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# TOWARDS VALUE-BASED MANAGEMENT OF FLEXIBLE IT ENVIRONMENTS

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## Abstract

*Senior executives often criticise the lack of visible returns from expensive investments in Information Technology (IT). In addition, accelerating changes in market environments demand higher business flexibility from IT services which exacerbates the difficulty of managing a return on IT-investment. This paper conducts a state-of-the-art review of methods currently in use for IT controlling, value-based IT management and IT flexibility maintenance. We conclude that no existing method is suitable for assessing the business value created by IT assets. Following a classification of management objectives pursued by IT investments that we derived from the literature survey, we then interviewed 22 top information management experts (CIOs & IT Consultant Partners) in depth. From these interviews we gathered a set of practise-based requirements for value-based IT management in today's flexible business environments.*

*We also determined from the interviews that much of the literature recommended methodology is too complicated to put into practice. We therefore have developed a process (IT Value Mapping), that guides IT managers in the selection of appropriate evaluation methods that match management objectives for an organisation's IT investments. A corresponding framework (IT Value Matrix) consolidates the results and provides an integrated view on the business impacts of IT assets. We conclude with a critical appraisal of our approach and suggestions for future research in this area.*

*Keywords: Business Value of IT, IT-Control, Flexibility, IT Management, Information Systems Evaluation.*

## 1 BUSINESS VALUE AND IT

After several years of cost savings in IT departments following the dotcom-hype, IT budgets have started to grow again. People may now be willing to pay somewhat more for IT, but IT must show that the expenditure adds value (Schnieder & Bettels, 2006 p 5). The most common complaint of executives is that the business value of expensive IT investments is not clear (Ross & Weill, 2002 p 85). To avoid IT-budget misallocations, it is necessary to predict the benefits of IT investments and to manage the implementation and costs of these investments. This requires indicators which are closely connected to business processes. The ex-ante evaluation of IT benefits becomes a vital topic for companies to ensure survival and sustained growth (Irani & Love, 2002 p 79). There is no common understanding about the role of monetary evaluations. Methods which go beyond monetary calculations are not commonly used in practice because of their complexity or subjectivity. To be able to improve these approaches, a deeper understanding about the evaluation process of IT investments in practice is required (Renkema & Berghout, 1997 p 9). Also academia has paid little attention to this

topic. (Walter & Spitta, 2004 p 178) found only 12 relevant studies in the IS literature that dealt with this issue. There is a need for research that supports developing and selecting relevant approaches to value-based IT Management. This issue becomes even more complex in the context of new flexible IT architectures and landscapes that are being introduced.

This article is structured as follows: Section 2 provides an overview of the extant research literature on IT value-based control methods and management of IT flexibility. Section 3 describes an empirical study that explored current practices for managing and controlling IT infrastructures. Section 4 builds upon the identified requirements (both from the literature and the empirical study) and introduces *IT value mapping* - a method for selecting appropriate approaches to controlling costs and obtaining benefits for a given organisation's IT environment. Section 5 discusses the findings and outlines future research.

## **2 RESEARCH SPEAKS TO PRACTICE: FUNDAMENTALS OF VALUE-BASED CONTROLLING AND MANAGEMENT OF IT LANDSCAPES**

Any company that has been in operation for some time has built a base of IT resources, which in some cases are aligned to yesterday's business models (Duggan, 2005 p 2). But, today's IT managers have to ensure that their IT infrastructure also meets future business needs. Beside an effective management of IT landscapes, their flexibility gains additional importance. Without strict controlling focused on the IT value proposition, managers often have to resort to the academic literature as to what steps to take to meet these future needs. This section summarises previous research on managing IT value.

### **2.1 Management of IT Landscapes**

An *IT landscape* includes all software and hardware components within a company that are associated with Information Technology. An application landscape only covers the software part of IT and it is therefore a subset of the IT landscape. Architectures are the underlying organisation of information systems. Schematic drawings of such architectures help us to visualize proposed designs and existing relationships of these systems.

Zachman (1987) has proposed a widely used framework in IS literature for representing IS architectures and argues that such architectures always consist of several different representations. In contrast, Krcmar (1990) shows in his Integrated System Architecture (ISA) that the same object (IT architecture) can be regarded from different perspectives. An important part of the Information System Architecture is the IS Portfolio. This is a systematically defined compilation of application systems and their connectivity combined with an analysis of selected criteria such as process support or integration grades to describe their business value. Value-based management of IT landscapes is therefore strongly connected to managing an IS portfolio.

IS portfolio management has to ensure that a company's IS is aligned to its strategy (Kargl, 2001 p 30). On the one hand it has to be evaluated, if existing applications are aligned with the business goals (application portfolio management). On the other hand innovative initiatives with the highest added value have to be identified (project portfolio management).

### **2.2 IT Flexibility**

Today, companies have to cope with accelerating change. A flexible and adaptive organization replaces traditional periodical strategic planning (Heilmann, 2001 p 4). Flexibility in general comprises the mobility and adaptability of a system to the complexity of its surrounding system to weaken or exploit the consequences of surprises (Gronau, 2000 p 126). Surprises are subjective unexpected occurring events (Fischer, 2005 p 324). Increasing dynamics of markets enhance uncertainty. Uncertainty refers to the degree, in which future events can not be anticipated reliably. In consequence flexibility becomes a central strategic success factor for companies.

“CEOs must manage in a way to turn change into opportunity rather than an obstacle, and IT must help make the switch” (Lopez & Raskino, 2005 p I). The competitive effect of IS is to enable a company to react and act timely and coordinated in a dynamic environment of global markets. In practice IS are often a constraint to organizational flexibility. To achieve optimal business results a strategy aligned prioritized change is required that is driven by time-metrics and sponsored by senior executives (Lopez & Genovese, 2004 p 5). Beside efficiency and effectiveness, flexibility of IS comes to the fore.

Zhang (2006 p 97) shows that the IS support for strategic flexibility has a significant impact to the productivity for companies facing high environmental dynamism. Therefore flexibility demand and potential have to be estimated for an organization and the IS within an organization, respectively. This demand depends on the organizational environment and it is determined by the degree of utilization fluctuation, the variance of requirement types and their predictability.

Measurement and appraisal of flexibility or flexibility potential forms a continuous problem (Kaluza & Blecker, 2005 p 10f). Several authors tried to develop concepts based on real options referencing the flexibility which is created by the application of assets within a company (e.g. Anderson, 2000 p 251). A portfolio of real options reflects the grade of an organization to react on changes within a certain period of time. A higher volatility of the underlying asset amplifies the value of an option, wherefore uncertainty plays the major role in valuating real options (Kellermanns & Flyod, 2005 p 64).

The presumptions of the option theory caused strong criticism in literature regarding the application of real options. They are based on real investments, which are neither separable arbitrarily nor traded on financials markets continuously (Kruschwitz, 2005 p 444). Contrary arguments are that using no evaluation is worse than an approximation with real options. Additionally, real options can improve transparency over the value drivers of investments (Damodaran, 2002 p 804).

There is no doubt that IS flexibility will gain significance for business leaders. Adequate appraisal methods are lacking. Therefore current IT controlling cannot yet manage flexible IT environments.

## **2.3 Value-Based IT Controlling**

### *2.3.1 IT-Controlling and the Shareholder Value Concept*

The shareholder value concept was introduced by Rappaport (1986). Increasing the shareholder value becomes the major target of an organization applying value-based management. As control is a target-oriented function, in value-based controlling all core functions have to be aligned to the shareholder value philosophy, resulting in a three step process (Schierenbeck & Lister, 2001 p 80f.):

- estimation of the shareholder value,
- identification and analysis of value enhancement potentials and the
- controlling of value enhancement initiatives.

IT controlling has to ensure the formal targets efficiency and effectiveness as well as the business targets quality, functionality and on-time delivery. It comprises a coordination function for the entire Information Management within a company (Krcmar, 2005 p 420).

Value-based IT controlling in accordance to above thoughts has the mission to

- estimate the value proposition of IT, based on its efficiency and effectiveness,
- identify and assess value enhancement of IT initiatives and
- control their implementation with focus on quality, functionality and on-time delivery.

A direct connection between IT investments and productivity of companies has not been proven yet. But IT can contribute to the shareholder value by enabling optimized business processes or new business models (Wigand et al., 1998 p 159). Consequently the IT value proposition consists of the indicated value proposition in business departments and of the IT department itself (see Figure 1).

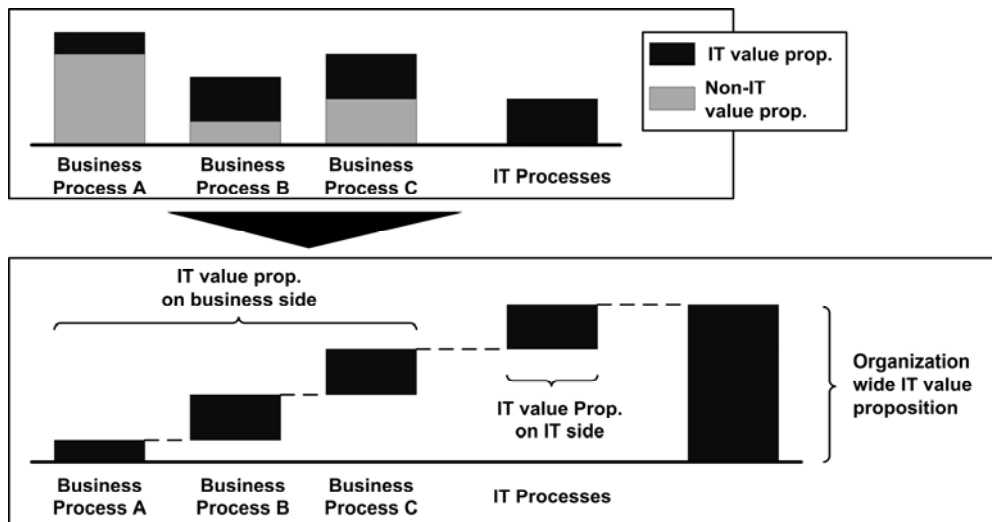


Figure 1: Value Proposition of IT (adapted from Dietze, 2004, p.126)

The business value of IT is connected to the management objectives pursued by the implementation of IT assets (Weill & Aral, 2004 p 1). These management objectives can be characterised by the definition of four different IT asset classes (ITAC): Strategic, Informational, Transactional and Infrastructure. This characterisation allows distinguishing different impacts of IT assets on the IT value proposition. Strategic and informational IT assets focus effectiveness gains in business processes and emphasise the enabler role of IT. Transactional IT assets target at efficiency gains within business processes by lowering their operational costs. In contrast investments into the infrastructural ITAC don't influence business processes directly. They target at raising the value proposition of the IT department itself, i.e. by providing additional flexibility. Each ITAC has a unique risk-return profile.

Indicators help to model a complex reality in a concise and characteristic manner. In value oriented performance measurement systems *value drivers* represent the relevant influencing factors of the shareholder value. A mathematical connection of all indicators is desirable but in practice often not achievable (Dietze, 2004 p 67). The analytical hierarchy process allows weighting the hierarchy resulting of cause and effect relationships (Fletcher & Smith, 2004 p 5).

IT-Controlling has to assess the business value of IT. Therefore a categorization of IT assets according to their management objectives seems reasonable. Value drivers help linking IS and business value.

### 2.3.2 Information System Evaluation methods

Today it is clear, that no single financial method provides the possibility to adequately assess the business value of any IT asset (Renkema, 2000 p 162). One possible solution is to combine several evaluation approaches to diminish weaknesses of single approaches. But not all approaches are compatible to each other and the whole evaluation process can become very expensive. „Suitable tasks for future research include the development of a selection framework for approaches [...]” (Walter & Spitta, 2004 p 178). There is a lack of concepts for choosing the appropriate evaluation approach in each case and for integrating the results into a holistic picture.

IS evaluation approaches can be systemized according to their purpose. Walter & Spitta (2004 p 173) distinguish between *effect-assessing* and *effect-locating* evaluation approaches. The first type assumes that all necessary data is available and thus focus on the calculation and description of investment impacts. The second type aims to locate these impacts and the relevant data for the assessment. Effect-assessing methods can be subdivided into financial, indicator and multi-criteria approaches. Financial approaches exclusively consider financial factors. Indicator approaches combine financial and quantitative non-financial factors. Multi-criteria approaches finally appraise investments using a score combining financial and non-financial factors.

The model of Retter & Bastian (1995) as an effect-locating approach is a good starting point for localizing the impacts of IT investments or assets within a company. Due to the different impacts of IT assets on the IT value proposition, the characterisation by IT asset classes can help to identify the appropriate effect-assessing evaluation approach. For investments in the strategic or informational IT asset class a multi-criteria approach is required, as indirect effects on business process effectiveness have to be assessed. In this case a simple cost-benefit analysis could be adequate. For impacts of transactional or infrastructure IT assets financial approaches such as the net present value approach should be applied (see Figure 2).

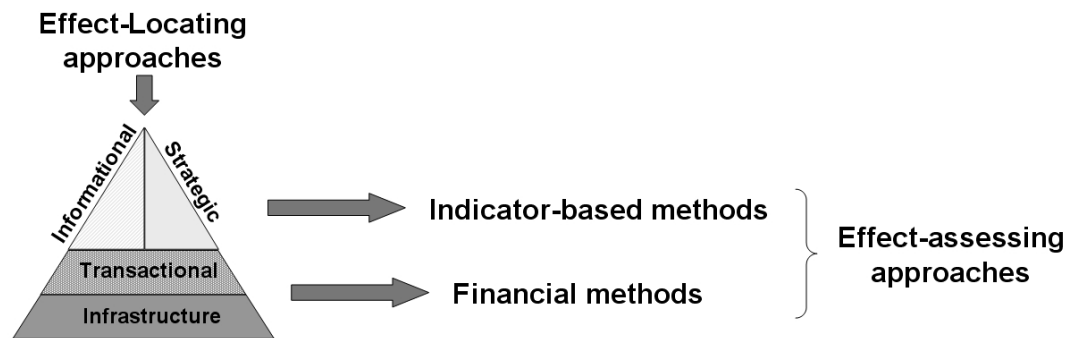


Figure 2 Selection framework of approaches (adapted from Weill & Aral (2004 p 1))

### 3 PRACTICE SPEAKS TO RESEARCH: REQUIREMENTS FOR VALUE-BASED MANAGEMENT OF FLEXIBLE IT ENVIRONMENTS

#### 3.1 Methodology of empirical study

Requirements for an approach for value-based controlling of flexible IT environments have been collected following a qualitative research approach. Selected theoretical aspects have been analysed ex ante and consolidated in an interview guideline. Following this guideline the data has been collected in semi-structured expert interviews. The responses have been analysed using qualitative content analysis, which in general is used in conjunction with guideline based interviews (Flick, 2002 p 282). The result is a set of categories assigned to specific text passages. These categorisations can be evaluated statistically (Mayring, 2002 p 117). In an interview study it is important which individuals or organizations participate (sample selection) and which groups they descend from (sample group selection) (Flick, 2002 p 97).

The sample groups are built upon *industry* and *size* of the participating companies. Several studies indicate that difficulties regarding information system evaluation are industry-specific (Kohli & Devaraj, 2003 p 128). To avoid common-source bias it is reasonable to choose strong diversified industries, which all should have a high relevance to the application of IS. For practical reasons the number of industries is limited to three in this research.

We have chosen the amount of IT spending per industry as indicator for the IT relevance of the industries. Based on Gartner's Vertical Forecast Database the industries *Financial Services*, *Communications* and *Manufacturing* resulted as sample groups for this study (Desouza et al., 2004). To gather an additional perspective on the topic, *Management Consultancies* build a fourth sample group, whose experts have significant experiences with several organizations and are able to make deliver valuable insights.

Another influencing factor is company size, which can be measured in number of employees. Three sample groups have been defined: *small* (less than 4k employees), *medium* (4k up to 40k employees) and *large* (more than 40k employees). Company size is not relevant for the participating management consultancies.

The selection of samples for data collection aims at a consistent allocation of all cells in the sample structure (Flick, 2002 p 99). At least five samples are assigned to each sample group to assess the range of statements. Each combination of size and industry should be represented by at least one sample.

For the beginning, 25 companies matching the sample structure had been contacted. 22 of them followed the request to participate in this study indicating the high relevance of this topic in practice. While face-to-face interviews have been preferred, eight of the interviews had to be conducted via phone due to budget or schedule restrictions. Ten of the interviewees were head of an IT controlling department. Six of them worked as IT strategy consultant on manager or partner level. Three interviewees held the title of a Chief Information Officer. Two lead an IT strategy department and one interviewee finally was head of a software development department. The average interview duration was 52 minutes within a range from 30 to 90 minutes.

The results of the empirical study are structured according to the predefined aspects emerging from the topic. This allows a rough segmentation in four thematic segments. The first segment deals with *controlling of IT environments* in general. It comprises the decision making process, today's challenges of IT controllers and possible perspectives in which organizations regard their IT landscape. In the second segment the understanding of *flexibility* is analysed. Especially relevance, drivers and the exposure to flexibility in practice are discussed in detail. To get an impression of *value orientation* in IT departments, the third segment deals with value oriented controlling and the appendages for IT to generate shareholder value. The fourth segment finally focuses *management reporting* to discover which information is considered decision-relevant by senior executives. For each segment the present situation is displayed and requirements from practice are derived by interpreting and consolidating different statements from the interviews.

### **3.2 Controlling of IT environments**

This section aims at revealing how IT environments are managed today and if room for improvement exists. For this purpose, the *role of IT controlling* and the *decision making process of IT investments* is investigated. Then we focus on if and how *business and IT processes are aligned* to each other. Subsequently existing *challenges* for IT departments and specifically for IT controlling are elaborated. In the last step we investigate from which *perspectives* IT management looks at the IT landscapes.

The role of IT controlling seems to develop from a past-oriented passive monitoring function towards a future-oriented active steering function. One indicator for this development is the increasing number of companies implementing a portfolio controlling. As a consequence the business value of IT comes to the fore. A vital requirement regarding a value-based controlling of IT environments therefore is the evaluation and presentation of the business value of IT. In particular the cause and effect relationships between business and IT have to be clarified.

Return on invest calculations of IT investments are conducted ex-ante in most of the participating companies. But only very few of them audit consequently if underlying predictions and assumptions prove true. This prevents discrepancies from being recognized early and impedes counteractive measures. On top, a double-loop-learning effect to improve predictions can not be realized. In line with value-based controlling of IT environments investments and relevant assumptions should be subject to a consequent and periodically examination.

The practitioners are controversial about business IT alignment if it is achieved solely by clearly defined specification and prioritization. Companies which tightly link IT strategy, architecture and controlling in their organizational structure tend to have advantages in developing relevant metrics and quality assurance processes. Therefore a value-based controlling of IT environments should be able to assess the business IT alignment.

Standardisation and flexibilisation are seen as the biggest challenges for IT departments in the upcoming years. Only a few companies have explicitly identified the clarification of the business value of IT as a key issue. It can be assumed, that this topic is not placed willingly on the official

agenda of CIOs, as it has the flavour of a marketing initiative that carries no direct benefit for other departments. Nevertheless, participating consultants state that it is a high priority topic on CIOs' internal agendas. Value-based controlling of IT environments should enable IT executives to better communicate the contribution of IT initiatives to company goals. IT managers have to justify IT investments to their senior executives.

The interviewees regard the IT landscape today primarily from a business process perspective. Several companies structure their IT landscape to match their organizational structure or their business segments. Only a few companies regard the importance of structuring IT to match their business. Herein lies a possibility to increase transparency of the benefits or risks of IT for the business. Consequently value-based controlling of IT can be supported by structuring the IT landscape in a way that business processes match expected business impact.

### 3.3 Flexibility

In theory, flexibility of organizations and their IT gains increasing significance. We aim at estimating the importance of flexibility in practice regarding the management of IT environments. As a first step, *relevance* and *drivers* of organizational flexibility are explored. Next the *impact* on the *planning process* and on the *IT landscapes* itself is analysed. Finally we asked for (existing) metrics which allow to *control* or *measure* flexibility in practice.

The majority of the study participants stated accelerating changes of the market environment. The main reasons for this development are increasing throat-cutting competition caused by saturated markets and the increase of M&A activities.

As a consequence, the IT planning process itself has to be designed more flexible. To improve an organization's reaction time most participants claim a shortening of planning periods. Likewise approximate forecasting replaces exact planning. To balance uncertainties in planning, a budget for ad-hoc initiatives should be defined. To completely overcome budgets, like beyond-budgeting approaches suggest, is not regarded as practicable. Unnecessary surprises can be avoided by a better integration of IT executives in the business planning processes.

A flexible and standardized IT landscape can improve organisational flexibility according to the majority of the participants. As improving flexibility costs additional money, more flexibility should be created selectively.

A possible indicator for the IT flexibility need of business is the standardisation grade of the product lifecycle process regarding business segments or the change interval regarding business processes. Time-to-Market is the most important metric to measure business flexibility. But an exact estimation of flexibility need or potential is considered impossible by most of the study participants.

### 3.4 Value orientation

A growing number of companies focus on shareholder value creation. According to the value driver concept it should be revealed *whereby* IT can increase shareholder value. Subsequently it is investigated if the IT value proposition can be *quantified*. Finally it is questioned, if a value-based management approach in general is *reasonable* for IT executives.

The business value of IT is tightly connected to the role of IT within a company. The majority of the participating companies use IT to improve business efficiency. Therefore process automation is recognized as most important value driver. Organisations with a more comprehensive understanding of IT emphasize the know-how of business process optimization. Other addressed IT value drivers refer to a raise of organizational flexibility or innovative potential of a company (see figure 2).

The quantification of the IT value proposition in general is seen as a big challenge. Cost transparency is a prerequisite, which is not reached by all participating companies. To estimate the business value of IT we distinguish projects (investments) and operations (assets). The value of IT investments can be estimated using a business case. But many companies are facing problems in estimating the business value of IT assets. This is only possible using business value drivers influenced by them.



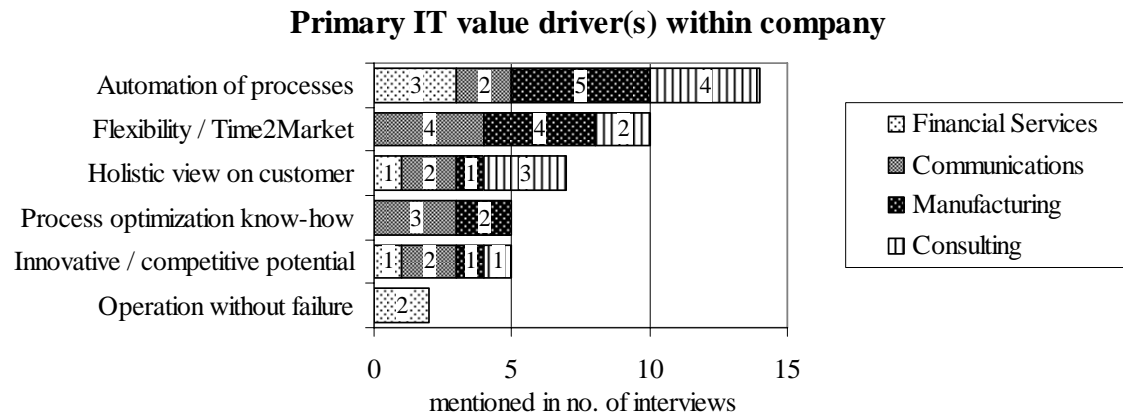


Figure 3: Primary IT value drivers

In particular financial holdings apply value oriented management of business segments. Predominantly excess profit methods like the economic value added are used. A solely monetary-oriented management of IT departments is seen as not feasible or at least as questionable by the majority of the participating companies. Therefore a value-based controlling of IT environments should not exclusively rely on monetary metrics.

### 3.5 Management Reporting

This section aims at revealing which *kinds of reports* are used in IT departments in which *intervals*. Additionally the *content* of management reports is investigated.

Today costs are clearly emphasized in management reports of the participating companies. The majority uses a balanced scorecard for reporting non-monetary indicators. The explicated value proposition is not included in any of these reports. Technical indicators in general are considered inferior. A business interpretation of these indicators only takes place in particular cases. Herein lies a possibility to improve the IT understanding of business executives. Therefore a value-based controlling of IT environments should have the ability to interpret technical performance indicators in a business way and to communicate the IT value proposition in regular reports to the senior management.

### 3.6 Summary of requirements for an approach for value-based management of IT landscapes

First, the *current situation* in companies is displayed. Afterwards collected *requirements* for the approach for value-based management of flexible IT environments will be condensed to several key statements.

Today in many of the participating companies a changing role of IT is noticeable. The explication of the business value of IT against senior and business management gains additional significance for CIOs. But only few companies are in the position to estimate this business value. Investments and their business cases often do not underlie an ongoing controlling of achievements and assumptions. A reporting regarding the IT value proposition does not exist. Practice therefore requires an approach to illustrate the IT impact on the business.

The majority of the participating companies expect increasing market dynamics in the future. As result, flexibility becomes an important competitive success factor. Consensus is that in this context additional flexibility demand for IT departments arises. Despite these developments and the insight, that more flexibility costs more money, the majority relies on mere “gut feelings” for making decisions regarding this topic. Reason is that no metric exists, which allows to explicate flexibility demand or potential within companies.

The requirements derived from this empirical study are summarised in table 1. The column “Support by” indicates the amount of interviews that contributed to the derived requirement. These requirements

can be condensed into two major categories requirements: An approach for value-based management of flexible IT environments should

- make visible, *where* in the operational structure *which* IT asset in *what role* generates *how much* value. This should include new IT initiatives and existing IT assets, respectively;
- optimize scope and reaction time of companies by estimating flexibility demand and potential and eventually provide a reasonable amount as ad-hoc budget for short-term changes.

No.	Requirement	Supp. by	Sect.
1	Value-based IT-Controlling should improve transparency regarding current business impact and value proposition of IT assets	14	3.2
2	Within the scope of value-based IT-Controlling investments should be controlled consequently regarding their objective achievement and underlying assumptions.	13	3.2
3	Value-based IT-Controlling should be capable of estimating the alignment of IT assets to business processes and strategy.	6	3.2
4	To justify investments value-based IT-Controlling should be able to communicate the IT value proposition towards business executives.	14	3.2
5	Modelling an IT architecture from a business process perspective and a business impact perspective enables value-based IT Management.	3	3.2
6	Increasing cut-throat competition and broader M&A activities require a flexible planning process which has to be considered in value-based IT Management.	7	3.3
7	Flexible planning includes estimating an ad-hoc budget for short-term initiatives to compensate uncertainties.	6	3.3
8	The management of flexible IT environments requires assessing the business flexibility demand and the IS flexibility potential to enable a selective creation of flexible IT assets.	10	3.3
9	To estimate the IT value proposition the role of IT within a company has to be considered.	7	3.4
10	Value-based IT Controlling has to distinguish between projects and assets. To assess the business value of IT, business performance indicators have to be considered.	6	3.4
11	Value-based IT Controlling should not focus solely on monetary figures.	9	3.4
12	Value-based IT Controlling should be able to economically interpret technical key figures and regularly report the IT value proposition to senior executives.	5	3.5

Table 1: Practice requirements for value-based management of IT landscapes

## 4 AN APPROACH FOR VALUE-BASED CONTROLLING OF FLEXIBLE IT ENVIRONMENTS

In order to develop an approach for value-based controlling of flexible IT environments we propose a *framework* and a *process* for applying this controlling. This process has to be aligned to the shareholder value concept (see section 2.3.1). Flexibility has to be considered adequately (see section 2.2). We close in discussing *strengths and limitations* of our proposed approach.

### 4.1 The Framework: IT Value Matrix

According to theory value-based IT-Controlling aims at assessing the business value of IT (see section 2.3.1). Practice as well states a need for more transparency regarding the impacts of IT on the shareholder value (see section 3.6). We therefore need a feasible way to communicate the IT value proposition to business and senior executives. Several evaluation methods of IT investments have to be combined (see section 2.3.2). An effect-locating approach delivers the framework for the appraisal of IT investments and assets.

The IT Value Matrix (ITVM) integrates several relevant aspects for the appraisal of IT assets and investments building this framework. Value-based IT controlling should make visible, *where* in the operational structure *which* IT asset in *what role* generates *how much* value (see section 3.6). To answer where in the operational structure value is generated by IT assets; the relevant business processes build the columns of the ITVM. The rows of ITVM are defined by the IT asset classes representing the role of IT assets. As subject of matter each IT assets is represented within one or several cells of the ITVM. To estimate how much value an IT asset contributes to a business process, effect-assessing approaches are applied in accordance to the relevant dimensions predetermined by the coordinates within the matrix. Finally the assessment results are consolidated within each cell of the

ITVM. For each column and row an overall status can be derived indicating the IT value contribution to business processes or the IT strategy alignment (see Figure 4).

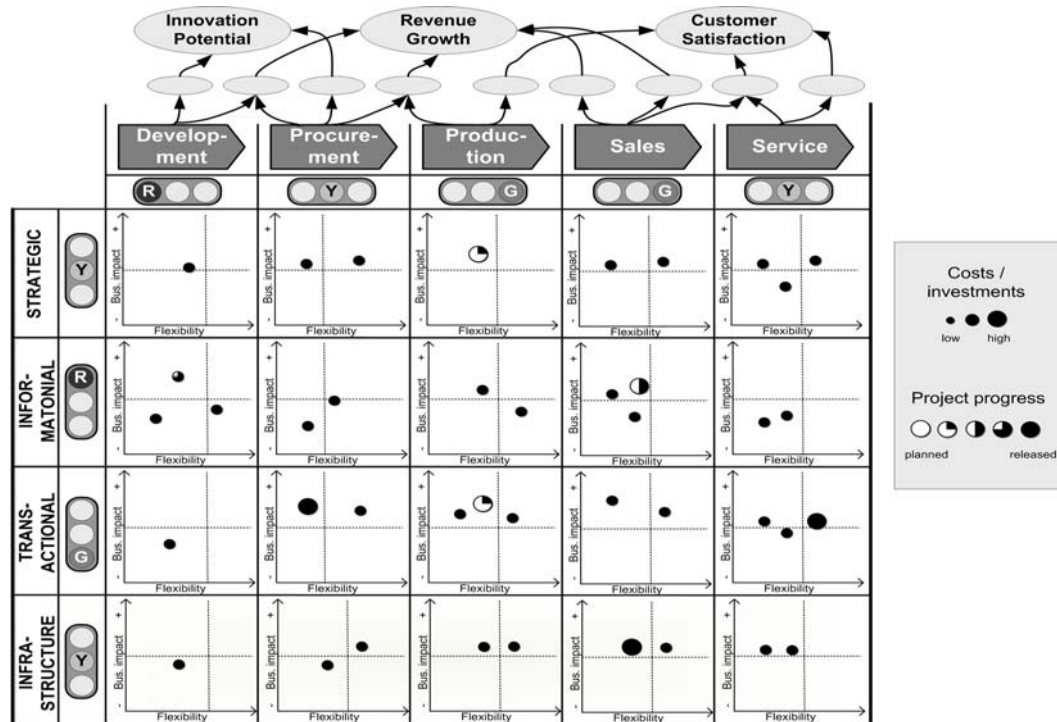


Figure 4 Aggregated IT Value Matrix as management report (illustrative)

IT assets can either have an impact to the efficiency of a business process, the effectiveness of a business process represented by key performance indicators or to the efficiency of other IT assets (see section 2.3.1).

Beside the current impact of an IT asset its flexibility potential representing the continuity of this impact has to be considered. Three hypotheses emerge:

- At given flexibility potential of an IT asset an optimization of its efficiency and effectiveness impacts maximizes its value proposition.
- At given efficiency and effectiveness impacts of an IT asset a maximization of its flexibility potential maximizes its value proposition.
- A maximization of an IT asset's value proposition requires a concurrent optimization of its effectiveness, efficiency and flexibility, respectively.

## 4.2 The process: IT Value Mapping

Based on the framework developed in section 4.1, the process of value-based controlling of flexible IT environments should be subsumed under the term "IT Value Mapping". It consists of three steps following theory of value-based management (see chapter 2.3.1): First step is the *evaluation* of the current IT value proposition. Second step is the *identification and prioritization* of possible value enhancement initiatives. Third step is to *control the implementation* of value enhancement initiatives.

For the evaluation of the current IT value proposition it is important to have a clear process hierarchy within a company. For each process the possible or intended impact of relevant IT assets should be investigated as Retter & Bastian (1995) suggest in their model. A well-defined IT architecture can help during this process. The intended impact should be classified using the IT asset classes. After assigning each IT asset to one or several cells of the IT value matrix, their current impact and flexibility potential have to be revealed using the selected appraisal approaches. As result, each matrix cell can be filled with the relevant data indicating the IT value proposition for each business process.

For identifying possible value enhancement initiatives, single cells, rows or columns in the IT value matrix should be investigated and compared to each other. Possible initiatives should be described, located in the matrix and assessed using the same methods as existing assets. This allows to predict their business impact and to prioritize the initiatives according to executives' preferences.

Controlling of value enhancement initiatives means focusing on IT investments. It has to be assured, that anticipated value is generated in practice. Deviations have to be noticed as soon as possible to initiate countermeasures. It should be distinguished between the controlling of premises and the controlling of project achievements. The fill of the data bullets in the IT Value Matrix indicates the project state according to the most important common milestones for IT projects.

#### **4.3 Strengths and limitations**

The majority of practice requirements have been incorporated in the IT Value Mapping and some previously identified deficiencies have been removed. Both the process and IT Value Matrix as a framework are grounded in respective theories. By combining effect-locating and effect-assessing appraisal approaches IT Value Mapping enables a flexible adoption of evaluation criteria to the determining factors of the subject of matter. Thus a too complex appraisal can be avoided when assessing simple artefacts, but an adequate appraisal of complex artefacts is still possible. The integrated consideration of different approaches assures their comparability.

Nevertheless we have to consider, that the assumptions we made for this approach are critical. A high quality of existing business performance indicators is essential for the success of IT Value Mapping. Cost transparency regarding processes and applications is presumed, but often not existent in practice. For the application of our approach in practice, company-specific modifications and additions are necessary. If the proposed assumptions prove true has to be investigated by future research.

## **5 SUMMARY AND IMPLICATIONS FOR FURTHER RESEARCH**

This paper aimed at developing an approach for value-based controlling of flexible IT environments. First we gathered theoretical fundamentals via a literature review of the state-of-the-art in value-based IT -Controlling and flexibility. We found that the Shareholder Value concept needs to influence IT controlling significantly and that different appraisal approaches were required to adequately assess the impact of IT investments. The IT asset classes by Weill & Aral (2004) provided a reasonable classification for characterizing IT investments according to the management objectives pursued by them. The increasing impact of market dynamics make it necessary to consider business flexibility demands and IT flexibility potential.

We then interviewed IT decision makers that govern value-based controlling of flexible IT environments and conducted 22 semi-structured expert interviews across three industries. Experts indicated that transparency regarding IT impact and the business value of IT investments was increasingly becoming essential. They stated that IT flexibility would continue to grow in significance in the upcoming years.

Finally we compiled a set of implications for IT controlling from the theory and in-practice activities to build a feasible approach for value-based controlling of flexible IT environments. This approach involves both a framework and a process for selecting from a set of possible IT strategies those that match an organisation's business goals. The IT Value Matrix represents our framework. It supports delimiting the impact of an IT asset or investment within an organisation. The corresponding process called IT Value Mapping enables value-based controlling of flexible IT environments in three steps.

Further research needs to be done on the assumptions and propositions underlying IT Value Mapping. The hypotheses built into this mapping approach require further validation. A next step would be a proof of concept in practice of our proposed approach. For this purpose our approach has to be adapted to the needs of an individual company. To compare the results with existing IT valuation methods it should be implemented in parallel. As the IT Value Matrix provides a snapshot on the current situation and presumed development, the time dimension could be made explicit, e.g. by integrating in the IT

lifecycle concept. Last but not least, further research on the measurement of flexibility is required, as there exists no common accepted approach in literature.

The variety of future research possibilities highlights the complexity of Information System Evaluation (ISE). This work expands the scarce standard of knowledge regarding ISE and IT controlling in practice. IT Value Mapping is an approach which could help practice to increase transparency regarding the business value of IT.

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