

An Exploratory Study on the Development and Application of Integrated Information Technology Management Model

Emre Beşli

Büyükdere Cad, Beytem Plaza, No. 22K.9, 34381 Istanbul, Turkey
emre.besli@tr.ey.com

M. Atilla Öner

26 August Campus, IIBF Rm#648, 34755 Ataşehir, Istanbul, Turkey
maoner@yeditepe.edu.tr

Received 25 February 2012

Accepted 27 April 2013

Published 9 April 2014

The purpose of this study is to explore how Turkish companies are implementing information technology (IT) governance to achieve desirable behavior in the use of IT. A literature-based integrated IT management model (IITMM) is developed. Research objectives further include a high-level assessment of organizations' perceived level of IT governance capabilities by applying the proposed IITMM.

The IITMM discusses the IT governance literature in three management levels (i.e. normative, strategic and operational) and in three management dimensions (i.e. goals, structures and behaviors). The model was applied to five companies from Turkish automotive supply industry. Based on the IITMM, a questionnaire was developed to provide a structured interview pattern for face-to-face interviews. An interview with a business or IT executive was conducted in each company.

Results of the study revealed that except *strategic goals* and *operational goals*, different IT governance capability patterns exist for each company. Although the *strategic goals* and *operational goals* of IT governance are well understood by all participating companies, there is a room for improvement in *structures* and *behaviors* dimensions, especially in *normative behaviors* and *strategic behaviors*, as well as in *strategic structures* and *operational structures*. In addition, specific IT governance constructs are identified as drivers or inhibitors of effective IT governance implementation. Finally, some IT governance mechanisms, such as IT control framework, independent assurance, IT project management, committees and councils, IT principles and end-user involvement in determining IT strategies, were perceived as not effectively implemented. In summary, the results indicate that the IITMM provides a useful framework for determining the current IT governance capabilities of companies considering model's ability to recognize different levels of capabilities and to identify general and specific improvement opportunities.

Keywords: Information technology governance; information technology management; integrated management; internal control; information technology audit.

1. Introduction

One model of sustainable international competitive advantage identifies technological capability, managerial capability and resource exploiting capability as three interdependent innovation capability dimensions [Ma and Liao (2006)]. Information is considered as a critical resource that directly affects the ability of an organization to compete and survive in a rapidly changing business environment. Information is defined as a new production factor added to the traditional factors of production — capital, labor, energy and materials [Seger and Stoddard (1993)]. Access of management to timely information and accelerating the information flow are considered critical for accomplishing business objectives [Blanks (1991)]. Management requires information in order to make informed judgments [Drucker (1995)]. Furthermore, the speed at which decisions are expected to be made has accelerated since 1990's [Loughman *et al.* (2000)].

In the 1990's, information technology (IT) has evolved from its traditional administrative support function toward a more strategic role within the organization [Henderson and Venkatraman (1993)]. Besides replacing manual working methods, IT has also enabled new services that were not previously available [Brooking (1996)]. IT also provides the tools that enable organizations to manage information [Nolan and Seger (1993)] and hence contributes to management's decision-making process. In order to make effective and efficient decisions, management must be able to rely on the information provided by IT processes [Luftman *et al.* (1993); Saka (2001)].

The increased dependence on IT has created its own risks and emphasized the need of effectively managing and controlling IT within an organization. It is widely accepted that delivering business value from IT is one of the key concerns of business executives [Soh and Markus (1995); Luftman *et al.* (1999); McKay and Marshall (2004)]. Issues such as integrating business processes with complex IT processes, building IT skills within the organization, acquisition and development of applications, controlling IT related costs, and complying with regulations and standards are considered as mission-critical tasks of today's organizations. Moreover, systems theory has made clear that changes made in one part of a system create changes in other system areas [Loughman *et al.* (2000)]. This substantially increases the risk exposure of IT considering the increased organizational use of Internet, extranets and intranets for routine business transactions.

Besides increasing dependence on IT, another driver has also changed the business environment significantly, this time from a regulation and governance perspective. Corporate scandals, such as Enron, WorldCom and Tyco, have led to a restructuring in the accounting and auditing profession and increased the interest in corporate governance. In 2002, the US Sarbanes–Oxley Act was issued to re-establish the investor confidence. The regulation emphasizes the concept of corporate governance and requires organizations to prepare an internal control report that states management's responsibilities for establishing and maintaining adequate internal controls over the financial reporting process. 2008 World Financial Crisis has been

attributed to malpractices in the derivatives markets facilitated by IT systems [Betz and Khalil (2011)].

Similar governance and audit requirements have been also established by regulatory bodies in various countries. The capital markets board (CMB) of Turkey announced the “Corporate Governance Principles” in June 2003 [CMB (2003)]. In May 2006, the banking regulation and supervision agency (BRSA) of Turkey issued a regulation that includes a mandatory and periodic independent IT audit which also refers to IT governance [BDDK (2006)].

The increased need to effectively manage and control IT among the corporate governance requirements has caused a new discipline to emerge: “IT governance”. The term was traditionally understood as the locus of IT decision-making authority [Korac-Kakabadse and Kakabadse (2001); Brown and Grant (2005); Dahlberg and Kivijarvi (2006)] in the form of IT or information systems (IS) governance arrangements. Besides this traditional research interest, the IT governance research has also focused on its relationships with corporate governance, strategic alignment of business and IT, mechanisms and control frameworks to implement IT governance and evaluation of IT governance practices including IT auditing. IT governance is still considered as an emerging concept in the literature [Peterson (2004); Dahlberg and Kivijarvi (2006)] and there is no agreed definition of IT governance as discussed in Sec. 2.3.

The purpose of the study is to explore how Turkish organizations are implementing IT governance to achieve desirable behavior in the use of IT. Due to the diversification of IT governance literature and the emergent nature of the IT governance phenomenon, an exploratory research was necessary. The exploratory research approach aimed at understanding the perceptions about current IT governance practices of organizations rather than testing *a priori* hypotheses. Research objectives also included a high-level assessment of organizations’ perceived level of IT governance capabilities by applying the proposed integrated IT management model (IITMM).

The paper is structured as follows. Section 2 consists of the literature review on the description, implementation and evaluation of IT governance. Section 3 includes *Concept of Integrated Management* and discusses the levels and components of the IMM and its relations with the systemic management. Section 4 discusses the proposed IITMM and its constructs. Section 5 consists of the application and the results of the field study. The final section includes the conclusion and implications for further research.

2. Literature Review on IT Governance

2.1. IT from a resource perspective

A resource-based approach to IT is proposed in the 4th edition of COBIT framework [ITGI (2005)]. The framework defines four IT resources: information, applications, infrastructure and people. The definitions of these resources are presented in Table 1. Throughout the thesis the term “information technology” has been considered from a resource perspective as described by ITGI [2005].

Table 1. COBIT's definition of IT resources [ITGI (2005)].

	Definition	Properties suggested
Information	Information is the data in all their forms input, processed and output by the IS, in whatever form is used by the business.	Information; business use
Applications	Applications are the automated user systems and manual procedures that process the information.	Automated user systems; information processing
Infrastructure	Infrastructure is the technology and facilities (hardware, operating systems, database management systems, networking, multimedia, etc., and the environment that houses and supports them) that enable the processing of the applications.	Technology and facilities combined to a single resource; supports application processing
People	People are the personnel required to plan, organize, acquire, implement, deliver, support, monitor and evaluate the IS and services. They may be internal, outsourced or contracted as required.	Evaluation of IS; source of the people

2.2. Definition of IT governance

The term “governance” stems from the word “kubernan”, which means *navigation or the process of continuously orienting and adjusting* in Greek language [Haes and Grembergen (2006)]. As noted by various researchers, “IT governance” is a relatively new term in the academic literature [Brown and Grant (2005); Simonsson and Johnson (2005); Dahlberg and Kivijarvi (2006); Haes and Grembergen (2006); Webb *et al.* (2006)]. Definitions of IT governance identified during the literature review are presented in Table 2 indicating the new *properties suggested* by each definition.

It can be easily noted that each definition includes one or more different aspects that are associated with the term “IT governance”. Some definitions reflect corporate governance principles by focusing on the control and accountability [e.g. Boynton *et al.* (1992); Brown and Grant (2005); Weill (2004); Webb *et al.* (2006)] while others link the term to the strategic alignment [e.g. Henderson and Venkatraman (1993); MITI (1999); ITGI (2000); Korac-Kakabadse and Kakabadse (2001); Webb *et al.* (2006)] and IT decision-making arrangements [e.g. Sambamurthy and Zmud (1999); Weill (2004); Simonsson and Johnson (2005)]. Other definitions reflect the mechanisms including structures that constitute the IT governance within an organization [e.g. ITGI (2000); Korac-Kakabadse and Kakabadse (2001)].

Based on a number of IT governance definitions identified in the literature, Simonsson and Johnson [2005] and Webb *et al.* [2006] proposed new definitions consolidating the different aspects of the term. Simonsson and Johnson [2005] noted that most IT governance definitions agree that IT governance is a concern of the top management to control the strategic impact of IT and its value delivery to the

Table 2. Definitions of IT governance.

Author	Definition	New properties suggested
Boynton <i>et al.</i> [1992], cited in Brown and Grant [2005]	IT governance is concerned with the location, distribution and pattern of managerial responsibilities and control that ultimately affect how IT resources are applied and then implemented.	Patterns of responsibility and control; focus on resources
Henderson and Venkatraman [1993]	The selection and use of mechanisms (e.g. joint ventures with vendors, strategic alliances, joint research and development of new IT capabilities) for obtaining the required IT competencies.	Mechanisms, focus on competencies
Sambamurthy and Zmud [1999]	IT governance arrangements refer to the patterns of authority for key IT activities in business firms, including IT infrastructure, IT use and project management.	Patterns of authority; focus on IT activities
MITI [1999]	IT governance is defined as the organizational capacity to control the formulation and implementation of IT strategy and guide to proper direction for the purpose of achieving competitive advantages for the corporation.	Organizational capacity, strategy; focus on competitive advantage
ITGI [2000]	IT governance is defined as the structure of relationships and processes to direct and control the enterprise in order to achieve the enterprise's goals by adding value while balancing risk versus return over IT and its processes.	Structures, relationships, processes to direct and control; focus on value and risk
Korac-Kakabadse and Kakabadse [2001]	IS/IT governance concentrates on the structure of relationships and processes to develop, direct and control IS/IT resources in order to achieve the enterprise's goals through value-adding contributions, which account for balancing risk versus return over IS/IT resources and its processes.	A combination of former properties
Weill [2004]	IT governance is defined as specifying the framework for decision rights and accountabilities to encourage desirable behavior in the use of IT.	Decision rights and accountability; focus on desirable behavior
Simonsson and Johnson [2005]	IT governance is basically about IT decision-making: The preparation for, making of and implementation of decisions regarding goals, processes, people and technology on a tactical and strategic level.	A combination of former properties
Webb <i>et al.</i> [2006]	IT governance is the strategic alignment of IT with the business such that maximum business value is achieved through the development and maintenance of effective IT control and accountability, performance management and risk management.	A combination of former properties and performance management

business. Accordingly, both authors consider corporate governance as a major area that have an influence on the evolution of IT governance. Webb *et al.* [2006] further include strategic IS planning as another influencing discipline.

The most significant difference between both consolidated definitions is that the definition of Webb *et al.* [2006] omits the IT decision-making aspect of IT governance. It focuses on the outcomes (strategic alignment and value delivery) rather than mechanisms that are designed to facilitate the implementation of good governance practices. This approach is based on the argument that the existence of structures, policies and procedures is not evidence of IT governance within an organization [Peterson (2000); Trites (2004); Webb *et al.* (2006)]. On the other hand,

ITGI's [2000] definition of IT governance includes both arguments by considering mechanisms (... *relationships and processes to direct and control the enterprise*) and outcomes (... *achieve the enterprise's goals by adding value while balancing risk versus return over IT and its process*) at the same time.

According to the rules for formal conceptual definitions as set by Wacker [2004], definitions should:

- (i) include only unambiguous and clear terms;
- (ii) have as few as possible terms in the conceptual definition to avoid violating the *parsimony* virtue; and
- (iii) not make any term broader.

IT governance definitions of ITGI [2000]; Simonsson and Johnson [2005] and Webb *et al.* [2006] violate these rules by including numerous unclear terms that make the definition less exclusive. On the other hand, Weill [2004] definition of IT governance achieves compliance with these rules and focuses both on mechanisms (... *the framework for decision rights and accountabilities*) and outcomes (... *desirable behavior in the use of IT*) as intended by ITGI's [2000] definition. One could argue that the *desirable behavior* is an ambiguous expression. Weill [2004] explained that the *desirable behavior is one that is consistent with the organization's mission, strategy, values, norms and culture such as behavior promoting entrepreneurship, sharing and reuse or relentless cost reduction*. Desirable behaviors are different in every organization and they are the basis for value creation [Weill and Ross (2004b)] and may be influenced by political behavior in an organization [Chang (2006)]. In summary, desirable behavior points out to IT governance's "organization specific" outcomes that are strategically determined within the decision rights and accountability framework, and therefore achieves an unambiguous nature in that specific organization. This approach is also supported by the *imperfectly imitable* [Peterson (2000)] nature of IT governance.

Throughout the study, the IT governance definition of Weill [2004] is preferred considering that it focuses on both principal aspects of IT governance and complies with the rules for formal conceptual definitions of Wacker [2004].

2.3. Consolidation of IT governance literature

Numerous papers discussed the IT governance from different perspectives in the literature. In this study, the IT governance literature is classified in three consecutive domains covering "description", "implementation" and "evaluation" of IT governance. Literature for each domain includes different perspectives or research streams as shown on Table 3.

The IT governance research started in the early 1990's in the "description" domain with a focus of strategic alignment of business and IT including studies on IT value delivery. This domain covered different models such as strategic alignment model (SAM) [Henderson and Venkatraman (1993)], strategic IS management profile [Sabherwal *et al.* (2001)] and strategic alignment objectives model (SAOM) [OGC (2005)]. Soh and Markus [1995]; ITGI [2003] and Dahlberg and Kivijarvi

Table 3. Literature on IT governance.

Domain	Perspective	Literature
Describing IT governance	Definition of IT governance and consolidation of literature	Simonsson and Johnson [2005]; Dahlberg and Kivijarvi [2006]; Webb <i>et al.</i> [2006]
	Relationships with corporate governance	MITI [1999]; Korac-Kakabadse and Kakabadse [2001]; Nestor [2002]; ITGI [2003]; Hamaker [2003]; Haes and Grembergen [2004]; Trites [2004]; Weill and Ross [2004b]; Damianides [2005]; Kaarst-Brown and Kelly [2005]; Musson and Jordan [2005]
	Strategic alignment of business and IT	Henderson and Venkatraman [1993]; Soh and Markus [1995]; Luftman <i>et al.</i> [1999]; Sabherwal <i>et al.</i> [2001]; ITGI [2003]; Legrenzi [2003]; Grembergen <i>et al.</i> [2004]; McKay and Marshall [2004]; Peterson [2004]; OGC [2005]; Dahlberg and Kivijarvi [2006]
	Locus of IT decision-making	Brown and Magill [1998]; Sambamurthy and Zmud [1999]; Peterson [2000, 2004]; Weill [2004]; Weill and Ross [2004a]; Brown and Grant [2005]
Implementing IT governance	Mechanisms of IT governance	McFarlan [1981]; McFarlan <i>et al.</i> [1983]; Blanks [1991]; Currie [1995]; Brown [1999]; Luftman <i>et al.</i> [1999]; Peterson [2000, 2004]; Grembergen <i>et al.</i> [2004]; Haes and Grembergen [2004]; Wilson and Howcroft [2005]
	Control and governance frameworks	COSO [1992]; Colbert and Bowen [1996]; ITGI [2000, 2004b, 2004c, 2005, 2007a, 2007b]; AICPA [2001]; Bladergroen <i>et al.</i> [2001]; IARF [2001]; Ernst and Young [2002]; AICPA and CICA [2003]; Champlain [2003]; Singleton and Flesher [2003]; Ridley <i>et al.</i> [2004]; Aksoy [2005]; Bedard <i>et al.</i> [2005]; Damianides [2005]; Gelinis <i>et al.</i> [2005]; OGC [2005]; Oud [2005]; Skinner [2006]; Wagner [2006]; Webb <i>et al.</i> [2006]
Evaluating IT governance	Approaches for IT governance evaluation	Brooking [1996]; MITI [1999]; ITGI [2000, 2004a, 2005, 2007b]; Grembergen [2000]; Luftman [2000]; Guldentops <i>et al.</i> [2002]; Guldentops [2003]; Hamaker [2003]; CICA [2004]; Wheelen and Hunger [2004]; Grembergen and Haes [2005]; Peterson [2004]; Weill and Ross [2004a]; Damianides [2005]; Cram [2007]
	IT audit	Blanks [1991]; Elliot [1992]; Williams [1992]; Yau and Davis [1993]; Arens and Loebbecke [1997]; McNamee and Selim [1998]; Rezaee and Reinstein [1998]; ITGI [2000, 2005, 2007b]; Saka [2001]; Woda [2002]; Legrenzi [2003]

[2006] proposed additional models that discuss the strategic alignment from a value perspective. This was followed by research on IT decision-making arrangements toward the end of the decade covering discussions on different IT governance archetypes. Due to the significant research on this stream, IT governance was often referred to the locus of IT control until new perspectives were proposed in the 2000's.

In the 2000's, the literature started to focus on the "implementation" and finally on the "evaluation" domains, whereas the research in the "description" domain was

extended to include relationships of IT governance with corporate governance. The research on the IT governance mechanisms primarily focused on the dimensions of processes, structures and relationships. In addition, applicability of the existing control frameworks (such as COSO, COBIT, SAC/eSAC, SAS 55/78/94, ITIL and Trust Services) to the IT governance was also discussed in the “implementation” domain. In the “evaluation” domain, the literature covered different approaches for the evaluation of IT governance practices in the organization, as well as the role of IT audit.

Starting from 2005, some research was reported on the consolidation of the IT governance literature and re-definition of IT governance due to extended perspectives other than business-IT alignment and locus of IT decision-making.

3. Integrated Management Model

3.1. Introduction

Managers and consultants use a wide range of tools and techniques to support strategic decision-making in increasingly complex, competitive and dynamic business environments. The choice of what management tool to use, and how to deploy it most appropriately, can be very confusing due to the proliferation of approaches developed by academics, consultants and firms [Phaal *et al.* (2006)], although some claim to be simple, yet powerful, approach to the management of technology [e.g. Hull *et al.* (2007)] and propose that integrated innovation between technology and organization is critical for the improvement of competitiveness [Guan and Liu (2007)].

In 1991, Bleicher introduced *The Concept of Integrated Management* which is based on the system approach developed by Hans Ulrich in the University of St. Gallen. According to the *St. Gallen Management Concept* of Ulrich [1984; cited in Bleicher (1999)], the management has the following three functions:

- (i) *Forming*: It is about the design of an integrated framework that enables the viability and development of the organization through the achievement of its goals.
- (ii) *Steering*: Guiding the organization by determining goals and defining, initiating and controlling activities of the system and its elements.
- (iii) *Development*: Development occurs over time as a result of forming and steering processes. In social systems, it is also an autonomous and evolutionary result of integrated accumulation of knowledge, competencies and preferences.

Bleicher extended this approach by defining two dimensions of the management. As shown in Fig. 1, different management levels (normative, strategic and operational) are defined according to the impact of time in the horizontal dimension. While the normative management deals with the development and viability of the organization, the strategic level is concerned with the construction, maintenance and utilization of success potentials. The operational management executes the implementation function for actual value delivery. The three management levels can

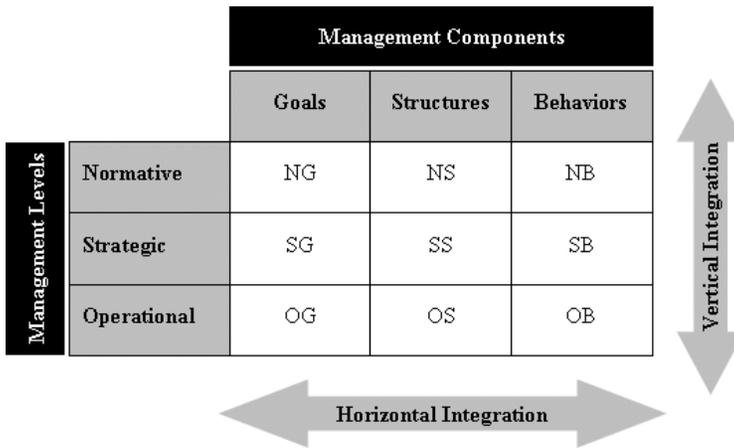


Fig. 1. Integrated management matrix [Bleicher (1999); Alsan and Öner (2003)].

also be described as *conception, clarification — orientation and implementation — realization*, respectively [Saritas and Oner (2004)].

The vertical dimension of the IMM includes three management components defined as goals, structures and behaviors. Goals include all activities related to the forming, steering and development functions of the management. Structures include the system elements and their relationships, as well as the instruments required for their arrangement. Behaviors deal with the social and cultural aspects of the organization and its integration with the environment. The IMM assumes that after goals are determined, organizational structures are manipulated, and finally a basic behavioral pattern is determined and created [Alsan and Öner (2003)].

3.2. Notions of systemic management

Researchers have emphasized the importance of systemic approach to understand the fit between technology strategy and corporate strategy [Chen *et al.* (2008)]. In a system, no variable can influence another variable without being affected by it [Bleicher (1999)]. Likewise, the IMM assumes that the nature of the problem cannot be understood separate from its solution [Saritas and Oner (2004)].

The IMM is based on the following notions of systemic management [Schwaninger (2000); Saritas and Oner, (2004)]:

- (i) The IMM is *integrative*. By combining different levels and dimensions of management, the model builds on *a comprehensive set of essential variables*. This complex structure enables effective organizational development and transformation.
- (ii) The IMM considers the management as a *multidimensional* process. The dimensions include goals, structures and behaviors on the vertical view.

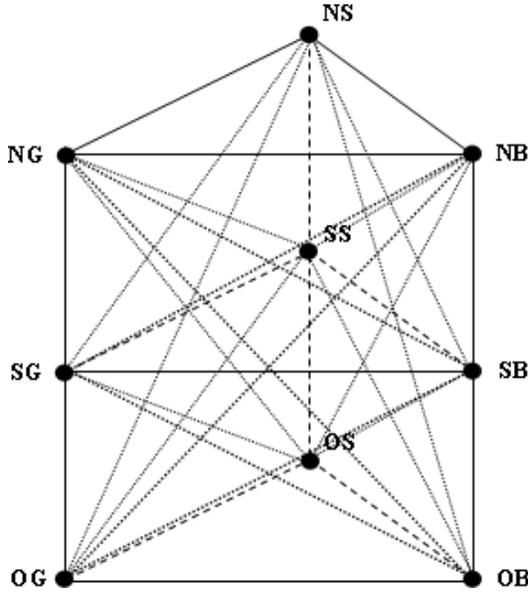


Fig. 2. IMM illustrated as a triangular prism.

- (iii) The IMM considers management as a *multilevel* process by defining normative, strategic and operational levels on the horizontal view.
- (iv) According to the IMM, the management is a *recursive* process. A recursive structure comprises autonomous units within autonomous units. As a result, the model can be applied to any level of recursion within an organization.
- (v) All components of the IMM are *dynamically inter-related*.

Figure 2 illustrates the integrative, multidimensional and multilevel nature of the IMM as a triangular prism developed and proposed by the present study. The nodes correspond to each component of the IMM while the lines represent the dynamic interrelation between these components.

4. The Integrated IT Management Model

4.1. The development of the proposed model

Bleicher's [1999] IMM has been used as a conceptual modeling framework for a number of researches in the literature. The literature-based IITMM is exclusively based on the IMM framework and inherits its virtues. Throughout the design of the IITMM, the IMM was used as a framework to include *a comprehensive set of essential variables* [Schwaninger (2000)] identified throughout the literature review on IT governance. To provide an integrated and holistic view of the IT governance, these essential variables were then classified according to the levels and dimensions of the IMM.

The set of constructs and their classifications were reviewed by three experts, including a board member of TAYSAD, as part of questionnaire reviews which will be later discussed in Sec. 5.1 Based on the feedback collected, the following updates were made to the model in general:

- (i) Reclassifications were made for some constructs.
- (ii) Holistic implementation or evaluation methods such as IT balanced scorecard and maturity models were dropped from the proposed model. The proper classification of these construct was considered practically unfeasible as they self-included a range of already identified constructs and were organization-specific in nature.
- (iii) One reviewer argued that a construct may exist in more than one level or dimension of the model. This argument was especially supported by other reviewers through IMM's vertical dimension approach where goals are determined, organizational structures are manipulated, and finally a basic behavioral pattern is determined and created [Alsan and Öner (2003)]. Following this approach, relevant constructs have been included to other levels and dimensions where a literature support was found. For example, risk management has been considered in the model as an IT governance goal, as a structure (i.e. risk management approach, methodology or system) and as a behavior (i.e. whether the established approach is consistently followed).

4.2. Constructs of the integrated IT management model

Following the IT governance definition of Weill [2004], it can be argued that the IT governance is mostly related with the normative level of the management as it is *about systematically determining who makes each type of decision (a decision right), who has input to a decision (an input right) and how these people (or groups) are held accountable for their role*. However, considering the notions of the systemic management as discussed in Sec. 3, the IITMM involves the strategic and operational levels in addition to the normative level to explain the IT governance in a dynamically inter-related framework. Accordingly, essential variables that refer to the strategic and operational levels of the IMM were also identified during the literature review and considered within the model. As a result, the IITMM also deals with the relationships of IT governance with the IT management, which is about what specific decisions are made [Weill (2004)]. This approach is also in-line with the argument that IT governance covers different management layers including all reporting lines from team leaders through board of directors [ITGI (2003)]. In the case of IITMM, the model covers normative, strategic and operational management levels.

On the following sections, the constructs of the IITMM will be introduced in the order of normative, strategic and operational levels. Table 4 in the following pages provides the final list of IITMM constructs after expert reviews, with a specific reference to the publications identified during the literature review.

Table 4. Integrated IT management model.

Goal	Structure	Behavior
Normative		
<ul style="list-style-type: none"> • IT mission statement MITI [1999]; ITGI [2000] • Management's expectations MITI [1999]; ITGI [2000, 2005] • Corporate governance MITI [1999]; Korac-Kakabadse and Kakabadse [2001]; Nestor [2002]; Hamaker [2003]; ITGI [2003]; Haes and Grembergen [2004]; Trites [2004]; Weill and Ross [2004b]; Musson and Jordan [2005] • Best practices ITGI [2000, 2005]; OGC [2005] • Control objectives ITGI [2000, 2005]; IARF [2001]; AICPA and CICA [2003] • Reliability COSO [1992]; ITGI [2000, 2005]; IARF [2001] • Compliance COSO [1992]; ITGI [2000, 2005]; IARF [2001] 	<ul style="list-style-type: none"> • Authority Luftman <i>et al.</i> [1999]; MITI [1999]; Sambamurthy and Zmud [1999] • Responsibility Luftman <i>et al.</i> [1999]; Weill and Ross [2004a]; ITGI [2005] • Accountability Weill [2004]; Weill and Ross [2004a] • IT principles Weill and Ross [2004a] • IS/IT ethical standards ITGI [2000, 2005]; Korac-Kakabadse and Kakabadse [2001] • IT control framework COSO [1992]; ITGI [2000, 2005]; AICPA [2001]; IARF [2001]; AICPA and CICA [2003]; OGC [2005] 	<ul style="list-style-type: none"> • IT's participation in decision-making process Barney [1991]; MITI [1999] • Corporate governance MITI [1999]; Korac-Kakabadse and Kakabadse [2001]; Nestor [2002]; Hamaker [2003]; ITGI [2003]; Haes and Grembergen [2004]; Trites [2004]; Weill and Ross [2004b]; Musson and Jordan [2005] • Independent assurance Blanks [1991]; IARF [1991]; Elliot [1992]; Williams [1992]; Yau and Davis [1993]; ITGI [2000, 2005]; AICPA [2001]; Woda [2002]; AICPA and CICA [2003]; Damianides [2005]; Grembergen and Haes [2005] • Best practices ITGI [2000, 2005]; OGC [2005] • Control objectives ITGI [2000, 2005]; IARF [2001]; AICPA and CICA [2003] • IS/IT ethical standards ITGI [2000, 2005]; Korac-Kakabadse and Kakabadse [2001] • IT principles Weill and Ross [2004a] • Relevant social groups Wilson and Howcroft [2005] • Company culture Korac-Kakabadse and Kakabadse [2001]

(Continued)

Table 4. (Continued)

Goal	Structure	Behavior
Strategic		
<ul style="list-style-type: none"> • Strategic alignment Henderson and Venkatraman [1993]; Luftman <i>et al.</i> [1999]; ITGI [2000, 2003, 2005]; Sabherwal <i>et al.</i> [2001]; Hamaker [2003]; Grembergen <i>et al.</i> [2004]; Weill [2004]; OGC [2005] • IT value delivery McFarlan <i>et al.</i> [1983]; Soh and Markus [1995]; MITI [1999]; Korac-Kakabadse and Kakabadse [2001]; ITGI [2003, 2005]; Hamaker [2003]; Legrenzi [2003]; Peterson [2004]; Weill [2004]; Weill and Ross [2004a]; Dahlberg and Kivijarvi [2006] • IT risk management Hamaker [2003]; ITGI [2003, 2005]; Weill and Ross [2004a]; Dahlberg and Kivijarvi [2006] • IT resource management Hamaker [2003]; ITGI [2003, 2005]; Weill [2004]; Weill and Ross [2004a]; Dahlberg and Kivijarvi [2006] • Effectiveness ITGI [2000, 2005]; IARF [2001] 	<ul style="list-style-type: none"> • Formal positions and roles Brown and Magill [1998]; Brown [1999]; MITI [1999]; Sambamurthy and Zmud [1999]; ITGI [2000, 2005]; Peterson; Peterson [2000, 2004]; Haes and Grembergen [2004]; Weill [2004]; Weill and Ross [2004a] • Committees and councils McFarlan <i>et al.</i> [1983]; Brown [1999]; MITI [1999]; ITGI [2000, 2005]; Peterson [2000]; CICA [2004]; Haes and Grembergen [2004] • IT core competencies Yau and Davis [1993]; Brooking [1996]; MITI [1999]; ITGI [2000, 2005]; CICA [2004]; Damianides [2005] • IT risk management Hamaker [2003]; ITGI [2003, 2005]; Weill and Ross [2004a]; Dahlberg and Kivijarvi [2006] • IT resource management Hamaker [2003]; ITGI [2003, 2005]; Weill [2004]; Weill and Ross [2004a]; Dahlberg and Kivijarvi [2006] • IT performance management ITGI [2003, 2005]; CICA [2004]; Weill [2004]; Weill and Ross [2004a]; Dahlberg and Kivijarvi [2006]; Webb <i>et al.</i> [2006] • IS planning McFarlan <i>et al.</i> [1983]; Blanks [1991]; ITGI [2000, 2005]; CICA [2004]; Haes and Grembergen [2004] 	<ul style="list-style-type: none"> • Strategy formulation Henderson and Venkatraman [1993]; MITI [1999] • Committees and councils McFarlan <i>et al.</i> [1983]; Brown [1999]; MITI [1999]; ITGI [2000, 2005]; Peterson [2000]; CICA [2004]; Haes and Grembergen [2004] • Conflict resolution Peterson [2000]; Haes and Grembergen [2004] • End user involvement McFarlan [1981]; McFarlan <i>et al.</i> [1983]; Blanks [1991]; MITI [1999] Legrenzi [2003] • IS planning McFarlan <i>et al.</i> [1983]; Blanks [1991]; ITGI [2000, 2005]; CICA [2004]; Haes and Grembergen [2004] • IT risk management Hamaker [2003]; ITGI [2003, 2005]; Weill and Ross [2004a]; Dahlberg and Kivijarvi [2006] • IT resource management Hamaker [2003]; ITGI [2003, 2005]; Weill [2004]; Weill and Ross [2004a]; Dahlberg and Kivijarvi [2006] • IT performance management ITGI [2003, 2005]; CICA [2004]; Weill [2004]; Weill and Ross [2004a]; Dahlberg and Kivijarvi [2006]; Webb <i>et al.</i> [2006]

(Continued)

Table 4. (Continued)

Goal	Structure	Behavior
<i>Operational</i>		
<ul style="list-style-type: none"> • IT value delivery Soh and Markus [1995]; ITGI [2003]; Peterson [2004] • Efficiency McFarlan <i>et al.</i> [1983]; ITGI [2000, 2005]; IARF [2001]; Korac-Kakabadse and Kakabadse [2001]; ITGI [2003]; Peterson [2004]; Weill [2004]; Weill and Ross [2004a] • Confidentiality ITGI [2000, 2005]; IARF [2001]; AICPA and CICA [2003] • Integrity ITGI [2000, 2005]; Korac-Kakabadse and Kakabadse [2001]; AICPA and CICA [2003]; Hamaker [2003] • Availability McFarlan <i>et al.</i> [1983]; ITGI [2000, 2005]; IARF [2001]; AICPA and CICA [2003]; Hamaker [2003]; Peterson [2004] • Privacy Korac-Kakabadse and Kakabadse [2001]; AICPA and CICA [2003]; Hamaker [2003] • Flexibility Soh and Markus [1995]; ITGI [2000, 2005]; Peterson [2004] • Scalability McFarlan <i>et al.</i> [1983]; ITGI [2000, 2005]; Hamaker [2003]; Peterson [2004] • End-user satisfaction MITI [1999]; Grembergen [2000]; ITGI [2000, 2005] 	<ul style="list-style-type: none"> • IT policies and procedures ITGI [2000, 2005]; AICPA and CICA [2003]; OGC [2005] • IT processes Henderson and Venkatraman [1993]; ITGI [2000, 2005]; Sabherwal <i>et al.</i> [2001]; Hamaker [2003]; OGC [2005] • Prioritization MITI [1999]; Luftman <i>et al.</i> [1999]; ITGI [2000, 2005]; Hamaker [2003]; Weill [2004] • IT project management McFarlan [1981]; McFarlan <i>et al.</i> [1983]; ITGI [2000, 2005]; Hamaker [2003] • Service levels ITGI [2000, 2005]; Weill and Ross [2004a]; OGC [2005] 	<ul style="list-style-type: none"> • Informal networking practices Brown [1999]; Peterson [2000]; Haes and Grembergen [2004] • Shared learning Brown [1999]; Peterson [2000]; Haes and Grembergen [2004]; Grembergen and Haes [2005] • IT policies and procedures ITGI [2000, 2005]; AICPA and CICA [2003]; OGC [2005] • Independent assurance Blanks [1991]; IARF [1991]; Elliot [1992]; Williams [1992]; Yau and Davis [1993]; ITGI [2000, 2005]; AICPA [2001]; Woda [2002]; AICPA and CICA [2003]; Damiauides [2005]; Grembergen and Haes [2005] • Compliance COSO [1992]; ITGI [2000, 2005]; IARF [2001] • Prioritization MITI [1999]; Luftman <i>et al.</i> [1999]; ITGI [2000, 2005]; Hamaker [2003]; Weill [2004] • IT project management McFarlan [1981]; McFarlan <i>et al.</i> [1983]; ITGI [2000, 2005]; Hamaker [2003] • Business knowledge of IT management MITI [1999]; Grembergen and Haes [2005] • IT knowledge of business (line) management Brown and Magill [1998]; Sambamurthy and Zmud [1999]; Grembergen and Haes [2005] • End-user IT knowledge McFarlan [1981]; Soh and Markus [1995]; ITGI [2000, 2005]

5. Field Study

5.1. Research design

5.1.1. Methodology

A research design is defined as *the logical sequence that connects the empirical data to a study's initial research questions and, ultimately, to its conclusions* [Yin (2003)]. A two-phased research approach was applied beginning with a conceptual modeling as covered in Sec. 4. Conceptual modeling was followed by the case study phase which employed structured face-to-face interviews as a data gathering strategy.

The case study was considered as the appropriate research strategy by meeting the following three conditions as described by Yin [2003]:

- (i) A case study is suitable where the form of research question is “how” and “why”. The research question of this study is formulated as “How are Turkish organizations implementing IT governance to achieve desirable behavior in the use of IT” and therefore complies with the first condition.
- (ii) A case study is preferred where the researcher’s control over the behavioral events is restricted. In this study, the research objectives do not require a direct control of the events. Therefore, this condition is also met.
- (iii) Finally, a case study deals with a contemporary phenomenon that needs to be investigated within a real-life context. This study involves a literature-based model to understand organization’s perceived level of IT governance capabilities within its real-life context. Thus, the research complies with this condition as well.

Interviews are considered as one of the primary sources of case study information [Yin (2003)]. Structured interviewing was applied as the data gathering strategy in the case studies for two reasons. First, this method allows capturing people’s perceptions of the object reality [Meredith *et al.* (1989)]. This was required to understand the interviewee’s perceptions of the current level of organization’s IT governance capabilities, in-line with the research objectives. Second, structured interviewing enables the researcher to control the responses to achieve uniform results [Meredith *et al.* (1989)]. Given the fact that IT governance is considered as an emerging concept in the literature, and the constructs are complex in nature, as suggested by one expert during the questionnaire reviews, structured interviews were preferred in order to collect consistent responses for each discussed construct.

Following the conceptual modeling phase, a questionnaire was developed to provide a structured interview pattern for face-to-face interviews in case studies. The questionnaire was considered as a device that connects the proposed model to the case studies. More specifically, the questionnaires enabled a reflection of *a priori constructs* of the proposed model as suggested in case studies to *provide better grounding of construct measures*, thus improving the construct validity [Eisenhardt (1989)]. Finally, combined with face-to-face interviews, the questionnaire allowed obtaining both qualitative and quantitative data, therefore providing a *synergistic view of evidence* [Eisenhardt (1989)].

The draft questionnaire was sent to the e-mail group of a research community consisting of more than 50 people to collect an initial feedback on the understandability of questions. Seven responses were collected within three weeks after two additional reminders were sent to the group. The updated questionnaire was then reviewed by three experts, including an IT governance and audit practitioner, to enhance the validity and reliability of the study. Review notes were documented as e-mail correspondence and additional discussions were made to follow-up with the reviews. To improve the applicability of the questionnaire, a face-to-face pilot study was performed with a board member of TAYSAD who also participated in the case study.

Based on the feedback collected from the research community, all experts and the pilot study, following updates were made to the questionnaire:

- (i) Reclassifications were made for some constructs in the model as discussed in Sec. 4.
- (ii) Some inconsistencies in the scales were corrected such as missing ranges.
- (iii) Ambiguous questions were reworded to improve the understandability.
- (iv) Scales for revenue, number of employees and questions regarding the IT organizational structures in place were updated in-line with the recommendations of the board member of TAYSAD in order to collect more precise data.
- (v) In addition, as IT governance is an emerging concept in the literature, one expert suggested that there will be only a few candidates in each company who have the ability to reliably respond to the questions. As noted earlier, this was one of the main reasons of why structured interviews were considered as the data gathering strategy.

After the questionnaire was finalized, the case study phase started. In line with research's objectives, a *holistic multiple-case* approach [Yin (2003)] was applied. A *specified population* was targeted for selecting cases as suggested by Eisenhardt [1989] to improve the external validity. Eight companies that operate in Turkish automotive supply industry and are also members of TAYSAD were selected on the basis of availability and accessibility. However, a *theoretical sampling* was also considered to include examples of polar types (i.e. companies with very small or no IT departments and companies with relatively larger IT departments) as suggested by Eisenhardt [1989]. Only five out of eight companies accepted to participate in the study.

To mitigate the complexity limitation for constructs and questions, as noted by one expert, and to improve the reliability of the study, an interview was scheduled with the CIO or IT manager (or equivalent) level in each company. Where a CIO, IT manager or an equivalent could not be identified due to simpler IT arrangements in place, the interviews were scheduled with a top management executive. Prior to structured interviews, all participants received a one page summary including an introduction to the questionnaire. Each questionnaire was completely discussed including informative sections, open-ended questions and perceptions of IMM levels and dimensions. After reviewing and discussing all questions, two interviewees

preferred to use the web-based questionnaire to document their responses for the perceived level of IT governance capabilities. At the end of each interview, the researcher confirmed with the interviewee his understanding of the issues noted during the interview. Each of the interviews lasted between 1½ and two hours were conducted between December 2007 and February 2008.

5.1.2. *Limitations*

First, although the proposed model is based on a comprehensive literature review covering a range of academic publications, professional frameworks, standards and regulations, it should be recognized that a critical construct may be unaddressed. This limitation is mitigated to a certain degree by model and questionnaire reviews performed by three experts as discussed in the previous section.

Second, the research is performed in a single industry with five companies and the generalization of the results is limited to implications for future research. The quantitative data collected is only used for visual inspection to support the qualitative findings.

Third, interviews are subject to bias, poor recall and inaccurate articulation [Yin (2003)] and therefore may lead to inaccurate assessments of the perceived level of IT governance capabilities. To mitigate this limitation, the “assessment” objective of the study was not disclosed during the interviews.

Finally, the collected data refers to the organization’s IT governance capabilities which are assessed as “point-in-time”. To explore the evolution of perceived level IT governance capabilities over time, the research needs to be repeated with a longitudinal focus.

5.2. *Results*

5.2.1. *Case description*

Five companies that operate in Turkish automotive supply industry and are also members of TAYSAD were selected for case studies as discussed in the methodology section. A summary profile of these companies are provided in Table 5 including years in business, legal form, percentage of foreign shares, public status, number of employees, annual revenue, number of IT personnel, number of total IT users within the company and annual IT budget. All companies share some common characteristics such as the legal form is corporation, the shares are not publicly traded in any stock exchange and there is no foreign shareholder in the ownership structure. All companies operate in the same industry for at least more than 20 years where two companies (Company A and D) are approaching to 50 years of experience in the business.

As can be noted in Table 5, the participated companies differ in size considering the number of employees and the annual revenue. The number of employees varies from between 50 to 99 (Company B) to more than 1000 (Company D and E), whereas the annual revenue differs from less than \$5 000 000 (Company B) to more than \$25 000 000 (Company C, D and E). The IT figures also vary in terms of

Table 5. Company profiles.

Information ^a	Company A	Company B	Company C	Company D	Company E
Years in business	40–50	20–30	40–50	30–40	40–50
Legal form	Corporation	Corporation	Corporation	Corporation	Corporation
% foreign shareholder	0%	0%	0%	0%	0%
Public company	No	No	No	No	No
Number of employees	100–249	50–99	500–999	1000 and more	1000 and more
Annual ^b revenue (in thousand \$)	15,000–19,999	0–4,999	25,000 and more	25,000 and more	25,000 and more
Number of IT personnel	0–1	0–1	2–5	2–5	6–10
Number of IT users	10–49	50–99	100–249	250–499	100–249
Annual ^b IT budget (in thousand \$)	250–499	100–249	250–499	100–249	250–499

^aTo ensure the confidentiality of responses, all information in this table is presented by ranges, as collected via questionnaires. The “years in business” information is a conversion of the actual year of foundation to a corresponding range.

^bAnnual figures in this table refer to the forecasted figures for 2007, as obtained during the interviews.

number of IT personnel, total number of IT users in the company and the annual IT budget. Company A and B have only one dedicated IT personnel, whereas others have larger IT organizations in place, Company E having the most IT employees. Company D has the largest IT user base among all companies participated in the study.

Table 6 further provides a summary profile of interviewees in each company. All interviewees have at least an undergraduate degree and their total years of experience varies from 11–15 to more than 21 years. Moreover, the total years of experience with the participant company is at least six years in Company D and E, whereas it is more than 21 years in Company A and C. This successfully positions all interviewees to reliably participate in the study as representatives of their companies and to rate the perceived level of IT governance capabilities in place.

Table 6. Interviewee profiles.

Information	Company A	Company B	Company C	Company D	Company E
Position in the company	Head of Executive Committee	CEO	Manager of Inf. and Comm. Systems	IS Manager	IT Group Manager
Level of education	PhD	Graduate, MBA	Graduate, MS	Undergraduate, BA	Undergraduate, BS
Experience in years	21 and more	11–15	21 and more	21 and more	11–15
Years with the company	21 and more	11–15	21 and more	6–10	6–10
Reports to	Chairman of the Board	Board of Directors	Deputy CEO	CEO	Finance Group Director

Table 7. Capability scale.

Average perceived	
IITMM score	Capability
1.00–1.99	Low
2.00–3.49	Low-Mid
3.50–4.99	Mid-High
5.00–6.00	High

In Company A and Company B, a CIO, IT manager or equivalent was not designated due to the simple IT governance arrangements in place. Therefore, an interview with a top management executive was held to complete the questionnaire. The interviewees in other companies are the IT executives responsible for the management of IT functions.

The average perceived scores of current IT governance capabilities calculated for each IITMM component are converted to a “capability scale” to enable more efficient comparison of results. The ranges in Table 7 were used for the conversion, e.g. the average score for a particular IITMM component refers to “a low IT governance capability” for that component, if its score is between 1.00 and 1.99.

5.2.2. Perceived drivers and inhibitors of IT governance

Interviewee’s responses to the open-ended questions regarding the perceived drivers and inhibitors of effective IT governance implementation, as discussed in the within-case analysis section, are summarized in Tables 8 and 9, respectively. For each driver and inhibitor identified, the corresponding IITMM construct and its level and dimension is further noted.

Table 8. Perceived drivers of effective IT governance implementation and the corresponding IITMM constructs.

Drivers	Fq. ^a	IITMM construct	IITMM component
Top management’s commitment	2	—	All
Availability of adequate IT budget	2	IT resource management	SG, SS, SB
Requirements for alignment of IT and business processes	2	Strategic alignment — strategic fit	SG
Need for availability	2	Availability	OG
Business demand for adequate data processing capacity	1	Scalability — capacity management	OG
Integration requirements with parent industry	1	IT value delivery — business flexibility	SG
Need for reliability	1	Reliability	NG
Need for efficiency in production	1	Efficiency	OG
End-user expectations	1	End-user satisfaction	OG
Availability of sufficient IT competency	1	IT core competencies	SS
Adequate prioritization of investments	1	Prioritization	OS, OB

^aFrequency (Fq.) refers to number of cases where the particular driver or inhibitor was identified.

Table 9. Perceived inhibitors of effective IT governance implementation and the corresponding IITMM constructs.

Inhibitors	Fq.	IITMM construct	IITMM component
Lack of required IT competency	3	IT core competencies	SS
Lack of end-user involvement in IT projects	2	End-user involvement-IT projects	SB
No adequate IT budget available	2	IT resource management	SG, SS, SB
Lack of end-user IT knowledge	1	End-user IT knowledge	OB
Incompliance with procedures	1	IT policies and procedures	OS, OB
Lack of top management's commitment	1	—	All
Low return on investment for IT	1	IT resource management	SG, SS, SB
Difficulty in measuring return on investment of IT	1	IT resource management	SG, SS, SB
Infrastructure and availability problems faced	1	Availability	OG
High IT turnover — difficulty in maintaining IT competency	1	IT core competencies	SS

As can be noted in Tables 8 and 9, the drivers and inhibitors identified by interviewees do not concentrate on any IITMM level or dimension, and are rather dispersed across the IITMM. Some drivers and inhibitors refer to the same IITMM construct representing a reflection of each other. “Top management’s commitment” identified both as a driver and inhibitor is not mapped to any specific IITMM construct. Being based on the IMM, the IITMM inherently integrates top management commitment in all levels and dimensions.

5.2.3. IITMM constructs with extreme perceived scores

In this section, the average perceived scores of IITMM constructs are further analyzed to identify the constructs with the highest and lowest perceived scores in each IITMM component. Table 10 summarizes such an analysis where IITMM constructs with highest and lowest perceived scores are represented for each IITMM component.

As can be noted in Table 10, *compliance* and *availability* in the goals dimension received the highest possible rating from all interviewees confirming the requirements of information suggested by the literature. In addition, *IT resource management*, noted both as a driver and inhibitor in the previous section, was identified in strategic goals and behaviors in the table. On the other hand, *independent assurance* in operational behaviors has the overall lowest perceived score together with *committees and councils* in strategic structures. *Independent assurance* was further noted in the normative behaviors component. This shows that, although considered as an important element of IT governance in the literature, companies in general do not perform internal or external IT audits and if done, the results of the audits are not sufficiently taken into consideration by the board of directors. The relatively lower score for *IT control framework* in normative structures can be explained by the lack of an implementation of formal IT control frameworks in all companies. Although control frameworks are utilized on an *ad hoc* basis in some of the companies,

Table 10. IITMM constructs with extreme perceived scores in each component.

Goal	Structure	Behavior
Normative		
<i>Highest</i>		
Compliance 6,0	Responsibility 5,8	Relevant social groups 5,2
<i>Lowest</i>		
Corporate governance 4,6	IT control framework 4,0	Independent assurance IT principles 3,2
Strategic		
<i>Highest</i>		
IT risk management IT resource management 5,8	Formal positions and roles 5,4	IT resource management 5,0
<i>Lowest</i>		
IT value delivery — business flexibility 4,5	Committees and councils 2,6	End-user involvement — IT strategies 2,8
Operational		
<i>Highest</i>		
Availability 6,0	IT policies and procedures IT processes 4,8	Informal networking practice — physical collocation and IT networks Business knowledge of IT management 5,4
<i>Lowest</i>		
Efficiency Scalability 4,8	IT project management 3,0	Independent assurance 2,6

no companies have actually implemented an IT control framework in place. Moreover, only two companies do have plans to deploy a framework (ITIL) in the future.

In summary, this analysis revealed the specific strengths and weaknesses of the IT governance implementation in five participated companies regarding each IITMM component. The lowest scores in each IITMM component can be considered as starting points for improving the overall IT governance implementation in companies.

5.2.4. Comparison of perceived IT governance capabilities

In this section, the perceived IT governance capabilities of participated companies are compared to explore potential patterns. The average IITMM component scores for each company are presented on Table 11 including basic descriptive statistics such as mean, standard deviation (St. D.), minimum and maximum values. Following this table, the overall perceived IITMM component scores of five companies are further visualized by a radar diagram in Fig. 3.

The analysis revealed various similarities and differences of IT governance capabilities of participated companies. First, a similarity lies in “high” IT governance capabilities of IITMM’s strategic goals and operational goals in all companies. As

Table 11. Comparison of perceived IITMM scores.

	Co. A	Co. B	Co. C	Co. D	Co. E	Mean	Min.	Max.	St. D.
NG	5,13	5,67	5,89	4,89	4,33	5,18	4,33	5,89	0,62
NS	4,17	5,17	5,50	4,83	5,83	5,10	4,17	5,83	0,64
NB	4,00	4,00	4,70	3,30	4,10	4,02	3,30	4,70	0,50
SG	5,36	5,42	5,50	5,00	5,58	5,37	5,00	5,58	0,22
SS	3,33	3,78	4,78	4,33	5,22	4,29	3,33	5,22	0,76
SB	4,22	2,44	4,78	3,44	3,89	3,76	2,44	4,78	0,88
OG	5,40	5,67	5,53	5,07	5,33	5,40	5,07	5,67	0,23
OS	3,40	4,60	5,60	3,80	4,20	4,32	3,40	5,60	0,84
OB	4,07	3,43	5,21	3,71	4,36	4,16	3,43	5,21	0,69

presented in Table 11 and can be noted in Fig. 3, strategic goals and operational goals have also the lowest standard deviation among all IITMM components. This indicates that the strategic goals and operational goals of IT governance are well understood by all participated companies, and there are no major differences in these IT governance capabilities compared to other IITMM components.

Second, normative behaviors and strategic behaviors have the lowest average perceived score among all IITMM components. Moreover, there is no company with “high” IT governance capabilities in these components. Strategic behaviors component further has the highest standard deviation compared to other IITMM components. Given the fact that the operational behaviors component also does not have an average “high” IT governance capability, the behaviors dimension in general indicates an important IT governance improvement area for companies.

Third, besides the behaviors dimension, some other IITMM components including strategic structures and operational structures do not have an average “high” IT

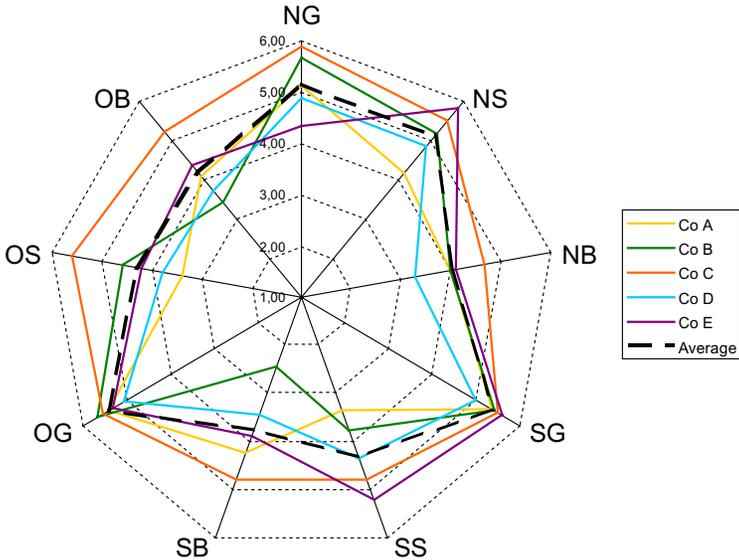


Fig. 3. Radar diagram of perceived IITMM scores.

governance capability. These IITMM components can be further considered as general improvement areas.

In general, the results indicate that except strategic goals and operational goals, different IT governance capability patterns exist for each studied company. The differences are more visible for some of the IITMM components. For example, the IT governance capabilities in strategic structures and operational structures and operational behaviors vary between “low-mid” to “high”.

5.2.5. Discussion

There are no theoretical propositions available in the current IT governance literature that discusses the possible links between the IITMM components. However, following IMM’s assumption that after goals are determined, organizational structures are manipulated, and finally a basic behavioral pattern is determined and created [Alsan and Öner (2003)], a similar pattern can be expected within IITMM. As can be noted in Table 11, the average score of goals, structures and behaviors decrease throughout the vertical view of IITMM, which confirms this proposition. On the other hand, this exact pattern is only found in three companies (Company B, C, D), whereas the goals dimension still scored higher than the behaviors dimension in Company A and E. Considering the relatively higher standard deviation of strategic structures and operational structures as noted in Table 11, and the lack of some mechanisms found in these components as documented in within-case analysis, future research is suggested to explain the overall influence of strategic structures and operational structures to the IITMM.

In general, the possible links between the IITMM components may be influenced by a number of other variables including the ones summarized as company profiles in Table 5. For example, all participated companies have formal IT organizations, where Company A and B have only one IT staff in place, as some important IT functions are outsourced to service companies. At this point, the effect of outsourcing on the perceived IT governance capabilities can be further investigated. Moreover, other possible relationships may exist between perceived IITMM component scores and the perceived level of competition and company performance. Future explanatory research is also suggested for this area.

On the other hand, the differences in IT governance capability patterns identified as a result of the cross-case analysis have a significant literature support. At this point, the reader should be reminded that throughout this study, the IT governance is defined as *specifying the framework for decision rights and accountabilities to encourage desirable behavior in the use of IT* [Weill (2004)]. As discussed in Sec. 2.2, desirable behavior points out to IT governance’s “organization specific” outcomes that are strategically determined within the decision rights and accountability framework, and therefore achieves an unambiguous nature in that specific organization. Moreover, IT governance is considered as a unique resource from a resource-based view (RBV) [Barney (1991)] and thus considered as imperfectly imitable [Peterson (2000)]. As a result, it can be concluded that each organization has a different IT governance implementation which may result in different perceived level IT governance capabilities as suggested by

IITMM scores. In this study, the application of the IITMM captured these differences at two points. First, different patterns were identified throughout the IITMM dimensions and levels as presented in Table 11 and in Fig. 3. Second, the drivers and inhibitors identified by interviewees did not concentrate on any IITMM level or dimension, and were dispersed across the whole IITMM.

The study's results further revealed three sources of opportunities to improve the current IT governance capabilities of companies:

- (i) The IITMM constructs identified as drivers or inhibitors of effective IT governance implementation as presented in Tables 8 and 9 can be a focus point in order to mitigate the possible negative influences or to leverage the driver characteristics.
- (ii) Using IITMM, specific improvement points can be identified for each IITMM components as shown on Table 10.
- (iii) Finally, overall improvement areas in terms of levels and dimensions of IITMM can be identified as noted in Table 11.

6. Conclusion

6.1. Summary and conclusion

The purpose of the study was to explore how Turkish organizations are implementing IT governance to achieve desirable behavior in the use of IT. For this purpose, a literature-based IITMM was developed to understand organization's perceived level of IT governance capabilities. The model was then applied to five companies from Turkish automotive supply industry.

Our study, as a first attempt to explore the IT governance phenomenon in Turkish organizations, has important contributions to the literature. First, the literature review on IT governance in the study identified and discussed three consecutive domains (i.e. describing, implementing and evaluating IT governance), which represents a new approach in consolidating IT governance literature. Second, the proposed IITMM discussed the IT governance literature in nine different management components which are integrated through three horizontal levels and vertical dimensions. Third, the results of the application of IITMM indicated some similarities and differences in perceived level of IT governance capabilities. In addition, general and specific focus areas were identified to improve the IT governance capabilities of organizations. Finally, implications for further research were identified.

Results of the study revealed that except strategic goals and operational goals, different IT governance capability patterns exist for each studied company, as also suggested by the literature. The strategic goals and operational goals of IT governance are well understood by all participated companies, and there are no major differences in these IT governance capabilities compared to other IITMM components. On the other hand, there is a room for improvement in structures and behaviors dimensions, especially in normative behaviors and strategic behaviors, as well as in strategic structures and operational structures. Besides these general improvement areas, specific IT governance constructs are identified as drivers

or inhibitors of effective IT governance implementation, which can be further considered as focus points. Finally, some IT governance mechanisms discussed in the IT governance literature, such as *IT control framework*, *independent assurance*, *IT project management*, *committees and councils*, *IT principles* and *end-user involvement* in determining IT strategies, are not perceived as effectively implemented.

To conclude, the results of this study indicate that the IITMM provides a useful framework for determining the current IT governance capabilities of companies considering its ability to recognize different levels of capabilities and to identify general and specific improvement opportunities.

6.2. Managerial and public policy implications

Based on a broad review of academic and professional IT governance literature, the IITMM can offer a practical approach for self-assessment of IT governance capabilities in an organization. It can also be used as a benchmarking tool for different organizations and industries.

The IITMM can also be utilized in the public sector to understand the IT governance capabilities of public organizations. Another implication can be the consideration of general and specific improvement areas [e.g. public sector healthcare services; Savory (2006)] to increase the IT governance capabilities of organizations.

6.3. Implications for further research

A virtue of an exploratory study is to develop new ideas for further studies [Yin (2003)]. Considering the purpose, scope, limitations and results of this study, the following future research is recommended.

First, possible inter-relations between the IITMM components and the factors affecting these relationships, including the effect of IT outsourcing and the influence of strategic structures and operational structures to the overall pattern of IT governance capabilities, can be further investigated by explanatory studies. Statistical validity tests of the proposed model can be performed as part of these studies. Second, possible relationships between perceived IITMM component scores and the perceived level of competition and company performance can be a future explanatory research area.

Another direction for future research would be to examine the evolution of IT governance capability levels and inter-relations between the IITMM components over time by repeating the study with a longitudinal focus.

Finally, the IT governance phenomenon can be investigated in other industries to identify any industrial similarities and differences which may provide important public policy implications.

References

- Aksoy, T. (2005). Ulusal ve uluslararası düzenlemeler bağlamında iç kontrol ve iç kontrol gerekliliği: Analitik bir inceleme. *Mali Çözüm*, Sayı, **72**: 138–164.
- Alsan, A. and Öner, M. A. (2003). An integrated view of foresight: Integrated foresight management model. *Foresight*, **5**, 2: 33–45.

- American Institute of Certified Public Accountants (AICPA) (2001). Consideration of internal control in a financial statement audit; Source: SAS No. 55; SAS No. 78; SAS No. 94. AU Section 319. Available at <http://www.aicpa.org>, 31.08.2006.
- American Institute of Certified Public Accountants (AICPA) and Canadian Institute of Chartered Accountants (CICA) (2003). Suitable trust services criteria and illustrations. Available at <http://www.aicpa.org>, 31.08.2006.
- Arens, A. A. and Loebbecke, J. K. (1997). *Auditing: An Integrated Approach*, 7th edition. Prentice Hall, New Jersey.
- Bankacılık Düzenleme ve Denetleme Kurumu (BDDK) (2006). Bankalarda Bağımsız Denetim Kuruluşlarının Gerçekleştirilecek Bilgi Sistemleri Denetimi Hakkında Yönetmelik. Resmi Gazete, 16 Mayıs 2006. No. 26170.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, **17**, 1: 99–120.
- Bedard, J.C., Jackson, C. M. and Graham, L. (2005). Issues and risks in performing systrust engagements: implications for research and practice. *International Journal of Accounting Information Systems*, **6**, 1: 55–79.
- Betz, F. and Khalil, T. M. (2011). Technology and financial innovation. *International Journal of Innovation and Technology Management*, **8**, 1: 1–25.
- Bladergroen, D., Maas, B. et al. (2001). *Delivering IT Services*. Kluwer BedrijfsInformatie, Deventer, Netherlands.
- Blanks, E. E. (1991). Enterprise analysis and global needs assessment. *Journal of Systems Management*, **42**, 7: 18–37.
- Bleicher, K. (1999). *Das Konzept Integriertes Management*. Auflage, Campus, Frankfurt/New York.
- Brooking, A. (1996). *Intellectual Capital: Core Asset for the Third Millennium Enterprise*. International Thomson Business Press, London.
- Brown, A. E. and Grant, G. G. (2005). Framing the frameworks: A review of IT governance research. *Communications of the Association for Information Systems*, **15**: 696–712.
- Brown, C. V. (1999). Horizontal mechanisms under differing IS organization contexts. *MIS Quarterly*, **23**, 3: 412–454.
- Brown, C. V. and Magill, S. H. (1998). Reconceptualizing the context-design issue for the information systems function. *Organization Science*, **9**, 2: 176–194.
- Canadian Institute of Chartered Accountants (CICA) (2004). *20 Questions Directors Should Ask About IT, Revised Edition*, Toronto.
- Capital Markets Board of Turkey (CMB) (2003). Corporate governance principles. Available at <http://www.spk.gov.tr>, 07.03.2006.
- Champlain, J. J. (2003). *Auditing Information Systems*, Second edition. John Wiley and Sons, New Jersey.
- Chang, L.-H. (2006). The political behavior intention in information system development from MIS professionals' perspective: A study based on the theory of planned behavior. *International Journal of Innovation and Technology Management*, **3**, 4: 341–360.
- Chen, J., He, Y.-B. and Jin, X. (2008). A study on the factors that influence the fitness between technology strategy and corporate strategy. *International Journal of Innovation and Technology Management*, **5**, 1: 81–103.
- Colbert, J. and Bowen, P. (1996). A comparison of internal controls: COBIT, SAC, COSO and SAS 55/78. *IS Audit & Control Journal*, **4**: 26–35.
- Committee of Sponsoring Organizations of the Treadway Commission (COSO) (1992). Internal control-integrated framework (COSO Report).
- Cram, A. (2007). The IT balanced scorecard revisited. *Information Systems Control Journal*, **5**: 3–36.
- Currie, W. (1995). The IT strategy audit: Formulation and performance measurement at a UK bank. *Managerial Auditing Journal*, **10**, 1: 7–16.

- Dahlberg, T. and Kivijarvi, H. (2006). An integrated framework for IT governance and the development and validation of an assessment instrument. *Proceedings of the 39th Hawaii International Conference on System Sciences*, Hawaii. Available at <http://www.computer.org>, 28.02.2008.
- Damianides, M. (2005). Sarbanes–Oxley and IT governance: New guidance on IT control and compliance. *Information Systems Management Journal*, **22**, 1: 77–85.
- Drucker, P. F. (1995). The information executives truly need. *Harvard Business Review*, January–February, pp. 54–62.
- Eisenhardt, K. M. (1989). Building theories from case study research. *The Academy of Management Review*, **14**, 4: 532–550.
- Elliot, R. K. (1992). Information technology: The third wave. *The CPA Journal*, **62**, 11: 22–27.
- Ernst & Young LLP (2002). Preparing for internal control reporting — A guide for management’s assessment under section 404 of the Sarbanes–Oxley Act. Ernst & Young SCORE Retrieval File No. EE0677, USA.
- Gelinas, U. J. Jr., Sutton, S. G. and Hunton, J. E. (2005). *Accounting Information Systems*, 6th edition. Thomson South-Western, USA.
- Grembergen, W. V. (2000). The balanced scorecard and IT governance. *Information Systems Control Journal*, **2**. Available at <http://www.isaca.org>, 02.06.2007.
- Grembergen, W. V., Haes, S. D. and Guldentops, E. (2004). *Strategies for Information Technologies Governance*. Idea Group Publishing, Belgium.
- Grembergen, W. V. and Haes, S. D. (2005). Measuring and improving IT governance through the balanced scorecard. *Information Systems Control Journal*, **2**: 35–42.
- Guan, J. and Liu, J. (2007). Integrated innovation between technology and organization. *International Journal of Innovation and Technology Management*, **4**, 4: 415–432.
- Guldentops, E. (2003). Maturity measurement — First the purpose, then the method. *Information Systems Control Journal*, **4**, 28.02.2008.
- Guldentops, E., Grembergen, W. Van and Haes, S. D. (2002). Control and governance maturity survey: Establishing a reference benchmark and a self-assessment tool. *Information Systems Control Journal*, **6**. Available at <http://www.isaca.org>, 02.06.2007.
- Haes, S. D. and Grembergen, W. V. (2004). IT governance and its mechanisms. *Information Systems Control Journal*, **1**: 27–33.
- Haes, S. D. and Grembergen, W. V. (2006). Information technology governance best practices in Belgian organizations. *Proceedings of the 39th Hawaii International Conference on System Sciences*, Hawaii. Available at site <http://www.computer.org>, 28.02.2008.
- Hamaker, S. (2003). Spotlight on IT governance. *Information Systems Control Journal*, **1**: 15–19.
- Henderson J. C. and Venkatraman, N. (1993). Strategic alignment: Leveraging information technology for transforming organizations. *IBM Systems Journal*, **32**, 1: 472–484.
- Hull, C. E., Baroody, A. J. and Payne, B. R. (2007). Supplementing the six facets model of technology management with a modified analytic hierarchic process: The effective evaluation of new technology prior to implementation. *International Journal of Innovation and Technology Management*, **4**, 1: 59–68.
- Institute of Internal Auditor’s Research Foundation (2001). Electronic systems assurance and control (eSAC) model. Available at <http://www.tarrani.net/kate/docs/eSACModel.pdf>, 28.02.2008.
- IT Governance Institute (2000). Control objectives for information and related technology (COBIT), 3rd edition, Rolling Meadows (IL). Available at <http://www.isaca.org>, 02.06.2007.
- IT Governance Institute (2003). *Board Briefing on IT Governance*, 2nd edition, Rolling Meadows (IL). Available at site <http://www.isaca.org>, 02.06.2007.
- IT Governance Institute (2004a). IT governance global status report, Rolling Meadows (IL). Available at <http://www.isaca.org>, 02.06.2007.

- IT Governance Institute (2004b). IT control objectives for Sarbanes–Oxley: The importance of IT in the design, implementation and sustainability of internal control over disclosure and financial reporting, Rolling Meadows (IL). Available at <http://www.isaca.org>, 02.06.2007.
- IT Governance Institute (2004c). COBIT mapping: Overview of international IT guidance, Rolling Meadows (IL). Available at <http://www.isaca.org>, 02.06.2007.
- IT Governance Institute (2005). Control objectives for information and related technology (COBIT) 4.0, Rolling Meadows (IL). Available at <http://www.isaca.org>, 02.06.2007.
- IT Governance Institute (2007a). COBIT mapping: Mapping of ITIL® with COBIT® 4.0, Rolling Meadows (IL). Available at <http://www.isaca.org>, 02.12.2007.
- IT Governance Institute (2007b). Control objectives for information and related technology (COBIT) 4.1, Rolling Meadows (IL). Available at <http://www.isaca.org>, 02.12.2007.
- Kaarst-Brown, M. L. and Kelly, S. (2005). IT governance and Sarbanes–Oxley: The latest sales pitch or real challenges for the IT function? *Proceedings of the 38th Hawaii International Conference on System Sciences*, Hawaii. Available at <http://www.computer.org>, 28.02.2008.
- Korac-Kakabadse, N. and Kakabadse, A. (2001). IS/IT governance: Need for an integrated model. *Corporate Governance*, **1**, 4: 9–11.
- Legrenzi, C. (2003). The second edition of the European survey on the economic value of information technology: Inventory of practices concerning IT governance. *Information Systems Control Journal*, **3**: 50–55.
- Loughman, T. P., Fleck, R. A. and Snipes, R. (2000). A cross-disciplinary model for improved information systems analysis. *Industrial Management and Data Systems*, **100**, 8: 359–369.
- Luftman, J. (2000). Assessing business-IT alignment maturity. *Communications of the Association for Information Systems*, **4**, 14: 2–51. Available at <http://cais.isworld.org>, 28.02.2008.
- Luftman, J. N., Lewis, P. R. and Oldach, S. H. (1993). Transforming the enterprise: The alignment of business and information technology strategies. *IBM Systems Journal*, **32**, 1: 198–221.
- Luftman, J. N., Papp, R. and Brier, T. (1999). Enablers and inhibitors of business-IT alignment. *Communications of the Association for Information Systems*, **1**, 11: 2–33. Available at <http://cais.isworld.org>, 28.02.2008.
- Ma, N. and Liao, M. (2006). A firm-level study of the international competitiveness: Theoretical analysis and empirical findings. *International Journal of Innovation and Technology Management*, **3**, 1: 21–41.
- McFarlan, F. W. (1981). Portfolio approach to information systems. *Harvard Business Review*, September–October, pp. 142–150.
- McFarlan, F. W., McKenney, J. L. and Pyburn, P. (1983). The information archipelago — Plotting a course. *Harvard Business Review*, January–February, pp. 145–155.
- McKay, J. and Marshall, P. (2004). Deriving business value from IT expenditures into assets with desired impacts. *Proceedings of the 12th European Conference on Information*, Turku School of Economics and Business Administration, Turku, Finland. Available at <http://csrc.lse.ac.uk/asp/aspecis/20040106.pdf>, 28.02.2008.
- McNamee, D. and Selim, G. (1998). *Risk Management: Changing the Internal Auditor's Paradigm*. Institute of Internal Auditors Research Foundation. Available at <http://www.mc2consulting.com>, 28.02.2008.
- Meredith, J. R., Raturi, A., Amoako-Gyampah, K. and Kaplan, B. (1989). Alternative research paradigms in operations. *Journal of Operations Management*, **8**, 4: 297–326.
- Ministry of International Trade and Industry (MITI) (1999). Corporate approaches to IT governance, Japan. Available at <http://www.jipdec.jp/chosa/gavanance9903/MITIBE/MITIbe.pdf>, 28.02.2008.
- Musson, D. and Jordan, E. (2005). The broken link: Corporate governance and information technology. *Australian Accounting Review*, **15**, 3: 11–19.

- Nestor, S. (2002). Corporate governance trends in the OECD area: Where do we go from here? Available at <http://www.oecd.org/dataoecd/6/55/1873098.pdf>, 28.02.2008.
- Nolan, R. L. and Seger, K. N. (1993). Note on information technology and strategy. Discussion Note, Harvard Business School Publishing Division, 9-193-059.
- Office of Government Commerce (OCG) (2005). Introduction to ITIL, TSO, London.
- Oud, E. J. (2005). The value to IT of using international standards. *Information Systems Control Journal*, **3**: 35–39.
- Peterson, R. R. (2000). Emerging capabilities of information technology governance: Exploring stakeholder perspectives in financial services. *Proceedings of the 8th European Conference on Information*, Vienna, Austria. Available at <http://is2.lse.ac.uk/asp/asppecis/20000194.pdf>, 02.06.2007.
- Peterson, R. (2004). Crafting information technology governance. *Information Systems Management Journal*, **21**, 4: 7–22.
- Phaal, R., Farrukh, C. and Probert, D. (2006). Technology management tools: Generalization, integration and configuration. *International Journal of Innovation and Technology Management*, **3**, 3: 321–339.
- Rezaee, Z. and Reinstein, A. (1998). The impact of emerging information technology on auditing. *Managerial Auditing Journal*, **13**, 8: 465–471.
- Ridley, G., Young, J. and Carroll, P. (2004). COBIT and its utilization. *Proceedings of the 37th Hawaii International Conference on System Sciences*, Hawaii. Available at <http://www.computer.org>, 02.06.2007.
- Sabherwal, R., Hirschheim, R. and Goles, T. (2001). The dynamics of alignment: Insights from a punctuated equilibrium model. *Organization Science*, **12**, 2: 179–197.
- Saka, T. (2001). *Türk Bankacılık Sektöründe Bilgi Teknolojileri Denetimi*. Türkiye Bankalar Birliği, İstanbul.
- Sambamurthy, V. and Zmud, R. W. (1999). Arrangements for information technology governance: A theory of multiple contingencies. *MIS Quarterly*, **23**, 2: 261–290.
- Saritas, O. and Öner, M. A. (2004). Systemic analysis of UK foresight results — Joint application of integrated management model and roadmapping. *Technological Forecasting & Social Change*, **71**, 1–2: 27–65.
- Savory, C. (2006). Does the UTTO model of tech transfer fit public sector healthcare services? *International Journal of Innovation and Technology Management*, **3**, 2: 171–187.
- Seger, K. and Stoddard, D. B. (1993). Managing information: The IT architecture. Discussion Note, Harvard Business School Publishing Division, 9-193-137.
- Simonsson, M. and Johnson, P. (2005). Defining IT governance: A consolidation of literature. EARP Working Paper MS103, Department of Industrial Information and Control Systems Royal Institute of Technology (KTH). Available at <http://www.ics.kth.se>, 02.06.2007.
- Singleton, T. and Flesher, D. L. (2003). A 25-year retrospective on the IIA's SAC projects. *Managerial Auditing Journal*, **18**, 1–2: 39–53.
- Skinner, C. (2006). Governance and ICT projects — A volatile mix! Presentation of the Australian Computer Society (ACS). Available at <http://www.acs.org.au/nsw/signs/pm/GOVERNANCEICTPROJECT20060215.pdf>, 03.06.2007.
- Soh, C. and Markus, M. L. (1995). How IT creates business value: A process theory synthesis. *Proceedings of the 16th International Conference on Information Systems*, Amsterdam, Netherlands. Available at <http://www.bus.ucf.edu/csaunders/ism7939/Soh%20Markus%20ICIS%20process%20theory.pdf>, 02.06.2007.
- Trites, G. (2004). Director responsibility for IT governance. *International Journal of Accounting Information Systems*, **5**: 89–99.
- Wacker, J. (2004). A theory of formal conceptual definitions: Developing theory-building measurement instruments. *Journal of Operations Management*, **22**: 630–650.
- Wagner, H. T. (2006). Managing the impact of IT on firm success: The link between the resource-based view and the IT infrastructure library. *Proceedings of the 39th Hawaii*

- International Conference on System Sciences*, Hawaii. Available at <http://www.computer.org>, 03.06.2007.
- Webb, P., Pollard, C. and Ridley, G. (2006). Attempting to define IT governance: Wisdom or folly? *Proceedings of the 39th Hawaii International Conference on System Sciences*, Hawaii. Available at <http://www.computer.org>, 03.06.2007.
- Weill, P. (2004). Don't just lead, govern: How top-performing firms govern IT. Center for Information Systems Research (CISR), MIT Sloan School of Management, CISR Working Paper No. 341. Available at <http://web.mit.edu/cisr/working%20papers/cisrwp341.pdf>, 03.06.2007.
- Weill, P. and Ross, J. W. (2004a). IT governance on one page. Center for Information Systems Research (CISR), MIT Sloan School of Management, CISR Working Paper No. 349. Available at <http://web.mit.edu/cisr/working%20papers/cisrwp349.pdf>, 03.06.2007.
- Weill, P. and Ross, J. W. (2004b). *IT Governance — How Top Performers Manage IT Decision Rights for Superior Results*. Harvard Business School Press, Boston, Massachusetts.
- Wheelen, T. L. and Hunger, J. D. (2004). *Strategic Management and Business Policy*, 9th edn., Pearson Prentice Hall, New Jersey.
- Williams, B. C. (1992). Auditing and recent developments in IT. *Managerial Auditing Journal*, 7, 5: 18–25.
- Wilson, M. and Howcroft, D. (2005). Power, politics and persuasion in IS evaluation: A focus on “relevant social groups”. *Journal of Strategic Information Systems*, 14, 1: 17–43.
- Woda, A. (2002). The role of the auditor in IT governance. *Information Systems Control Journal*, 2: 18–20.
- Yau, C. and Davis, T. (1993). Using analytic hierarchy process (AHP) to prioritize auditing tasks for large scale software-systems. *Journal of Systems Management*, 44, 11: 26–31.
- Yin, K. R. (2003). *Case Study Research: Design and Methods*, 3rd edn., Sage Publications, Thousand Oaks, London and New Delhi.

Biography

Emre Beşli is an Advisory Partner in Ernst Young Turkey. He specializes in IT auditing, governance, strategy, risk management, information security and IT due diligence services, and has more than 13 years of field experience. He is a founding member of ISACA Istanbul Chapter and holds many professional certifications including CISA, CGEIT, CRISC and CRMA.

M. Atilla Öner is an Associate Professor of production and operations management at the Department of Business Administration at Yeditepe University, Istanbul, Turkey. His research interests are integrated management modeling, foresight methodology, technology roadmapping. R&D management, technology management. He supervises M.Sc./M.B.A. and Ph.D. theses on national innovation systems, pilot national (sectoral) foresight studies and system dynamic modeling of R&D management, project management and public policy issues.