clear, studies on the actual evaluation of processes have so far been mostly limited to the assessment of running processes. For instance, process performance measurement (e.g., Kueng, 1998) or process mining (e.g., van der Aalst, 2005) literally require existing processes as a starting point, and at that mostly even automated processes.

Our intention is not to discredit the value of such approaches. In fact, analyzing existing processes, e.g., by means of process mining, may bring up eluding insights that may identify substantial process improvement opportunities. The intention of our research, however, is to more intensively consider methods of evaluation during the build-time phase of processes, that is, already during actual process (re-) design.

The question then is how to leverage process modeling for the assessment of the business value of processes, and the business value of changes to these processes, already in the design phase of processes.

The imperative of our research is to identify and to describe the different aspects that contribute to the long-term financial value of a process design. With this focus, our work addresses one potential driver of process re-design – process efficiency and the related exercises of cost-cutting and revenue increasing. Admittedly, we do not consider other, equally important potential drivers for process re-design such as standardization (Davenport, 2005) or compliance management (Nielsen and Main, 2004). Yet, process re-design projects in their essence present significant investments (Devaraj and Kohli, 2002) to project sponsors who, ultimately, are interested in the return-on-investment from engaging in process re-design projects. Accordingly, we consider a value-oriented perspective so as to be able to estimate, and gauge, the financial success of such projects.

In this paper we propose a framework that distinguishes three levels of evaluation including the operational, the budgeting, and the corporate level. Furthermore, we show how these different financial dimensions can be identified by the help of a process model, and how this financial data relates to process change decisions. Overall, we call this approach *value-oriented process modeling*.

The remainder of this paper sets out to introduce and discuss this approach. We proceed as follows. In the next section we discuss relevant literature in the areas of process modeling, as well as value-oriented budgeting, evaluation and accounting approaches. On this basis, we then suggest a framework of financial dimensions of a business process design. In the following section We describe in detail our approach for identifying different financial aspects in business process models by means of exemplary methods. We proceed by discussing two case studies, one to highlight the application of the approach, and one to highlight potential application areas of the approach.

Following the case studies, we discuss potentials and limitations of our approach and conclude with an outlook to future work in the last section.

## **2. Background**

### *A) Prior Research on Process Modeling*

Process modeling is an approach for describing how businesses conduct their operations and typically includes graphical depictions of at least the activities, events/states, and control flow logic that constitute a business process (Curtis et al., 1992). Additionally, process models may also include information regarding the involved data, organizational/IT resources and potentially other artifacts such as external stakeholders and performance metrics to name just a few (Recker et al., 2009). Process models are specified using process modeling methods such as BPMN (BPMI.org and OMG, 2006) or ARIS (Scheer, 2000), which support the depiction of the control flow of the process and potentially other information of interest such as involved application systems, organizational resources or process-related risks.

Recently, academics and practitioners alike have recognized a need to extend process modeling approaches to capture process-relevant information beyond the pure control flow (Green and Rosemann, 2000). To that end, recent years have seen the development of extensions of process modeling towards the incorporation of organizational goals (Soffer and Wand, 2005), risks (Rosemann and zur Muehlen, 2005) or other contextual factors pertinent to process design (Rosemann et al., 2008). These approaches have in common that they seek to extend the documentation and analysis support of traditional, flow chart-based process modeling approaches towards the consideration of other relevant information, so as to support relevant business decisions regarding risk mitigation, strategic alignment, or organizational resilience to environmental disturbances.

While these works denote promising extensions to classical process modeling, the most prominent application area of process modeling – the support of process (re-) design projects – appears to be still under-supported. More precisely, a consideration of value-related information in process models is still outstanding. This is surprising, given that process re-design projects continue to be important business investment decisions for high-level managers (Gartner Group, 2009), and typically consume between 40 and 70 % of process management spending – which equates to figures between \$500,000 and \$ 10 million spent by an organization on process management per annum (Wolf and Harmon, 2008). Given the substantial investment decisions associated with process (re-) design, we argue that the consideration of value-related information is critical for managers to make appropriate decisions when evaluating alternative process designs. To that end, we report in Section 3 on the development of a process model-based measurement system that considers value-related information pertaining to process designs.

### *B) Theoretical Foundations of Value-Orientation*

Value-orientation is one of the essential concepts in business and management science. Its roots can be traced back to microeconomics, where the value of a good corresponds to its importance of satisfying people's needs (Pindyck and Rubinfeld, 2008). Assessing value in microeconomics particularly eludes the relation between shortage and value: that which is rare is considered to be of value. This stresses the relation between supply and demand of goods with respect to price. In business science, the concept of the 'people's needs' relates to the objectives of an organization. By means of evaluation, the various effects in and outside a company become comparable as they are described by means of their impact on the value system of an organization (Garrison et al., 2007). However, it is well disputable how to design such a value system (Johnson and Kaplan, 1987), as the objectives of an organization are not always easily given. Theoretically, two approaches are contrasted: the stakeholder value approach and the shareholder value approach.

The *stakeholder value approach* looks at organizations being a 'coalition' of various actors (Barnard, 1938; Cyert and March, 1963) driving the business (so-called: stakeholders) and thus calls for multi-dimensional measurement systems. It is argued that each stakeholder brings in certain contributions vital to the organization and – in turn – receives certain incentives for doing so. Typical stakeholders include, for instance,

*customers, suppliers, employees, managers and stakeholders*. The approach concludes that there needs to be a kind of balance of contributions and incentives (Freeman, 1984) in a way that stakeholders should – following a long-termed thinking – have the perception to “win more than they pay”. Otherwise they would seek for alternative ways of spending their contribution, just as stakeholders would look out for alternative investment.

The *shareholder value approach* (Rappaport, 1986) puts special emphasis on the perspective of those stakeholders that contribute financial resources to the coalition (the so-called shareholders). On the one hand it is pointed out that in market-based economies the objectives of those people holding the shares of a company may well be of prior importance. On the other hand it is argued that the willingness to invest into a company may also be seen as an indicator for the value attached to this company by the market players (Young and O'Byrne, 2000). This approach results in a plea for financial, particularly monetary, value assessment in order to manage the return on investment of shareholders (Koller et al., 2005). Hence, in- and out-payments are examined and computed for a certain time-scale particularly including ratios and tax. Typical top-tier measures are, for instance, the *economic value-added (EVA)*, the *economic profit (EP)*, the *return on investment (ROI)* or the *cash flow return on investment (CFROI)* (Shapiro, 2004).

In practice, both approaches have to be aligned. Typically, this is done by analyzing ‘cause and effect’-relations between the various relevant dimensions. This way, value drivers and value results can be differentiated. The balanced scorecard approach (Kaplan and Norton, 1992) is a well-cited example for a specifically multi-dimensional, particularly non-monetary, measurement. In this approach, cause-and-effect relations are essential to consider non-financial dimensions as drivers for future financial results. For example, ‘Learning & Growth’ supports ‘Internal Business Processes’, which satisfy ‘Customers’, thereby allowing for good results in ‘Finance’ (Kaplan and Norton, 2004). Likewise, work on valuation (Koller et al., 2005), being rather shareholder-oriented in nature, reflects the relevance of non-monetary considerations as value drivers on subjacent layers in according measurement system.

Taking the above considerations into account, we can learn that (a) “value” may be defined from different perspectives, and (b) one of the foremost tasks when implementing a value-oriented approach is to analyze, specifically, the relevant business objectives as appropriate value dimensions. In addition, existing approaches also elude some kind of general principles for the design of appropriate measurement systems. Looking at existing approaches we see that (c) different value dimensions are structured on certain levels of abstraction. Whereas (d) lower levels aim at capturing original data on specific measures of interest, (e) higher levels serve to increasingly translate these effects into monetary consequences from a corporate perspective.

### C) Value-Orientation in the IS Discipline

Also in the IS discipline, there is a relevant body of research concerning value considerations. The work may particularly be traced back to the so-called “productivity paradox” (Brynjolfsson, 1993) which resulted in a vivid discussion on the value contribution of IT in general (Carr, 2003). Up to date, the discussion shows that there seems to be consensus about the leverage IT may offer for business value. Hence, the question is not so much *whether* IT contributes to corporate value creation, but rather *how* the IT value added can be realized in a certain business context (vom Brocke et al., 2009). In light of this discussion, methods for evaluating and managing the value contribution of IT plays an essential role, especially before the background of investment decision involving IT investments, such as those made in the context of process re-design.

In considering how to evaluate IT investments and their impact, classical accounting and investment evaluation approaches tend to provide only a partial view of the decision situation typically associated with process re-design. For example, the popular Activity-based Costing approach was defined for a better assignment of indirect costs to products and services according to the actual consumption by each in the relevant product or service business process (Cooper and Kaplan, 1988). Key to this concept is the consideration of actual usage equipment and resources (e.g., machinery, human resources) in the activities that constitute the business process. This approach takes a stance that is quite close to the operation level of a business process that we consider in our approach below. On the downside, Activity-based Costing does not discuss any changes in technology (Bromwich and Hong, 1999), which is a key element of business process re-design. The same holds true for related approaches such as process performance measurement (Kueng, 1998) or process mining (Weske et al., 2004). In particular, these approaches focus on the analysis of running processes but do not support new, or re-designed, business processes during build-time, which are the ones we focus on in our paper. Hence, these approaches do not consider evaluations of process-relevant IT investments *over time*, hence lacking the consideration of relevant value depreciations, investment return payments, and so forth.

IT investment evaluations, on the contrary, are particularly designed in order to evaluate the benefits of changes in technology. In addition to qualitative assessments (Farbey et al., 1995), quantitative assessments particularly focus on the so-called Total Cost of Ownership analysis (Ferrin and Plank, 2002). The essential idea of these evaluations is to accumulate all costs that come along with the ownership of an information system both from a temporal and factual perspective. The approach was originally introduced by the Gartner Group (1997), when analysis migration projects from mainframe to personal computers had shown that the initial investment is only a minor part of the investment caused by an information system but that the major part is actually caused by factors such as maintenance, support and also idle time caused by potential system failure. The approach has been further developed in several aspects ever since, one essential aspect being looking at the “ownership” as an investment and thus applying well established methods from investment accounting (Grob, 1993). This means to collect the various



payments (rather than costs) related to an information system over a multi-periodic time scale. In doing so, long-term economic consequences related to a change of technology can be taken into account such as depreciation, interest rates and tax payments (Shapiro, 2004). From a methodological perspective a wide range of methods, such as the net present value and the pay off period, can be calculated. Following this line of thought, research on evaluating the financial implications of system design has been intensified over recent years (vom Brocke, 2007; vom Brocke et al., 2009). So far, however, these approaches are limited to specific fields of applications, such as the profitability of service-oriented architectures. An original approach for evaluating the financial implications of process re-design in general, however, is still an open issue, which is why we approach this topic in this paper.

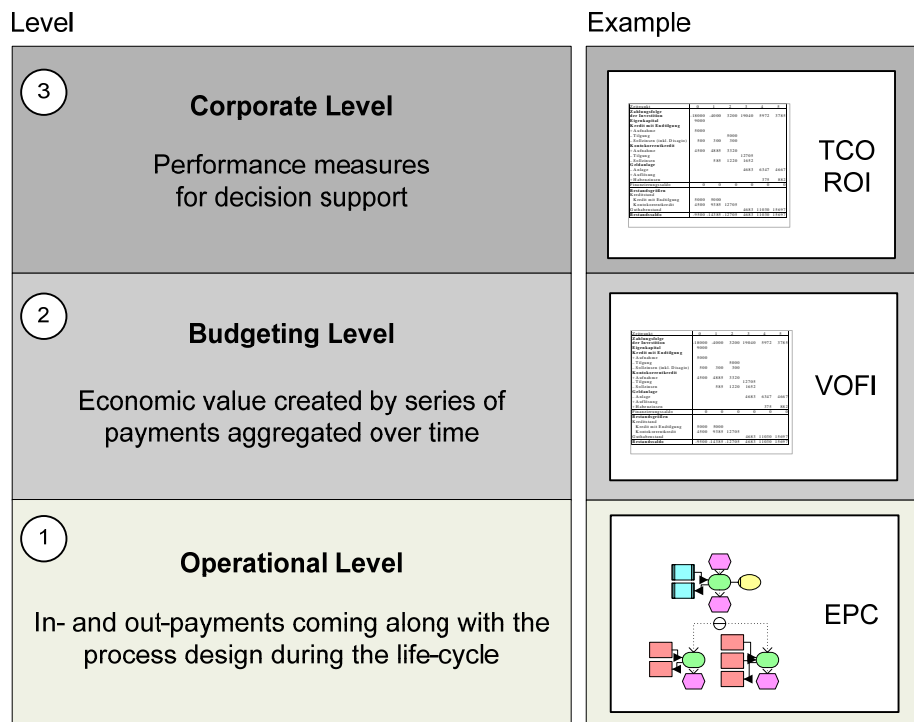
Summing up, we conclude that the approaches described above definitively elude important aspects for the evaluation of processes regarding alternative changes. However, only partial elements are focused on: either, (a) the evaluation of running processes given a certain technology is at the core of attention; or (b) the evaluation of changes in technology, though without systematically capturing its implications to the processes. In addition, process change is typically only partly related to changes of technologies. Even more often, changes of the process structure or changes related to the group of people running processes have to be decided upon. Hence, a comprehensive methodology of evaluating the economic consequences of process change in its various facets is needed.

Against this background we now aim at bridging the gap between issues of operational process design on the one hand and financial measures on the economic consequences of this design on the other. We intend to suggest essential elements of a measurement system to be further analyzed and extended accordingly, which takes into account principles from classical accounting and investment evaluation approaches such as Activity-based Costing and IT investment evaluation.

### **3. A Framework for Measuring the Economic Value of Processes**

#### *A) Preliminaries*

The measurement system presented in this paper distinguishes three levels of evaluation: the operational level, the budgeting level, and the corporate level (see Figure 2). The operational level serves the collection of relevant payments associated with a specific process design. The economic value of these payments referring to a company's situation is subsequently evaluated on the budgeting and on the corporate level. The budgeting level aggregates payments of process designs over time and the corporate level condenses the data to key performance indicators that can form the basis for decision-making.



**Figure 2. Framework for Measuring the Economic Process Value (EPV)**

On the operational level payments (out-payments) and receivables (in-payments) are calculated. They can be directly assigned to decisions on the process design (consider, for instance, payments driven by the process performance). Obviously, these payments considered to be relevant in a specific situation may vary according to a specific decision situation. Research in the field of value-based business process management focuses on the analysis of typical situations in order to derive sets of payments representative for certain application areas.

On the budgeting level, additional parameters are taken into account for establishing the economic value created by respective series of payments. Relevant parameters are derived from specific conditions of funding and tax obligations that a company has to meet. These series of payments are consolidated over time by applying methods of capital budgeting (e.g., Seitz and Bauer, 2003; Grob, 1993; Shapiro, 2004). This way, a survey of financial consequences is created.

Finally, on the corporate level, the profitability of a process design and operation has to be judged by condensing the aggregated economic process data into key performance indicators. Measures like the Total Cost of Ownership (TCO) and the Return on Investment (ROI) help to consider relevant parameters for this purpose (Shapiro, 2004; Gartner Group, 2003; Seitz and Ellison, 1999). While the TCO measure sums up all relevant costs chargeable to an information system throughout its life-cycle, the ROI measure denotes a ratio that sets the total profit in relation to the stock of capital provided for the investment.

As for the budgeting and corporate level, well-established measurement systems already exist (e.g., Grob, 1993; Shapiro, 2004). Our framework is designed to integrate these methods from financial management into the context of process re-design. This allows measuring the financial implications of a process design. In doing so, however, the challenge is to find relevant in- and out-payments on the operational level. One promising approach in this context could be the use of Activity-based Costing (e.g., Sapp et al., 1998), which is a method to decompose cost measures alongside the activities of a business process to identify critical cost drivers. And indeed, several process management and modeling tools such as ARIS, WizdomWorks!, Provision EnterprisePro or Proforma include Activity-based Costing as part of their business process analysis features (Blechar, 2007; Ami and Sommer, 2007). This tool functionality, in turn, allows analysts to capture, and analyze, relevant cost information for each process considered.

Still, we have to note that the notion of ‘corporate success’ typically transcends beyond financial measures. As further described in our chapter on the theoretical foundations of value-orientation, the Balanced Scorecard approach (Kaplan and Norton, 1992), for instance, takes multiple perspectives into consideration. It distinguishes four perspectives of performance measurement, including ‘Financial’, ‘Customer’, ‘Internal Business Processes’, and ‘Learning & Growth’. Of these, we focus on the financial perspective, which measures the economic value generated within the other perspectives, in particular by improvements to business processes.

The basic idea of our approach is based on the observation that in every process, each and every function brings about payments (out-payments) and receivables (in-payments). The approach we propose is to estimate these and aggregate them based on the overall process structure.

The method provided in this chapter sets certain assumptions for covering this task:

- Costs lead to in- and out-payments. The reason for this is that multiple time periods are considered. Accordingly, factor input and/or creation has long term consequences on capital costs. Capital costs are dependent on capital stock that is influenced by means of payments (and not by means of costs and performances).
- Costs have to be allocated to a process. Calculating the value of a single process implies that relations to various other processes have to be taken into account. Here, payments are calculated in relation to the process they are caused by.

Against the background of these preliminaries, methods for the value assessment of business processes on each layer shall now be presented.

### *B) Measurement on the Operational Level*

Payments can be calculated according to different schemas. In this section, basic operations for calculating out-payments are presented. Factors serving as input in the

process are identified and assessed. As to the apportionment, factors for both consumption and usage have to be distinguished. Factors of consumption are objects that are consumed by functions. Factors of usage, however, are objects of input that serve as resources for processing a function. They can either be calculated fully or partitioned according to certain keys. The concept of the prevailing calculation is shown in Figure 3 using the Event-driven Process Chains (EPC) notation (Scheer, 2000). The EPC is a modeling technique for the representation of temporal and logical dependencies of activities in a business process. The EPC denotes one of the most popular approaches to process modeling and are heavily used in practice (Davies et al., 2006), which is why we use them for illustration purpose. EPCs include function type elements that can be used to capture activities of a process and event type elements that describe pre- and post-conditions of these functions. Furthermore, there are three kinds of connector types in EPCs to specify the control flow logic of a process. For details refer to (Scheer, 2000).

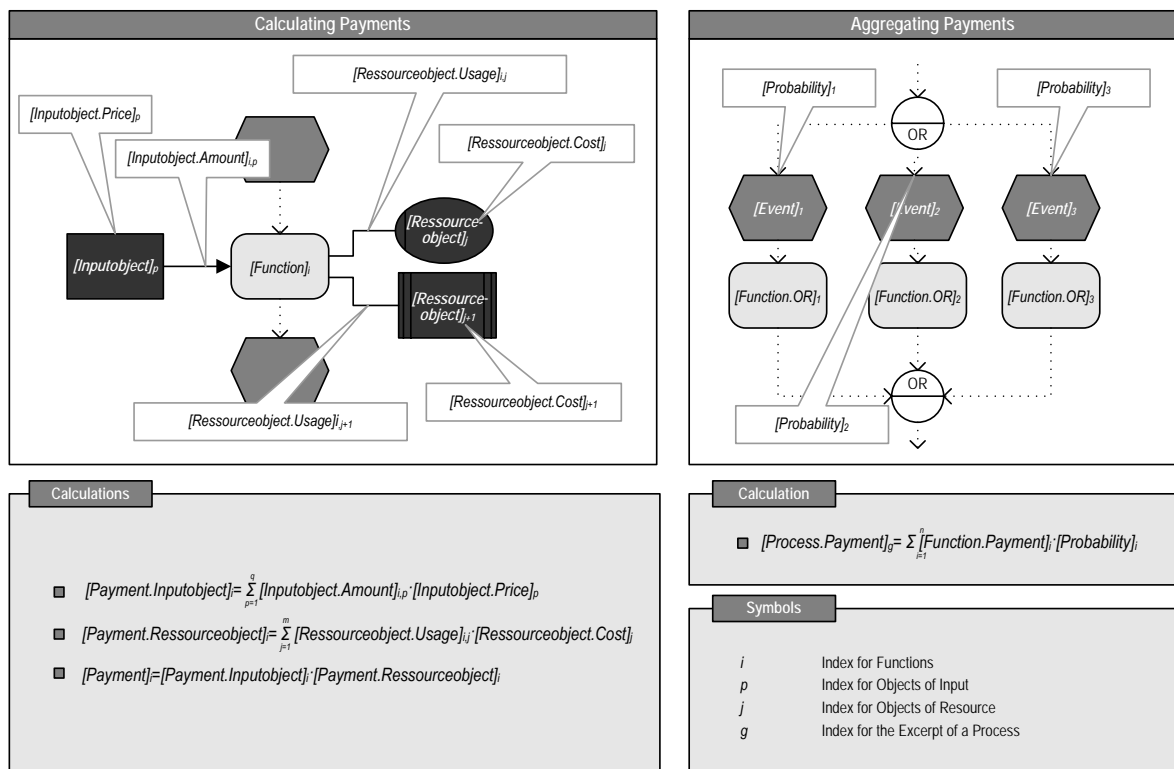


Figure 3. Principles of Calculating and Aggregating Payments on the Basis of Process Models

Out-payments of a function are assembled by payments for the required objects of usage as well as the objects of input that were consumed in the execution of the function. We assume that the payments are aggregated per period such that they capture the operational inventory. In order to calculate objects of input, the amount (and type) of the objects applied in the function have to be accounted for. In order to assess out-payments, the amounts have to be multiplied by the cost per unit. The payment for objects of usage is calculated according to the frequency-of-utilization principle. This procedure is similar in application to the procedure of activity-based costing. That is, the percentage of resource-

utilization of a function is calculated. For this calculation, resource units that are used by a certain function are proportional to the total sum of all units provided by this resource (see Figure 3).

Payments related to functions now need to be aggregated for each specific process and each period within the planning-horizon. Generally, payments of all functions have to be added. In case of process branches in which an alternative processing takes place, the probability of branches has to be considered.

In order to investigate the probability, relative frequencies can be estimated in which events re-occur when instantiating the process multiple times. While probabilities of all events related to a branch clearly have to sum up to one in case of an XOR connector, the sum of rates can differ from 100% in the case of OR connectors.

In order to partition both in- and out-payments on various periods during the phase of operation, constant trend rates can be applied. In addition, special payments can also be planned explicitly and included in the calculation.

### *C) Measurement on the Budgeting Level*

On the budget-level, the financial consequences are measured that are derived by the payments on the operational level. For that purpose, well-established methods from investment accounting and capital budgeting can be used. In essence, summing up all payments identified on the operational level into one consistent *series of payments* services as the interface. This series of payments relates to the original payments caused by a specific design alternative of a process. As such, it can well be calculated further by using the same set of methods commonly used for assessing financial implications of investment decisions (Shapiro, 2004).

In this study, we use the approach of capital budgeting with financial plans for assessing the financial implications relevant in a change initiative, also referred to as VOFI – the Visualization of Financial Implications (Grob, 1993) As opposed to formulas applied by conventional methods of capital budgeting (e.g., Present Value or Annuity of an Investment Project), financial plans are based on spreadsheets. With this structure, financial plans offer a greater flexibility for customizing the decision model (e.g., according to the specific financial situation). In effect, financial plans are widely used specifically in the context of IT value assessments (vom Brocke, 2007). Another benefit of this approach is that financial plans nicely visualize the various parameters relevant on the budgeting level and thus turn out to be appropriately demonstrative for the sake of introducing our approach. A template of a basic financial plan is illustrated in Figure 4.

Financial Plan				
Point in Time	0	1	...n...	h
<b>Series of Payments</b>				
<b>Internal Funds</b>				
- Withdrawals				
+ Deposits				
<b>Instalment Loan</b>				
+ Credit Intake				
- Redemption				
- Debitor Interest				
<b>Annuity Loan</b>				
+ Credit Intake				
- Redemption				
- Debitor Interest				
- Creditor Interest				
<b>Loan in Current Account</b>				
+ Credit Intake				
- Redemption				
- Creditor Interest				
<b>Financial Investment</b>				
- Reinvestment				
+ Disinvestment				
- Debitor Interest				
<b>Tax Payments</b>				
- Out-Payment				
+ In-Payment				
<b>Accounting Balance</b>	0	0	0	0
Balance on				
instalment loan				
annuity loan				
current account				
financial investment				
<b>Net Balance</b>				[Final Value]

Investment
Financing
Balance
Capital Stock

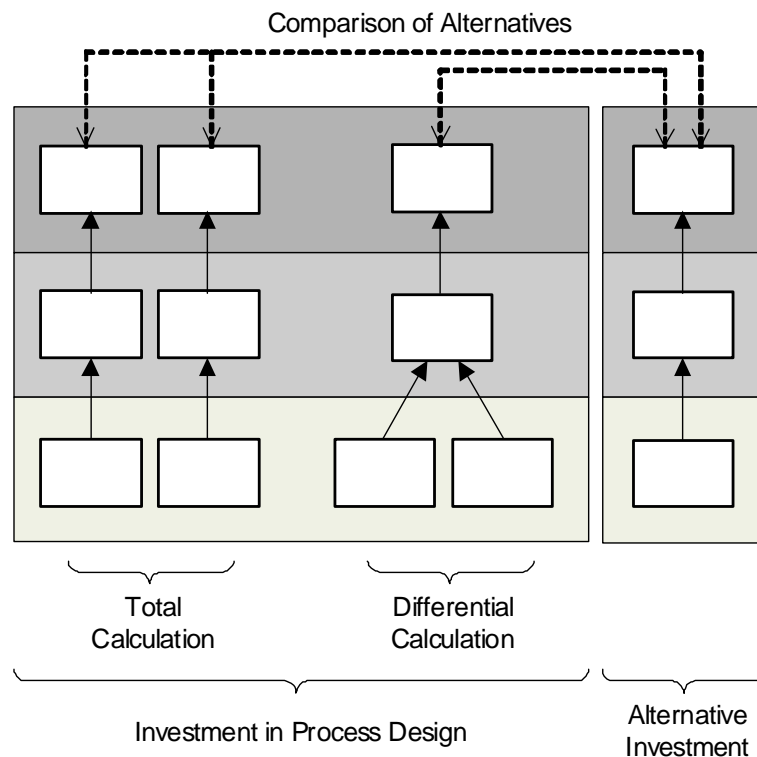
**Figure 4. Template for Calculating the Financial Consequences of Processes**

The algorithm calculating the final value of an investment using a financial plan may briefly be described as follows: Starting in period zero, each period has to be calculated in a way that there is a balance between in- and out-payments. In the first period, usually an out-payment has to be financed. If the internal funds available are insufficient, a loan has to be taken out. As usual, various conditions for loans can be agreed upon, and also a combination of various loans can be calculated in the calculation. Correspondingly, multiple forms of funding can be included. As for the calculation above, interest rates for bullet loan, loan in current account and financial investment accounts for 4 per cent, 5 per cent and 3 per cent respectively. In each period, the periodical in- and out-payments have to be balanced. As a check-up, the net funding value, which is defined as the accounting balance of all in- and out-payments, should be zero. On the basis of these flow figures, the capital stock can be updated periodically. The accounting balance for loans and funds finally results in the net balance of the total investment. Within the spreadsheet, the value of an investment in a process design can be monitored for each period during the life-cycle simply by observing the net balance in each relevant period. The net balance of period  $t=n$  is then the final value of the investment.

*D) Measurement on the Corporate Level*

Apart from general measures provided by capital budgeting, other measures can be calculated that tackle special interests associated with process management. A thorough discussion is provided by vom Brocke (2007). Our approach is not restricted to the assessment of single business processes. On the contrary, it can be used to facilitate decision-making between different process designs. And indeed, economic process value in a narrow sense can only be assessed properly when at least two alternatives are compared: taking a certain decision or not taking this decision – or in more practical terms: sticking to the as-is state or implementing a to-be model.

In comparing alternative process designs, two different approaches can be applied: a total and a differential calculation (see Figure 5).



**Figure 5. Comparing alternative Process Designs**

According to a total calculation scheme, each process is measured independently. The comparison takes place on the corporate level by evaluating the performance measures for each design. This approach provides high flexibility, as numerous alternatives can be compared. However, the effort of establishing precise value measurements for each design alternative is substantial.

Under the differential calculation scheme, the idea is to focus on additional payments only that are relevant in the comparison of two alternatives (e. g., not the total but only the additional expenditure for the implementation of a to-be model, compared to the current state). In this case, the comparison already takes place on the operational level, so that only one financial plan and set of measures is calculated on the corporate level that represents the added value of one alternative compared to another. The differential approach, however, is limited to pair-wise design comparisons. When comparing more than two alternatives, the amount of comparisons to be assessed is exponentially growing.

Following either of both approaches, the resulting measures should be compared with those resulting for alternative investments (the 'opportunity'). This way, the return of investments in a process design is compared to the return on investments in further fields (similar to a financial investment). Only in comparison the value of a process design can be assessed considering the specific situation of a company.

#### **4. Case Studies**

##### *A) Applying the Value-oriented Process Modeling Approach*

To demonstrate how to apply the value-oriented process modeling approach, we first consider an illustrative case study. This case concerns the process "Dialog marketing planning", in which selected target customers are identified by means of customized marketing measures. The process is supported by means of an in-house data warehouse solution (DW system) and a customer relationship management system (CRM system). Both systems contain some customer data, yet, up to now they are poorly integrated. Customer data stored in the DW system originates from operative systems and is extracted from customer transactions. Data of the CRM system, on the other hand, is recorded from dialogues with customers not having any direct relation to customer transactions.

The process starts with the selection of a customer group for which a marketing campaign is to be planned. By passing proper selection criteria to the DW system, a suitable target group can be identified. After assorting the addressees, actuality and validity of customer data is to be checked. This check is necessary since due to potential customer data inconsistencies between the DW system and the CRM system. For the consistency check, queries on customer data of the CRM system have to be executed. The queries yield result lists that have to be compared with the customer data reported by the DW system. In seven out of ten cases, the customer data is consistent and can be employed in subsequent planning procedures. In the remaining 30 % of consistency checks, however, inconsistencies are identified that necessitate corrective activities. A repeated check yields a positive result in the majority of cases, and, hence, no conditional probabilities need to be considered in the calculations. Next, on the basis of consistent customer data, a customer profile is compiled containing all relevant information for the marketing campaign. In particular, the profile comprises turnovers, traveling destination preferences as well as notes taken by customer consultants during face-to-face conversations. After compiling a customer profile, a customer consultant can appoint an individual marketing



activity. For this, the CRM system provides suggestions on the basis of past planning activities. As a result, a plan of marketing activities individual to a customer is generated containing specific communication content. The marketing planning completes by documenting the current marketing planning and adding cost estimates. The documentation is saved in the DW system as well as in the CRM system.

In this situation, an integration of the DW and the CRM system may be considered on a data level. For that purpose, a web service can be implemented that acts as a wrapper and therefore warrants an integrated recording of customer data both in the DW system as well as in the CRM system. This way, customer data selected in the DW system would automatically be made available within the CRM system. Next, several opportunities for re-engineering the process of »Dialog marketing planning« arise, ranging from eliminating activities to improving their efficacy. Through integrated data handling the above-mentioned activities associated with consistency checks become obsolete. Moreover, documentation archiving can be automated since the manual input into the CRM system is cancelled.

We consider a to-be process model of the planning process by eliminating the activities »Check customer data« and »Correct customer data«. From a structural perspective, this improvement recommendation appears reasonable. However, no evidence is gained as yet concerning the cost-benefit ratio of the effort of introducing web services contrasted to the potential savings due to integration. For that purpose, the value-oriented approach might give insight. The corresponding calculation is illustrated in Figure 6.

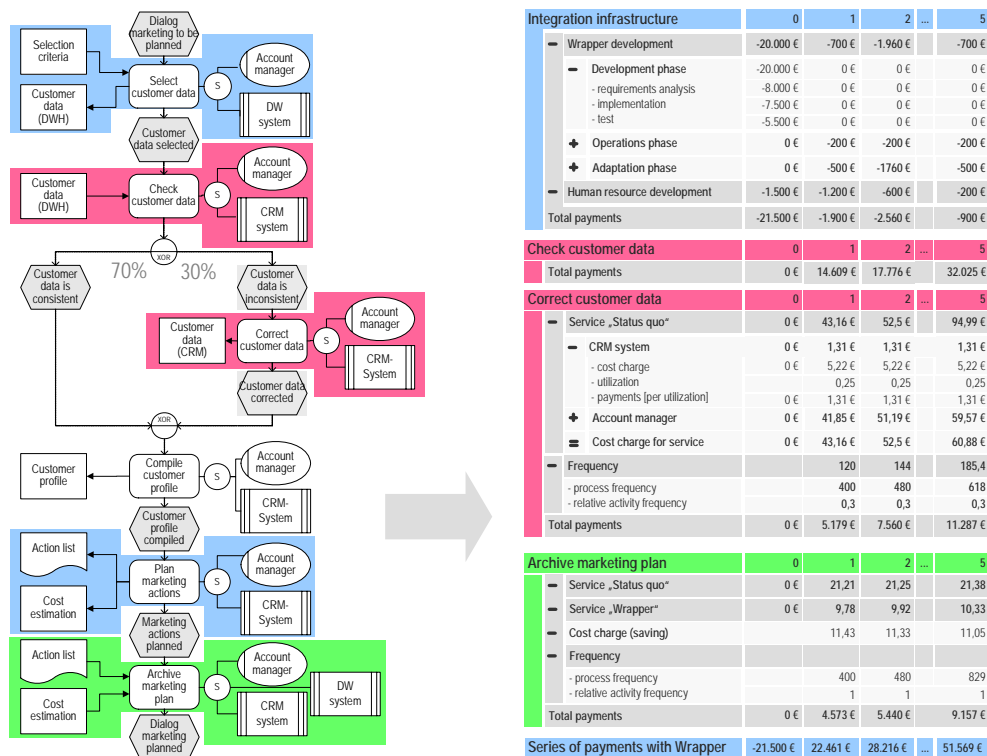


Figure 6. Exemplary Calculation of payments on the process level

According to a partial calculation, the savings earned by eliminating the activities »Check customer data« and »Correct customer data« as well as improving efficiency of the activity »Archive marketing plan« are calculated. In addition, the investment to be taken for implementing the web services is also computed and all relevant payments are summed up to the series of payments. The following examples illustrate the computation:

The data correction is done by an account manager, who uses the CRM system for his work. This activity requires 25 minutes on average. Given the underlying cost charges, calculations result in payments of 1.31 € for system utilization (= 0,25 hours x 5.22 € per hour) and 41.85 € for workforce (= 0.25 hours x 167.4 € per hour, displayed in total here). Altogether, payments for correcting the customer data amount to 43,16 € per execution in the first period.

In addition, the frequency of relevant activities has to be computed. For the activity »Correct customer data« the frequency can be calculated by multiplying the overall process frequency with the relative activity frequency. According to the process model depicted in Figure 6, correcting customer data is required in 30% of total process executions. These 30% represent the relative activity frequency for activity »Correct customer data«. Therefore, the actual frequency amounts to 120 transactions in the first period (= 30% x 400 process executions). Hence, a total of 5.179 € for data correction in the first period can be assessed. In period 2 to 5 a progression of both loan costs and process frequency result in an increase of the payments saved up to 11.287 €

To date an account manager needed 15 minutes to archive a marketing plan. Since the new wrapper provides for an automated data transfer from DW to CRM system, the activity execution accelerates by five minutes. Hence, for a single execution of an archiving activity 9.54 € have to be accounted, resulting in savings of 11.43 € per instance of the process. Considering the frequency of activity execution per period, payments accruing within the planning horizon can easily be calculated (e.g., payments amount to -4,573 € for the first period and mount up to 9,157 € in the fifth period).

In order to realize the savings calculated above, a certain investment into the redesign has to be taken into account. These investments are related to the development of a web service (acting as a wrapper) as well as associated activities of re-organization. They sum up to 20,000 EUR in the first period following a sum of 700 EUR in the following periods, except in period 2 where additional payments for adoption purposes are expected in order to incorporate improvements to the implementation.

Consolidating all payments, a series of payments is computed that serves as an interface in order to further compute the monetary consequences on the budgeting and corporate level. The calculation is illustrated in Figure 7.

Financial Plan	0	1	2	...	5
Series of payments	-21.500 €	22.461 €	28.216 €	...	51.569 €
Internal Funds	10.000 €				
+ initial balance		0 €	0 €	...	0 €
- withdrawal	0 €	0 €	0 €	...	0 €
+ deposit	0 €	0 €	0 €	...	0 €
Bullet loan					
+ credit intake	11.500 €	0 €	0 €	...	0 €
- redemption	0 €	0 €	11.500 €	...	0 €
- debtor interest (6 % and 5 % disagio)	575 €	690 €	690 €	...	0 €
Loan in Current Account					
+ credit intake	575 €	0 €	0 €	...	0 €
- redemption	0 €	575 €	0 €	...	0 €
- debtor interest (10 %)	0 €	57,5 €	0 €	...	0 €
Financial Investment					
+ reinvestment	0 €	21.489 €	16.496 €	...	52.629 €
- disinvestment	0 €	0 €	0 €	...	0 €
+ creditor interest	0 €	0 €	752 €	...	1630 €
Taxes (t=35 %)					
- payment		0 €	280 €	...	570 €
+ refund		350 €	0 €	...	0 €
<b>Net Funding</b>	<b>0 €</b>	<b>0 €</b>	<b>0 €</b>	...	<b>0 €</b>
Balances					
on bullet loan	11.500 €	0 €	0 €	...	0 €
on loan in current account	575 €	0 €	0 €	...	0 €
on financial investment	0 €	21.489 €	37.895 €	...	98.914 €
<b>Net Balance</b>	<b>-12.075 €</b>	<b>9.989 €</b>	<b>37.895 €</b>	...	<b>98.914 €</b>

- Performance Measures		
+	Future value of investment	98.914 €
+	Future value of opportunity	11.875 €
+	Net future value	87.039 €
+	ROI	37,85 %

**Figure 7. Calculation of payments on the budgeting and corporate level**

The calculation yields a positive net future value by 98,814 EUR and a Return on Investment of 37.85%. Hence, the initiative to overcome integration shortcomings in the process »Dialog marketing planning« can be recommended from a financial perspective. However, it should be noted that variations of the parameters could result in different recommendations. For example, it can be expected that an increase of out-payments for the wrapper development may lead to an unprofitable integration initiative from a monetary perspective. Apart from this, the saving on the activity »Archive marketing plan« can be influenced significantly by changing the frequency of process executions.

We conclude that the methods of value-oriented process modeling serve as a valuable means for decision support. They provide a basis for studies on the monetary consequences of business process re-design rather than for making decisions on single results. This means to analyze the monetary consequences by means of sensitivity analysis, calculating for example results for a best, worst and average case scenario. In addition, we do not recommend taking decisions only on the basis of monetary measures. On the contrary, as further illustrated in the introduction, we rather focus on the financial perspective of an entire decision support system. The results, therefore, have to be balanced with further information relevant for decision making and particularly also comprising qualitative aspects. Hence, even when acting against recommendation gained from a financial perspective, one at least may gain transparency of the “costs” resulting from this decision.

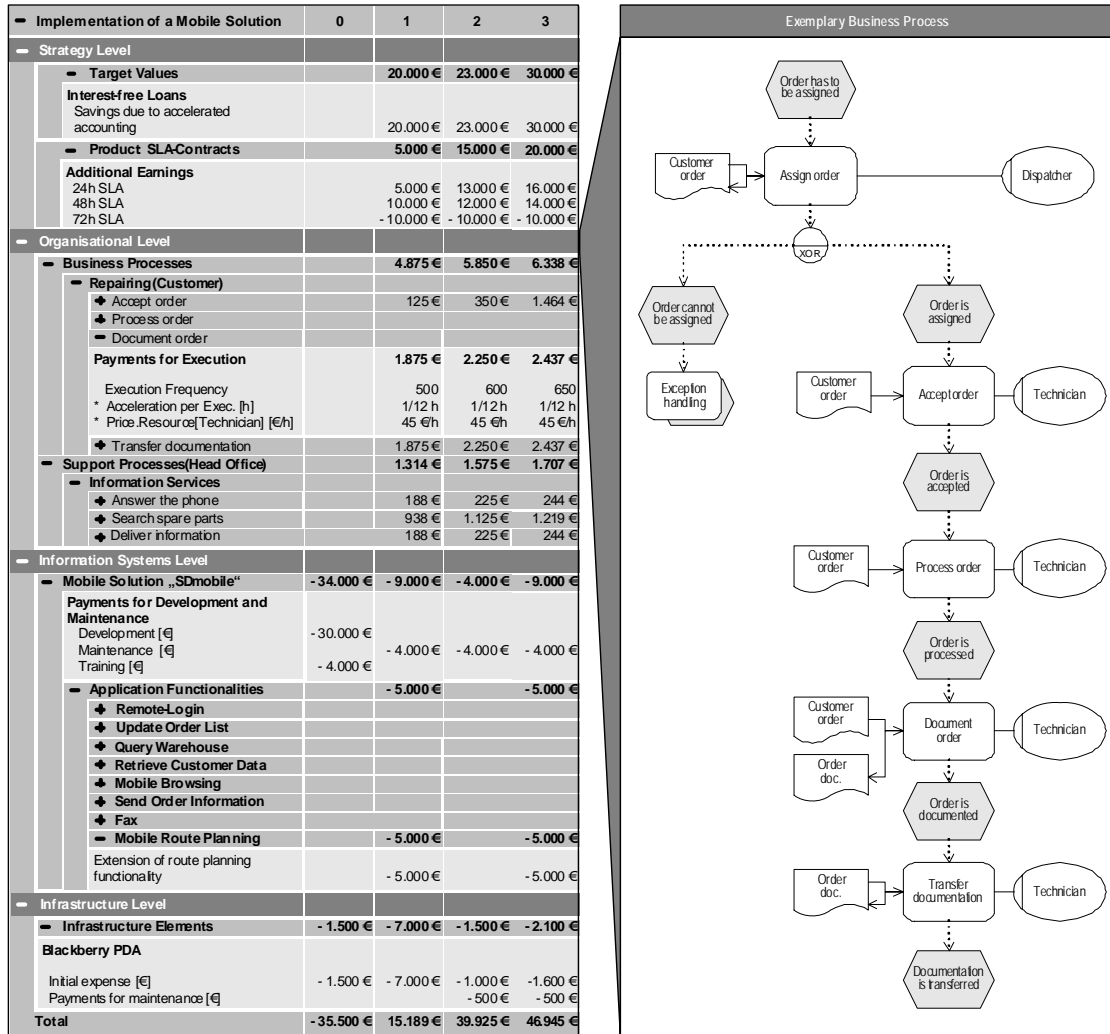
### *B) Using the Value-oriented Process Modeling Approach*

In our second case study, we illustrate how the value-oriented process modeling approach can also be leveraged in process management decisions other than classical process re-design. We consider the case of an Austrian IT service provider that used the approach in the re-design of an enterprise architecture to support on-site IT service delivery processes.

The case organization is a medium-sized company of 40 employees providing services related to IT and communications infrastructures, such as maintenance, support and recovery of hardware components of an IT infrastructure. In this case study, we assisted the organization in capturing and documenting their business processes, and we introduced the value-oriented process modeling approach. Several interviews and workshops were conducted with relevant primary and secondary stakeholders, and key performance data (e.g., processing times, IT investment costs and payment plans) were collected. After conduct of the case study, we carefully inspected notes taken during the interviews, as well as the created process models and the gathered performance and financial data.

We found in the case study that the business processes of the case organization were coined by asynchronous work and document (e.g., orders, invoices, timesheets, etc) flows, stemming from the lack of an information architecture integrated with the processes. Thus, the case organizations decided to re-design the enterprise architecture so that a mobile solution could be implemented that could support IT service employees on-site in real-time.

Enterprise architecture designers developed a solution that comprised a mobile solution on basis of the SD.mobile software. On this basis, on-site IT service delivery processes could be supported with access to real-time information through mobile devices, allowing, amongst others, a real-time billing and invoicing process. Management was then awarded the task to evaluate the financial consequences of the solution, with the planning timeframe being three years. Objective was to examine the value-add of the re-designed IT service processes on basis of a mobile solution, when taking all build- and run-time investments (e.g., implementation of the SD.mobile software, changes in processing and turn-around times etc.) into account. Figure 8 shows some of the relevant out-payments of the suggested process solution.



**Figure 8. Calculation of relevant payments of the mobile business solution on the operational level**

On basis of the data shown in Figure 8, measures can be calculated for the different budgeting levels (budgeting, corporate). The objective is to estimate the monetary and long-term financial consequences of investing into the suggested mobile business solution and the resulting process re-design. Excerpts from the calculations are illustrated in Figure 9.

<b>Finance Plan</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
<b>Series of Payments</b>	<b>- 35.500 €</b>	<b>15.189 €</b>	<b>39.925 €</b>	<b>46.945 €</b>
Internal Funds + initial balance - withdrawal + deposit				
Loan in Current Account „Cash Pooling“ + credit intake - redemption - debtor interest (2.9 %)	35.500 €	7.363 € 1.030 €	20.337 € 816 €	3.309 € 1.064 €
Financial Investment „Cash Pooling“ + reinvestment - disinvestment + creditor interest (0.9 %)				16.493 €
Taxes (t = 48 %) - payment + refund		6.797 €	18.772 €	22.425 €
<b>Net Funding</b>	<b>0 €</b>	<b>0 €</b>	<b>0 €</b>	<b>0 €</b>
Balances on loan in current account on financial investment	35.500 €	28.137 €	7.800 €	16.493 €
<b>Net Balance</b>	<b>- 35.500 €</b>	<b>- 28.137 €</b>	<b>- 7.800 €</b>	<b>16.493 €</b>
<b>Financial Measures</b>				
<b>Final Value(Investment)</b>				<b>16.493 €</b>
<b>Final Value(Opportunity)</b>				<b>0 €</b>
<b>Return on Investment(ROI)</b>				<b>8.90 %</b>
<b>Reference Interest Rate</b>				<b>1.14 %</b>

**Figure 9. Calculation of payments of the mobile business solution on the budgeting and corporate level**

On basis of the calculations shown in Figure 9, the positive net future value and ROI can be computed. The case organization assumed interest rates of 2.9% for long-term investments and 0.9% for short-term investments. These interest rates were facilitated through cash pooling together with five other companies in the industry. Overall, the calculation yields a positive net future value by 16,493 EUR and a Return on Investment of 8.9%. Hence, the initiative to introduce a mobile business solution to re-design the IT service processes can be recommended from a financial perspective.

## 5. Conclusions

### A) Contributions

In this paper we presented and discussed an approach to extend typical process modeling approaches with value-related information. This way, managerial decision-making in the context of process management, most notably process re-design, can better be supported. By highlighting value-related information in suggested process design, better support can be offered to compare and evaluate the potential costs of ownership, and the expected return-on-investment, of process decisions. With this work, in turn, our approach presents

a stronger business case for process modeling. We showed how process modeling can be leveraged to more cohesively and comprehensively provide stakeholders with the type of information required to assist process change management.

### *B) Implications*

We first discuss implications for research and then implications for practice.

In our research, we have highlighted business process re-design as an investment decision. Such a perspective is not new, but hardly aligned with existing approaches to re-design based on process models. The contribution of our work shows how business process modeling and financial decision making can be combined towards what we call *value-oriented process modeling*. This combination is significant for research, as re-design using process models has been taken mostly as a tool for supporting creative reasoning on processes (e.g., Reijers and Mansar, 2005). Clearly, such an approach is not sufficient in light of both shareholder and stakeholder orientation. We deem it to be important to analyze financial success of process modeling initiatives in the future and their dependence on value-orientation. Key to such an effort is a broad foundation on empirical research involving real-world project data. We illustrated through two case studies how the approach can (a) be effectively applied, and (b) lead to well-founded decisions in process re-design, as shown in the case of enterprise architecture design to support IT service processes.

The design research approach followed here allows practitioners to directly re-use the proposed design artifacts in practice. This includes the templates and meta model extensions of the three layers that we identified as well as the overall approach we defined. In practice, many process modeling initiatives are allocated to the directorship of the chief information officer. As such, they are under considerable pressure to justify their benefit to the information technology development and to the business as a whole. Value-orientation in process modeling projects can be regarded as a suitable means to better align business process re-design on the technical level with financial success orientation on the top management level. In this way, the combination of value thinking and modeling might at least partially contribute to closing the gap between top level decision making and technical process (re-) design.

### *C) Limitations & Outlook*

The presented research findings have to be contextualized in light of some limitations. While we consider the application of the suggested approach in two case studies, we acknowledge that the utility of our approach could benefit from further empirical testing. However, we successfully amalgamated existing, proven practices from both process management and financial management practice, and demonstrated the utility of our approach through two preliminary cases. Second, we have not considered other, potentially relevant, non-monetary measures of process change that could or should be considered explicitly in process design efforts. Values of culture, training, people, governance, knowledge, resistance to change, leadership and the like also display pertinence to the success of process re-design projects. To that extent we follow a shareholder value approach that may well be extended taking in the notion of a so-called stakeholder value approach. Third, we considered process modeling on basis of the

Event-driven Process Chain. Recently, the Business Process Modeling Notation (BPMN, BPMI.org and OMG, 2006) has gained momentum as a new industry standard for process modeling (Recker, 2010). This notation is similar to EPCs in that it also considers event, activities (denoted as ‘tasks’) and logical connectors (denoted as ‘gateways’). While we lack evidence for this claim, we do not expect major difficulties in translating the approach presented to the case of BPMN, given the similarity between the two notations.

In any case, we do not consider our research complete. We do hope, however, that we made a case towards long-needed extensions of process modeling practice so as to be able to better leverage the graphical articulation of processes for various types of decision-making scenarios. Our work serves as a conceptual cornerstone of knowledge towards more comprehensive – and contextualized – process modeling practice that not only takes into account the mere behavioral aspects of business operations but also puts the design into perspective – in our case into the perspective of long-term financial consequences. As such, we complemented other existing research streams that argue extension to process modeling practice, such as, for instance, for process compliance (Sadiq et al., 2007), business rules management (Kovacic, 2004), or context management (Rosemann et al., 2008).

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