

# **Is board IT governance a silver bullet? A capability complementarity and shaping view**

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## **Abstract:**

This article examines how the impact of Information technology (IT) governance by the board of directors on firms' financial performance can be mediated through IT operating capabilities, and how such board IT governance (B-ITG) can modulate the influence of IT operating capability on financial performance. Findings based on a survey of 89 corporate directors indicate that both B-ITG and IT operating capability increase financial performance. They further point to complex B-ITG effects on financial performance, including complementarity with and shaping IT operating capability. They show that high B-ITG suppresses the effect of IT operating capability on financial performance and that B-ITG effects on financial performance are partially mediated through IT operating capability.

## **Highlights:**

- IT Governance by the board (an IT capability) can increase financial performance
- IT operating capability (an IT-enabled capability) can increase financial performance
- There is a suppression complementarity association between these two capabilities
- IT operating capability is shaped by board IT governance and mediates the effect of board IT governance on financial performance
- Board IT governance moderates (suppresses) the effect of IT operating capability on financial performance

## **Keywords:**

IT governance, board of directors, IT capabilities, capability complementarity, financial performance, resource-based view

## **1. Introduction**

Information technology (IT) can produce business value (Melville et al., 2004), and this is the primary reason why firms invest in IT (Chan, 2000; Hitt and Brynjolfsson, 1996). IT governance (ITG) is a planning and oversight mechanism that governs the translation of IT investments into business value. ITG is defined as: “the leadership and organizational structures and processes that ensure that the organization’s IT sustains and extends the organization’s strategies and objectives” (IT Governance Institute, 2003, p. 10). It is the joint responsibility of executive management team (e.g., the CIO or CEO) and the board of directors (IT Governance Institute, 2003, p. 10; De Haes and Grembergen, 2009). While most ITG studies have focused on executive-level ITG (ITG exercised by the executive team) (e.g., Ali et al., 2012; Bowen et al., 2007; Prasad et al., 2012), literature on board-level ITG (B-ITG, i.e., ITG exercised by the board of directors) has been sparse (Jewer and McKay, 2012). Nevertheless, recent studies unanimously show that B-ITG is an important component of overall ITG (Nolan and McFarlan, 2005), and that it can increase firms’ financial performance (Turel and Bart, 2014). Hence, the relatively isolated focus on executive-level ITG limits our understating of ITG and its impacts.

B-ITG is: “the board’s actions to ensure that the organization’s IT sustains and extends the organization’s strategies and objectives” (Turel and Bart, 2014, p. 224). Given its potential to improve various aspects of firm performance (Jewer and McKay, 2012; Turel and Bart, 2014; Turel et al., 2017), calls have been issued for setting a stand-alone board IT committee (Nolan

and McFarlan, 2005). However, more than a decade later, only a small number of boards have done so. For this study, we checked the existence of IT committees in Standard & Poor's 500 companies. Our findings indicate that as of 2018 only 4.4 % of listed companies had a board-level IT committee. This may not be indicative of the existence of IT governance efforts, but is certainly informative regarding the emphasis boards put on ITG. In contrast, over 80% of Standard & Poor's 500 companies had CIO or CTO positions. This difference may reflect the common misperception that IT is an operational matter and as such, should not concern the board (Turel et al., 2017). This gap seems to be out of step given the increased strategic importance of IT and the growing risks presented by IT.

There also seems to be a large gap between the academically-claimed benefits of B-ITG and the low emphasis on B-ITG in organizations (Turel et al., 2017). This represents a "board ITG paradox": low-level or no B-ITG does not seem to be associated with apparent poor or inferior firm performance. This paradox suggests that B-ITG influence may be contingent on other IT-related capabilities or situational factors. Focusing on these capabilities, we raise the research question: Does the interplay of B-ITG with other IT-related capabilities matter for financial performance? The objective of this study is to examine this question.

To address this question, we rely on the resource-based view (RBV) of the firm (Wernerfelt, 1984) and apply the concept of capability complementarity (Helfat, 1997). This theoretical perspective assumes that B-ITG is a special type of IT capabilities that can complement other capabilities (Turel and Bart, 2014). The other capability this study emphasizes is firm-level IT operating capability, defined as the ability of a firm to effectively and adequately use IT tools and functions to support ordinary processes and operations (Ravichandran and Lertwongsatien, 2005). This complementary capability choice is driven by three prime reasons. First, IT operational excellence drives firm performance (Subramani, 2004; Tippins and Sohi, 2003). Second, IT operating capability exists, to some extent, in all types of organizations, even when they do not have an IT unit. Third, IT operating capability may be influenced by, and complement B-ITG. In other words, IT operating capability may help translating B-ITG effects into financial performance.

Specifically, we posit that B-ITG represents an upper-echelons capability that complements and shapes firm-level operational capabilities related to IT, and that through this interplay it influences

financial performance. This perspective extends the RBV in IT contexts by (1) better explaining the complex effects of B-ITG on financial performance, and (2) showing that capability complementarity matters and should be considered in future RBV research. It can also address the abovementioned paradox, and explain why some firms with low B-ITG emphasis still perform well. We test the proposed model with data collected from 89 board members (directors). The findings indicate that B-ITG and IT operating capability are two important predictors of financial performance. The results also extend main-effect findings by showing that capability complementarity exists between B-ITG and IT operating capability, and that when IT operating capability is strong, it can reduce the effect of B-ITG (at least temporarily) on financial performance.

## **2. Theoretical Background**

This section provides a literature review of B-ITG, the IT capabilities we focus on, and the concept of capability complementarity.

### **2.1 ITG and B-ITG**

Because many business opportunities and risks are fundamentally IT-enabled and/or -related, firms have recognized the necessity and importance of ITG (Sambamurthy and Zmud, 2012). In their review, Wilkin and Chenhall (2010) identified 496 academic papers that focused on executive-ITG during the period 1998-2008. While these studies generate useful insights for executives (e.g., Ali et al., 2012; Bowen et al., 2007; De Haes and Grembergen, 2009; Prasad et al., 2012; Héroux and Fortin, 2018), they omitted board members, and consequently were limited in their B-ITG focus. For the current study, we searched Proquest database using keywords such as IT governance and board of directors, or similar terms. We read all abstracts of relevant scholarly articles, and selected papers that focused on both ITG and boards. Our review identified only 16 academic papers in the Information Systems (IS), Accounting Information Systems (AIS) and management fields as of 2018 (See Table 1). It is worth noting that two AIS journals<sup>1</sup> contributed 37.5 percent of the papers. Hence, AIS journals are an important voice for B-ITG research and can serve as a key information source for B-ITG practice.

It is also clear from the table that the year of 2010 was a tipping point in B-ITG research. We can call pre-2010 the "preliminary phase" and post-2010 the "developing phase". In the "preliminary phase",

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<sup>1</sup> Namely, the International Journal of Accounting Information Systems and the Journal of Information Systems.

research has been primarily exploratory, prescriptive and conceptual in nature. For example, Trites (2004) identified directors' main responsibilities in B-ITG, and Nolan and McFarlan (2005) explain key situational IT contingency factors boards should consider. In the "developing phase" more empirical research regarding B-ITG has emerged. For example, Jewer and McKay (2012) offered a broad picture of B-ITG, where both antecedents and outcomes of this practice were included and tested. Similarly, Turel and Bart (2014) empirically tested and supported Nolan and McFarlan's (2005) proposition that IT usage mode is a predictor of B-ITG. Taking a resource-based view (RBV), they also showed that B-ITG has a direct impact on financial performance. Since then, B-ITG has become an important topic in IT business value research. Most recently, Benaroch and Chernobai (2017) used secondary data to examine the "dark side" of IT and its consequences for B-ITG. Moreover, Turel et al. (2017) showed that communication style between the board and executives influence the translation of B-ITG into performance gains, and that strategic alignment mediates this translation. From Table 1, we can also conclude that RBV has been the main theoretical lens for empirical research on B-ITG.

**Table 1:** List of B-ITG articles

Reference	Fields	Conceptual or Theoretical	Descriptive or Empirical	Data Sources	Antecedents	Outcomes	Effects
Kambil and Lucas (2002)	MIS		Empirical	37 CEOs (Survey)		Size of IT investment	Direct
Trites (2004)	AIS	Conceptual					
Read (2004)	AIS	Conceptual					
O'Donnell (2004)	AIS	Conceptual					
Nolan and McFarlan (2005)	Management	Contingency theory			IT usage mode		
Huff et al. (2006)	MIS	Conceptual	Descriptive	17 directors and 17 CIOs (Survey)			
Li et al. (2007)	AIS		Empirical	220 firms (Secondary)		IT control material weakness	Direct
Andriole (2009)	MIS		Descriptive	50 CIOs and CTOs (Survey)			
Parent and Reich (2009)	Management	Conceptual					
Bart and Turel (2010)	AIS	Contingency theory	Descriptive	94 Directors (Survey)			

Jewer and McKay (2012)	MIS	Strategic choice theory, Institutional theory	Empirical	193 Directors (Survey)	Board Independence, Board Size, Role of IT, Board IT expertise, and Firm age	Financial Performance	Direct
Valentine and Stewart (2013)	Accounting	Conceptual					
Turel and Bart (2014)	MIS	RBV and Contingency theory	Empirical	171 Directors (Survey)	IT usage mode	Financial Performance	Direct
Higgs et al. (2016)	AIS	Signaling Theory	Empirical	281 security breaches (Secondary)		Security breaches and abnormal return	Direct
Turel et al. (2017)	MIS	RBV and paternalistic style view	Empirical	98 directors and 104 directors (Survey)		Strategic Alignment and Financial performance	Direct Indirect Interactive
Benaroch and Chernobai (2017)	MIS	RBV	Empirical	110 IT failures (Secondary)	Operational IT failure		Direct

Note: AIS = accounting information systems, MIS = management information systems.

## 2.2 IT Capabilities and IT-enabled Organizational Capabilities

The resource-based view of the firm (Wernerfelt, 1984) is a useful perspective for describing possible effects of IT capabilities on firm performance. The basic idea of RBV is that firms hold organizational resources that can allow them to achieve competitive advantage and potentially improve firm performance (Barney, 1991; Wernerfelt, 1984). Specifically, when a resource is rare, valuable, heterogeneously distributed and imperfectly mobile, it can create business value (Mata et al., 1995), and afford sustainable competitive advantage (Wade and Hulland, 2004). We follow Wernerfelt (1984) and Helfat and Peteraf (2003) in suggesting that organizational resources include both tangible and intangible assets. We also follow Wade and Hulland (2004) and Héroux and Fortin (2018) in suggesting that organizational capabilities are repeatable patterns of actions related to acquiring and utilizing resources.<sup>2</sup> In line with these definitions, it is reasonable to state that having IT resources may

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<sup>2</sup> In this paper, we adopt a narrower definition of resource, which is usually an input or output of a capability. In contrast, a capability uses some resources to generate other resources.

not necessarily mean possessing IT capabilities; but resources are a necessary condition for desirable capabilities.

Prior research has identified and defined different types of organizational capabilities, each of which usually captures the ability to perform particular organizational tasks (Helfat et al., 2009). IT-related capabilities represent one family of organizational capabilities that centers on IT resources and practices. It is an important family of capabilities because it can enhance firm performance (Bharadwaj, 2000; Chakravarty et al., 2013). Broadly speaking, IT-related capabilities can be broken down into two types. The first one is *IT capabilities*, which have been primarily drawn from within the firm's IT unit and/or the executive management team, and largely capture the ability of the central unit and the team to plan, deploy, implement, and manage IT projects and systems. Examples include IT planning capabilities, IT developing capabilities, and IT management capabilities (see Bharadwaj, Anandhi S, 2000; Bharadwaj et al., 1999; Bhatt and Grover, 2005; Feeny and Willcocks, 1998; Kettinger et al., 2013; Mithas et al., 2011; Wade and Hulland, 2004). Turel and Bart (2014) argue that B-ITG is a special IT management capability, given that it involves routine actions, that it is often rare, not easy to imitate and can consequently influence financial performance. We adopt this perspective here.

The second type is IT-enabled organizational capabilities, or *IT-enabled capabilities*. They are formed through integration between IT resources and organizational capabilities (Kohli and Grover, 2008; Nevo and Wade, 2010). IT resources can increase the value of organizational capabilities (Liang et al., 2010), for example, by creating cross-unit coordination (Tanriverdi, 2005). Consequently, IT-enabled capabilities can deliver business value and lead to performance gains (Liang et al., 2010).

When a capability has multiple components or is enabled by multiple information systems, it can also be regarded as a complex capability (Lamin and Dunlap, 2011). Extending this view, we argue that firms can leverage different IT resources and various organizational capabilities to build broad and spanning IT-enabled capabilities, namely firm-level cross-functional capabilities. In this study, we focus on an overarching type of spanning and cross-functional capabilities. It captures the general ability of *the firm*, rather than *the IT unit* alone, to utilize IT for obtaining business objectives. The overarching and spanning IT-enabled capability is called "IT operating capability". It is defined as the ability of a firm to effectively and adequately use IT tools and functions to support ordinary processes and operations (Ravichandran and Lertwongsatien, 2005). The de-centralization of IT capabilities in

modern firms makes the focus on a broad IT operating capability fruitful. First, not all firms have a standalone IT unit. Firms can just buy or rent IT resources and services and concentrate on operating external IT tools. Second, not all IT-related processes pertain to the IT unit, even if it exists. Employees and managers across the organization, and not just the IT unit, contribute to operating various IT functions and tools.

### **2.3 Capability Complementarity**

The literature thus far has mostly implied that IT resources play an interdependent role with other organizational capabilities. How one resource or capability may influence another and how the relationship between them might affect firm performance is termed "complementarity" (Teece, 1986). Black and Boal (1994) argue that one resource or capability can have one of two opposite effects on another capability: enhancing (synergetic) or suppressing (diminishing).<sup>3</sup> An enhancing effect means one resource or capability magnifies the impact of another. A suppressing effect exists when one diminishes the impact of another. In the economic literature, resource complementarity is described using different terminology: super-additive and sub-additive complementarity. Although the labels are different from those used in RBV, they carry a similar meaning. Super-additive complementarity means that a combination of resources produces better performance than either resource alone (i.e., there is synergy), whereas complementarity is sub-additive when the combination of resources results in worse performance than either one alone (Arora, 1996; Vassolo et al., 2004).

The RBV literature on complementarity has mostly focused on enhancing complementarity between IT resources and organizational resources or capabilities. That is, the focus has been on situations in which the relationship between firm capabilities and performance is reinforced by the presence of some IT resources. For example, Melville et al. (2004) propose that IT and complementary organizational resources positively affect firm performance; Nevo and Wade (2010) suggest that IT resource and organizational resources interact to achieve competitive advantages; and Liang et al. (2010) show that firm performance can be improved by the integration of IT resources and organizational capabilities.

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<sup>3</sup> Black and Boal (1994) also used the term "destroying" to describe an extreme case of suppressing relationships where the presence of one capability completely destroys or substitutes for another capability. In our paper, however, we just use the terms "suppressing" or "diminishing" to refer to more general and less extreme situations. As in the definition of resources, we adopt a narrower definition of complementarity, which manifests in a moderating effect. Specifically, enhancing complementarity manifests in positive moderation, whereas suppressing complementarity manifests in negative moderation.

The current study extends IT resource complementarity research to focus on IT capability complementarity. In other words, it examines complementarity of two capabilities, namely B-ITG (an IT capability) and IT operating capability (an IT-enabled capability). This integration is needed because capabilities are not operating in isolation; the interaction of organizational capabilities may help or impede performance improvements (Black and Boal, 1994). When studying multiple IT-related capabilities it can be important and informative to consider their relationships (i.e., how one capability interacts with another to impact financial performance). Similar views regarding the need to study IT capability complementarity have been expressed, for example, by Rai and Tang (2010) who show that two IT capabilities operate as complements to influence competitive performance; and Benitez-Amado and Walczuch's (2012) who propose a moderation hypotheses of two IT capabilities. Following the latter study, it is reasonable to argue that moderation effect is a valid operationalization of capability complementarity. Specifically, positive moderation represents enhancing complementarity (super-additive), and negative moderation represents suppressing complementarity (sub-additive). Another example is in macroeconomic measures of technological capabilities of countries, where the sources of capabilities are complementary (Cerulli and Filippetti, 2012). Although the unit of analysis is "country", rather than "firm", the logic of capability complementarity is similar.

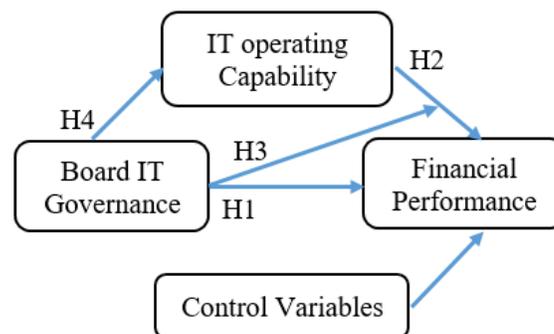
#### **2.4 Capability Shaping**

IT capabilities can shape or build other IT-enabled capabilities (Sambamurthy et al., 2003). During the capability shaping process, IT capabilities act as an enabler of IT-enabled capabilities, and improve the integration of IT and firm resources. When an IT capability is at a higher-level than an IT-enabled capability, the capability shaping is smooth. Specifically, high-level capabilities involve strategic processes and are often regarded as dynamic capabilities, whereas low-level capabilities includes specific routines and are mainly operational in nature (Winter, 2003). Moreover, high-level capabilities are exercised by boards of directors that can identify and foresee the opportunities and threats available in the IT domain. Low-level capabilities, in contrast, are performed by managers and employees who implement decisions. Hence, high-level capabilities can shape and modify lower-level capabilities, which, in turn, directly influence firm performance. This is consistent with upper-echelons theory, according to which the spirit and actions of the upper-echelons diffuse and influence the spirit and actions of lower echelons (Hambrick and Mason, 1984).

In addition, depending on the scope of the organizational tasks, Grant (1995) describes a hierarchy of organizational capabilities, where specialized capabilities can be integrated into broader capabilities, such as marketing capability and new production development capability. In a similar vein, Wade and Hulland (2004) introduce the concept of spanning capabilities, which integrate multiple narrower capabilities. Similarly, specialized IT capabilities can enable the integration of different IT resources and various organizational capabilities to shape broad and spanning IT-enabled capabilities. Consequently, the broad capability will have a stronger, aggregated impact on firm performance (Grant, 1995).

### 3. Hypotheses

The proposed research model (Figure 1) is rooted in the RBV of the firm, combined with Black and Boal’s (1994) typology of complementarity, and operationalized with Benitez-Amado and Walczuch’s (2012) moderation and mediation hypotheses of two IT capabilities. It posits that B-ITG and IT operating capabilities increase the firm’s financial performance, but that they do so differently. While IT operating capability directly drives financial performance, B-ITG directly and indirectly influences financial performance as well as moderates the effect of IT operating capability on financial performance. The model then points to the possible complexity of this interplay of two capabilities.



**Figure 1:** Research Model

#### 3.1 Direct Effects of Two IT Capabilities: B-ITG and IT Operating Capability

The board directs the executives’ attention to IT issues that the board perceives to be important (new risks and opportunities), requires careful budgeting and planning, and oversees the performance on various IT related metrics. These efforts have been shown to lead to performance gains (Cannella and

Pettigrew, 2001; Mueller and Barker, 1997). Specifically, B-ITG can produce temporary and potentially sustained competitive advantage (Turel and Bart, 2014), which can lead to IT-related improvements in financial performance (Jewer and McKay, 2012) and ultimately to superior firm outcomes (Wiggins and Ruefli, 2002).

B-ITG specifically can improve financial performance through three channels: (1) directing executives' attention to IT issues, risks and opportunities that would be ignored otherwise and creating an atmosphere of accountability regarding IT matters, (2) informing the organization regarding best practices in other organizations with which directors are familiar (i.e., importing knowledge from other organizations), and (3) providing access to resources (financial, knowledge, experts, etc.) that would not be available to the organization otherwise (Turel and Bart, 2014). Such capabilities create a trajectory of growth and can consequently lead to a better position in the market and to performance gains (Cockburn et al., 2000). In general, in order to have a positive effect on performance, a capability needs to be valuable, heterogeneously distributed and imperfectly mobile (Mata et al., 1995). B-ITG meets the above three criteria; accordingly, it has been shown to increase financial performance (Jewer and McKay, 2012; Turel and Bart, 2014). Replicating these results:

**H1:** The level of B-ITG is positively associated with financial performance.

We propose that IT operating capabilities can lead to financial performance improvements. Similar effects have been demonstrated regarding many IT capabilities (Bharadwaj, 2000; Chakravarty et al., 2013; Santhanam and Hartono, 2003) and specifically regarding IT operating capability (Ravichandran and Lertwongsatien, 2005; Tippins and Sohi, 2003). The logic is that IT operating capability requires experience, knowledge and learning to ensure that daily IT operations cater to firm goals. Hence, IT operating capability is rare, valuable, and difficult to imitate; these attributes can create a competitive advantage for firms that possess such capabilities. In essence, when a firm knows how to utilize IT effectively for its daily operations and it does so better than its competitors through a proper mix of IT resources, skills and routines (i.e., it has high IT operating capability), it will likely do well and outperform its competitors.

Performance gains accrue because IT operating capability can directly contribute to competitive advantages and superior financial performance, at least temporarily (Augier and Teece, 2009). It can specifically improve financial performance by (1) supporting business strategies and functions to achieve strategic IT alignment which can lead to performance gains (Chan, 2002; Reich and Benbasat,

1996), and (2) enabling smooth day-to-day functioning, and as such, avoiding the costs of malfunctioning and associated errors and delays. Therefore, we posit that:

**H2:** The level of IT operating capability is positively associated with financial performance.

### **3.2 Enhancing Complementarity between Two IT Capabilities: The Positive Moderating Role of B-ITG**

Past research has discussed enhancing complementarity (e.g., Benitez-Amado and Walczuch, 2012; Rai and Tang, 2010; Zhu, 2004). It is an important characteristic of many IT resources, and serves as a basis for IT-enabled capabilities. Recently, enhancing complementarity has also been shown to improve competitive position or performance (Teece, 2010). For example, top management commitment to IT can interact with IT capabilities to positively affect firm performance (Wade and Hulland, 2004).

We similarly argue that it is plausible that B-ITG enhances the effect of IT operating capability on financial performance. We can consider B-ITG to be a compass, helping to steer IT operating capabilities in an optimal direction. The logic is that the effect of IT operating capability on financial performance may require constant renewal and modification; capabilities that were good yesterday may not suffice today, given industry and business dynamics. When the board's compass is active and accurate (i.e., B-ITG is high), IT operating capability should be better steered toward up-to-date goals and tuned to current needs; IT operating capability will consequently be better targeted at improving financial performance. In contrast, when B-ITG is weak, IT operating capability may be high, but not be properly tuned for the extant industry needs, and may not be properly monitored. In such cases future adjustments may not be in an optimal direction as they will be based on partial and perhaps incorrect information stemming from poor monitoring. In essence, impactful IT operating capability may be more transient in organizations with low B-ITG, and be more sustainable in organizations with high B-ITG.

In addition, the board can present IT-related questions to the management team; through this process it reduces the information asymmetry between IT management and stakeholders and ultimately prevents opportunistic behaviors of IT management and ensures proper investment in IT resources and IT capabilities (e.g., good IT training as opposed to a pay raise to the CEO). Therefore, B-ITG can protect and sustain the effect of IT operating capability on financial performance.

Lastly, directors are often affiliated with multiple organizations and have industry and governance experience (Zahra and Pearce, 1989). They can therefore provide firms with access to IT resources, information, knowledge and capital, to which executives may not have access. External IT knowledge may include the IT oversight practices developed in another firms or experiences gained with an outsourcing vendor. Access to IT capital may include the ability to secure funds for a system implementation project. The added value B-ITG produces through such actions can further improve the effect of IT operating capability on financial performance. For example, good IT acquisition and deployment abilities will not suffice if the board does not initiate an important strategic project its members observed elsewhere, or if the board cannot secure or approve the funding for the project. Taken together, all of these arguments suggest that it is possible that B-ITG can strengthen the effect of IT operating capability on financial performance. Hence:

**H3:** The effect of IT operating capability on financial performance is moderated (strengthened) by B-ITG.

### **3.3 Shaping IT Operating Capability through B-ITG: The Mediating Role of IT Operating Capability**

According to upper echelons theory, boards' choices and actions can be reflected in organizational outcomes through mediated influences on firm employees' behaviors and attitudes (Hambrick and Mason, 1984). Applied here, it implies that the board's ITG efforts can diffuse down in the organization and shape IT operating capabilities. In other words, B-ITG can help financial performance through the direct enhancement of organizational capabilities that are executed by lower echelons. We specifically argue that B-ITG can shape and cultivate superior IT operating capability. This effect is possible since the board is at a higher level in the organizational hierarchy than IT managers and employees (i.e., those who handle IT operations). The board is not a direct participant in the day-to-day operations of IT, and instead assumes the responsibilities of initiating and steering the needed planning at the executive level, monitoring top management and its plans, setting compensation schemas for executives (including the CIO or CTO), and measuring top management and firm performance. As part of its duties, board can apply "bottom-line control": firing inferior CIOs and IT managers and hiring good ones (Mizruchi, 1983; Weisbach, 1988), which in turn should lead to improved IT operating capability.

In addition, as directors are often affiliated with multiple organizations, they can raise important IT issues, invest in IT resources and provide IT information and knowledge, which are necessary components for improving IT operating capability. Therefore, B-ITG can directly improve IT operating capability. Moreover, as boards are familiar with the business environment, B-ITG can renew and modify the IT operating capability when there are changes in the environment (Winter, 2003). As such, B-ITG can help creating, adjusting and maintaining superior IT operating capability. This hypothesis implies that in addition to the direct effect of B-ITG on financial performance, B-ITG can also influence financial performance through IT operating capability improvements. Hence, IT operating capability is proposed to be a partial mediator of the effect of B-ITG on financial performance. Therefore:

**H4:** The level of B-ITG is positively related with the levels of IT operating capability.

#### **4. Methodology**

We used a paper-based survey to collect data about the main constructs, control variables and descriptive variables, including the industry in which the organization operates (e.g., advanced technology, banking, chemicals), board roles of respondents (e.g., chair, vice chair), number of boards participants serve on, and the age of the organization (see Appendix A).

We administered the survey to 708 directors who attended general corporate director governance training programs in Canada and the USA. The survey was given during a break between training sessions. The study received ethics approval. Because respondents could serve on multiple boards, we asked them to focus on a single board and organization with which they are most familiar. We did not collect identifying information in order to ensure that respondents do not face legal risks and feel free to report the current rather than the desired state of affairs in their organizations. Out of the invitees, 91 started the survey. Two surveys were incomplete and were removed and a sample of 89 board members representing 89 distinct boards and 89 participating organizations (response rate of 12.7%) was retained<sup>4</sup>. This response rate is acceptable, because surveys of boards and top management have been plagued by very low response rate (Gulati and Westphal, 1999). For example, Jewer and McKay

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<sup>4</sup> Since we could not collect any identifying information about the organizations, we had to rely on the descriptive information such as firm size, firm age, board size, board age and so on to ensure the 89 boards are distinct. Chances of duplicate organizational representation were further reduced by the fact the vast majority of organizations (97%) had sent a single board member for the training.

(2012) report 7% response rate in their survey of directors. We recorded the survey sources (Canada, n=72 or the USA, n=17), and found using multivariate analysis of variance that there are no significant difference between board members from these two countries (Pillai's Trace =0.058,  $F_{4,71} = 1.098$ ,  $p < 0.36$ ). We hence used the whole dataset. Descriptive statistics are given in Table 2.

**Table 2:** Descriptive Statistics of surveyed boards and firms

	Mean	Standard Deviation
Board Characteristics:		
Years of experience (years)	6.1	5.3
No. of boards serving on	2.2	1.3
Board size (people)	9.9	5.1
Chair (%)	17%	
Vice Chair (%)	15%	
Chair of a committee (%)	43%	
Board member only (%)	40%	
Firm Characteristics:		
Firm age (years)	45.1	38.2
Sales (million dollar)	567	2041
Firm size (people)	101-500	
CEO on board (%)	66.3%	
Have CIO position (%)	39.3%	

Note: The total board role is over 100%, since the chair and vice chair could also chair committees.

We adapted most items from existing validated scales and used a seven-point scale for all multi-item constructs. The dependent variable was financial performance that was measured with items from Turel & Bart (2014). It is a self-reported measure of performance that captures how directors perceive their organization's performance from a financial standpoint. We adapted a self-reported financial performance measure for several reasons. First, the validity of such measures has been demonstrated (Tallon, 2010; Tallon et al., 2000; Turel and Bart, 2014). It is worth noting that the board is in a good position to assess financial performance because its members receive periodical reports dedicated to financial performance. Second, directors often face legal risks of disclosing actual financial performance or observations regarding their firms, so we could not collect any identifying information, including links to financial reports and other objective performance measures. Third, perceptive financial performance measures can be advantageous compared to objective metrics, especially if the source providing the information is well informed because objective performance measures tend to be

influenced by the type of industry and can be meaningless when not contrasted with competitors' performance metrics and expectations (Bart, 1993). The advantage also stems from the comparison to peers (which is not reflected in financial reports), and from overcoming the "cooking" and strategizing that manifest in financial performance indices (e.g., deciding if an expense is deducted now or later on; which can be done differently in different firms).

The two main independent variables are B-ITG and IT operating capability. B-ITG includes five items that were adapted from Jewer & McKay (2012); it is a focused measure that taps into IT governance actions in which the board actively engages. IT operating capability has two items that were based on Tippins & Sohi's (2003) measures and interviews with board members. The items capture the extent to which organizations effectively use IT to achieve its objectives and run its daily operations. These items are closely aligned with the conceptual definition of operational capability.

Note that the board is in a good position to report IT operating capability. First, IT operating capability is a spanning firm-level IT-enabled capability, not a specific IT capability derived from within IT unit. Moreover, strategic planning exercises and retreats often involve preliminary insights from boards on various operational capabilities (including IT) and these serve as a basis for planning changes and improvements. Not being aware of the overall IT-enabled capabilities of the firm they govern can be perceived as a breach of their fiduciary duty, especially since regulations such as SOX requires directors to have reasonable assurances regarding the accuracy of their data and reporting systems. Second, it is not uncommon to collect IT-related measures from directors. For example, Jewer and McKay (2012) collect measures about general roles of IT in the organization, and Turel and Bart (2014) collect measures about the needs of IT at the firm level. Therefore, boards should be aware of this firm-level measure.

All items were initially approved by 15 board members and 10 CIOs as relevant to the content domain of the construct. We then pilot tested these scales with 30 MBA students in IT leadership roles; all scales were reliable ( $\alpha > 0.7$ ) and had the expected loading pattern. Next, all items were pretested with five directors for clarity, understandability and content validity; the items were deemed to be appropriate.

#### **4.1 Control Variables**

Control variables included firm size (number of employees), industry IT dependence as adapted from Kearns and Lederer (2004), the percent sales spent on IT (IT expenses divided by total sales), director

experience with the board, and a dummy variable capturing the survey source. Finally, board independence (percent of outside directors) was operationalized by dividing the self-reported number of independent directors ("How many outside directors are on the board?") by the self-reported number of board members ("How many directors are on the board?"). Such variables were shown to be plausibly important determinants of board behavior and dynamics, as well as financial performance (Jewer and McKay, 2012; Mallette and Hogler, 1995; O'Shannassy, 2010; Shivdasani and Yermack, 1999; Turel and Bart, 2014).

#### **4.2 Validity Assessments**

We tested construct validity for the multi-item constructs. All Cronbach's alphas (see Table 3) were above 0.80 which indicate acceptable reliability. Supporting convergent and discriminant validities, four components emerged and all item loadings were above 0.71 with cross-loadings below 0.33 in a principal component analysis model with oblique rotation implemented in SPSS 24. Moreover, these validities were supported by the high and acceptable composite reliability and average variance extracted (AVE) scores (Fornell and Larcker, 1981). Discriminant validity was supported by the fact that the square root of AVE scores were higher than other correlations for all constructs (see Table 3).

We tested for potential common method variance (CMV) using two techniques. We first performed Harman's single factor test. The measurement items were subjected to a principal component analysis model with no rotation in SPSS 24. The four expected factors emerged, explaining a total of 81.2 percent of the variance and the first component explained only 42 percent of the total variance. This demonstrates that there is no single factor that accounts for all the variance. Second, a common latent factor (MacKenzie and Podsakoff, 2012; Podsakoff et al., 2003; Podsakoff et al., 2012) that captures the communal variance of all indicators of the measurement model was added to a confirmatory factor analysis model which included all multi-item scales. The confirmatory factor analysis model was then estimated with and without this common latent factor, and the differences in loadings were found to be negligible (0.03–0.07) and below the 0.2 cutoff. Taken together, these results indicate that it is unlikely that a bias as a result of CMV is pertinent in these data.

### **5. Analysis and Results**

Descriptive statistics, correlations and reliability measures (for multi-item constructs) were calculated (see Table 3).

**Table 3: Descriptive Statistics, Correlation Matrix and Reliability Indices**

Constructs	Mean (SD)	1	2	3	4	5	6	7	8	9	
Main Variables	1. IT Operating Capability (ITOC)	4.78 (1.18)	<b><i>0.88 (0.84) [0.85]</i></b>								
	2. Board ITG (B-ITG)	3.86 (1.36)	0.39 **	<b><i>0.81 (0.91) [0.90]</i></b>							
	3. Interaction ITOC x B-ITG	-	-0.08	0.17	-						
	4. Financial Performance	5.16 (1.04)	0.54 **	0.38 **	-0.18	<b><i>0.82 (0.83) [0.85]</i></b>					
Control Variables	5. Industry IT Dependence	5.5 (1.37)	0.30 **	0.22 *	-0.00	0.29 **	<b><i>0.88 (0.87) [0.87]</i></b>				
	6. Percent of Outside Directors	0.83 (0.51)	0.25 *	-0.16	-0.28 **	0.16	0.12	-			
	7. Firm Size (No. of Employees Scale)	3 (1.67)	0.10	0.15	-0.15	0.13	0.34 **	0.03	-		
	8. Percent of IT Expense of Sales	0.06 (0.10)	0.03	0.01	-0.06	0.07	-0.11	0.09	-0.13	-	
	9. Experience (No. of years on Board)	6.06 (5)	0.21 *	-0.07	-0.16	0.24 *	0.20	-0.08	0.08	-0.08	-
	10. D_Survey Source	-	0.07	0.07	0.00	-0.13	0.17	-0.09	0.11	-0.06	0.08

Note: Square root of AVE, ( $\alpha$ ) and [Composite Reliability] scores are bolded and italicized on the diagonal for multi-item constructs.

## 5.1 Model Estimation

Given the demonstrated reliability and validity, we next estimated the research model (operationalized with multiple-item scales) using the structural equation modeling facilities of AMOS 24. Initially, a confirmatory factor analysis model with multi-item scales was fit to the data and produced good fit indices ( $\chi^2/df$  ratio = 1.61, CFI = 0.96; IFI = 0.96; TLI = 0.95; RMSEA = 0.080; and SRMR = 0.059). All loadings were significant ( $P < 0.001$ ). Consequently, we proceeded to estimate the structural model. In order to separate the main, moderation and mediation effects, the model was estimated in a hierarchical fashion. First, a model with only main direct effects of IT operating capability and B-ITG was estimated. It included the H1 and H2 paths. The model presented acceptable fit indices ( $\chi^2/df$  ratio = 1.45, CFI = 0.94; IFI = 0.95; TLI = 0.92; RMSEA = 0.071 with P-close= 0.104; and SRMR = 0.076); H1 ( $\beta = 0.29, P < 0.05$ )<sup>5</sup>, and H2 ( $\beta = 0.39, P < 0.01$ ) were supported.

Second, a model that accounts for capability complementarity effects was specified by adding the interaction term of IT operating capability and B-ITG. This model produced good fit ( $\chi^2/df$  ratio = 1.42, CFI = 0.94; IFI = 0.95; TLI = 0.91; RMSEA = 0.069 with P-close= 0.117; and SRMR = 0.078). The results of hypothesis testing were consistent with the previous model: H1 ( $\beta = 0.33, P < 0.01$ ), and

<sup>5</sup> All  $\beta$ s are standardized coefficients.

H2 ( $\beta = 0.37$ ,  $P < 0.01$ ) were still supported. The moderation effect result did not support the hypothesized *enhancing complementarity* effect (H3), as indicated by the negative moderation coefficient ( $\beta = -0.16$ ,  $P < 0.05$ ). The negative coefficient implies a *suppressing complementarity* effect. That is, B-ITG seems to overpower the effects of IT operating capability on financial performance. An elaborated post-hoc analysis of this effect is provided in section 5.2, where we provide possible explanations for the observed suppressing complementarity effect.

Third, a model that also included the hypothesized mediation effect (H4) was estimated. This model also produced good fit ( $\chi^2/df$  ratio = 1.42, CFI = 0.94; IFI = 0.95; TLI = 0.92; RMSEA = 0.069 with  $P$ -close = 0.123; and SRMR = 0.079). The results of hypothesis testing were consistent with the previous models. The standardized path coefficients of four hypotheses, their levels of significance, and the endogenous variables' Squared Multiple Correlations (explained variance) are depicted in Table 4. The results support the mediated-moderation effect. They show that the effect of B-ITG on financial performance is mediated through IT operating capability (see elaborated analysis in section 5.3) and that B-ITG moderates the effect of IT operating capability on financial performance. This model explained 29% of the variance in financial performance, and 26% of the variance in IT operating capability. Among the control variables, only the dummy variable representing survey source had a significant effect on financial performance, indicating that sampled organizations in Canada performed better than sampled organizations in the USA.

**Table 4: Hypothesis Testing Results**

		Model 1	Model 2	Model 3
Controls	D_Survey Source	-0.21 *	-0.22 **	-0.22 **
	Years on the Board	0.11	0.10	0.09
	Percent IT expense of Sales	0.04	0.04	0.04
	Percent Outside Directors	0.04	0.01	0.01
	Industry IT Dependence	0.06	0.07	0.08
	Firm Size	0.09	0.06	0.06
Main and Interaction Effects	IT Operating Capability (ITOC)	0.39 **	0.37 **	0.38 **
	Board ITG (B-ITG)	0.29 *	0.33 **	0.32 **
	Interaction (ITOC x B-ITG)		-0.16 *	-0.16 *
	<i>Mediation Effect</i>			0.51 ***
R Square		0.263	0.286	0.287
Sample Size (n)		89	89	89

\*p<0.05; \*\*p<0.01; \*\*\*p<0.001. Mediation Effect: B-ITG => ITOC

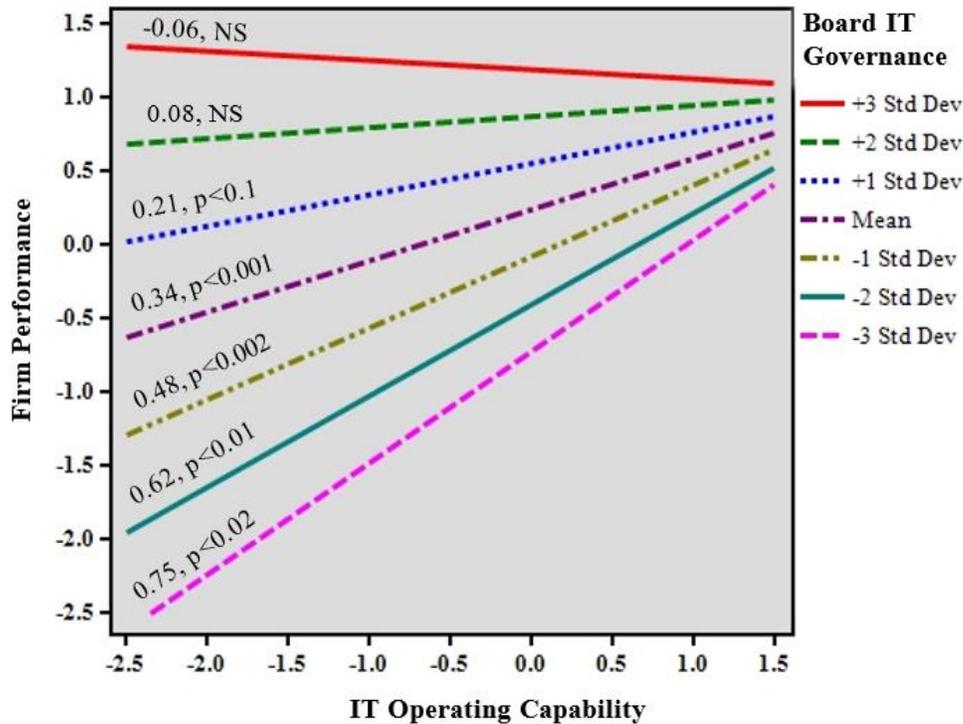
## 5.2 Post-hoc Analysis: Suppressing Complementarity

Our results show that the two capabilities of interest have a suppressing/diminishing (sub-additive) complementarity effect. One conceivable explanation for a suppressing effect is that the two capabilities may be somewhat redundant; it has been noted that capabilities can be at odds in specific situations and serve as substitutes for one another (Schreyögg and Kliesch-Eberl, 2007). For example, if the board directly approves IT projects, contracts with vendors, and closely oversees IT implementation (e.g., through intense monitoring), IT operating capability may not play a critical role in ensuring such projects are successful and contribute to financial performance. Another possible suppression explanation is competition. For instance, firms with more efficient and effective IT operations may lack the slack resources needed to implement new IT initiatives from the board. In summary, the existence of one capability diminishes the ability of the other capability to be optimally utilized.

Integrating these views, the existence of lower-level capabilities (e.g., the ability to effectively utilize IT through a proper mix of processes, training and technologies) may make higher-level oversight and involvement from the board less impactful because the lower-level capabilities override, and/or interfere with the higher-order ones. As such, IT operating capability and B-ITG can be redundant capabilities: when one (IT operating capability) is highly functional and accessible, the importance of and need for the second one (B-ITG), as well as its ability to contribute to financial performance, diminishes. In extreme cases these capabilities may not just be competing, but one capability (B-ITG)

may lead to negative effects of the other (IT operating capability) on financial performance because the operating capability wastes resources and is not utilized in a direction that will benefit the organization. This may happen, for instance, if the board's involvement in IT matters is too high (e.g., weekly progress reports are provided to the board), and consequently, IT resources and capabilities are diverted to deal with unsubstantiated board needs rather than with the implementation of relevant IT projects. Such suppressing complementarity of IT capabilities is largely overlooked in the literature. The significant negative interaction is further illuminated in Figure 2. The slopes and their significance levels (p-values) are reported above each regression line. The regression lines for the IT operating capability - financial performance effect at a level of B-ITG of two and three standard deviations above the mean are non-significant; the regression line for B-ITG one standard deviation above the mean is marginally significant ( $p < 0.1$ ); and the regression lines for B-ITG with values around the mean or below are statistically significant (at least at  $p < 0.02$ ). Hence, IT operating capability seems to produce performance gains only when B-ITG is around or below the mean. When B-ITG is high, IT operating capability has no effect on financial performance, and perhaps in extreme cases of very high B-ITG can even have negative effects (as per the sign of the coefficients, though these effects were not significant).

Our model also implies a mediation effect through which B-ITG influences financial performance. In order to be able to contrast and compare these effects, a bootstrapping procedure (200 re-samples, 95% confidence intervals) was performed in AMOS 24. The standardized total effect of B-ITG (0.514,  $p < 0.005$ ) is somewhat higher than the total effect of IT operating capability (0.377,  $p < 0.025$ ) on financial performance (though not significantly, since the confidence intervals overlap). Hence, it can be argued that these capabilities are at least equally important in determining financial performance. The analysis also supports our view that the effect of B-ITG on financial performance is partially mediated through IT operating capability.



**Figure 2:** Interaction between IT operating capability and board ITG

## 6. Discussion

The study sought to address the research question: Does the interplay of B-ITG with other IT-related capabilities matter for financial performance? It was addressed by showing a suppressing complementarity relationship between B-ITG and IT operating capability and a complex set of direct and indirect influences of B-ITG on financial performance.

### 6.1 Theoretical Implications

First, this study untangles the complex effects of B-ITG on financial performance. Past research has shown that this effect is direct and simple (Jewer and McKay, 2012; Nolan and McFarlan, 2005; Turel and Bart, 2014). Accordingly, it was suggested that "boards of directors should attempt to cover the broad range of IT issues, regardless of the current and obvious IT needs." (Turel and Bart, 2014, p 235). While this may be true, our findings suggest that B-ITG can influence firm-level IT-enabled capabilities which in turn impact financial performance, and that considering the two types of capabilities simultaneously is important. IT capabilities are normally not a contingency that is considered for adopting a B-ITG stance (Nolan and McFarlan, 2005); our findings indicate that IT operating capabilities should be considered when making B-ITG plans and can be considered to be an important contingency factor for such decisions.

Second, by relying on the RBV of the firm, we show that B-ITG and IT operating capability are generally fruitful; they have similar magnitude of positive total effect on financial performance (see section 5.3). Nevertheless, we also show that there are situations in which they can be less impactful. Specifically, in some cases B-ITG may be detrimental to financial performance (although the direct effect is positive). The existence of strong B-ITG means that the effect of IT operating capability is diminished. Considering Figure 2, it seems that with B-ITG values of about 2.5 (two and a half standard deviations above the mean, since we use factor scores), IT operating capability can be detrimental to financial performance, as the effect of IT operating capability on financial performance can become negative. The results point to the need of the IT business value literature to consider suppressing capability complementarity (i.e., how one IT capability suppresses another IT capability's effects), rather than focusing solely on the main effects of such capabilities.

Third, as we show in this study, in some situations researchers should expect suppressing complementarity. This may be especially true regarding relations between two IT capabilities that can compete for resources and relevance, such that when one is high there is insufficient resources for the other, or little incentive to develop the other capability. It is also possible that there are some contextual variables or a time factor that cause two capabilities to behave in an enhancing or a suppressing complementarity manner. In other words, two IT capabilities can possibly show different complementarity associations under different circumstances and at different times. Similarly, it may be possible to observe suppressing complementarity in macroeconomic measures of technological capabilities of countries. Nevertheless, such suppressing complementarity effects are largely ignored in the current complementarity research. Hence, exploring these ideas is a promising future research direction.

Fourth, when considering capability shaping, it is worth noting that the effect of a specific capability (e.g. B-ITG) is mediated through a spanning capability (e.g. IT operating capability). The findings contribute to the RBV and IT capability literatures by further emphasizing the importance of broad IT-enabled capabilities. Many studies have emphasized the importance of capabilities of the IT unit (Kohli, Rajiv and Grover, Varun, 2008; Wade and Hulland, 2004). Similarly, many studies on ITG have focused on this IT unit and how it manages IT projects and operations (Jewer and McKay, 2012). Nevertheless, many organizations do not have a central IT unit, and this illuminates the need for future research to focus on broad capabilities not just on specific capabilities derived from an IT unit. Many IT-enabled capabilities (e.g., innovation and collaboration capabilities) are good candidates to be

considered as broad organizational capabilities. Future research can also integrate such capabilities into our model.

To summarize, our findings extend knowledge regarding and contribute to the literatures on B-ITG, IT capabilities, IT business value, and capability complementarity. They also extend knowledge regarding corporate governance, as they help direct boards to optimize their ITG efforts as a function of IT operating capabilities.

## **6.2 Implications for Practice**

Our findings are aligned with past research in that they point to recommendations to increase IT operating capability (Tippins and Sohi, 2003), and B-ITG (Bart and Turel, 2010; Jewer and McKay, 2012; Nolan and McFarlan, 2005; Turel and Bart, 2014) in order to achieve performance gains. As per such studies, this may be achieved by creating awareness regarding the strategic and operational contributions of IT, providing training to board members (e.g., for engaging in ITG), and investing in IT-enabled capabilities that increase coordination and integration among organizational units.

The capability complementarity and the mediation hypotheses we tested in this study point to additional recommendations. They suggest that while B-ITG and IT operating capabilities are indeed generally encouraged, the effort that goes into them should vary. B-ITG improves financial performance directly and indirectly through increasing IT operating capability. However, strong IT operating capability diminishes the effect of B-ITG on financial performance. While we do not examine the reasons for this, we can reasonably assume that this may be, at least in part, due to permissive leadership of the board. Good performance in the IT operations domains simply decreases the board's motivation to intensely monitor and demand changes from top management. Such board actions may actually waste the management team and employees' time, and push them to deviate from the advantageous practices they have already developed or adopted.

In essence, B-ITG and firm-level operating capability are at least partially interchangeable, and firms need to find the right balance between them. Specifically, it is interesting to consider that B-ITG is one driver of IT operating capability. Hence, boards of directors that are mindful of their time investments may want to spend much effort on ITG when IT operating capability is low to medium. When such a capability has matured and reached sufficiently high levels, B-ITG may become redundant and reduce the ability of IT operating capability to increase financial performance. In such cases, the board may

want to adopt a laissez-faire approach to IT matters and invest its time in other activities, while still just advising on IT issues.

To implement this recommendation, boards should (1) track operational IT budgets vs. expenses compared to industry standards and competitors at every board meeting. For example, boards can ask the management team to present such metrics in the meetings; (2) include the CIO or CTO on board meetings and ask them questions about IT operations and report on the organization's level of IT operating capability; and (3) ask the management team to survey employees about the use of IT in their routines and processes and review and highlight any major non-technical IT issues. The findings of this exercise can help boards prioritize ITG efforts vs. the efforts they invest in other duties. Our findings can therefore help boards balance their duties, and focus on performance-yielding activities. We nevertheless caution readers that more research is needed to generate specific guidelines.

### **6.3 Limitations and Future Research**

Several limitations that point to future research are noteworthy. First, this study was conducted in a North American context. Given possible regulatory and cultural differences (Klijn et al., 2013; Reuer et al., 2014; Volonté, 2015), the findings regarding boards in other continents may vary and should be examined. Research shows that European and Asian companies have stronger IT focus in the boardroom than companies in the USA (Andriole, 2009). The differences could be due to cultural or regulatory factors. For example, in high power distance cultures, firm personnel are more likely to comply with IT governance - driven initiatives; and this may lead to stronger translation of IT governance into operational capabilities. Such differences represent a fruitful area for future research. Second, this study examined two IT-related capabilities. These capabilities have unique features: one is specific and pertains to the board and the other is spanning and pertains to the organization. Hence, the effects we observed may not be generalized to other types of capabilities. We hence call for future research to examine different combinations of capabilities (e.g., two firm-level IT capabilities, two specific IT capabilities). This would allow expanding the understanding of the effects of IT capability complementarity, and/or set boundary conditions around findings regarding the effects of various capabilities (Lee and Baskerville, 2003). Another interesting topic for future research is the complexity of IT-enabled capabilities. Following the definition of component complexity and coordinative complexity by Wood (1986), a capability is complex when it involves many different elements including technologies, functions, and systems, and shows many different ways of interactions among

the elements. Studying how to control and leverage complex capabilities is important, as complexity can lead to negative consequences such as "complexity catastrophe" (Kauffman, 1993) or positively outcomes such as "agility" (Sambamurthy et al., 2003).

Third, in line with much research in this area (Jewer and McKay, 2012; Turel and Bart, 2014), we used previously validated perceptual measures of financial performance. We did so because given the legal risks directors face and the fierce competition for some firms, many directors do not want to report actual financial results or their firm identities (Bart and Turel, 2010; Turel and Bart, 2014). While such measures have advantages (e.g., relative performance may be more relevant than actual financial information) (Bart and Turel, 2010; Turel and Bart, 2014), future research may benefit from considering actual financial metrics in conjunction with the perceptual measures used in this study. Moreover, we used a two-item measure to capture operating capability. We did so in order to keep the survey short, while ensuring the measure fits the context. While such measures are not ideal (2-items make structural equation modeling convergence difficult and may not capture the whole breadth of operational capabilities), they tend to work well; even single item perceptual measures can have similar utility to this of multiple item measures (e.g. Hoeppeur et al., 2011). Nevertheless, we call for future research to replicate and extend our findings with different, longer and broader measures. For example, future research can consider collecting measures of IT operating capability from CIOs or CTOs to triangulate our results.

It is worthwhile to note that some very detailed IT measures actually do not fit well to our context. Boards of directors were assumed to usually not be aware of the items such measures focus on. For example, IT personnel expertise, IT infrastructure flexibility, and IT maintenance capabilities pertain to the IT unit and are likely beyond to general oversight boards have. These measures usually are long, specific and detailed, and at low level, therefore they don't fit our context. However, IT managers, CIOs or CTOs are in a good position to answer questions about these measures.

Fourth, our sample was relatively small. While our model was small too (only four hypothesized paths), and the sample size did not create structural model convergence problems, our results should be treated as preliminary and our model could benefit from further validation with larger datasets.

Lastly, our study was cross-sectional and did not consider time effects. It is possible that current IT operating capability levels are the result of past B-ITG efforts. In other words, it could be that B-ITG once showed enhancing complementarity effects, and it changed after IT operating capability has

improved. This, however, does not change the relevance of our findings and recommendation because these are based on the current state of affairs. Future longitudinal designs may be used for examining possible dynamic interactions among B-ITG and IT operating capability.

## **7. Conclusion**

The increased dependency of organizations on IT for operation and success has pushed researchers and practitioners to examine to what extent boards of directors should get involved in IT matters, and to examine the roles of B-ITG in obtaining financial gains. This study provides one explanation regarding the "board ITG paradox" by showing a suppression complementarity: when operating capability is high, B-ITG may be less needed (at least temporarily, until industry dynamics require changes). This implies that some largely beneficial capabilities may at some point deteriorate the positive effects of other capabilities on financial performance. These findings can serve as a springboard for further examining capability complementarity, B-ITG impacts on firms, and the mechanisms through which IT-enabled capabilities influence business value. We call for future research on these important topics.

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## Appendix - Scales

**Table A1: Measurement Instrument**

Construct	Measurement Items
Please select one organization on which you are currently serving as a board member, the one you are most familiar with, and refer to it in all of the following questions in the survey.	
Board IT Governance (Jewer and McKay, 2012)	<p>Please indicate the extent to which the board is involved in the following activities: (1= To a very small extent, 7= To a very large extent)</p> <ul style="list-style-type: none"> <li>- Monitors that IT delivers against the strategy through clear expectations and measurement</li> <li>- Performs IT governance assurance and self-assessment</li> <li>- Identifies possible IT threats and opportunities critical to the future of the organization</li> <li>- Shapes the business/IT strategic alignment</li> <li>- Advises during major IT decisions</li> </ul>
IT operating Capabilities (Tippins & Sohi, 2003)	<p>Please rate your level of agreement with the following statements: (1= Strongly disagree, 7= Strongly agree)</p> <ul style="list-style-type: none"> <li>- The organization effectively uses IT functionality in its activities.</li> <li>- The organization adequately utilizes IT tools in its operations.</li> </ul>
Firm Financial Performance (Turel and Bart, 2014)	<p>What is the relative "performance standing" of the organization in its industry (i.e., compared to competitors)? (1= Significantly below, 7=Significantly above)</p> <p>Please rate the following: (1= Not at all satisfied, 7=Extremely satisfied)</p> <ul style="list-style-type: none"> <li>- The Board's satisfaction with the organization's current financial performance.</li> <li>- My satisfaction with the organization's current financial performance.</li> </ul>
Controls	
Industry IT dependence (Kearns and Lederer, 2004)	<p>To what extent would you consider organizations in your industry to: (1= To a very small extent, 7=To a very large extent)</p> <ul style="list-style-type: none"> <li>- be dependent on IT for their operations?</li> <li>- be dependent on IT for strategic advantage?</li> </ul>
Ratio of outside directors	<p>the number of outside directors divided by the total number of director in an organization</p> <ul style="list-style-type: none"> <li>- How many directors are on the board?</li> <li>- How many outside directors are on the board? (Outside directors are those members on the board who are not employed as part of the organization's management team, their subordinates, relatives, or managers of the organization's subsidiaries. Also these directors are not members of the organization's immediate past management team.)</li> </ul>
Ratio of IT spending from sales	<p>IT expenses divided by total sales</p> <ul style="list-style-type: none"> <li>- Total \$ spent last year on Information Technology (IT) (Millions \$; e.g., for 10,000,000, put in 10):</li> <li>- Recent year sales (Millions \$; e.g., for 10,000,000, put in 10):</li> </ul>

Construct	Measurement Items
Organization Size	Approximately how many employees does the organization have? (from less than 50 to over 10,000)
Director Experience with the board	Approximately how many years have you been serving on this organization's board? (open ended, numerical) _____ years
Survey Source	(Automatically generated) - Canada/ USA
Descriptive Variables	
Board Role/s	What are your current board title(s) in this organization? Please select as many as apply: - Chair, Vice Chair, Chair – Audit and Finance Committee, Chair – Governance and Nominating Committee, Chair – Human Resources and Compensation Committee, Chair – Strategic Planning Committee, Chair – Other (please specify in the box below), Board Member (only)
Number of Boards a Director serves on	How many boards do you currently serve on – including this one? _____ boards
Age of firm	When was the organization (the one you refer to) founded? _____
Industry	Please pick from the list below the industry which best describes the market in which this organization operates: Advanced technology, Agriculture, Bank and savings, Chemicals, Construction and building, Consumer products, Government corporation, Ecommerce, Education, Electronics, Energy/ utilities, Entertainment/hospitality, Forest and paper products, Healthcare products/ Pharmaceutical, Other