

# Integration Deficits of IT Controlling – Historical Background, Analysis of Integration Potentials and Method Integration

The paper is based on the thesis that IT controlling suffers from two integration deficits. On the one hand, this is a lack of synchronization between research on IT controlling methods and developments in practice; on the other hand, a lack of integration of IT controlling methods with methods of business and information systems engineering (BISE). Historical developments in IT controlling practice and research are explored to reason about potentials for further integration.

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## 1 Introduction

Information technology (IT) controlling is investigated in the scientific disciplines business and information systems engineering (BISE) and business administration. BISE considers IT controlling to be one of its core research areas (Krcmar and Son 2004, p. 165) and investigates it as a special managerial function of information management (Krcmar 2005, p. 420; Heinrich and Lehner 2005, p. 168). Business administration treats IT controlling as a subfield to controlling – a field of study common in German management literature; akin to Management Accounting – (Reichmann 2006, pp. 699 ff), and regards it as a functional specialization of corporate controllership (Horváth 2006, p. 689). The practical relevance of controlling the information systems function can be traced back to the 1950s: As early as in 1959, Schuff emphasized the meaning of economic efficiency and effectiveness of electronic computer systems in corporate use in the first issue of the journal “elektronische datenverarbeitung” (Schuff 1959; cited following Schauer 2007, p. 4). In the following four decades, substantial research activities have led to elaborated IT controlling concepts and methods, including e. g. refined cost and benefit concepts, performance measurement systems, and methods for assessment of efficiency, effectiveness, and profitability (Baumöl 2008, p. 653).

However, the current state of implementation of these instruments in practice appears critical for BISE as an application-oriented discipline. Since the early 1990 s, empirical studies have repeatedly

revealed deficits, especially with regard to the use of advanced methods (Zanger and Schöne 1994; Becker et al. 2006; Gadatsch et al. 2007). In business practice, “classical” accounting approaches dominate, which do not adequately account for present challenges of IT controlling, especially with regard to identifying and justifying the contribution of IT to the creation of business value. At the same time, business practice articulates a demand for further methodical support for IT controlling, which does not seem to be covered by currently available methods. This is shown by recent developments in practice, such as the “Val IT Framework” (IT Governance Institute 2006) as an extension to the “Control Objectives for Information and Related Technology” (COBIT).

The main thesis of this paper – and a suspected cause for this unsatisfactory situation – is that IT controlling currently suffers from two integration deficits. The first deficit alludes to IT controlling methods being inadequately integrated with fundamental methods of BISE – such as e. g. modeling methods. The second deficit alludes to relevant developments in practice and in scientific research being largely carried out in isolation from each other.

This paper pursues two objectives: First, it develops and substantiates the main thesis. Second, it aims at highlighting integration potentials – with methods of BISE as well as with methods developed in practice. Two examples illustrate integration opportunities and corresponding challenges.

The next section reconstructs historical stages of the development of IT control-

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ling to look into reasons for the suspected integration deficits. Section 3 analyzes the integration potentials and concretizes the integration requirements. Section 4 illustrates the benefits of an advanced integration based on two examples. The paper concludes with comments on a research agenda in Section 5.

## 2 Historical development of IT controlling

### 2.1 Reconstruction of key development stages

The following retrospection aims at highlighting key developments in the history of IT controlling in German-speaking countries to support a differentiated understanding of the relationship between IT controlling and BISE as well as the corresponding practice and scientific research. In this section, common terms of their time are retained: data processing (DP), electronic data processing (EDP) and automated data processing (ADP).

#### Phase of internal and external audit

The audit phase is influenced by the incipient use of electronic data processing in commercial enterprises. At first, interest is primarily directed at the problem of proving the legally required compliance of electronic bookkeeping. By deploying EDP for accounting, accounts were only visible after printing them – a way rendering forbidden manipulations feasible. This problem led to the formation of a separate discipline “revision and control of EDP” in the technical commission for modern accounting systems at the German Institute of Chartered Accountants (FAMA 1966; Lindemann and Nagel 1968; Horváth 1972).

#### Phase of cost awareness and efficiency concepts

Along with the increasing commercial use of EDP, higher costs draw the attention to questions on charging business units for using EDP and on the economic justification of EDP. First reflections are focused on the analysis of the cost structure of EDP (Anselstetter 1984) and EDP cost accounting (Stüve 1969). With the advent of integrated information systems, EDP

increasingly achieves effects beyond narrowly defined business functions. A purely monetary profitability analysis does not account for these developments, so that the focus was set on developing advanced profitability concepts, taking also non-monetary benefits into account. A first approach understood “profitability” of EDP as a “degree of achieving business goals” pursued by EDP, resulting in the two pillars of a coherent assessment of EDP projects: cost effectiveness calculations and benefits justification (Bottler et al. 1972).

#### Phase of consolidation

The phase of consolidation is characterized by the emergence of client/server architectures and the corresponding increasing networking and integration of information systems. The relative share of acquisition costs of a DP-system’s life cycle cost decreases significantly in relation to costs of customization and maintenance. At the same time, the degree of differentiation of DP services increases. In a first consolidation, Horváth et al. combine preliminary work in the context of the then-current conception of controlling as “controlling tasks in the ADP area” (Horváth et al. 1975, pp. 97 ff): planning of ADP-projects, budgeting, profitability analysis, cost and benefit accounting, and internal control in the ADP area. To identify and assess effects of DP use, multi-level models of profitability are proposed (Mertens et al. 1982; Picot et al. 1985). Moreover, interest is directed at analyzing benefits of DP in commercial use (Mertens et al. 1982; Anselstetter 1984; Schumann 1992).

#### Phase of strategy orientation

The increasing recognition and use of strategic potentials of IT (Mertens and Plattfaut 1986) and information systems (Schumann and Hohe 1988) in combination with a strategic orientation of the controlling field initiate a reorientation of operational, efficiency-oriented DP controlling towards strategic IT controlling (Ruthekolck 1997), dealing with strategy-oriented usage of IT potential (Krcmar 1988; Seibt 1988). As a result, the first comprehensive conceptions of IT controlling evolve, emphasizing both an operational and a strategic orientation (Kargl 1993; Krcmar et al. 1994; von Dobschütz 1995). These concepts are supple-

mented by key performance indicators for the IT industry (an overview is given in Kütz 2007, pp. 139 ff).

#### Phase of standardization

For several years, further differentiation of IT services and changes in the regulatory as well as in the competitive environment have led to the development of frameworks and standards which have been developed largely detached from scientific research in business practice. These include COBIT (IT Governance Institute 2007) and the “IT Infrastructure Library” (ITIL) (Office of Government Commerce 2007) which result from work of English and American companies and authorities, serving as a basis for standards, e. g., of the International Organization for Standardization (e. g. as ISO 20000 based on ITIL and ISO 38500 using COBIT).

This brief reconstruction can only give a short overview and leaves a large body of literature unmentioned. However, the managerial roots of IT controlling and the largely independent developments in practice and research on the one hand as well as in business administration and BISE on the other hand become apparent.

### 2.2 Theses regarding the historical development of IT controlling

The history of IT controlling is characterized by different approaches and influences over the course of time. This section is aimed at recording prominent tendencies of this development. It faces the challenge of coping with the inherent contingency of the historical developments presented above. We meet this challenge by disclosure and – where possible – justification of the following theses.

*Thesis 1:* In the past, a significant part of method development for IT controlling occurred in (consulting) practice.

In addition to ITIL and COBIT, examples include the total cost of ownership concept developed by the Gartner Group (vom Brocke 2008b) and a variety of IT performance management approaches, e. g. by IBM Consulting (Wiggers et al. 2003).

*Thesis 2:* With regard to IT controlling, BISE has primarily taken a management-oriented perspective, i. e. with respect to the analysis of costs and benefits, BISE has largely refrained from specific (software technical) characteristics of information

systems and focused on economically relevant effects.

In BISE, contributions dealing with IT controlling typically take the information management perspective (Krcmar 2005, pp. 420 ff; Heinrich and Lehner 2005, pp. 168 ff) and rely on common management and accounting instruments (including, e. g., portfolio analyses, and cost-benefit analyses) and project management instruments (including, e. g., critical path analysis). In extension of such managerial approaches, BISE research recommends an orientation along the life cycle of IT systems as well as the use of information system architectures for IT controlling (Krcmar et al. 1994).

*Thesis 3:* In the past, central BISE research approaches – such as system analysis, system development, and conceptual modeling – only marginally considered concepts of IT controlling (e. g., costs, benefits, performance indicators).

Despite their undoubted importance, only recent works – except for essential basic concepts (e. g. Österle 1995; Scheer 2001) – deal with advanced concepts to support profitability analyses, for instance, the service-oriented process controlling approach (vom Brocke 2008a), “Value-based Software Engineering” (Biffel et al. 2006), and risk management approaches (Rieke and Winkelmann 2008). Apart from this, cost-benefit-analyses are dealt with in IT project management and IT project controlling, which is largely decoupled from system analysis, system design, and modeling methods.

### 2.3 Interpretation of the theses on the historical development of IT controlling

At first sight, the theses on the history of IT controlling are suggestive of the fact that the systematic study of profitability and effectiveness of information systems did not receive the attention in BISE research as they should have according to the discipline’s own profile (WKWI 1994). Such an interpretation, however, has to be annotated: It can be countered that especially because profitability is considered as a natural constituent of BISE research, its dedicated consideration may seem obsolete to many. Especially in the early days of DP, the implicit assumption might have prevailed that the deployment of DP systems was likely to promote efficiency in principle, so that a dedicated consideration of such issues was the

exception. Moreover, due to differentiated analyses of costs and benefits of different system classes in the 1980s (e. g. Mertens et al. 1982; Anselstetter 1984; Schumann and Hohe 1988), a largely satisfactory and persistent confirmation of the efficiency and effectiveness of information systems might have been perceived as established by many (see, however, Mertens 1998, p. 175). Finally, it has to be taken into account that BISE research focusing on the development and maintenance of complex information systems – including methods of systems development, systems architecture, or systems integration – regularly considered efficiency and effectiveness as a central motivation as well as an abstract objective. At the same time, such research has, however, been aimed at the specific aspects of the development and maintenance of information systems, which was likely due to the inherent complexity of the matter at hand.

However, it should not be ignored that IT controlling was predominantly shaped by a management perspective. While this certainly complies with the central motivation of IT controlling, it resulted in neglecting the particularities resulting from the development and deployment of IT artifacts. Such a one-sided focus involves the risk of a lacking perception of the contribution of IT to a firm’s success. A survey among 300 controllers by the German controller association “Internationaler Controller Verein” documents such an impending effect by concluding that – in many firms – top management still regards their IT as a black box which simply costs a lot of money (n. a. 2004).

The analysis of the historical development obviously provides indication that the development of methods of IT controlling and BISE methods as well as of methods in practice and in research have largely been carried out independently from each other which substantiates the initial thesis of a double integration deficit. The following sections are devoted to the analysis of existing integration potentials.

## 3 Analysis of integration potentials

### 3.1 Benefits of further integration

The insufficient integration with the approaches developed in practice on the

one hand and with the methods base of BISE on the other hand raises the question which benefits of such an integration are to be expected. Especially compared to business practice, it is not unusual that scientific research uses different terms and methods. In the case of IT controlling, however, this is a serious issue. Significant investments have been made for the implementation of standardized frameworks such as ITIL and COBIT. An application-oriented discipline cannot ignore this fact. At the same time, it is not adequate in the light of the innovation imperative of scientific research to simply accompany the approaches of practice in a commenting and partially complementary way. A better integration of these approaches with the relevant research promises a fruitful mutual exchange and allows to hope for a greater resonance for scientific methods in practice. In this regard, integration of approaches developed in practice must draw on already deployed concepts and methods if only for reasons of investment protection. Moreover, a specific support for IT controlling implies a need for developing new concepts and methods which are adapted to modified requirements – e. g. with regard to supporting IT Governance (Baumöl 2008). This suggests a practice-oriented presentation and adaptation of scientific methods as well as the investigation and specific analysis of approaches which have been widely adopted in practice. In addition, this contributes to the transfer of scientific research results to practice.

In this context, the division of labor between science and practice and between academic disciplines addressed in section 2 fulfills an important function: It provides links to established concepts and methods and thus to the paradigms of each perspective. However, especially with regard to cross-discipline topics such as IT controlling, insufficient integration of perspectives may lead to redundancy and (conceptual) inconsistency. An integration of approaches – and hence a greater cooperation between researchers and practitioners involved – not only enhances a holistic access (and thus better fulfills the demand for an integrated IT controlling), but also a multi-perspective enhancement of the methods. This primarily means a methods base which is characterized by reuse and, at the same time, meets the specific perspectives in an integrated manner. At least, a management- and a technol-

ogy-oriented perspective have to be considered. Beyond these fundamental perspectives, it is recommended to consider stakeholder-specific perspectives incorporating the specific views for concrete analysis purposes. For example, it is likely that the participating stakeholders in the context of strategic IT planning would like to refrain from considering software development details. In addition to the consideration of different perspectives, the variance of specific analysis purposes – from budgeting to software development – suggests to provide adaptability to the specific needs of certain stakeholders in terms of “method engineering” (Schelp and Winter 2006).

The development of pertinent IT controlling methods – as shown by the analysis of the historical development – is clearly dominated by managerial concerns. IT controlling methods largely abstract from the specifics of the IT artifacts under consideration. IT artifacts are conceptualized in the form of control objects (including IT projects, IT portfolios, IT infrastructure) (Krcmar 2005, p. 421). The focus of the analysis is primarily set on economic effects achieved by these control objects – e. g., a priori by investment appraisal methods and ex post by cost accounting methods. IT controlling methods usually do not include dedicated approaches for a differentiated analysis of information systems – e. g. at the level of individual system components. The focus of process models is typically set either on daily operations or project controlling (Baumöl 2008). Given the central role of IT artifacts for IT controlling as well as their considerable complexity, there is an exigent need for methods supporting a sophisticated analysis of IT artifacts from a managerial point of view. It seems appropriate to first consider specific methods of BISE in the area of systems analysis and systems design. These, however, focus mainly on the description of system properties and, at best, only rudimentarily account for the business context. Multi-perspective enterprise modeling methods seem to be more suitable: They are based on an abstraction – business process models – key to both IT controlling and BISE. They are, compared to methods of business process modeling, enhanced by perspectives and aspects which are of central relevance for IT controlling, including resources, business objectives, and strategies (Frank 2008a). However, they usually do not sup-

port sophisticated analyses of economic aspects, which is why they are – per se – not sufficient for the systematic support of IT controlling.

On the one hand, integration with methods of enterprise modeling promises an enrichment of IT controlling by sophisticated concepts to describe and analyze information systems. On the other hand, the common (methodical) discontinuity between project management, systems development, and systems management can – at least – be substantially mitigated by continuous and integrated methodical support for an extended system life cycle including IT-controlling-specific phases, i. e. project evaluation, project selection, risk management, and system replacement. Such an integrated support for an extended life cycle is suggested by both the high degree of interdependency between these phases and the risk of frictions at phase transitions – such as from system development to operations if different methods are used. Finally, there are mutual integration effects: New analysis scenarios, such as model-based cost accounting methods and sensitivity analyses, become available to IT controlling.

### 3.2 Requirements for method integration

In this context, the question arises of how to achieve the requested integration. Therefore, the previously intuitively used concept of integration has to be specified. At first, the concept of a method requires clarification in order to specify method-based integration. In general, a method is considered to be a systematic, well-planned, goal-oriented procedure for solving a class of problems leading to technical skills in solving theoretical and practical tasks (Lorenz 1995, p. 876). A method consists of at least one linguistic structure and at least one corresponding procedure (Frank 2006, p. 22). Based on such a method conception, integration is achieved through common concepts (conceptual integration) and corresponding process models referring to the common concepts (procedural integration). The conceptual integration of two methods is less problematic if corresponding terms are easily identifiable and have similar semantics to a large extent. However, this is not to be expected in the case of the problem addressed here. For instance, we suspect for the most part subtle differences between the technical language used in

practice and the scientific terminology of IT controlling research. At the same time, methods for enterprise modeling are characterized by a terminology which – at least partially – differs significantly from the terms used in business administration. The integration of methods therefore requires a systematic approach. First, relevant terms of the methods under consideration must be identified (i. e. the linguistic structure). Subsequently, the methods’ terminology has to be checked for semantic similarities or it has to be reconstructed in such a way that common notions arise (Frank 2008b, pp. 43–46). In a further step, the corresponding process models have to be extended, so that they reference the concepts of all methods to be integrated and structure the corresponding procedures. We will illustrate this approach in the next section by two examples.

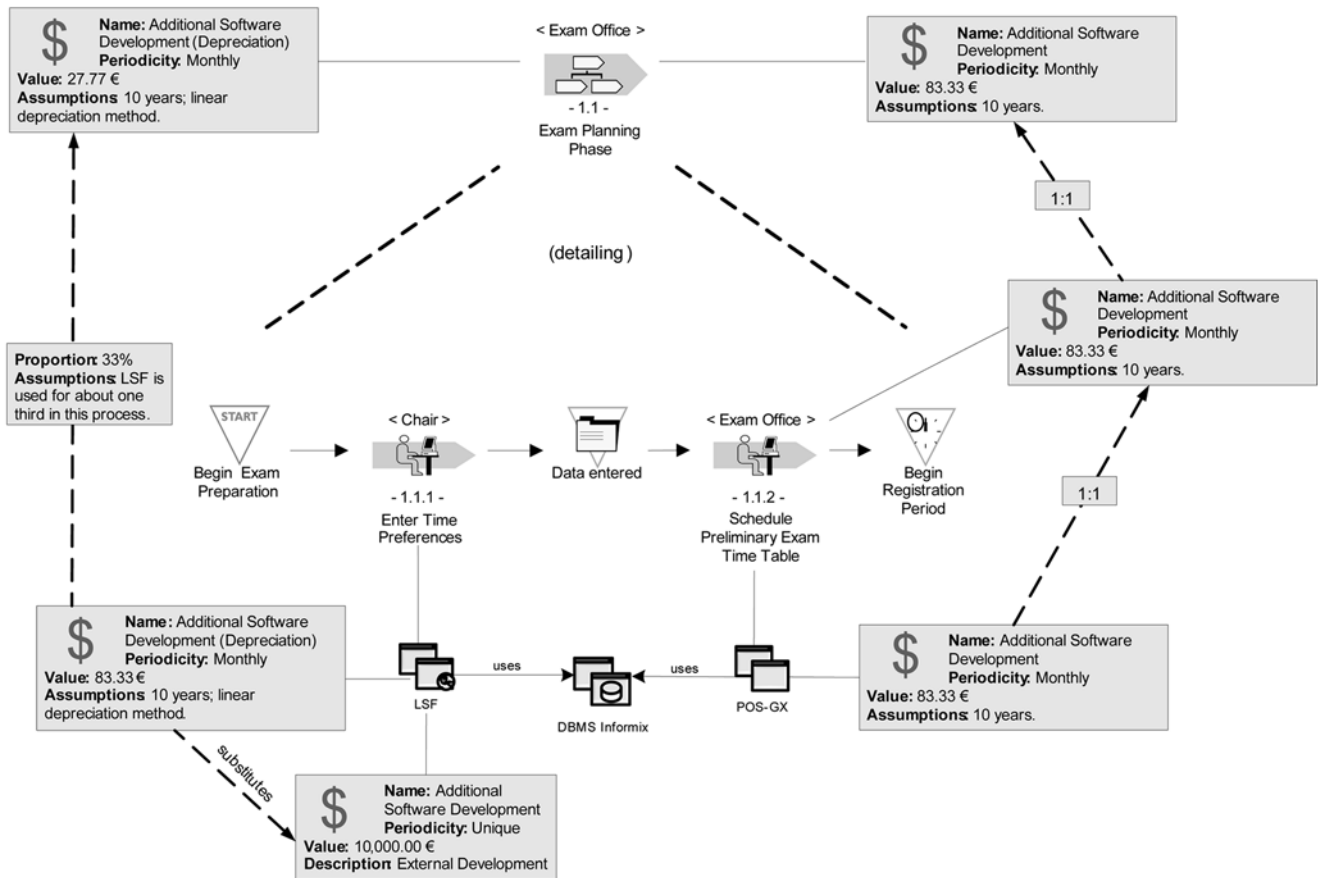
## 4 Analysis of selected integration approaches

The previous fundamental considerations suggest the design of a comprehensive research program focused on a distinctive integration of research approaches from BISE and business administration and an intensified exchange with practice. Even if such a claim seems justified, it is not constructive as long as it remains on an abstract level. The following sections therefore illustrate how this claim can be implemented by means of two examples. The first example focuses on the integration of the concepts associated with ITIL and, thus, on the bridging of research and practice. The second example aims at the integration of an enterprise modeling method with IT controlling concepts and methods.

### 4.1 Integration using the example of a reconstruction of central ITIL concepts

Integrating approaches developed in practice with methods of BISE presupposes a reconstruction of the terms used in practice and their relationships to each other, since the linguistic worlds of practice are often marked by ambiguities, inconsistencies, and vagueness. In this context, the contribution of ITIL is ambivalent. On the one hand, the framework includes a number of powerful concepts, which appear to be well justifiable. ITIL, for example,





**Fig. 2** Modeling concepts for allocating costs to resources and processes (taken from Heise et al. 2008)

tive linguistic worlds as well as covering the contingency of these linguistic worlds. The access to the technical language of practice can simply be restricted by lack of access to relevant sources such as documentation which is only available to customers of respective consulting firms. Moreover, the quality of available documentation may not be sufficient for a purposeful and consistent reconstruction. In many cases, it seems therefore also necessary to gain access to stakeholders in person in order to develop an appropriate reconstruction of terms.

**4.2 Integration using the example of an enterprise modeling method**

The second example is based on work by Heise et al. (2008) co-authored by the first author of this paper. **Fig. 2** illustrates the enrichment of an enterprise modeling method by IT controlling concepts: Integrated models of the IT landscape (shown at the bottom of **Fig. 2**) and business processes (middle and top of the figure) are augmented by IT controlling concepts. In **Fig. 2**, costs of resources as

well as relations between costs and associated reference objects at different levels of analysis are modeled. The integration is carried out by reconstructing selected IT controlling terms (shown here are costs, cost allocation, reference object) by means of the meta-modeling language used for enterprise modeling. In this way, a dedicated language for detailed description of IT resources is created, which is integrated with a business process modeling language.

Besides costs, the approach also reconstructs further IT controlling concepts, such as different valuation approaches, substitution relations between costs (e. g. due to cost depreciation) and cost allocations onto business processes incurring these costs. Thus, it forms the basis for integration with various IT controlling methods (e. g. activity-based costing). The presented approach is beneficial for IT controlling in that, e. g., information systems are not examined in isolation according to the abstractions typical for software development – such as the associated data models – but embedded as part of common abstractions of the enterprise

and its processes by the inclusion of models of processes, roles, objectives, and other aspects. Consequently, such an approach promises to support analyses of the impact of information systems which is enriched by corresponding concepts of IT controlling. The presented conceptual integration is supplemented by a procedural integration in order to achieve a comprehensive methodical integration: a corresponding process model induces the application of language concepts for the implementation of model-based profitability analyses.

The outlined integration promises several advantages:

- Based on the outlined methods integration, business analyses can be designed e. g. as part of cost accounting on the one hand, bearing a granularity of reference objects which can be selected for the specific purpose of analysis (such as an analysis of a highly aggregated process or a detailed process step). On the other hand, a model-driven development of business information systems such as by generating database schemas, which now may also contain IT controlling concepts (such as data on

average costs). In this respect, a mutual enrichment of enterprise modeling and IT controlling methods is achieved.

- Analyses previously omitted due to efficiency concerns become economically justifiable. The complex effect relationships of IT usage can be depicted in a coherent manner, creating a comprehensive information base for analyses. For example, the contributions of individual system components to support business objectives can be identified and potential savings through the reuse of individual system components can be determined.
- Communication between stakeholders with different professional backgrounds is facilitated due to the underlying common language base, which reconstructs the specialized languages of the different perspectives in an appropriate manner. Such enriched enterprise models are a medium for substantiated exchange between stakeholders with a managerial as well as technical background. The consistent retention of economic and technical concepts and methods may improve the mutual understanding of the challenges of each other's perspective and contribute to overcoming cultural barriers.
- The reuse of concepts and methods is promoted, and thus a contribution is made to avoiding redundancy. At the same time, integrity and consistency of the subsequent analyses is promoted. Methodical breaks at the intersection of the life cycle phases are reduced because integrated methods can be used in various application scenarios, such as e. g. for the analysis of investment needs (based on as-is models) and profitability analysis of IT investments (through as should-be models).

Simultaneously, this integration approach implies considerable complexity. Therefore, it is advisable to employ an evolutionary development approach, following the principle of gradual refinement and starting from those analysis scenarios that have been identified to be particularly promising. A fundamental challenge consists in the validation of the approach in practice, which – given the corresponding complexity of an application scenario – likely imply considerable labor costs and financial resources. A contribution to reducing this effort and yet another challenge at the same time pertains to the

development of software tools for modeling and model-based analysis utilizing the shown potential.

## 5 Final comment on a research agenda

This paper is based on the assumption that IT controlling suffers from two integration deficits. On the one hand, this applies to the insufficient synchronization of research with developments in practice; on the other hand, to the lack of integration with the methods of BISE. This assumption is substantiated by an analysis of the historical development of IT controlling. Potentials of an advanced integration are explored and illustrated based on two enterprise modeling examples.

The present study concludes that evidence for – still – unused integration potentials exists and that these potentials can be realized through methodical integration, in the examples given, based on an enterprise modeling method. For this purpose, the presented analysis proposes the implementation of a comprehensive IT controlling research program, focusing on a distinctive integration of research approaches in BISE and business administration as well as on substantial exchange with practice. In this respect, BISE takes on a special role both as a moderator as well as an integrator.

However, a successful research program requires a joint effort of research and practice dealing with IT controlling: Only if IT controllers appreciate such a research program and significantly intensify the exchange with research, a substantiated support of IT controlling practice can be achieved.

For BISE as an application-oriented discipline, such a research program provides an excellent opportunity to intensify its contribution to a methodical support of practical applications of IT controlling and to clearly distinguish itself from practical approaches through a scientific foundation.

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## Abstract

Stefan Strecker, Herbert Kargl

### Integration Deficits of IT Controlling – Historical Background, Analysis of Integration Potentials and Method Integration

The paper is based on the thesis that IT controlling suffers from two integration deficits with regard to its methods base: On the one hand, this is a lack of synchronization between research on IT controlling methods and developments in practice; on the other hand, a lack of integration of IT controlling methods with methods of business and information systems engineering (BISE). Based on this assumption, the paper investigates historical developments in IT controlling research and practice to derive theses about the present state of method integration. The analysis finds indications for further potential for method integration and identifies these potentials. Requirements towards method integration are derived from an analysis of the identified integration potentials and two examples illustrate how to realize further integration.

**Keywords:** IT controlling, IT controlling methods, Method integration



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