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EXAMINING KNOWLEDGE-BASED INFORMATION TECHNOLOGY MANAGEMENT COMPETENCIES OF BUSINESS EXECUTIVES

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Abstract

This paper examines IT management competencies of business executives, and analyzes how IT management competencies of business executives impact IT governance capabilities. A (knowledge-based) model interrelating explicit and tacit IT management competencies of business executives with IT governance capabilities is developed. Following a multi-method research design, preliminary results indicate that IT management competence is a multidimensional construct, in which explicit and tacit knowledge regarding IT and IT management are essential for building IT governance capabilities.

Keywords: IT management competence, IT governance capability, resource-based theory

Introduction

The involvement of IT competent business executives in the governance of IT is a fundamental and enduring theme in the field of Information Systems. Almost a decade ago, Rockart et al. (1996) concluded that unless IT is included in business management's strategy and mental models, the best IT organizations would not succeed. As innovative interorganizational enterprise systems, collaborative e-markets, and wireless networks continue to shape business models and organizational lifestyles, IT management competence of business executives has become a *sine qua non* for realizing IT value (Boynton et al. 1994; Mata et al. 1995; Peterson et al. 2000; Rockart et al. 1996; Ross et al. 1996; Sambamurthy and Zmud 1997, 1999).

Whereas previous studies address *organizational IT* competencies and core *IT organizational* capabilities (Bharadwaj 2000; Feeny and Willcocks 1998; Sambamurthy and Zmud 1997), with the exception of a few studies (e.g., Bassellier et al. 2001), there is a void in empirical research on the essential *knowledge*-based *IT management* competencies of *business* executives. Consequently, we have a partial and limited understanding of (contemporary) IT management competencies of business executives, and we are ill prepared for shaping appropriate insights on the requisite IT management competencies of business executives.

The present study aims at contributing to theory development in the field of IT management competencies of business executives. The research objectives are to (1) identify and validate the key dimensions of knowledge-based IT management competencies of business executives and (2) develop a (knowledge-based) model of IT management competencies and IT governance capabilities. The main research questions can be summarized as: *What is the requisite set of knowledge-based IT management competencies of business executives, and how do knowledge-based IT management competencies of business executives impact IT governance capabilities?*

Theoretical Background

In general, competence refers to a set of knowledge, skills, personality traits, and attitudes, integrated with (work) experience, that are deemed essential for effective performance. IT management competence of business executives is defined as *the set of IT management-related knowledge and experiences that a business executive possesses and develops over time, which enables him/her to exhibit effective behavior in the governance of IT* (Bassellier et al. 2001; Sambamurthy and Zmud 1997).

This knowledge-based approach of IT management competence emphasizes managerial IT competence, and excludes skills and/or personality traits, as the former assumes specific predefined tasks, while the latter focuses on general, non-task-related personal attributes, both of which are too static and generic to capture the dynamic nature and specificity of IT management competence (Bassellier et al. 2001). Focusing on knowledge and experiences emphasizes the explicit and tacit nature of IT management competencies, i.e., the formal, codified knowledge and embedded personal experiences and frames of reference (Nonaka 1994; Polanyi 1967; Senge 1990).

Based on an extensive review of the literature and expert consultations, Bassellier et al. (2001) develop a basic model of a business manager's IT competence (Table 1). Other authors have also discussed the importance of IT management competencies in IS curricula.

Table 1. Theoretical Model of Knowledge-Based IT Management Competencies

Explicit IT Knowledge	Elements	*Bassellier et al. (2001)*	*Ives et al. (2002)*	*Gorgone et al. (2001)*	*Gant (2001)*	*Reich (2000)*
Technology	Current Technology Portfolio	✓	✓	✓	✓	✓
	New Technologies	✓	✓	✓	✓	✓
	Competitor's IT use	✓	✓		✓	✓
Applications	Current Application Portfolio	✓	✓	✓		✓
	New Applications	✓	✓			✓
	Emerging Business Models		✓	✓	✓	✓
System Development	Development Methodologies	✓	✓	✓	✓	✓
	Project Management	✓	✓	✓		✓
	Change Management		✓	✓	✓	✓
Management of IT	IT Strategy, Policy and Planning	✓	✓	✓	✓	✓
	IT Resource Allocation	✓	✓			✓
	IT Relationship Management		✓	✓	✓	✓
Access to IT Knowledge	IT Knowledge Networking	✓				
	Secondary IT Knowledge Sources	✓				
Implicit IT Knowledge						
Experience	Personal IT Use	✓				✓
	IT Project Experience	✓				
	IT Management Experience	✓				✓
Frames of Reference	Business Activities	✓	✓		✓	✓
	IT Role	✓	✓		✓	✓

The general premise of this study is that knowledge-based IT management competence of business executives is positively associated with IT governance capability. This premise is based on resource-based and knowledge-based theories (Barney 1991; Grant 1996). The knowledge- or resource-based model distinguishes resources from capabilities, where (knowledge) resources represent organizational-specific (knowledge) stocks and processes, or competencies, and capabilities reflect the ability to combine and integrate (knowledge) resources and individual competencies (Grant 1996). In recent years, studies have successfully applied this resource-based logic, i.e., the interlinking of resources/competencies, capabilities, and performance, producing significant results (e.g., Bharadwaj 2000; Bharadwaj et al. 1999; Ravichandran and Lertwongsatien 2002; Ross et al. 1996). However, whereas these studies describe the importance of IS human capital, IS infrastructure, and IS relationships, *knowledge*-based *IT management* competencies of *business* executives have not been empirically analyzed.

This study builds on the resource-based model and previous studies applying the resource-based logic, yet focuses specifically on knowledge-based IT management competencies as a strategic resource, and their impact on IT governance capability. Boynton et al. (1994) find that managerial IT knowledge explains high levels of IT use. Reich and Benbasat (2000) conclude that shared domain knowledge influences strategic IT alignment. Brown and Magill (1994) and Sambamurthy and Zmud (1999) indicate that line-manager IT knowledge affects IT governance. Although limited, these studies suggest that IT management competence of business executives has an impact on *IT governance capability*, i.e., *the (cross-functional) managerial ability to direct and coordinate the multifaceted activities associated with the planning, organization and control of IT* (Sambamurthy and Zmud 1997). Bassellier et al. (2001) hypothesize that IT competence will lead to proactive behaviors by business managers and will result in strong relationships with IT managers. Hence, we hypothesize that *IT management competence of business executives has a significant and positive effect on IT governance capability.*

Research Design and Methodology

Due to the complex, contextual, and contemporary nature of IT management competencies of business executives, and the lack of a cumulative research base on the processes involved in IT governance capability building, a phased multi-method was deemed appropriate (Gable 1994; Yin 1994). To capture the richness of a complex construct in a robust manner, methodological triangulation is appropriate (Kaplan 1996). The positivistic research design consists of three interdependent phases, in which qualitative and quantitative research methodologies are employed to address reliability and validity of the intermediate and final results.

IT governance capability was operationalized following suggestions by Bassellier et al. (2001), Bharadwaj et al. (1999), Rockart et al. (1996), and Sambamurthy and Zmud (1997) (Table 2).

Table 2. Operationalization of IT Governance Capability

Construct	Items
IT Governance Capability	Line management sponsorship of IT initiatives
	Climate nurturing IT project championship
	Climate encouraging risk-taking and experimentation with IT
	Effective relationship between line management and IT management
	Multi-disciplinary teams to blend business and technology teams
	Clarity of vision regarding how IT contributes to business value
	Integration of business strategy and IT strategy
	Management's ability to understand the value of IT investments

IT management competence was operationalized following the basic model of IT competencies (Bassellier et al. 2001). A pilot study was conducted to assess *construct validity*. The pilot study was conducted through a survey questionnaire among 150 international MBA graduates, and requested their self-perception of IT management competencies. The average age of managers was 36.7 with an average working experience of 8.4 years in executive/line functions (70%) and support functions (30%), across manufacturing (46%) and service industries (54%).

Principal component analysis with varimax rotation and factor analysis were conducted. The results provide validation of the IT management competence construct (Table 3).

Table 3. Construct Dimensionality, Validity, and Reliability

	F1	F2	F3	F4	α	Statistics
System Development Methodologies	.94				.82	Unconstrained, multidimensional
Business Application Portfolio	.76					
New Technologies	.71					
Technology Portfolio	.67					$\chi^2 = 236.04$; df = 91,
IT Project Management	.66					$p = .000$
New Business Applications	.61					
IT Resource Allocation		.99			.85	Total explained
IT Relationship Management		.79				variance > 90% (91.42)
IT Change Management		.79				KMO >.80 (.86)
IT Strategy and Planning		.77				
Business View			.99		.82	
IT View			.86			
Management-of-IT Experience			.66			
Competitor's IT Use				.74	.75	
Emerging Business Models				.69		

All items have single and significant (p < .001) loadings on the corresponding factors (cut-off > .40), indicating evidence of good *convergent validity* (average loading = .77; average t-value = 7.4). Comparison of a unidimensional model ($\chi^2 = 2462.17$) with a multidimensional model ($\chi^2 = 236.04$) indicates that a multidimensional model comprising of four correlated first-order factors is superior to a unidimensional model. Further, an unconstrained model ($\chi^2 = 236.04$) provided a better fit over a constrained, perfectly correlated model ($\chi^2 = 272.15$), demonstrating the distinctiveness of theoretical constructs captured by the first-order factors, and thereby providing support for *discriminant validity*. The reliability scores range from .75 to .85, providing support for *construct reliability*.

Following the pilot study, multiple case studies were conducted to assess *analytical validity*. Analytical validity or logical inference is the process by which the researcher draws conclusions about the essential linkage between two or more characteristics in terms of some systematic explanatory scheme, i.e., a theory or a set of theoretical propositions (Yin 1994). Consistent with previous studies, a multiple embedded case study approach was chosen, i.e., the main unit of analysis is the business unit/division within the firm. In total, four large complex insurance companies were selected, and within each company, three strategic business units were selected.

Data collection was conducted through on-site interviews with business and IT executives. In total, 44 interviews were conducted (20 with business executives, 24 with IT executives). Interviews were tape-recorded and transcribed, and interview data was complemented by the collection and analysis of company documents, including, business strategy and IT organization/ management plans, IT decision-making procedures, and internal executive memos. A semi-structured interview protocol was used in all interviews. Participants were assured that their company and responses would remain anonymous. Based on the data, detailed case descriptions were written up and validation was sought from the different interviewees. Data analysis consisted of within-case and cross-case analysis through coding, clustering, data-triangulation, and pattern-matching techniques, and was

designed to meet internal validity requirements (Yin 1994). In the final stage of the research, a survey among 500 full-time executives was conducted to examine the relationship between IT management competence of business executives and IT governance capability.

Preliminary Results

Analyses confirm that IT management competence is a *multidimensional* construct consisting of both explicit and tacit IT management knowledge. However, both the pilot study and the case studies indicate that IT management competence consists of four dimensions—not seven as originally hypothesized in the theoretical model— involving (1) explicit knowledge regarding IT infrastructure and business applications, (2) explicit knowledge regarding industry IT use, including new business models, and (3) explicit and (4) tacit knowledge regarding the management of IT.

Access to IT knowledge is not regarded as a key IT management competence of business executives, and technology, applications, and systems are regarded as a single *technology* IT management competence for business executives. As for access to IT knowledge, the case studies indicate that this is not a problem, nor is it regarded as highly relevant due to the wide accessibility of information through different sources, including specifically the Internet (note: the insurance industry is an information-intensive sector). One business executive commented that, today, searching and finding information and knowledgeable sources about any aspect of IT is relatively simple: *"With easy access to the Internet, I can find most of the information I need. And if I can't find it, I always know someone who can."*

Regarding explicit IT knowledge, the results yield two distinct dimensions: *technology* and *managerial* IT management competencies. Technology IT management competencies consist of knowledge concerning *internal* and *external industry* applications of IT. These dimensions capture the inner and outer context of IT, and are consistent with previous studies that argue that business managers should be knowledgeable about the organization's IT portfolio and the industry-wide use of (emerging) IT applications (Bassellier et al, 2001). Furthermore, in several interviews, business and IT managers indicated that it was not only important to know what the current IT applications of the business were, but also how competitors, suppliers, and customers were using IT, and what type of new IT applications were emerging in the market. Managers also indicated that one of the biggest challenges was keeping abreast of the latest technologies, and relating these to their current IT portfolio.

As for managerial IT competencies, two distinct dimensions emerged from the analysis: *explicit* knowledge regarding strategic IT planning, IT relationship, and IT change management, and *tacit* knowledge regarding the transformational role of IT and a process view of the business, and IT management experience. These findings are consistent with previous studies, which argue that explicit and tacit IT knowledge need to be intertwined to create IT management competence (Bassellier et al. 2001; Nonaka 1994; Polanyi 1967; Sambamurthy and Zmud 1997; Senge 1990). As one executive stated during an interview, *"It is not enough to have knowledge about the latest techniques for planning IT….It is essential that business executives have personal experience with managing IT at a strategic level, which is meshed with an innovative IT vision for building relationships beyond the business' boundaries."* The case studies suggest that business executives not only require a process view of the business, but moreover a *relational view*.

Consistent with previous studies and common understanding, the results indicate that explicit knowledge regarding IT strategy, planning, policy, and resource allocation is a key IT management competence. However, contrary to the basic model of IT competencies proposed by Bassellier et al. (2001), IT relationship and change management are also considered key IT management competencies. The case studies suggest that *managerial* IT competencies are multifaceted, i.e., they are task, relationship, and change oriented. These findings are consistent with theories on strategic and situational leadership (Yukl, 1994).

In sum, the results suggest a four-dimensional model of knowledge-based IT management competencies consisting of knowledge regarding external and internal IT and explicit and implicit knowledge of IT management.

Conclusion

Acknowledging its many limitations, this study represents a step toward better understanding of IT management competencies of business executives, and their relationship with IT governance capabilities. This research holds important implications for future research, theory development, and practitioners. It provides a model that can be tested and/or extended, it contributes to

the developing body of knowledge on IT management competencies of business executives, and it may serve as an assessment and/or course-development model. The final results and implications will be presented at the conference.

References

Barney, J. "Firm Resources and Sustained Competitive Advantage," *Journal of Management* (17), 1991, pp. 99-120.

Bassellier, G., Reich, B. H., and Benbasat, I. "Information Technology Competence of Business Managers: A Definition and Research Model," *Journal of Management Information Systems* (17:4), 2000, pp. 159-182

Bharadwaj, A. "A Resource-Based Perspective on IT Capability and Firm Performance: An Empirical Investigation," *MIS Quarterly* (24:1), March 2000, pp. 169-197.

Bharadwaj, A. S., Sambamurthy, V., and Zmud, R. W. "IT Capabilities: Theoretical Perspectives and Empirical Operationalization," in *Proceedings of the Twentieth International Conference on Information Systems*, P. De and J. I. DeGross (eds.), Charlotte, NC, 1999, pp. 378-385.

Boynton, A. C., Zmud, R. W. and Jacobs, G. C. "The Influence of IT Management Practice on IT Use in Large Organizations," *MIS Quarterly* (18:3), 1994, pp. 299-318.

Brown, C. V., and Magill, S. L. "Alignment of the IS Functions with the Enterprise: Toward a Model of Antecedents," *MIS Quarterly* (18:4), 1994, pp. 371-403.

Feeny, D. F., and Willcocks, L. "Core IS Capabilities for Exploiting Information Technology," *Sloan Management Review* (39:3), 1998, pp. 9-21.

Gable, G. "Integrating Case Study and Survey Rresearch Methods: An Example in Information Systems," *European Journal of Information Systems* (3:2), 1994, pp. 112-126.

Gant, D. B. "Taking the Technology Out: Using a Strategic E-Commerce Focus in the CIS Classroom," *Communications of the AIS* (7:12), 2001 (available online at **http://cais.isworld.org/contents.asp**).

Gorgone, J. T., Gray, P., Feinstein, D. L., Kasper, G. M., Luftman, J. N., Stohr, E. A., Valacich, J. S., and Wigand, R. T. "Model Curriculum and Guidelines for Graduate Degree Programs in Information Systems," *Communications of the AIS* (3:1), 2000 (available online at **http://cais.isworld.org/contents.asp**).

Grant, R. M. "Prospering in Dynamically Competitive Environments: Organizational Capabilities as Knowledge Integration," *Organization Science* (7), 1996, pp. 375-387.

Ives, B., Valacich, J., Watson, R. T., Zmud, R., Alavi, M., Baskerville, R., Baroudi, J. J., Beath, C., Clark, T., Clemons, E. K., Davis, G. B., Davis, F., Dennis, A. R., El Sawy, O. A., Fedorowicz, J., Galliers, R. D., George, J., Ginzberg, M., Gray, P., Hirschheim, R., Jarvenpaa, S., Jessup, L., Kemerer, C. F., King, J. L., Konsynski, B., Kraemer, K., Luftman, J. N., March, S. T., Markus, M. L., Mason, R. O., McFarlan, F. W., McLean, E. R., Olfman, L., Olson, M. H., Rockart, J., Sambamurthy, V., Todd, P., Vitale, M., Weber, R., and Whinston, A. B. "What Every Bbusiness Student Needs to Know About Information Systems," *Communications of the AIS* (9:30), 2002 (available online at **http://cais.isworld.org/contents.asp**).

Kaplan, B. "Addressing Organizational Issues in the Evaluation of Medical Information Systems," *Journal of the American Medical Informatics Association* (4:2), 1996, pp. 94-101.

Mata, F. J., Fuerst, W. L., and Barney, J. B. "Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis," *MIS Quarterly* (19:4), 1995, pp. 487-505.

Nonaka, I. "A Dynamic Theory of Organizational Knowledge Creation," *Organization Science* (5:1), 1994, pp. 14-37.

Peterson, R. R., O'Callaghan, R., and Ribbers, P. M. A. "Information Technology Governance by Design," in *Proceedings of the Twenty-First International Conference on Information Systems*, W. J. Orlikowski, S. Ang, P. Weill, H. C. Krcmar, and J. I. DeGross (eds.), Brisbane, Australia, 2000, pp. 435-452.

Polanyi, M. *Tacit Dimension*. Routledge & Keegan Paul, London, 1967.

Ravichandran, T., and Lertwongsatien, C. "Impact of Information Systems Resources and Capabilities on Firm Performance: A Resource-Based Perspective, in *Proceedings of the Twenty-Third International Conference on Information Systems*, L. Applegate, R. Galliers, and J. I. DeGross (eds.), Barcelona, Spain, 2002, pp. 577-582.

Reich, B. H. "Designing the IT Course with an Executive MBA Program," *Communications of the AIS* (3:15), 2000 (available online at **http://cais.isworld.org/contents.asp**).

Reich, B. H., and Benbasat, I. "Factors that Influence the Social Dimension of Alignment between Business and Information Technology Objectives," *MIS Quarterly* (24:1), 2000, pp. 81-113.

Rockart, J. F., Earl, M. J., and Ross, J. W. "Eight Imperatives for the New IT Organization," *Sloan Management Review* (38:1), 1996, pp. 43-55.

Ross, J. W., Beath, C. M., and Goodhue, D. L. "Develop Long-Term Competitiveness through IT Assets," *Sloan Management Review* (38:1), 1996, pp. 31-42.

Sambamurthy, V., and Zmud, R. W. "Arrangements for Information Technology Governance: A Theory of Multiple Contingencies," *MIS Quarterly* (23:2), 1999, pp. 261-290.

Sambamurthy, V., and Zmud, R. W. "At the Heart of Success: Organizationwide Management Competencies," in *Steps to the Future: Fresh Thinking on the Management of IT-Based Organizational Transformation*, C. Sauer, P. W. Yetton, and Associates (eds.), Jossey-Bass Publishers, San Francisco, 1997, pp. 143-163.

Senge, P. M. *The Fifth Discipline*, Doubleday, New York, 1990.

Yin, R. K. *Case Study Research, Design, and Methods*, Sage Publications, London, 1994.

Yukl, G. *Leadership in Organizations* (3rd ed.), Prentice-Hall, Englewood Cliffs, NJ, 1994.