

The Influence of IT Governance, IT Competence and IT-Business Alignment on Innovation

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ABSTRACT

According to prior studies, innovation is crucial to organizational performance, information technology (IT) enhances the ability to detect opportunities for innovation, IT governance impacts innovation, and IT competence is needed from Boards of directors and executive management to make quality strategic IT-related decisions. Moreover, a priori, IT-business alignment can enhance innovation. However, organizations may lock themselves in a particular way of doing business if they are not flexible in aligning their IT to business. This can influence negatively innovation. In this study, we expected that IT governance (structures, processes and relational mechanisms), and Boards of directors and executive management IT competence would be positively associated with innovation (products and processes), and that IT-business alignment would moderate this association. Results from a survey of senior executives/officers in charge of IT suggest that, at a higher level of IT-business alignment, having more developed IT governance mechanisms gives rise to more product innovation while having a senior executive or officer in charge of IT governance as a full member of executive management is associated with less product innovation. At a lower level of IT-business alignment, having more IT governance mechanism is associated with less process innovation while executive management IT competence has no significant impact on process or product innovation. Regardless of the level of IT-business alignment, the Board's IT competence has no significant influence on innovation. IT intensity has a positive impact on both product and process innovation.

Keywords: IT governance - Board of directors - executive management - IT competence - IT-business alignment - innovation.

RÉSUMÉ

Selon la littérature antérieure, l'innovation est cruciale pour la performance organisationnelle, les technologies de l'information (TI) améliorent la capacité à détecter les opportunités d'innovation, la gouvernance des TI influence l'innovation, et la compétence en TI des conseils d'administration et des conseils de direction est nécessaire à une prise de décisions stratégiques de qualité en matière de TI. De plus, à priori, l'alignement TI-affaires peut accroître l'innovation. Cependant, les organisations peuvent se confiner à une façon particulière de "faire des affaires" si elles ne sont pas flexibles en alignant leurs TI aux affaires. Ceci peut influencer négativement l'innovation. Dans cette étude, nous nous attendions à ce que la gouvernance des TI (structures, processus et mécanismes relationnels), et la compétence en TI des conseils d'administration et des conseils de direction, soient associées positivement à l'innovation (en termes de produits et de processus), et que l'alignement TI-affaires modère cette association. Les résultats d'un sondage auprès de cadres-dirigeants responsables des TI suggèrent que, à un haut niveau d'alignement TI-affaires, avoir des mécanismes de gouvernance des TI plus développés entraîne davantage d'innovation en termes de produits, tandis qu'avoir un cadre dirigeant responsable de la gouvernance des TI comme membre du conseil de direction est associé à moins d'innovation en termes de produits. À un faible niveau d'alignement TI-affaires, avoir des mécanismes de gouvernance des TI plus développés est associé à moins d'innovation en termes de processus, tandis que la compétence en TI des conseils de direction n'a aucun impact significatif sur l'innovation en termes de produits ou de processus. Quel que soit le niveau d'alignement TI-affaires, la compétence en TI du conseil d'administration n'a aucune influence significative sur l'innovation. L'intensité TI a une influence positive tant sur l'innovation en termes de produits que de processus.

Mots clés: Gouvernance des TI – conseils d'administration – conseil de direction – compétence en TI - alignement TI-affaires - innovation.

INTRODUCTION

The contribution of information technology (IT) to organizational performance is an important management (Rivard et al., 2006) and governance (De Haes and Van Grembergen, 2013) issue. In a global and contemporary business environment, in all industries (Santamaria et al., 2009), organizations' ability to detect opportunities for innovation is vital to their performance (Sambamurthy et al., 2003). To enhance this ability (Sambamurthy et al., 2003) and their performance (Wilkin and Chenhall, 2010), organizations are increasingly relying on IT, "whether as a main activity or a facilitator of a firm's business and to make business processes more agile" (Scheeren et al., 2013, p. 622). For instance, IT flexibility and the ability to change direction very quickly are a matter of survival in fast-paced industries such as electronics, pharmaceuticals and financial services (Tallon, 2003). As pointed out by Chou et al. (2014), McAfee and Brynjolffson (2008) suggested that IT can be used to activate innovative ideas and to deliver these ideas. Further, when technology is used in innovative ways, new products and services arise (Valentine and Stewart, 2013).

The benefit of innovations using IT has been brought up in the literature (Chou et al., 2014). Indeed, a prior research has recognized that IT can facilitate and drive important process, product and service innovations (Arvanitis et al., 2013). For instance, IT supports different strategic methods such as innovative differentiation (Rivard et al., 2006) and inbound open innovation (i.e. leveraging the discoveries of others, Chesbrough and Crowther, 2006) (Cui et al., 2015). In spite of this research, the information systems (IS) literature has stressed the need for more studies that analyze the role of IT in firm innovation (Fernandez-Mesa et al., 2014).

IT governance "is an integral part of corporate governance and addresses the definition and implementation of processes, structures and relational mechanisms in the organization that enable both

business and IT people to execute their responsibilities in support of business/IT alignment and the creation of business value from IT-enabled investments” (De Haes and Van Grembergen, 2013, p. 61). IT governance is the responsibility of the Board of directors and executive (ITGI, 2003) and can have an impact on innovation (De Haes and Van Grembergen, 2013). Indeed, Board of directors (Zona et al., 2013) and executive management¹ (Prajojo and Ahmed, 2006) can help create an environment that fosters innovation.

Boards of directors can bring opportunities and sources of innovation with the knowledge and information they may provide (Chouaibi and Jarboui, 2012). In an environment where extreme changes (such as the use of mobile devices as a platform for new ways of working and the cloud to deliver big data) influence how organizations are doing business, Boards of directors must be able to ask relevant questions when management is presenting papers and proposals, and must be competent to make IT-related decisions (Valentine and Stewart, 2013). However, although Boards’ awareness of the importance of IT governance is increasing, there is still a gap between awareness and action (Valentine and Stewart, 2013), as some Board members might see the short-term IT needs but not the longer-term and strategic issues (Turel and Bart, 2014). This lack of Boards’ IT-related competence could negatively influence innovation.

Executive management involvement in innovation positively influences administrative, product, process, and human capital innovations, and “is the most important antecedent of product innovation” (Sing Wong, 2013, p. 722). Executive management controls resources and power that are needed for innovation purposes (Prajojo and Ahmed, 2006). It plays a crucial role in lowering the risks associated with innovation (Sing Wong, 2013), providing direction (Prybutok et al., 2008) and supporting employees to find innovative

¹ Prior studies refer to the group of individuals involved in strategic decision making at the highest level of a firm as the "top management team" (Bantel and Jackson, 1989; MacCurtain et al., 2010; Prajojo and Ahmed, 2006; Talke et al., 2010), the "senior management" (Sing Wong, 2013) or the "executive management team" (Turel and Bart, 2014). In this study, we use the expression “executive management” when we refer to the group of individuals that includes the Chief executive officer (CEO), the Chief information officer (CIO), and other senior executives.

opportunities (Sing Wong, 2013). Since IT contributes to innovation, having an IT-competent executive management is essential to favour innovation.

In sum, IT competence on the part of IT and non-IT executives (Subirana, 2004) and Board members (Valentine and Stewart, 2013) is important to support strategic initiatives such as innovation. Further, IT governance has an impact on innovation (De Haes and Van Grembergen, 2013).

IT governance enables both business and IT people to fulfill their responsibilities in support of strategic IT-business alignment (De Haes and Van Grembergen, 2013). A priori, there is a positive association between IT-business alignment and innovation (Chan et al., 1997; Chan, 2001; Chan and Reich, 2007). However, when IT-business alignment is characterized by a lack of flexibility (Tallon, 2003), a negative association can be found. These mixed results with respect to the impact of IT-business alignment on innovation could have an impact on the relationship between IT governance and IT competence, and innovation.

To our knowledge, no empirical study has looked at the influence of IT governance and Board of director and executive management IT competence on innovation, and the moderating effect of IT-business alignment on this relationship. In this study, we examine these relationships.

Results show that, *at a higher level of IT-business alignment*, IT governance is positively associated with product innovation, while executive management IT competence is negatively associated with product or process innovation. *At a lower level of IT-business alignment*, IT governance is negatively associated with process innovation, and executive management IT competence has no significant impact on innovation. Regardless of the level of IT-business alignment, the Board's IT competence has no significant influence on innovation. IT intensity has a significant positive impact on both product and process innovation. As

suggested in our discussion and conclusion, our results contribute to the IT governance, IT/IS and innovation literature.

In the next section, we develop the conceptual framework including our hypotheses. Thereafter, the methodology is described. Results are then presented, followed by the discussion and conclusion.

CONCEPTUAL FRAMEWORK

In this section, we develop hypotheses based on insights from IT governance, IT/IS and innovation studies. As shown in Figure 1, IT governance, as well as Board of director and executive management IT competence, are expected to have a positive influence on innovation. IT-business alignment is expected to moderate this influence.

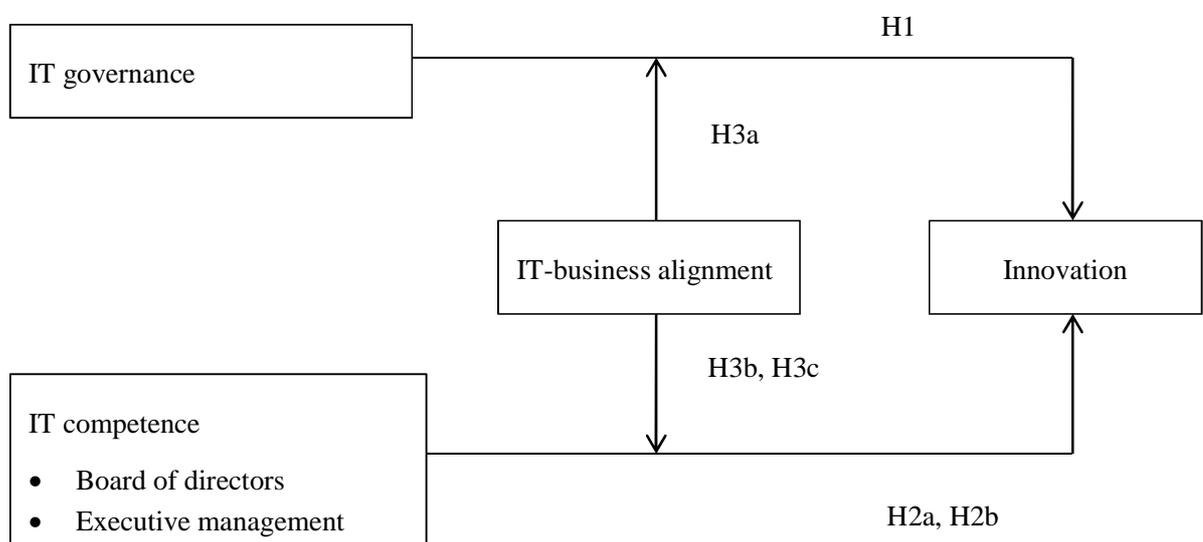


Figure 1. The conceptual model

IT governance “consists of the leadership and organizational structures and processes that ensure that the organization’s IT sustains and extends the organization’s strategy and objectives” (ITGI, 2003, p. 10). As part of corporate governance, IT governance structures, processes and relational mechanisms allow IT and business people to fulfill their responsibilities in support of IT-business alignment and IT-based value creation (Van Grembergen and De Haes, 2009). Structures and processes are usually mandatory and tangible while relational mechanisms are often implicit and intangible (Peterson, 2004). Structures are comprised of formal positions and roles for IT-related decision-making (Bowen et al., 2007; Peterson, 2004), as well as committees and councils (Peterson, 2004). Processes place emphasis on the implementation of IT management techniques and procedures (Bowen et al., 2007). Relational mechanisms involve IT leadership as well as other mechanisms such as partnerships and informal meetings between business and IT executives, job rotation and cross training between IT staff and business people, systems such as web portal to share knowledge about IT governance-related tasks and responsibilities (De Haes and Van Grembergen, 2009).

IT competence refers to the “organizational base of IT resources and capabilities” (Sambamurthy et al., 2003, p. 244). It includes skills and knowledge that enable organizations to manage IT products and services to innovate (Fernandez-Mesa et al., 2014). More specifically, IT competence consists of managerial/business or technical IT skills (Mata et al., 1995; Sambamurthy et al., 2003) and IT experience (Basselier et al., 2003). Managerial or technical IT skills can be developed through experience such as working on and managing IT projects (Basselier et al., 2003). In that spirit, CIOs’ IT knowledge and experience can be the base of organizations’ IT competence as they have become executive-level IT innovation leaders (Chun and Mooney, 2009).

IT-business alignment can be defined as the fit between business and IS strategic orientations (Chan et al., 1997). It “refers to the degree to which the business strategy and plans, and the IT strategy and plans, complement each other” (Chan and Reich, 2007, p. 300).

Innovation refers to “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations” (OECD/European Communities, 2005, p. 46).

Influence of IT governance on innovation - H1

Improving IT governance can enhance organizations’ capacity for innovation (De Haes and Van Grembergen, 2013). For instance, as a result of changes in IT governance structures, processes and relational mechanisms in a major airline, more resources have been allocated to IT innovation (De Haes and Van Grembergen, 2013). The implementation of IT governance structures and processes enhance the efficiency of IT-based tools (Gressgard et al., 2014). These tools can enhance employee-driven innovation as they support the acquisition, dissemination and exploitation of knowledge (Gressgard et al., 2014). The exchange of information/knowledge sharing (an IT governance relational mechanism) is associated with innovation (Zhou and Li, 2012; Liu et al., 2015), and can be encouraged by executive management (e.g. in an E-government innovation environment, Prybutok et al., 2008). Further, creating a collaborative environment by means of electronic newsletters or knowledge-sharing portals, i.e. IT governance relational mechanisms, encourages creative thinking and accelerates the innovation processes (Fernandez-Mesa et al., 2014). Other IT governance relational mechanisms, such as IT training of non-IT personnel/users, have a positive effect on innovation (Arvanatis et al., 2013). These results lead to the following hypothesis:

H1: IT governance has a positive effect on innovation.

Influence of IT competence on innovation - H2a, H2b

IT competence has an impact on competitive actions (Sambamurthy et al., 2003). Indeed, to innovate, organizations must have competent people in key roles (Valentine and Stewart, 2013). The effective use of IT competence can have a positive impact on innovation. For instance, Arvanatis et al. (2013) investigated the influence of different types of firms' soft IT capital related to IT knowledge and skills on product (good/service) and process innovation. They found that IT personnel and IT training of IT personnel have a strong positive effect on both product and process innovation. An executive management with greater IT competence leads the IT strategy by articulating and communicating its vision about the role of IT in innovation strategies (Héroux and Fortin, 2014). As stated previously, IT competence on the part of IT and non-IT executives (Subirana, 2004) and Board members (Valentine and Stewart, 2013) is important to support strategic initiatives such as innovation.

CIOs "have been responsible for many of the innovations that firms have taken advantage of" (Chun et al., 2014, p. 27). Indeed, effective CIOs have key competencies such as the "ability to engage in the creation and development of innovative technology-enabled growth strategies that aid an enterprise to maintain its competitive advantage in the marketplace" (Chun et al., 2014, p. 35). They are also actively involved in developing and improving business strategy (Chun et al., 2014).

The level of Boards of directors' involvement in IT strategic decision making and oversight is positively influenced by Board of director IT competence (Jewer and McKay, 2012). However, although CIOs play strategic roles, Boards of directors' often neglect CIO- and IT-related issues (Yayla and Hu, 2014). Since many directors view IT as a technical issue (Huff et al., 2006), and lack of IT knowledge on the part of Board members can limit their assessment of IT-based strategy (Huff et al., 2006; Bart and Turel, 2010), having Board members with IT knowledge or experience can keep the Board informed about the role of IT

in their organization and industry, and more involved with IT-related decisions (Yayla and Hu, 2014). This could enhance innovation.

This discussion leads to the following hypotheses:

H2a: Board of director IT competence has a positive effect on innovation.

H2b: Executive management IT competence has a positive effect on innovation.

Moderating effect of the IT-business alignment - H3a, H3b, H3c

As stated previously, IT-business alignment refers to the degree to which the business strategy and the IT strategy ‘complement’ each other. More specifically, IT-business alignment has been conceptualized as an IT governance focus area (Lee and Lee, 2009; Buckby et al., 2009; Wilkin and Chenhall, 2010) or domain (Lunardi et al., 2014), or an outcome of IT governance (De Haes and Van Grembergen, 2009; Wu et al., 2015) since IT governance can be used to foster/enable the alignment between IS and business strategy (Scheeren et al., 2013; Wu et al., 2015). Prior studies suggest that IT-business alignment can mediate the association between IT governance structures, processes and relational mechanisms and IT governance effectiveness (effective use of IT) (Lunardi et al., 2014) or organizational performance (Wu et al., 2015).

In this study, we argue that IT-business alignment can moderate the relationships between IT governance or IT competence, and innovation. In other words, we propose that the effect of IT governance and IT competence on innovation depends on the level of IT-business alignment. Indeed, prior studies suggest that IT-business alignment can enhance innovation (Chan et al., 1997; Chan, 2001). However, Tallon (2003) and Chan (2001) nuance these results. In fact, “when companies create an inflexible IT backbone as they align their systems to strategy, they risk locking themselves into a particular way of doing business” (Tallon, 2003). In that spirit, Chan (2001) examines two dimensions of IT-business alignment, i.e. ‘match’ and

'synergy', and found that a high 'match' alignment score has a negative impact on innovation, arguing that if everyone in an organization "was doing the same, innovation was not expected to be the primary result" (p. 62). Since the expression 'match' refers to similarity, parallelism and mirroring, while 'synergy' suggests complementarity, interaction, combination and reinforcement (complement each other) (Chan, 2001), Chan's (2001) results highlight "the importance of the synergy between business and IS strategic orientation, rather than a simple match between them" (Chan and Reich, 2007, p. 330). In other words, too much similarity ('match') between IT and business strategy can have a negative impact on innovation.

In the light of the above discussion, we argue that:

H3a: The positive effect of IT governance on innovation is moderated by IT-business alignment.

H3b: The positive effect of Board of director IT competence on innovation is moderated by IT-business alignment.

H3c: The positive effect of executive management IT competence on innovation is moderated by IT-business alignment.

METHODOLOGY

To collect data on internal organizational matters such as IT governance, IT-business alignment and innovation, the survey design is an appropriate research method (Judd et al., 1991). A mail survey was used. The questionnaire was sent to the senior executives/officers in charge of IT (Vice-president [VP] IT, CIO, Manager or Director in charge of technology, Chief technology Officer) of a sample of Canadian organizations. Contact information for target organizations was mainly collected from the *2014 Financial Post 500* database, which contains information on Canada's Top 800 private and public organizations, and from corporate web sites. When the contact information was not available for the executive in charge of IT,

the survey was sent to the President/CEO requesting that the questionnaire be completed by the top manager who has an overview or a sufficient knowledge of the organization's IT governance and IT strategic issues.

The conceptual framework has led to the development of the questionnaire. Questions were articulated around IT governance mechanisms, the IT competence of Board of Directors and executive management, IT-business alignment, and product and process innovation. Most of the questions were selected (and adapted, if needed) from existing instruments. English and French versions of the questionnaire were prepared. Two academics and a translator revised both versions of the instrument while three IT executives/directors pretested it. The questionnaire took approximately 30 minutes to complete. Ethics approval has been obtained from the institution's Research Ethics Committee.

Target population and survey implementation

The initial target population was comprised of all Canadian publicly traded and for profit para-governmental organizations in the *2014 Financial Post 500* database (i.e. excluding private companies). The final target population comprised 362 organizations (after organizations with all their business outside Canada, Canadian subsidiaries of foreign companies with IT governance outside Canada, holdings, closed end funds, wrong addresses, organizations that moved, etc.).

We followed Dillman's (2000) procedures in administering the survey, including a pre notice by email, an original mailing followed by a reminder card and a second mailing to non-respondents, then phone contacts or voice messages with targeted respondents or administrative assistants, and finally a third mailing to non-respondents that we were unable to contact. The survey procedures took place between April and July 2015. The mailed package included a cover letter and a self-addressed postage-paid envelope in

addition to the questionnaire. The cover letter stated that the information provided would be kept strictly anonymous and confidential, and that only summary statistics would be presented.

Sample

A total of 66 usable questionnaires were received, for a 18.2% response rate². This response rate is higher or comparable to that of other survey studies with senior executives/officers in charge of IT (e.g., Chun et al., 2014: 13.9%; Lunardi et al., 2014: 21.5%; Rivard et al., 2006: 13.7%; Yeh et al., 2012: 19.1%) or CEO-CIO pairs (e.g., Chan, 2001: 6.7%; Reinhard and Bugati, 2013: 19.4%). A sample of 66 is sufficient to build a multivariate model with up to 13 variables using the minimum of five observations per variable (Hair et al., 1998). The maximum number of variables in our regression models is nine.

Sample organizations' and respondents' characteristics are presented in Table 1. About three-quarters of the sample was comprised of listed firms, and one-fourth, of for profit para-governmental organizations, all of which were quite large and on average, profitable (Panel A). The industries most represented in the sample are from the Financial Services/Insurance, Oil & Gas and Retail/Wholesale sectors (Panel B). On average, respondents had more than six years of experience at their current position, about 11 years within their organization, and 29 years in total (Panel C). The majority of them (90%) had a position directly related to IT, and more than 75% of respondents had an educational background in IT (Panel D).

² Some targeted respondents indicated by email that their organizations' policy did not allow them to respond to questionnaires. Others mentioned that they did not have time to fill out the questionnaire while some simply mentioned that they would not answer.

TABLE 1
Sample organizations' and respondents' characteristics

Panel A: Organizations' size and performance						
Variables	N	Mean	Median	Std Dev.	Min.	Max.
Size						
Market value ^{b, c}	49	10,583,321	1,027,597	25,939,265	31,978	115,464,431
Assets ^{b, d}	66	63,750,674	2,002,502	201,009,674	113,610	944,742,000
Revenues ^{b, d}	66	5,065,970	1,330,645	9,845,578	102,298	53,203,000
Performance						
Net income ^b	66	787,968	64,116	1,955,129	-1,260,000	9,004,000
Panel B: Organizations' main industry						
Industry	N	Industry	N			
Financial services/Insurance	16	Retail/Wholesale	9			
Manufacturing	4	Services	6			
Mining	4	Telecommunications/Media/IT	6			
Oil & Gas	10	Utilities	5			
Forest	2	Amusement	4			
Panel C: Respondents' number of years of professional experience						
Number of years	N ^a	Mean	Median	Std Dev.	Min.	Max.
In total	66	29.1	30.0	7.2	7	45
Within the organization	64	10.9	7.5	9.8	1	40
At current position	64	6.4	4.3	5.4	1	20
Panel D: Respondents' position and general background						
Position within the organization	N	Educational background	N ^a			
VP IT or Senior VP Operations and IT	14	IS/IT	38			
VP IT and CIO	4	Business/IT	14			
CIO	16	Business/Accounting	7			
CTO	2	Engineering	2			
IT Director	18	Total	61			
IT Manager	6					
CFO	3					
CEO or COO or VP Business solutions	3					
Total	66					

^a Some respondents did not answer all the questions.

^b Numbers are in thousands of Canadian dollars.

^c The sample includes 49 companies listed on the Toronto Stock Exchange (TSX) and 17 for profit para-governmental organizations.

An analysis of non-response bias was performed to confirm the validity of the data. Analyses of variance comparing the group of respondents that answered to the first mailing with the group that answered to the second or third mailing (the latter being used as a proxy for the non-respondents) did not reveal any significant differences in the responses obtained for the main constructs of the study or for questions about assets, revenue, net income, and market value. Further, analyses of variance comparing respondents and

non-respondents revealed no significant differences with respect to revenue, net income and market value. Only sample organizations' asset size is significantly greater than that of non-respondents' organizations ($p \leq 0.05$, not tabulated). Thus, overall non-response bias does not seem to be a concern in this sample.

Measurements

The items for all the measurements are presented in the Appendix.

Innovation

Two types of innovations were measured, namely product and process innovation. Product innovation was defined in the questionnaire as follows: *Product innovation (customer goods or services) occurs when a firm develops products that are new to the firm, or has introduced completely new products or products with important modifications or new functions resulting from innovations, or has made changes to the design, presentation, materials, or composition of the product.* It was measured using 13 items. Five items came from Prajogo and Ahmed (2006) and eight from Talke et al. (2010). Process innovation was defined for participants as follows: *Process innovation refers to the introduction of significant modifications in the production process of customer goods or services (for example, new machines or methods of organization).* It was measured using eight items, four from each of Prajogo and Ahmed (2006) and Talke et al. (2010). A scale from very low = 1 to very high = 7 was used for the items from Prajogo and Ahmed (2006) and a scale from strongly disagree = 1 to strongly agree = 7 was used for the items from Talke et al. (2010). Composite indexes for product and process innovation were obtained by averaging the responses on the 13 and eight items respectively. Higher mean scores indicate that organizations are more innovative.

IT governance

IT governance structures were measured using 32 items from De Haes and Van Grembergen (2009), Weill and Ross (2005), Ali and Green (2007), Parent and Reich (2009) and Bowen et al. (2007). A composite sub-index was used to get an overall measure of IT governance structures (average of 32 items). To obtain a more complete description of IT governance structures, we had questions related to the presence of various roles and committees such as IT steering committee or IT project steering committee (Yes or No). *IT governance processes* were measured using 28 items from De Haes and Van Grembergen (2009), Weill and Ross (2005) and Bowen et al. (2007). A composite sub-index was used to get an overall measure of IT governance processes (average of 28 items). *IT governance relational mechanisms* were measured using 21 items from Kearns and Lederer (2003) and De Haes and Van Grembergen (2009). A composite sub-index was used to get an overall measure of IT governance relational mechanisms (average of 21 items).

A composite index comprised of the questions from the three sub-indexes described above was also computed to get an overall measure of IT governance mechanisms (structures, processes and relational capabilities) (average of 81 items). For all questions included in the governance indexes, the respondents were asked to indicate the degree to which they agreed with each of the items as they applied to their organization's IT mechanisms (strongly disagree = 1, strongly agree = 7). A higher mean score on governance indexes indicates that IT governance mechanisms are more developed.

IT competence

To measure *IT competence* across Boards of directors, we used three items from De Haes and Van Grembergen (2009) and Parent and Reich (2009). The respondents were asked to indicate the degree to which they agreed with each of the items as they applied to their Board of directors (strongly disagree = 1,

strongly agree = 7). A composite measure was then computed as the average of the three items. To measure executive management IT competence, we used an indicator variable, i.e. whether the senior executive or officer in charge of IT governance was a full member of the executive committee (De Haes and Van Grembergen, 2009). Such a presence on the executive committee provides IT expertise to the committee and ensures that IT matters are considered at the highest level in the organization.

Moderator: IT-business alignment

To measure *IT-business alignment*, we used 3 items from Lunardi et al. (2014) and 10 items from Kearns and Lederer (2003). The respondents were asked to indicate the degree to which they agreed with each of the items as they applied to their organization (strongly disagree = 1, strongly agree = 7). A composite index averaging responses to the 13 items was used for IT-business alignment. Higher mean scores indicate a higher level of IT-business alignment.

Control variables

As indicated previously, IT is a catalyst for innovative ideas (McAfee and Brynjolffson, 2008). Organizations in strategic mode use IT to innovate and to advance their competitive positions (Nolan and McFarlan, 2005). According to Parent & Reich (2009), these organizations are the most IT intensive. IT intensity has been shown to influence the impact of Board IT competence on firm performance (Yayla and Hu, 2014). Hence, we have to control for IT intensity when considering the relationship between IT governance and innovation. *IT intensity* was measured using five items from Brown and Magill (1994). The respondents were asked to indicate the degree to which their organization's main operations are dependent on IT for five strategic choices (not dependent = 1, totally dependent = 7). A higher mean score for the average of the five items indicates that organizations are more IT intensive.

Some studies demonstrated that organizational size significantly influences innovation (Acs and Audretsch, 1988; Askarany and Smith, 2008; Damanpour, 2010; Héroux and Fortin, 2016; Lee and Sung, 2005; Van Dijk et al., 1997; Yap et al., 2005; Zona et al., 2013). Indeed, larger organizations have sufficient resources to handle the risks of failure and absorb the cost of innovation (Damanpour, 2010). However, other research suggested that size has no effect (Audretsch and Acs, 1991; Mueller et al., 2009). Nevertheless, we controlled for its influence, measuring *size* through the natural logarithm of total assets, a method that alleviates the problems caused by nonnormal distribution (Hair et al., 1998).

Descriptive statistics and reliability of constructs

Descriptive statistics for the constructs are presented in Table 2. Overall for the 66 organizations, product innovation (mean = 3.05) and process innovation (mean = 3.14) are somewhat low since they are below the mid-point of the response scale. IT governance structures (mean = 3.57) are less developed than processes (mean = 4.61) and relational mechanisms (mean = 4.52). IT is reasonably aligned with business (mean = 4.72). Furthermore, these organizations are moderately IT intensive (mean = 4.27). Board IT competence is rather low (mean = 3.58, Table 2). Panel B (Table 2) shows that executive management IT competence is quite high since about 60% of organizations have senior executives (or officers) in charge of IT governance that are full members of the executive committee. Panel C (Table 2) provides an overview of IT governance structures and shows clearly that they are not developed at the Board of director level but well developed at the executive management level. Indeed, about 89% of the sample organizations have a senior executive/officer holding the IT governance function. About 94% of organizations have an IT officer or manager responsible for IT security, compliance and/or risk. An IT steering committee at the executive level (59%) and an IT project steering committee (74%) are quite common.

As shown in Panel A (Table 2), Cronbach's Alphas are at or above 0.90 for all constructs, except for Board IT expertise which is at 0.78, indicating excellent reliability overall (Nunnally, 1978; Hair et al., 1998).

TABLE 2
Descriptive statistics

Panel A: Variables measured on a Likert-type scale (N = 66)							
Variables	Nb. of questions	Cronbach Alpha	Mean	Median	Std Dev.	Min.	Max.
<i>Dependent variables</i>							
Product innovation	13	0.93	3.05	3.00	1.21	1.00	5.85
Process innovation	8	0.94	3.14	3.13	1.32	1.00	6.25
<i>Independent variables</i>							
IT governance	81	0.97	4.17	4.13	1.09	1.16	6.67
Structures	32	0.95	3.57	3.89	1.48	1.00	6.50
Processes	28	0.95	4.61	4.52	1.20	1.14	6.96
Relational mechanisms	21	0.91	4.52	4.60	1.08	1.43	6.62
Board IT competence	3	0.78	3.58	3.67	1.58	1.00	7.00
<i>Moderator</i>							
IT-business alignment	13	0.93	4.72	4.77	1.22	1.15	7.00
<i>Contextual variables</i> ^a							
IT intensity ^b	5	0.90	4.27	4.40	1.54	1.00	7.00
Panel B: Variable measured with a Yes/No question							
<i>Independent variable</i>				N	Yes	No	
Executive management IT competence				66	40	26	
Panel C: Overview of ITG Structures							
				N	Yes	No	
ITG Structures – Executive management level							
A senior executive (or officer) holds the IT governance function				66	59	7	
There is an officer or a manager responsible for IT security, compliance and/or risk				66	62	4	
IT steering committee at the executive (or senior management) level				66	39	27	
IT project steering committee				66	49	17	
IT security steering committee				66	27	39	
IT architecture steering committee				66	24	42	
ITG Structures – Board of directors level							
There is an IT strategy committee at the Board of directors level				66	14	52	
There is a committee at the Board of directors level (other than an IT strategy committee) that overviews IT assurance activities				66	22	44	

^a Organizations' size is presented in Table 1.

^b A respondent did not answer the questions on IT intensity.

RESULTS

Relationships between the constructs

Table 3 presents the correlations between the constructs of the study. Product and process innovation are significantly correlated with IT governance (particularly with processes and relational mechanisms; not with structures) while Board IT competence correlates only with product innovation. Executive management IT competence does not seem related to innovation. IT-business alignment is highly correlated with IT governance and innovation. It is also significantly associated with Board IT competence but not with executive management IT competence. IT intensity is associated with innovation, IT governance and IT-business alignment while size is highly correlated with IT governance but not innovation. All significant correlations are positive.

Organization characteristics according to innovation status

Before proceeding with the results pertaining to hypothesis testing, it is interesting to describe the characteristics of more or less innovative organizations. In Table 4, organizations are split according to the median of the product and process innovation scores with organizations that are at the median and below being classified in the less innovative group. The resulting scores for product and process innovation indicate that the two groups are in fact significantly different (Panel A). It can be noted that the more innovative organizations have a higher score for IT governance, due to more developed processes and relational mechanisms (Panel A). Board IT competence (Panel A) and executive management IT competence (Panel B) do not differ between more or less innovative organizations. IT-business alignment is significantly higher for organizations that are more innovative in terms of processes, but not products (Panel A). More innovative organizations both in terms of products and processes are more IT intensive (Panel A). However, there are no differences in terms of size between more or less innovative organizations (Panel A).

TABLE 3
Pearson correlations (N = 66)

Nb	Variables	1	2	3	4	5	6	7	8	9	10
1	Product innovation	1									
2	Process innovation	0.66	1								
3	IT governance	0.40	0.33	1							
4	Structures	0.18	0.11	0.88	1						
5	Processes	0.47	0.36	0.84	0.53	1					
6	Relational mechanisms	0.47	0.53	0.81	0.54		1				
7	Board IT competence	0.30	0.17	0.65	0.59	0.53	0.50	1			
8	Executive management IT competence	-0.09	-0.03	0.11	0.11	0.01	0.21	-0.05	1		
9	IT-business alignment	0.31	0.38	0.60	0.39	0.59	0.65	0.37	0.13	1	
10	IT intensity	0.55	0.38	0.37	0.23	0.30	0.49	0.14	0.12	0.37	1
11	Size (LnAssets)	0.15	0.16	0.61	0.53	0.60	0.36	0.42	-0.05	0.21	0.24

Note: Correlations ≥ 0.39 are significant at the 0.001 level; Correlations ≥ 0.32 are significant at the 0.01 level; Correlations ≥ 0.25 are significant at the 0.05 level; Correlations ≥ 0.21 are significant at the 0.10 level. Two-tailed tests for all correlations.

TABLE 4
Comparison of more and less innovative firms

Variables	Product Innovation			Process Innovation		
	Firms above median Mean (Std dev.) N = 31	Firms at median and below Mean (Std dev.) N = 35	<i>p</i>	Firms above median Mean (Std dev.) N = 30	Firms at median and below Mean (Std dev.) N = 36	<i>p</i>
Panel A: Likert scale variables ^a						
Product innovation	4.05 (0.77)	2.16 (0.72)	0.000	3.64 (1.16)	2.56 (1.02)	0.000
Process innovation	3.83 (1.23)	2.53 (1.09)	0.000	4.27 (0.95)	2.20 (0.70)	0.000
IT governance	4.38 (1.09)	3.99 (1.07)	0.071	4.51 (1.04)	3.89 (1.06)	0.009
Structures	3.62 (1.52)	3.52 (1.46)	0.388	3.69 (1.49)	3.46 (1.48)	0.265
Processes	4.97 (1.09)	4.28 (1.22)	0.010	5.05 (1.15)	4.24 (1.13)	0.003
Relational mechanisms	4.76 (1.08)	4.30 (1.04)	0.041	5.07 (0.97)	4.06 (0.94)	0.000
Board IT competence	3.72 (1.64)	3.45 (1.55)	0.245	3.84 (1.42)	3.35 (1.69)	0.106
IT-business alignment	4.83 (1.25)	4.62 (1.20)	0.487	5.19 (1.21)	4.32 (1.10)	0.003
IT intensity	4.77 (1.28)	3.81 (1.62)	0.005	4.60 (1.45)	3.98 (1.57)	0.054
Size (LnAssets)	15.27 (2.31)	14.85 (2.17)	0.454	15.42 (2.31)	14.73 (2.15)	0.213
Panel B: Yes/no questions ^b						
Executive management IT competence	17/31 55%	23/35 66%	0.258	19/30 63%	21/36 58%	0.437

^a One tail T tests except for IT-business alignment and Size.

^b One tail Fisher's exact test.

Hypotheses tests

Table 5 presents the regression models for testing the hypotheses. Models 1a and 1b contain only the control variables. As noted from the analysis of the correlations and the comparison of more or less innovative organizations, IT intensity is significantly related to innovation but not size. Models 2a and 2b³ show that IT governance is positively related to both product and process innovation as hypothesized by H1. Contrary to H2a, Board IT competence is not associated with either form of innovation. Executive management IT competence is related to product innovation only, but negatively. This relationship is in the opposite direction of the one hypothesized according to H2b.

TABLE 5
Regression models for testing hypotheses

Variables	Product innovation			Process innovation		
	Model 1a	Model 2a	Model 3a	Model 1b	Model 2b	Model 3b
IT governance (IT gov)		0.259*	-1.121**		0.351*	-1.388*
Board IT competence (Board IT comp)		0.132	0.681		-0.012	0.834
Executive management IT competence (Exec IT comp)		-0.371*	2.742**		-0.226	1.913
IT-business alignment (Align)			-0.316			-0.111
IT gov*Align			0.271**			0.308*
Board IT comp*Align			-0.103			-0.171
Exec IT comp*Align			-0.650**			-0.444
IT intensity	0.429***	0.397***	0.414***	0.312***	0.263***	0.238**
Size (LnAssets)	0.004	-0.114	-0.124*	0.038	-0.057	-0.022
Intercept	1.166	1.761	3.419	1.264	1.609	2.638
Adjusted R ²	0.276	0.353	0.384	0.118	0.127	0.157
Model <i>p</i>	0.000	0.000	0.000	0.008	0.023	0.027

* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$: one-sided tests except for Align, interactions with Align, and Size.

³ All the variance inflation factors were below 3.3 and, for conditions indexes above 15, the regression coefficient variance-decomposition matrix showed that there were no condition indexes that accounted for a substantial proportion of the variance for two or more coefficients. According to Hair et al. (1998), this indicates that multicollinearity does not seem to be a problem.

Models 3a and 3b include the moderating variable, i.e. IT-business alignment, and the interactions with the main variables in Models 2a and 2b. The relationship between IT governance and product and process innovation is affected positively by IT-business alignment. H3a proposed that the positive effect of IT governance on innovation is moderated by IT-business alignment. A moderating effect by IT-business alignment is effectively obtained. Board IT competence interaction with IT-business alignment is not significant for either product or process innovation. Thus, H3b's proposition of a positive effect of the Board of director's IT competence on innovation being moderated by IT-business alignment is not accepted. The negative relationship of executive management IT competence with product innovation is affected negatively by IT-business alignment. Therefore, there is a moderating effect of IT-business alignment on the relationship between executive management IT competence and product innovation. However, since this relationship is negative, H3c's hypothesis of a positive effect of the executive management's IT competence on innovation being moderated by IT-business alignment cannot be accepted.

DISCUSSION AND CONCLUSION

The objective of this study was to examine the influence of IT governance and Board of director and executive management IT competence on innovation, and the moderating effect of IT-business alignment on these relationships. At first glance, after controlling for the organization's main operations dependency on IT for strategic choices (IT intensity) and size, results support our prediction suggesting that IT governance has a positive effect on innovation (products and processes). However, contrary to our expectations, executive management IT competence (i.e., having a senior executive or officer in charge of IT governance as a full member of the executive management) has a negative impact on innovation, and Board IT competence has no significant influence. However, results show that the relationships between IT governance / IT competence and innovation may differ in strength at different levels of IT-business alignment.

First, as shown by the significant positive interaction term between IT governance and IT-business alignment (Table 5, Models 3a and 3b), the higher the level of IT-business alignment, the greater is the effect of IT governance on product and process innovation. More specifically, as illustrated in Figure 2, the effect of IT governance on *product* innovation is positive and significant when IT-business alignment is high, while this effect is not significant at a lower level of IT-business alignment. However, as illustrated in Figure 3, at a high level of IT-business alignment, there is no effect of IT governance on *process* innovation, while there is a significant negative effect of IT governance when IT-business alignment is low. *In other words, having more developed IT governance mechanisms gives rise to more product innovation at a higher level of IT-business alignment, while it is associated with less process innovation at a lower level of IT-business alignment.* For instance, when strategic business and IT plans are highly aligned, a firm having more developed structures such as formal positions and roles for IT-related decisions, processes focusing on the implementation of IT management techniques and procedures, and relational mechanisms favouring interaction between business and IT people, may shape an environment where business and IT work together to achieve organizational goals. This can support the development of new products, since IT could be used to activate and deliver innovative ideas. However, a misfit between the strategic business plan and the strategic IT plan might lead to confusion and block innovation initiatives, even if IT governance mechanisms are well developed. For example, without a business plan formally referring to IT and an IT plan considering business needs, on the one hand, people may hold on to mature IT governance structures, processes and relational mechanisms and may not favour the introduction of new methods of organization relying on technologies in the production process. On the other hand, underdeveloped IT governance mechanisms may informally encourage people to create new ways of using technologies to produce/deliver products. Overall, as shown in Figures 2 and 3, the highest level of product or process innovation occurs when a high level of IT-business alignment is combined with more developed IT governance mechanisms.

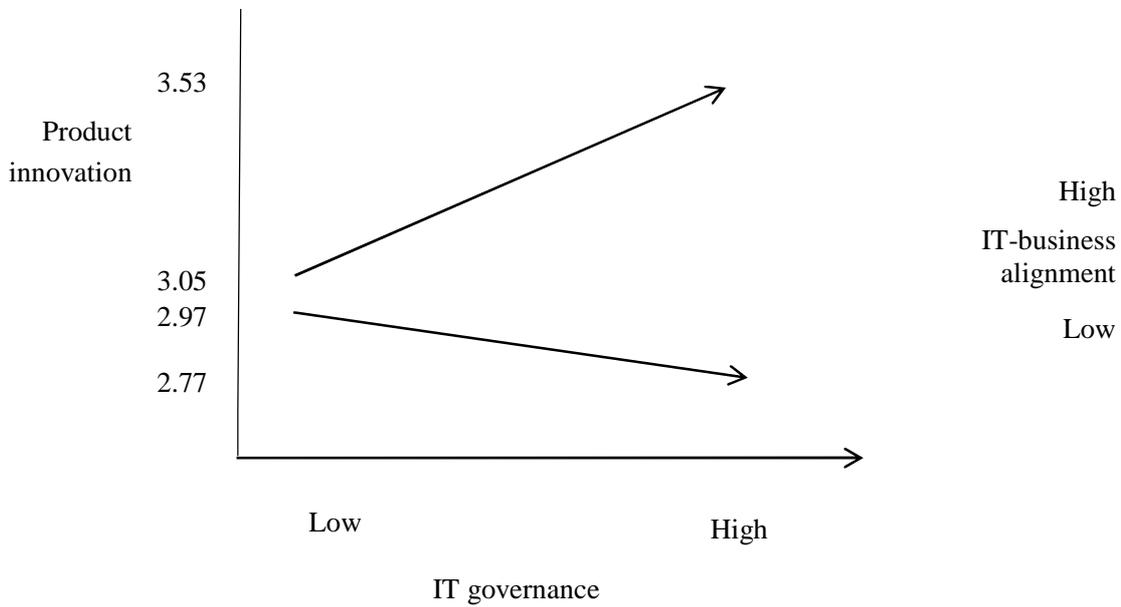


Figure 2. Effect of IT-business alignment on the relationship between IT governance and product innovation

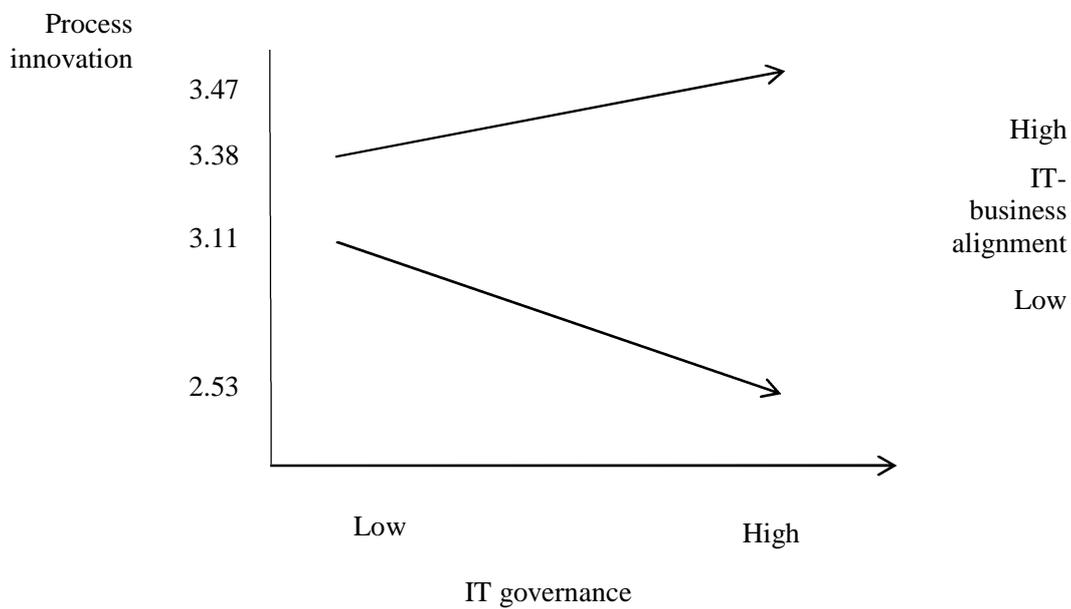


Figure 3. Effect of IT-business alignment on the relationship between IT governance and process innovation

Second, as shown by the significant negative interaction term between executive management IT competence and IT-business alignment (Table 5, Model 3a), at a higher the level of IT-business alignment, the effect of executive management IT competence decreases product innovation. More specifically, as illustrated in Figure 4, the effect of executive management IT competence on *product* innovation is negative and significant when IT-business alignment is high, while this effect is not significant at a lower level of IT-business alignment. *Process innovation* is not influenced by executive management IT competence regardless of the level of IT-business alignment (Figure not presented). *In other words, having a senior executive or officer in charge of IT governance as a full member of executive management is associated with less product innovation at a higher level of IT-business alignment, while it has no significant impact on product or process innovation at a lower level of IT-business alignment.* This result appears to be counter-intuitive as prior studies have suggested that IT competence enhances innovation. As previously discussed, we found no significant correlation between executive management IT competence (as indicated in terms of having a senior executive or officer in charge of IT governance as a full member of executive management), and product or process innovation (Table 3). Further, as compared to less innovative firms, more innovative organizations do not seem to have more IT competence on their executive management (Table 4). However, when the executive management IT competence variable is included in our moderating model to explain innovation, it has a significant negative influence. This may be partly explained by suggesting that an IT senior executive such as a CIO could “hold” to a strategic IT plan that is highly aligned to the strategic business plan, influencing executive management to lead business and IT to “do the same”, resulting in less product innovation. In light of Chan (2001), in such an environment where there is a high ‘match’ between IT and business, executive management IT competence can have a negative impact on innovation.

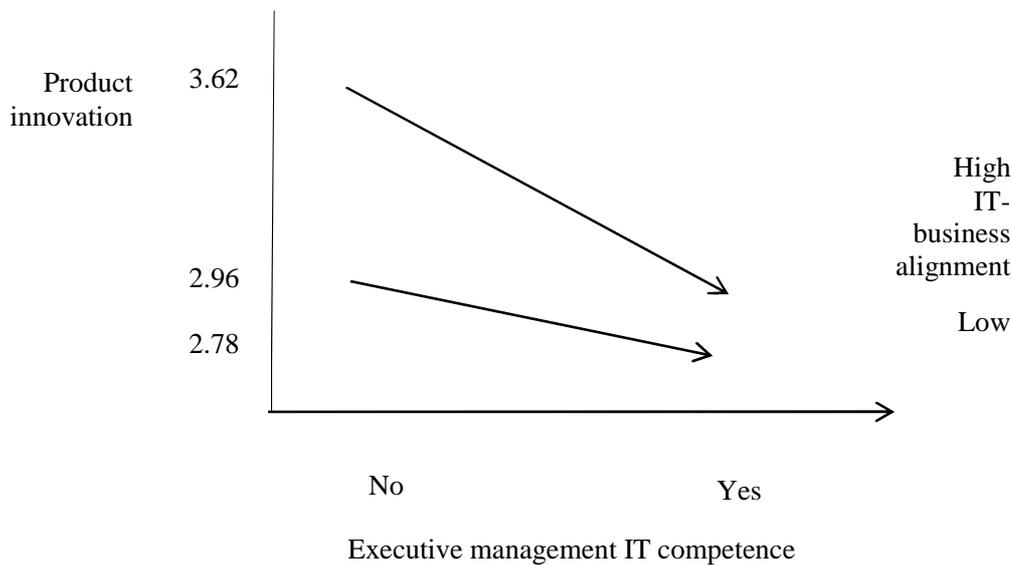


Figure 4. Effect of IT-business alignment on the relationship between executive management IT competence and product innovation

Third, regardless of the level of IT-business alignment, Board IT competence has no significant influence on innovation (Figures not presented). Board IT competence is rather low (mean = 3.58, Table 2) and quite diverse from one organization to another in the sample (standard deviation = 1.58) possibly reflecting a lack of IT knowledge on the part of Board members that can limit their assessment of IT-based strategy (as suggested by Huff et al., 2006; Bart and Turel, 2010). However, the high correlation between Board IT competence and IT governance ($r = 0.64$, Table 3) indicates that IT competent Boards and developed IT governance go together.

Overall, *at a higher level of IT-business alignment*, our results suggest that having more developed IT governance mechanisms gives rise to more product innovation, and a senior executive or officer in charge of IT governance as a full member of the executive management is associated with less product innovation. *At a lower level of IT-business alignment*, we found that having more developed IT governance mechanisms

is associated with less process innovation, and executive management IT competence has no significant impact on innovation. Finally, results indicate that IT intensity has a strong positive impact on both product and process innovation.

These results contribute to the IT governance, IT/IS and innovation literature. De Haes and Van Grembergen (2013) found that IT governance can enhance organizations' capacity for innovation. Wu et al. (2015) have demonstrated a mediating effect for IT-business alignment in the relationship between IT governance and performance. Our results show that IT-business alignment can have a moderating effect on the relationship between IT governance and innovation, an essential component of performance (Sambamurthy et al., 2003; Santamaria et al., 2009). This moderating effect is in line with that of Byrd et al.'s (2006) between IT investment and business performance. According to prior studies, when people in key roles have greater IT competence, there is more innovation. We looked at the Board of directors and executive management IT competence and found that executive management IT competence (proxied by having the senior executive in charge of IT as a full member of the executive committee) can have a negative impact on product innovation under a high IT-business alignment condition. These results nuance Chun et al.'s (2014) discussion on the positive role of the CIO in the development of technology-enabled growth strategies. Overall, our results are in line with those of Chan (2001) that have suggested that IT-business alignment has two dimensions (match and synergy) influencing differently innovation.

Practical implications

Our results have practical implications. Organizations should be aware that the combination of IT governance mechanisms with executive management IT competence is likely to produce 'IT-business synergy' that may influence positively or negatively product or process innovation under different levels of IT-business alignment. Indeed, at a high level of IT-business alignment, senior executives in charge of IT

(e.g., CIOs) can use their competencies to engage in innovative technology-enabled growth strategies or, as our results suggest, create an inflexible IT backbone that can harm an organization's ability to develop new products. Further, the lack of Board of director IT competence might limit their influence on innovation. Therefore, organizations should consider having other senior executives, as well as Board members, with some IT knowledge or experience to challenge ideas from the senior executive in charge of IT. Moreover, when their IT and business are not yet aligned, organizations may benefit from less developed IT governance mechanisms as they might allow for more "agility" to change direction very quickly in terms of production process. As IT and business become more aligned, organizations should reinforce their IT governance mechanisms in order to support the development of new products without inhibiting creativity. This could be challenging as it requires each organization to figure out at what point will be the "best" combination of IT-business alignment and IT governance mechanisms to innovate. Furthermore, as discussed, organizations from all industries should be able to innovate to survive, and are increasingly relying on IT to do so. In that spirit, our results provide insights to all organizations, whether they are more or less IT intensive.

Limitations and directions for further research

Overall, the validity of the data does not appear to be a concern, and the reliability of constructs is excellent. However, the modest sample size may limit the generalization of the results. Therefore, the study could be replicated on a larger sample. Since the effects of IT governance and IT competence on innovation may vary depending on the level of IT-business alignment, further research could extend the results by studying the effect of Chan's (2001) two dimensions of IT-business alignment using, i.e. a match alignment score (similarity) and a synergy alignment score (complementarity). Moreover, interview-based studies could provide additional insights about the influence of the Board and executive management IT competence on innovation.

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APPENDIX – Measurements

Innovation

Product innovation

Scale: **1** = Very low to **7** = Very high

1. The level of newness (novelty) of our firm's new products.
2. The use of latest technological innovations in our new products.
3. The speed of our new product development.
4. The number of new products our firm has introduced to the market.
5. The number of our new products that is first-to-market (early market entrants).

Scale: 1 = Strongly disagree to 7 = Strongly agree

The majority of innovations in our firm's product portfolio . . .

6. address completely new customer benefits.
7. offer customers unique advantages over competitors' products.
8. require changes in established attitude and behavioral patterns from customers.
9. require major learning efforts by mainstream customers.
10. are based on substantially different core technology never used in our industry before.
11. involve technology that makes old technologies obsolete.
12. use new technology that permits quantum leaps (big jumps) in performance.
13. use technologies that have an impact on (or cause significant changes in) the whole industry.

Process innovation

Scale: **1** = Very low to **7** = Very high

1. The technological competitiveness of our company.
2. The speed with which we adopt the latest technological innovations in our processes.
3. The updatedness or novelty of the technology used in our processes.
4. The rate of change in our processes, techniques and technology.

Scale: 1 = Strongly disagree to 7 = Strongly agree

The majority of innovations in our firm's product portfolio . . .

5. are based on substantially different core technology never used in our industry before.
6. involve technology that makes old technologies obsolete.
7. use new technology that permits quantum leaps in performance.
8. use technologies that have an impact on (or cause significant changes in) the whole industry.

IT governance

Scale: 1 = Strongly disagree to 7 = Strongly agree

Structures

1. There is a senior executive (or officer) who is in charge of IT governance. (No = 1; Yes = 7)
2. The officer or manager responsible for IT security, compliance and/or risk:
 - a) is responsible for developing and testing privacy and security policies.
 - b) has sufficient authority to enforce privacy and security policies.
 - c) is responsible for assessing IT risks (e.g., impact on business continuity).
 - d) is responsible for managing changes resulting from IT projects.
3. The IT steering committee at an executive (or senior management) level:
 - a) meets at least four times a year.
 - b) formulates the IT strategies / policies of the organization.
 - c) is involved in implementing the IT strategies / policies.
 - d) is responsible for determining business priorities in IT investments.
 - e) provides strategic direction to IT projects.
 - f) coordinates IT practices.
 - g) provides leadership in deriving benefits from IT.

- h) actively participates in the organization's IT decision-making processes.
 - i) understands the business and the IT objectives.
 - j) makes IT investment decisions based on business needs.
 - k) promotes IT strategic flexibility to meet the changing needs of the organization's internal and external environment.
 - l) has business representatives with extensive IT knowledge.
 - m) has IT representatives with extensive business knowledge.
 - n) has representatives from all major areas of the organization.
 - o) has the most appropriate representatives from each area.
4. The IT *project* steering committee:
 - a) is composed of business and IT people.
 - b) focuses on prioritising and managing IT projects.
 5. The IT *security* steering committee:
 - a) is composed of business and IT people.
 - b) focuses on IT related risks and security issues.
 6. The IT *architecture* steering committee:
 - a) is composed of business and IT people.
 - b) provides architecture guidelines and advice on their applications.
 7. The IT strategy committee at the Board of Directors level:
 - a) ensures IT is a regular agenda item and reporting issue for the Board.
 - b) provides strategic direction and the alignment of IT and business issues.
 - c) provides direction for sourcing and use of IT resources, skills and infrastructure to meet the strategic objectives.
 - d) provides direction to management relative to IT strategy.
 8. The committee at the Board of Directors level (other than IT strategy committee) overviews IT assurance activities:
 - a) is comprised of independent members (from outside the organization).
 - b) addresses IT risks.

Processes

1. A formal planning process is used to define the IT strategy.
2. A formal planning process is used to update the IT strategy.
3. IT budgets are used to control and report on IT activities / investments.
4. There are IT performance measures (e. g. organization contribution, user orientation, operational excellence or future orientation).
5. Methodologies are used to charge back IT costs to business units.
6. There are formal agreements between business and IT service about IT development projects or IT operations.
7. An IT governance and control framework (such as CoBit) is used to govern IT.
8. The COSO (Committee of Sponsoring Organizations) or ERM (Enterprise Risk management) framework for internal control is used to govern IT.
9. There are regular self-assessments or independent assurance activities on the governance and control over IT.
10. The organization regularly engages outside agencies to test its security systems or to conduct security audits.

Evaluation, selection and management of IT projects

11. There is a prioritization process of IT investments and projects in which business and IT are involved (e. g. business cases, return on investment).
12. Explicit criteria are used to help evaluate IT projects.
13. Both qualitative and quantitative criteria are used to evaluate IT projects.
14. A cost/benefit analysis is used to evaluate IT projects.

15. Project cost data are fully identified (direct, indirect, ongoing).
16. IT investment benefits are identified using quantitative and/or qualitative data that relate directly to business strategies and performance improvement (tracking of business value of IT).
17. The expected timeframes for development and implementation are explicitly specified.
18. All foreseeable risks are identified.
19. The organizational impacts of IT projects are evaluated.
20. The availability of personnel resources relative to IT projects is assessed.
21. Project management methodology is used to manage IT projects.
22. Processes are used to monitor the planned business benefits during and after implementation of the IT investments / projects.

IT strategies and policies:

23. are clearly written so that employees impacted by IT projects can understand them.
24. provide these employees with extensive guidance regarding how to manage IT projects.
25. define objectives and expectations, such as accountability and responsibility.
26. are communicated to all employees impacted by IT projects (portals or other information services sources).
27. are accessible to all employees impacted by IT projects.
28. are updated following feedback from employees.

Relational mechanisms

1. The senior executive / officer in charge of IT articulates a vision for IT's role in the organization.
2. The senior executive / officer in charge of IT ensures that the vision for IT's role is clearly understood by managers throughout the organization.
3. There is job-rotation (IT staff working in the business units and business people working in IT).
4. Business and IT people are physically located close to each other.
5. Business people are trained about IT or IT people are trained about business.
6. Systems such as Intranet are used to share and distribute knowledge about the IT governance framework, responsibilities, tasks, etc.
7. Business / administrative managers act as in-between business and IT.
8. Senior business and IT management act as "partners".
9. Senior business and IT management informally discuss activities of the organization and IT's role.
10. Internal corporate communication regularly addresses general IT issues.
11. There are campaigns explaining the need for IT governance to business and IT people.

The IT Executive or senior manager ...

12. regularly attends business planning meetings.
13. contributes to the formulation of business goals
14. has regular informal contacts with executive management
15. has easy access to the CEO.
16. has frequent contacts with the CEO.

The CEO ...

17. plays an important role in the IT steering committee.
18. becomes knowledgeable about competitors' use of IT.
19. has frequent informal contacts with IT management.
20. becomes knowledgeable about IT opportunities within the firm.
21. regards spending on IT as strategic investments rather than expenses to be controlled.

Board IT competence

Scale: 1 = Strongly disagree to 7 = Strongly agree

1. Members of the Board of Directors have expertise and experience regarding value and risk of IT.
2. The Board of Directors is committed to an ongoing training program with respect to IT.
3. The Board of Directors has a thorough understanding of the IT risks based on discussions with the IT executive and/or the audit committee.

Executive management IT competence

Scale: Yes/No

The senior executive (or officer) who is in charge of IT governance is a full member of the executive committee.

IT-business alignment

Scale: 1 = Strongly disagree to 7 = Strongly agree

1. IT projects are aligned with the company's business strategies.
2. IT is in harmony with business strategies, goals and needs established by executive management.
3. Implemented IT solutions are aligned with the company's business.

The business plan ...

4. refers to the IT plan.
5. refers to specific IT applications.
6. refers to specific information technologies.
7. utilizes the strategic capability of IT.
8. contains reasonable expectations of IT.

The IT plan ...

9. reflects the business plan mission.
10. reflects the business plan goals.
11. supports the business strategies.
12. recognizes external business environment pressures.
13. reflects the business plan resource constraints.

IT intensity

Please indicate the degree to which your organization's main operations are currently dependent on IT for each of the following strategic choices.

Scale: **1** = Not dependent to **7** = Totally dependent

1. Introducing new products.
2. Creating product differentiation.
3. Establishing competitive advantage.
4. Improving market access.
5. Avoiding competitive disadvantage.