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ASSESSING THE INFLUENCE OF MANAGEMENT CONTROL ON IT PERFORMANCE
- AN EMPIRICAL ANALYSIS-

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Abstract

Control and governance of corporate IT departments have become quite critical in organizations due to enormous size of their expenditure. Surprisingly, this topic is rarely discussed in management accounting and IS literature. In this paper, we present a research model that examines the relationship between the design and use of management control systems and their direct or indirect impact on IT performance. Based on data from 58 organizations the model is tested using Partial Least Squares (PLS) analysis. As a result, we identify various types of management control information and controller capabilities that have a significant impact on IT performance.

Keywords: One, Two, Three, Four.

1 INTRODUCTION

New competitive and technological challenges faced by companies have resulted in tremendous IT expenditures and increasing complexity in IT management (Cash and Konsynski 1985; Johnston and Carrico 1988). Effective IT management requires a set of coherent coordination efforts associated with planning, controlling, costing, directing and decision-making concerning the implementation and use of IT resources within a firm (Verner et al. 1996). A number of studies have also found out that the role of IT within a firm significantly influences IT planning and management control systems and the empowerment and role of the IT executive (Bacon 1992; Benbasat et al. 1980; Boynton and Zmud 1987; Boynton et al. 1994; Premkumar and King 1992; Premkumar and King 1994; Ross et al. 1999). Management control in IT organizations changed drastically during the past two decades. The focus of management control shifted from being loose/informal, project and technically based to being more tight/refined and managerially based (Karimi et al. 2001; Kirsch 1996; Kirsch et al. 2002). New concepts of management control with a focus on benefits, cost consciousness, and multidimensional performance measurement were adopted (Martinsons et al. 1999; Ross et al. 1999; Van Grembergen 2002; Van Grembergen and Saull 2001). Several management control practices have been applied during the last years in IT management such as governance mechanisms, performance measurement (e.g. Balanced Scorecard), and chargeback arrangements. But surprisingly, a recent study of the IT Governance Institute (ITGI) that covered 335 CEOs and CIOs in 21 countries, found out that "while more than 91 percent of executives recognize that information technology (IT) is vital to the success of their businesses, more than two-thirds of CEOs are not comfortable answering questions about governance and control over their IT processes." The study validates that the major problem keeps "on being the inadequate view of on how well IT is performing" (ITGI 2004). At the same time, the low priority ranking of this number one problem indicates the lack of hope in overcoming this problem and is therefore a serious mandate for Management Control and IS research.

In this paper, we provide a framework to estimate the perceived value of management control in IT organizations. In order to create a common understanding of relevant terms and concepts, it is first necessary to review related literature. We also explore the direct and indirect relationships between the design of management control systems and information (MCSI), its use in decision-making and the resulting impact on IT performance. Hypotheses are developed based on a comprehensive literature review (see Appendix A) and tested by using data from 58 organizations. Partial Least Squares (PLS) analysis is used to test the causal model. Finally we present some conclusions and further research recommendations. Results indicate full and partial effects of the use of management control information on overall IT performance. This paper contributes to Management Control and IS research streams by analyzing the complex relationships between different types of management control information (MCI), use of MCI, coordination and communication capabilities of IT controllers and their impact on IT performance.

2 MANAGEMENT CONTROL SYSTEMS AND THEIR APPLICABILITY IN IT ORGANIZATIONS

2.1 Clarification of terms and definitions

A number of definitions about "management accounting and control" have been publicized in literature. Horngren (1996) re-emphasized that management accounting's focus should be on decisions and thus on decision-support. He reminds researchers and professionals to start each evaluation by looking at the grand total, especially to "back off and look at it in large" (Horngren et al. 1996). Management

controllers are forced to concentrate on basics, which are decisions and decision-support. For him, the cost-benefit test is an overarching criterion in management accounting theory. Even management accounting systems have to be challenged in terms of benefits (i.e. expected improvements in corporate decision-making) and in terms of costs (i.e. cost of running the systems plus required management time). In general, management control systems have two roles: First, the transmission of information to help reach wise economic decisions (decision-facilitating role) and second, the motivation of users to aim and strive for organizational objectives or goals (decision-influencing role). The literature describes management control systems as mechanisms that provide managerial relevant information to decision-making, ultimately to enhance the performance outcomes. We adopt this view of management control as part of the informational support process in the firm that ensures effective decision-making.

2.2 Difficulties in implementing management control systems for IT activities

See thesis.

3 THE VALUE OF MANAGEMENT CONTROL IN IT ORGANIZATIONS

3.1 Literature review and hypotheses

How does management control influence the efficiency and effectiveness of IT organizations? Based on recent approaches and studies relating to management control and its impact on firm performance we aim to understand and evaluate what type of and how much management control lead to overall performance improvements within an IT organization. Much of the management control literature (broadly defined) proposes new management control systems (e.g. activity-based costing, IT balanced scorecard), recommends various design principles and focuses on contingencies between organizational factors and their impact on management control practices. Typically, it is argued that new management control systems are better than existing systems. What is remarkably absent from the research literature is any systematic analysis of what better means, how better should be measured, and what challenges are encountered in making these measurements. IT executives and board directors have a demand for quantifying the net benefits from implementing management control systems such as chargeback arrangements, performance measurement systems or incentive schemes. In management control theory, it was Feltham (1968) who first mentioned the value of information while providing "payoff relevant" attributes for managerial accounting system (Feltham 1968). He distinguished relevance, timeliness and accuracy as key determinants of information value. Other researchers extended his three criteria by e.g. scope, fineness, flexibility, and costs (Adams 1975; Barua et al. 1989; Bruns and McKinnon 1993; Gordon and Scott-Morton 1971; Marschak and Radner 1972; McKinnon and Bruns 1992; Mendoza and Bescos 2001; Schäffer and Steiner 2004). Management control – or more precisely better management control – can be considered like any other asset that is costly to maintain and provides benefits to decision-making authorities. The challenge is to identify the settings and attributes in which implemented or upgraded management control systems are likely to yield the greatest net benefit. From an economic standpoint, management control systems have little intrinsic value. Management control generates value when it facilitates or influences decision-making processes. Therefore, management control can create value by supporting decision-makers and changing actions, which themselves create value. Our framework includes following management control system attributes: relevance, accuracy, fineliness, broadness and timeliness. These attributes were investigated within a comprehensive study of several journals and text books. Several authors have also considered the impact of skills on the production and use of management control information as a coordination mechanism and their impact on outcome measures, such as managers' satisfaction or perceived orga-

nizational performance (Bruns and McKinnon 1993; Mendoza and Bescos 2001; Wouters and Verdaasdonk 2002). The attributes and their relations to other variables (hypotheses) are described below:

- Relevance was suggested by Feltham (1968) as an important criterion for evaluating managerial information. An ex post viewpoint of information relevance (or signal relevance as defined by Feltham) is that its receipt changes the decision. From an ex ante perspective we assume that the implementation or upgrade of management control systems needs to provide additional or different signals that correlate with occurring events and that some of these differences lead to differences in the decisions made. In general, decision makers will ignore new management control systems unless they estimate improvements in decisions or deliver additional predictive signals (Feltham 1968).

H8: The degree of management control information's relevance affects positively the outcome of decisions-making processes through its effective use.

- Difference measures, such as variance and entropy, have been used to calculate the relationship between the "real" events and measures recorded. Although it is difficult to define it quantitatively or qualitatively, it contains of two components: information systems error and information perception errors(Emmanuel et al. 1990; Merchant and Van der Stede 2003). Errors in monitoring systems (e.g. service level monitoring) can be caused by measurement or by errors in processing and transmitting key performance indicators. These errors cause additional uncertainty about past events, therefore additional uncertainty about future events, and probably lead to poorer decisions. An information perception error arises if the decision maker does not completely understand the performance measures of management control systems. Performance measures, overloaded IT reports or complex business cases for new software projects can be accurate, but without any value for the decision maker. Therefore, it is not the information sent to the decision maker which is important; it is only the meaning a decision maker's (receiver) gains from the information (Mendoza and Bescos 2001). Accountants, IT executives and business area managers must recommend actions or in other terms, must determine the decision rules the decision maker would use if the signals were perceived correctly. Perceptions can be improved significantly by improved presentation of data, additional background information and explanations (such as decision-facilitating comments), switching from technical terms to business terms, and his training.

H7: The degree of management control information's accuracy affects positively the outcome of decisions-making processes through its effective use.

- Fineliness describes the vertical richness (granularity) of managerial information, such as level of details in IT reports (drill down options) and includes performance measures across different hierarchical layers within IT organizations from employee level to firm level.

H6: The degree of management control information's fineliness affects positively the outcome of decisions-making processes through its effective use.

- Timeliness covers reporting intervals and reporting delays that result because information gathering functions are typically separated from information-using functions of organizations. Reporting delay and reporting intervals are affecting the expected payoff in two ways. First, they increase the uncertainty about past events, thereby increasing un-certainty about future events. Second, IT executives or business area managers may hesitate with their decisions until the information has re-

ceived. This can lead to lost opportunities because relevant measures or reports are received too late to adjust any input (Drury 2003).

H4a: The degree of management control information's timeliness affects positively the coordination and communication capabilities of IT controllers. .

H4b: The degree of management control information's timeliness affects positively the outcome of decisions-making processes through its effective use.

- Broadness refers to the horizontal richness of managerial information. It enhances the scope of information flows and reports by shifting the time horizon encapsulated in IT reports from short-term to long-term, by adding non-financial metrics to IT reports (Ittner and Larcker 1998), by comparing the IT performance with internal and external benchmarks, and by cross-divisional information that affect directly IT service delivery (e.g. launch of E-Leasing within an automotive company).

H5a: The degree of management control information's broadness affects positively the coordination and communication capabilities of IT controllers. .

H5b: The degree of management control information's timeliness affects positively the outcome of decisions-making processes through its effective use.

2.3 Core capabilities of IT controllers

As a reaction to the tremendous size of IT expenditure in firms and the progress in academic and professional knowledge in the domain of management control for IT activities, many firms have gone so far to create an entirely new functional role – a chief financial officer or controller of the IT department (Hoffman 2004; Krass 2002; May 2004). More than 20 percent of large businesses have established these hybrid financial-technology executives. Large corporations like Intel, DHL and Allstate Insurance Corp. have already experimented with this new role and confirm the need for a financial expert in IT organization as a colleague of the CIO and with direct reporting lines to the corporate CFO. CFO's of IT are experts who understand IT to a great extent, but at the same time have wide knowledge and experience in core accounting practices. In other words they "feel as comfortable in spotting trends on a corporate balance sheet as analyzing the flow of a computer-networking diagram" (Krass 2002). Despite the fact that most of the companies have trouble in preparing their accounting systems to assimilate IT-related finances into its core accounting practices, it is still acknowledged that an IT controller improves the communication between business and IT staff and increases transparency (Bruns and McKinnon 1993). Therefore, we assume that

H3: The level of skills and qualification of IT controllers have a positive impact on their coordination and communication capabilities.

2.4 The impact of management control systems and IT controllers on corporate IT performance

The effective application of management control systems accompanied by IT controllers is critical for achieving higher organizational performance in IT departments. Management control information assists in the coordination within the IT unit or between business and IT units within an organization

(Brown 1999; Brown and Magill 1994). Previous empirical literature on the relationship between management control and performance was investigated. Theoretically, we argue that the availability of useful management control systems and related information enhances directly managerial performance and affects indirectly corporate IT performance in organizations. Thus, we assume

H1: The effective design and use of management control systems and related information have a positive impact on corporate IT performance.

We also conclude that IT controller play an important role in coordinating intra and inter-unit activities and providing valuable informal feedback to IT and business executives with regard to financial aspects of IT service delivery.

H2: The degree of IT controller's coordination and communication capabilities has a positive impact on corporate IT performance.

We recognize that management control information flows through a series of stages from its production in management control systems through its use and to its impact or influence on IT performance. Thus, we examine the relationship between these constructs in our research framework in the next section and test its validity with empirical data based on a PLS approach.

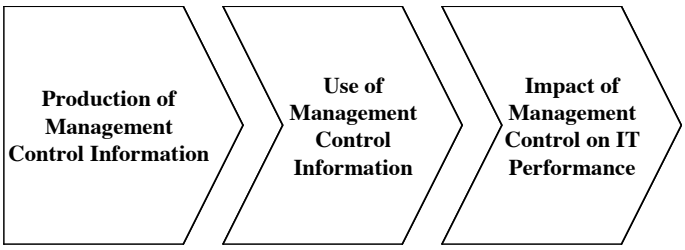

Figure 1 Research framework

3.2 Research method

3.2.1 Sample selection and data collection

To test our hypotheses, a survey was conducted in Germany. A questionnaire was sent via dedicated mails to different work groups in Germany. The questionnaire was pre-tested with three professionals of different companies and additionally reviewed by research colleagues from another university (TU Munich). Minor changes were incorporated in order to increase the understandability of questions and to improve the overall response rate. The participating organizations were:

- *ISACA Germany* – an international association of IT auditors and executives
- *Internationaler Controller Verein* – an association of accountants located in German-speaking countries.
- *GI FG 5.7 IT-Controlling* – a practitioner's-working group of practicing IT controllers in Germany.
- *Bitkom* – a professional IT association with members from science and practice of Germany.

- *TÜV Rheinland IT Management Work Groups* – members of a German Technical Supervisory Association with primary focus on IT management issues.

Due to the duty of our contact persons to protect the privacy of their members, we could only distribute the questionnaire via them acting as "door openers" for us. Although the response rate was relatively low (58 respondents), our descriptive statistics show that we have a balanced distribution of responds over following functional categories: 17% business managers, 17% IT managers, 17% auditors, 20% accountants and 27% other IT experts (e.g. consultants or business analysts). It should be also noted that our respondents answered to all relevant questions accurately.

3.2.2 Variables and measures

Variables were measured by asking respondents to indicate on a 5-point Likert scale (1= strongly diagree to 5 = strongly agree) the extent to which each indicator are representative to their organizational context. For instance, IT performance was measured in terms of quality, efficiency, flexibility, customer orientation and business value contribution.

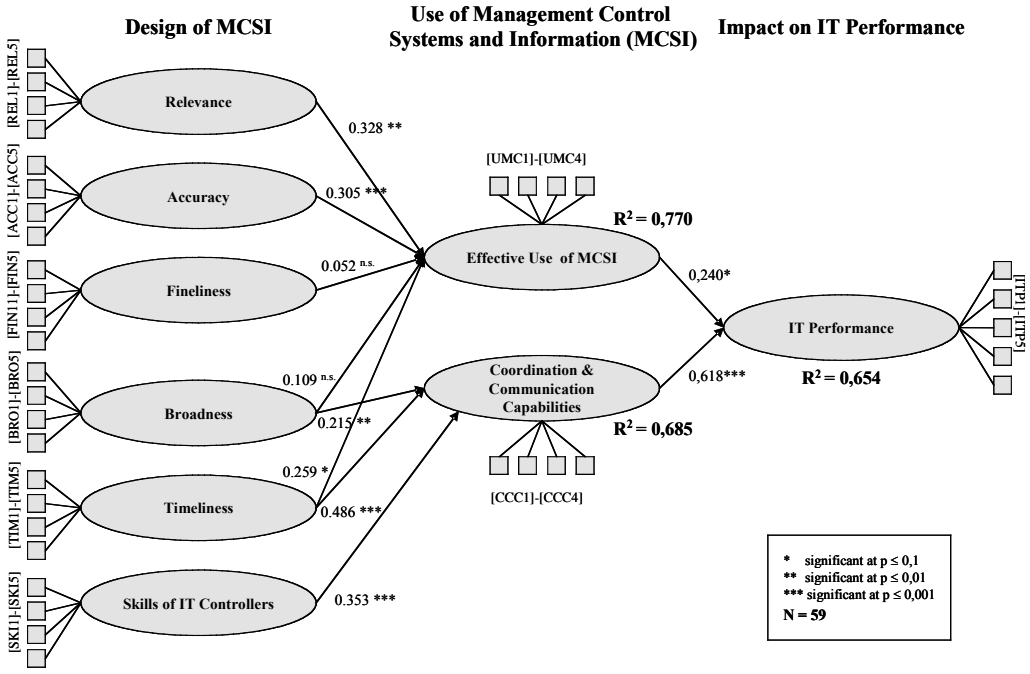

Figure 2 Structural Equation Model using PLS

3.2.3 Data analysis and results

Our research model was tested using Partial Least Squares (PLS), a statistical method which allows simultaneous assessment of the structural (theoretical) model along with the measurement model. While covariance-based structural equation methods, such as LISREL, are only applicable under specific conditions; PLS is more suited to this study by offering a component-based strategy to the measurement of multiple dependent constructs and to the estimation of predictive structural coefficients in a model (Chin and Newsted 1999; Chin 1998; Chin 1998; Chin and Todd 1995).

The measurement model specifies the relations between observed items and latent variables. The structural model assesses the relations between latent constructs. PLS models are investigated in two stages. First, the strength of the measurement model was tested by examining the convergent and

discriminant validity of constructs. The sequence ensures that the selected construct measures are valid and reliable before attempting to draw conclusions regarding the relationships among constructs (Barclay et al. 1995) . Convergent validity is evaluated in our model by examining the individual reliability of each indicator (manifest variable), the composite reliability (ρ_c) of constructs, and the average variance extracted (AVE) by each construct (Fornell and Larcker 1981). Individual item reliability is considered as adequate when an item has factor loading that is greater than 0.707 on its respective construct (Carmines and Zeller 1979). According to Fornell and Larcker (1981) the composite reliability should be above 0.8 and the average variance extracted (AVE) for all latent variables should be also greater than 0.5 to ensure a good fit between constructs and underlying items. Table 1 shows the individual item loadings for each construct. All items have a loading above 0.700 and therefore provide explanatory power for the research model. It also includes the composite reliability measure of Fornell and Larcker. As shown in Table 1, the composite reliability score for each variable is above 0.80, which indicate acceptable reliability. Convergent validity is assessed by AVE statistics. The AVE for each variable is 0.50 and above which demonstrates adequate convergent validity (Chin 1998; Hair 1998). Overall, the results from the PLS measurement model indicate that each variable exhibits satisfactory reliability and validity.

Construct	**Indicator**	**Loading**	**Composite reliability (ρ_c)**	**Average variance extracted (AVE)**
Relevance	REL1 REL2 REL3 REL4 REL5	0.830 0.846 0.820 0.830 0.809	0.916	0.684
Accuracy	ACC1 ACC2 ACC3 ACC4 ACC5	0.858 0.846 0.918 0.808 0.848	0.932	0.734
Fineliness	FIN1 FIN2 FIN3 FIN4 FIN5	0.892 0.871 0.757 0.798 0.815	0.916	0.687
Broadness	BRO1 BRO2 BRO3	0.916 0.864 0.858	0.911	0.774
Timeliness	TIM1 TIM2 TIM3 TIM4 TIM5	0.853 0.896 0.859 0.862 0.855	0.937	0.749
Skills of IT Controllers	SKI1 SKI2 SKI3	0.723 0.901 0.775	0.844	0.613
Effective Use of MCSI	UMC1 UMC2 UMC3 UMC4 UMC5	0.844 0.875 0.814 0.854 0.809	0.932	0.694
Coordination and Communication Capabilities	CCC1 CCC2 CCC3	0.778 0.700 0.811	0.852	0.590

Construct	Indicator	Loading	Composite reliability (ρ_c)	Average variance extracted (AVE)
	CCC4	0.777		
IT Performance	ITP1	0.8253	0.888	0.613
	ITP2	0.7858		
	ITP3	0.7794		
	ITP4	0.7840		
	ITP5	0.7368		

Table 1 Measurement model results

To test the hypotheses, the structural model needs to be estimated. The main objective of PLS is to maximize variance explained rather than fit, therefore prediction-orientated measures, such as R^2, are used to evaluate PLS models (Chin 1998). We also estimated the strength of our hypotheses (path coefficients) and evaluated the statistical significance of each path coefficient by applying bootstrapping (100 samples with replacement). Finally, we examined Q^2 values which determine the predictive relevance of structural model. Consistent with Chin (1988), R^2 should be above 65% to provide a substantial prediction effect. Chin also stated that Q^2 needs to be positive for all predicted variables (Chin 1998). Consistent with expectations, Table 2 shows significant positive correlation between various design elements concerning management control and its impact on the effective use in decision-making or on controller's capabilities to coordinate activities within the IT organization. The R^2 for each endogenous variable and related path coefficients are shown in Table 2. The results reported in Table 2 indicate how the effective use of management control information and the coordination capabilities of IT controllers influence the perceived corporate IT performance.

Hypothesis	Path coefficient (β)	t-statistic (bootstrap)	Variance explained	Q^2
Effects on IT performance	□	□	65.4%	□
H1: Effective Use of MCSI	0.240*	1.9925	□	0.694
H2: Communication and Coordination Capabilities	0.618***	5.334	□	0.590
Effects on communication and coordination capabilities	□	□	68.5%	□
H3: Skills	0.353***	3.4249	□	0.646
H4a: Timeliness	0.486***	5.0656	□	0.749
H5a: Broadness	0.215**	2.8373	□	0.774
Effects on effective use of MCSI	□	□	77.0%	□
H4b: Timeliness	0.259*	2.4146	□	0.749
H5b: Broadness	0.109$^{n.s.}$	1.5081.	□	0.774
H6: Fineliness	0.052$^{n.s.}$	0.4674	□	0.686
H7: Accuracy	0.305***	3.4096	□	0.734
H8 Relevance	0.328**	3.0595	□	0.684

Table 2 Structural model results

4 CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

Uncertainties related to the real economic value of management control systems still exist. At a broad level, our results add to the extant literature on the effective design and use of management control systems; more specifically the results add to our understanding of the relationship between various management control system attributes and their direct impact on managerial performance and indirect impact on corporate IT performance. The study also provides valuable insights that IT controller's skills and their role as coordinators are mission critical for achieving higher performance results of the corporate IT function. Unfortunately, accounting or IS literature does not have agreed standards regarding how to evaluate whether certain management control systems are better than existing systems. Few firms currently challenge their managers to quantify the expected benefits from updating their IT-related management control systems and processes. Justifying the expected benefits of such monitoring and coordinating systems require analysis and quantification of what improved transparency, increased business/IT-alignment and therefore better decision-making means. We believe that IS researchers can add much value in the development of methods that quantify the benefits of new control or governance mechanisms. Consulting firms sometimes conduct such analyses when estimating the cost savings or revenue enhancements associated with their proposals for new work with clients. However, we are unaware of any research that examines the reliability of the methods that consultants (or IT executives) use to make their projected governance benefits computations. "Show me the evidence" is a challenge IS researchers in these areas should acknowledge.

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