Explaining IT governance disclosure through the constructs of IT governance maturity and IT strategic role

Explaining IT Governance Disclosure through the Constructs of IT Governance Maturity and IT Strategic Role

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Highlights

- IT governance maturity is positively associated with IT governance disclosure.

- Planning and organization maturity impacts IT strategic alignment disclosure.
- Monitoring and evaluation maturity impacts IT performance disclosure.
- Strategic role of IT in the industry is associated with IT governance disclosure.

Abstract

This study investigates the relation between the maturity of IT governance processes and the IT governance disclosure of firms. Furthermore, it examines whether the strategic role of IT in an industry induces systematic variation in IT governance disclosure. Based on a content analysis of annual reports and a field survey on the maturity of the implementation of COBIT processes, the results demonstrate a role of IT governance frameworks in stimulating accountability and transparency via enhanced external reporting of relevant IT information to external stakeholders, in particular in settings where the strategic role of IT is high.

Keywords: *IT governance maturity, COBIT, disclosure, industry level strategic role of IT*

1. Introduction

Senior management is increasingly engaged in the implementation of IT governance frameworks to provide structure, processes, and relational mechanisms for efficient IT decision making and the monitoring of IT assets (Lunardi, Becker, Maçada, & Dolci, 2014; Van Grembergen & De Haes, 2009). In fact, the last published IT governance global status report of the IT Governance institute (ITGI, 2011) found a considerable increase in the adoption and maturity of best practice-based IT governance frameworks to improve IT performance at the firm level. Consistent with this, some recent academic studies have shown that the level of IT governance maturity has a

significant positive impact on IT performance as well as firm performance (De Haes, Huygh, Joshi, & Van Grembergen, 2016; Lunardi et al., 2014; Wu, Straub, & Liang, 2015; Zhang, Zhao, & Kumar, 2016).[1]

Although these studies have contributed to our understanding of the complex association between maturity of IT governance practices and firm performance, what remains unclear is how IT governance maturity in firms influences firms' overall IT information environment, and more importantly external reporting on IT governance. Given that IT capabilities are dominant in achieving strategic business goals (Martin-Oliver & Salas-Fumas, 2012), IT-related information becomes crucial for external stakeholders (e.g., customers and investors) to assess firms' IT-related capabilities (Zmud, Shaft, Zheng, & Croes, 2010). In this regard, only few prior studies have explored the impact of corporate governance (Joshi, Bollen, & Hassink, 2013) and industry characteristics (Dehning, Richardson, & Zmud, 2003; Zmud et al., 2010) on IT governance transparency and the IT signaling behavior of firms. However, by and large, the association between maturity of IT governance practices and IT governance disclosure remains unexplored in the extant literature.[2]

On a theoretical level, the relationship between IT governance maturity and IT governance disclosure partly is mechanistic. Firms that are more engaged in the adoption and implementation of IT governance frameworks, by design will have more IT-related information available internally, which may also lead to more disclosure to relevant external stakeholders as predicted by voluntary disclosure theory. To empir-

[1]According to Simonsson, Johnson, & Ekstedt (2010, p.11), the term IT governance maturity implies how well an efficient organization is aligned with best practice-based IT governance frameworks.

[2]In this study, we use the term IT governance transparency interchangeably with IT governance disclosure and define it as "the extent to which firms provide adequate and relevant IT governance information timely and effectively to their stakeholders such as investors, policy makers, and regulatory bodies, so that they can assess management's behavior in using IT."

ically address these issues, the first *main research objective of this study is to examine how the level of IT governance maturity influences firms' external reporting on IT governance practices.*

However, the disclosure of IT-related information is also to a large extent a managerial issue, in particular for firms where IT is an important strategic resource. Drawing on signaling literature, Dehning et al. (2003) observed that investors react positively to IT investment disclosures in IT-intensive industries and Zmud et al. (2010) have noted systematic differences in IT information signaling across industries depending on the strategic role of IT within that industry. Prior empirical research on the strategic role of IT at the industry level has focused on the impact IT signaling (for example, disclosure on IT investment) has on firm performance (e.g., Anderson, Banker, & Hu, 2003; D. Chatterjee, Pacini, & Sambamurthy, 2002; Dehning et al., 2003; Zmud et al., 2010). This research stream has clearly noted that, depending on the strategic role of IT at industry level, systematic variation exists regarding firms' specific IT information disclosure. Given that IT disclosure is widely used to understand firms' IT-related behavior (Zmud et al., 2010), it is surprising that there is a lack of research examining how the strategic role of IT at the industry level impacts firms' overall IT governance disclosure. To fill this research gap, *the second research objective of this study is to examine whether the strategic role of IT in an industry induces systematic variation in IT governance disclosure.*

Given the fact that firms for which the strategic importance of IT is high, are more likely to adopt IT governance frameworks as a result of which the maturity of IT governance frameworks within these firms is also likely to be high, it remains unclear that to what extent increased levels of IT governance disclosure can be contributed to the adoption of these IT governance frameworks, or to the incentives that manag-

ers in these firms have to engage in IT signaling. Consequently, the impact of the adoption and implementation of IT governance frameworks on the level of IT governance disclosures is not only mechanical but also the result of opportunistic managerial behavior. Therefore, the main theoretical contribution of this paper is to disentangle the mechanistic and opportunistic relationship between IT governance maturity and IT governance disclosure.

This study uses cross-sectional data from 124 firms to examine how IT governance maturity and the strategic role of IT at the industry level relate to the level of IT governance disclosure. We measure firms' IT governance disclosure by using a framework developed by Joshi, Bollen, & Hassink, (2013). We use annual reports as the primary source of data, because previous literature has indicated it to be the most reliable source of information in examining voluntary information disclosure behavior of firms (Zmud et al., 2010). Following the IT governance literature (Simonsson, Johnson, & Ekstedt, 2010; Van Grembergen & De Haes, 2009), we assess firms' IT governance maturity by employing the Control Objectives for Information and Related Technologies (COBIT) framework.[3] Specifically, the findings of an international field survey conducted across different industry sectors to assess the level of maturity on COBIT processes are used to proxy IT governance maturity in this study setting. Following literature on the strategic role of IT (Anderson et al., 2003; Debabroto Chatterjee, Richardson, & Zmud, 2001; Dehning et al., 2003; Zmud et al., 2010; Zuboff, 1988), we classify a firm's IT strategic role at the industry level in to three categories: automate, informate, and transform. In automate industries, IT replaces human labor. Informate industries are classified by the use of IT for creating

[3]Control Objectives for Information and Related Technologies (COBIT) is a well-known IT governance framework for implementing a set of best practices for management, control, and assurance of IT. The next sections in the study will discuss the framework in more detail.

efficient and effective information flows for decision making across upper and lower levels of the firm. In transform industries, IT is deployed to "fundamentally redefine business and industry processes and relationships" (Dehning et al., 2003, p. 639). Our analysis suggests that the level of IT governance maturity is positively associated with the level of IT governance disclosure. This study also finds that transform and informate IT strategic roles at industry level are associated with a higher level of IT governance disclosure when compared with automate industries. These findings corroborate the findings of previous literature on IT signaling behavior of firms (e.g., Zmud et al., 2010). We also hypothesize and analyze the moderating effect of the industry-level strategic role of IT on the association between IT governance maturity and IT governance disclosure. The analysis does not provide evidence for moderating effect. However, the level of IT governance maturity is the most influential explanatory variable to explain the level of disclosure when analyzed together with the strategic role of IT across industries.

2. Background and Hypotheses

2.1. COBIT as IT governance framework

IT governance provides firms with effective mechanisms, such as the allocation of IT decision rights and management of IT risks, to achieve firms' business goals (Van Grembergen & De Haes, 2009). It also ensures that the role and responsibility of IT within organizations is not only limited to acquiring internal IT efficiency through establishing better IT processes or by addressing regulatory compliance issues. The ultimate objective of IT governance is to create synergy between business and IT to obtain business value through IT investments (Weill & Ross, 2004). To uphold this view, Van Grembergen & De Haes (2009, p. 3) describe the enterprise governance of IT (EGIT) as "an integral part of corporate governance and addresses the defini-

tion and implementation of processes, structures, and relational mechanisms in the organization that enable both business and IT people to execute their responsibility in support of business/IT alignment and the creation of business value from IT-enabled business investments." Several IT governance frameworks exist that incorporate all elements of the aforementioned definition and assist organizations in deploying effective IT governance. The basic premise of these frameworks is to offer firms a set of best practices to effectively design structures, processes, and relational mechanisms to govern their IT assets.

COBIT is a well-known industry IT governance framework to implement a set of best practices for management, control, and assurance of IT. COBIT is widely accepted as a unifying framework that incorporates other IT standards, including ISO 17799, ISO/IEC 38500, Information Technology Infrastructure Library (ITIL), and Capability Maturity Model Integration (CMMi).[4] COBIT is developed and distributed freely by Information Systems Audit and Control Association (ISACA).[5] Initially developed as a framework to conduct IT audit assignments, COBIT has now emerged as one of the major *de facto* frameworks to implement and assess the maturity of IT governance practices in organizations. In its fourth revised version, COBIT 4.1 (ITGI, 2007) represents a comprehensive IT control and management framework with inclusion of

[4]The focus of this study is on COBIT as an IT governance framework. For brevity, a discussion of other IT standards/guidance is not provided. A detailed comparison of COBIT to most of the above-mentioned IT standards can be found in Van Grembergen & De Haes (2009).

[5]Founded in 1967, ISACA is engaged in providing guidance, tools, and benchmarking practices to firms that employ information systems. According to ISACA's website, the organization has more than 100,000 members and 180 branches across 75 countries. ISACA has developed several IT governance frameworks including COBIT, VALIT, and Risk IT governance frameworks. Further research and publication on these frameworks is conducted at the IT governance institute (ITGI), which works under the flagship of the ISACA. Next to these activities, ISACA also provides several information systems related certification programs. More details on its activities and initiatives can be found at: www.isaca.org.

metrics and maturity models for IT processes.[6] The framework consists of 34 generic IT processes organized in four domains (See Appendix C). For each of the 34 processes, the framework describes control objectives, management guidelines, and a maturity model. Each process of the framework has one high-level control objective followed by several detailed objectives. More specifically, COBIT 4.1 describes 34 high-level control objectives and 210 detailed control objectives across four domains: Plan and Organize (PO), Acquire and Implement (AI), Deliver and Support (DS), and Monitor and Evaluate (ME).

PO domain includes ten IT processes that deal with recognizing a suitable way to contribute to the achievement of business objectives. In this view, the PO domain processes involve strategy and tactics for the information and technology architecture, strategic IT planning, assessment and management of IT risks, a well-structured IT organization, IT human resource management, communication of management's aims and direction, and management of IT investments and projects. The AI domain is mainly concerned with the identification of suitable IT solutions to realize the IT strategy of the organization, the acquisition and maintenance of application software and technical infrastructure, creating documentation and user training for users of information systems. Additionally, this domain also manages application changes and maintenance requirements to continue and fulfil business objectives. Following the AI domain, the focus of the Delivery and Support (DS) domain is on the delivery of required services that cover defining and managing service-level agreements, ensuring business continuity, configuration management, data man-

[6]The focus of this study is on COBIT 4.1 as an IT governance framework. While completing this research study, ISACA has launched its new version, COBIT 5.0, which therefore is out of the scope of this study. Nonethless, it is important to note that all the COBIT 4.1 proccesses are well integrated into COBIT 5 (ISACA, 2012).Thus, the use of COBIT 4.1 does not manifest any potential impediment to our study.

agement, problem management, performance and capacity management of hardware, providing education and training to users, management of information systems operations, and physical environment. The fourth and last domain, ME, provides a set of IT processes to assess the quality and compliance with the control requirements for all IT processes prescribed under the other three domains. The domain specifically includes performance management, monitoring of internal control, regulatory compliance, and establishing IT governance.[7] ISACA did develop COBIT as a broad framework in the context of a "generic organization" and "what" needs to be done in the context of EGIT. From a practice-oriented perspective, COBIT's limitation here is that a "specific" (not generic) organization still needs to translate the necessary information and transform it to "how" each of the identified EGIT domains can be implemented through an organization-specific template or approach suitable in the context of its contingencies such as size, culture, industry, etc. (De Haes & Van Grembergen, 2015). Notwithstanding this practical limitation, from a research perspective we believe this broad generic orientation toward the "what needs to be done in EGIT" makes COBIT a very suitable framework to be leveraged a proxy to analyze and measure the EGIT construct.

Although initially seen as a practitioner-based IT governance framework, in the last decade, COBIT has also undergone rigorous academic investigation similar to theory-driven conceptual models (De Haes, Van Grembergen, & Debreceny, 2013; Ridley, Young, & Carroll, 2008a; Tuttle & Vandervelde, 2007). Building on COBIT as an IT governance framework, a considerable amount of academic studies have examined a wide range of IT governance topics that include the impact on IT governance

[7]The above discussion of COBIT domains and its high-level processes is based on the description provided in Van Grembergen & De Haes (2009, p.137-163). Additional discussion on control objectives, management guidelines, and maturity models can be found in the official version of COBIT 4.1 of the ITGI (2007).

performance, IT-business alignment, business performance, trust in electronic commerce, and audit setting (Bowen, Cheung, & Rohde, 2007; De Haes & Van Grembergen, 2009a, 2010; Huang, Shen, Yen, & Chou, 2011; Simonsson et al., 2010; Tuttle & Vandervelde, 2007). Collectively, these studies have indicated that a higher level of IT governance maturity is positively associated with higher IT-business alignment, IT governance performance, customer trust, and business performance. While these studies have certainly contributed to our understanding of the complex association between best IT practices and business outcomes, what remains unclear is how IT governance maturity in organizations influences their overall IT information environment, and specifically their external reporting on IT governance. In a wider context, existing literature has already noted the value relevance of IT information in external reporting practices (Dehning et al., 2003; Gordon, Loeb, & Sohail, 2010). Given that IT assets are fundamental to achieving strategic business objectives and competitive advantage (Martin-Oliver & Salas-Fumas, 2012; Mata, Fuerst, & Barney, 1995), we expect that IT-related information is crucial for external stakeholders (e.g., customers and investors) to assess the firm's IT-related capabilities and firm value.[8] Therefore, we posit that implementation of an IT governance framework like COBIT will influence a firm's IT information environment. Specifically, we anticipate that the level of IT governance maturity will potentially improve and increase the information dissemination opportunities for firms in relation to IT governance disclosure. Nonetheless, we observe a paucity of research to examine this association.

[8]In this study, we use the term internal and external stakeholders to describe the type of stakeholders involved in IT governance. Internal stakeholders, for example includes IT leadership, IT and business managers, and different IT users of management information systems. External stakeholders include customers, investors, and regulatory authority.

2.2. The association between IT governance maturity and IT governance disclosure

According to Simonsson et al. (2010, p. 11), "a maturely governed IT organization is an organization that is efficient and aligned with-state-of-the-practice-frameworks (such as COBIT)." It is argued that IT governance maturity exhibits the internal IT organization efficiency measured on an IT process-based framework like COBIT. The term IT organization essentially relates to IT-related decision making and includes participants from both the IT and business sides of the organization. In this study, we adhere to the above definition to conceptualize and simplify our understanding of IT governance maturity.[9] The current strategic information systems and accounting information systems literature provides a variety of studies to understand two important contributions of IT governance using COBIT. First, as stated earlier, firms that exhibit higher IT governance maturity will show a positive impact on IT-business alignment, IT-related performance, and overall organizational performance (e.g., De Haes & Van Grembergen, 2009b; Simonsson et al., 2010; Van Grembergen & De Haes, 2009). This stream of literature specifically emphasizes the influence of IT governance in improving the IT-related performance to achieve business objectives. This describes the role of IT governance in creating IT capabilities to increase firm value and gain competitive advantage.

A second important contribution of IT governance, specifically using COBIT, is noted in establishing efficient and effective internal control systems in organizations (Kerr & Murthy, 2013). Since the introduction of the Sarbanes-Oxley Act of 2002 (SOX), executive management of firms under the section 404 of this act is required to report

[9]The concept of maturity within COBIT 4.1 is described as IT governance maturity model. This maturity model concept is based on the Software Engineering Institute's maturity model for software development capability to assess the maturity on 34 COBIT processes.

on the quality of firms' internal controls over financial reporting.[10] This act also explicitly demands disclosure on material weaknesses including IT material weaknesses.[11] Given that IT-enabled systems in firms are pervasive in supporting management to formulate earnings forecasts, financial statements, and to make critical business decisions, it has become essential for firms to establish efficient and effective IT controls to ensure reliable financial reporting (Li, Peters, Richardson, & Weidenmier Watson, 2012). In this view, COBIT provides a valuable and most suitable IT process control framework. It explains IT processes in detail, outlines their control objectives and essential quality indicators, and also provides a guideline to self-assess firms' maturity level in implementing each IT process (Hardy, 2006; McFarlane, 2005). In the last decade, a substantial amount of literature has been developed that has explored the topic of IT internal control and IT auditing employing the COBIT framework, and has established its importance in developing IT governance practices in firms (Lainhart IV, 2000; Merhout & Havelka, 2008; Ridley, Young, & Carroll, 2008b; Tuttle & Vandervelde, 2007).

Collectively, the aforementioned contributions can be attributed or *"mapped"* to the five focus areas of IT governance namely, IT strategic alignment (ITSA), IT value delivery (ITVD), IT resource management, IT risk management (ITRM), and IT performance measurement (ITPM) (Buckby, Best, & Stewart, 2008; ITGI, 2007).[12] While

[10]The Sarbanes-Oxley Act (SOX) was passed by the US Congress in 2002 in response to a number of corporate governance scandals, for example, Enron and WorldCom. The act is focused on improving corporate governance practices, providing reliable and high-quality financial reporting, and improving audit effectiveness.

[11]According to the Public Company Auditing Oversight Board (PCAOB), "A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the company's annual or interim financial statements will not be prevented or detected on a timely basis." For more details see: (PCAOB, 2007).

[12]A detailed discussion of the IT governance and its focus areas can be found in ITGI's board briefing on IT governance (ITGI, 2003). Also, a comprehensive literature summary is provided in Buckby, Best, & Stewart (2008).

the first type of literature provides a significant documentation of the topic of ITSA, ITVD, and ITPM, notable research studies on IT internal control have helped to develop our understanding of IT resource management and ITRM topics. In this study, we argue that the influence of effective IT governance practices and their impact on the above-mentioned five focus areas is not only relevant or limited to the firm and its internal stakeholders. In fact, there is a broader ramification of these practices on external stakeholders. As effective and mature IT governance in firms can ensure IT leadership and other internal stakeholders about firm-wide performance of IT assets, it also has the potential to directly influence a variety of issues relevant to external stakeholders. For example, Gordon, Loeb, Lucyshyn, & Sohail (2006) showed that voluntary disclosure of information security activities has dramatically increased (over 100%) since the introduction of SOX. They have also noted that such a type of voluntary disclosure of firms not only improves the transparency on non-financial topics, but also has resulted in enhancing their market value.

Drawing on voluntary disclosure theory and the notion of information asymmetry, research in IT governance has clearly advocated the importance of IT governance communications to external stakeholders of the firm (L. Gordon et al., 2006; Gordon et al., 2010; Raghupathi, 2007). Voluntary disclosure theory suggests that firms can improve firm valuation, market reputation, and can reduce litigation costs and the cost of capital by disseminating information, which is beyond the mandatory requirement in their communication activities to stakeholders (Diamond & Verrecchia, 1991; Healy & Palepu, 2001; Jensen & Meckling, 1976; Narayanan, Pinches, Kelm, & Lander, 2000). In the context of IT, Kim and Lim (2011) have used voluntary disclosure theory to predict that capital markets react positively to firms that voluntarily disclose specific costs, goals, and risk related to IT. Acknowledging that the disclosure on IT governance is voluntary (see Gordon et al., 2010), we argue that firms

that are more engaged in the adoption and implementation of IT governance frameworks, i.e. have higher IT governance maturity, by design will have more IT-related information available internally, decreasing the costs to collect and disclose such information, therefore leading to an increased level of voluntary disclosure to relevant external stakeholders.This prediction is hypothesized as follows:

H1a: The level of IT governance maturity is positively associated with the level of IT governance disclosure.

To examine this hypothesis, we use 1) all the 34 IT processes across the four COBIT domains to assess the IT governance maturity and 2) the IT governance disclosure framework developed by Joshi et al. (2013) to measure the level of disclosure on key focus areas of IT governance. As reported earlier, the five focus areas of IT governance could be well mapped on to the four COBIT domains. In this regard, we note a potential association between the PO domain of the COBIT with the strategic alignment focus area of IT governance. Prior literature suggests that firms that have organized different IT governance structures to align business and IT engage in disclosing these activities to increase firm value. For example, Chatterjee, Richardson, & Zmud (2001) show that the announcement of the creation of a Chief Information Officer (CIO) position has a significant positive impact on the stock price of the firm.[13] Likewise, we also note a relationship between the ME domain and ITPM focus area. For instance, Im, Dow, and Grover (2001) show a positive market performance of firms that provide information about their IT spending. The empirical evidence certainly warrants further examination of a domain-level association of COBIT maturity with the disclosure behavior of firms. To this end, we specifically identify and focus

[13]From the PO domain perspective, creating a CIO position is part of establishing and implementing IT roles and responsibilities, nevertheless, it is also seen as a mechanism to create synergy between IT and business.

on the PO and ME domains that are primarily concerned with those IT processes that potentially affect IT-business alignment and performance measurement (Van Grembergen & De Haes, 2009). Therefore, we predict that the maturity of the PO and ME domains will show a positive and significant association with the disclosure of ITSA and ITPM focus area of IT governance, respectively. Unlike the PO and ME domains, which are addressed in H1b and H1c, the existing literature does not provide any substantial theoretical basis nor is there any empirical evidence to posit an association between AI and DS with any of the disclosure categories in the IT governance disclosure framework. Therefore, we do not develop any specific hypothesis for the AI and DS domains. In sum, this discussion leads to following two hypotheses:

H1b: The level of maturity of the PO domain within COBIT is positively associated with the level of disclosure on ITSA.

H1c: The level of maturity of the ME domain within COBIT is positively associated with the level of disclosure on ITPM.

2.3. Industry-level strategic role of IT and IT governance disclosure

The extant information systems research has extensively examined the dominant role that IT deployment plays for competing firms in an industry (Chiasson & Davidson, 2005; Crowston & Myers, 2004). There is a basic premise that the strategic role of IT across industries varies because of the difference in the nature of competitive opportunities and pressures, business processes, and the need to develop certain IT infrastructure capabilities to meet the requirements of information processing (Kobelsky, Richardson, Smith, & Zmud, 2008). Nonetheless, variation in the requirements at the firm level results in a considerable similarity in the nature of IT deployment within industries (Dehning et al., 2003).

The information systems research classifies these similarities of IT strategic role at the industry level into three distinct categories: automate, informate, and transform (Schein, 1992; Zuboff, 1988). Automate industries signify that a primary role of IT is to substitute human labor by automating business processes. In *automate* IT strategic role, IT deployments help firms to reduce the cost of operating business processes in order to pursue a cost leadership strategy (Anderson et al., 2003). According to Zmud et al (2010, p. 154), firms in automate industry category are perceived to be more stable, and "digitization of business processes, products or services for such firms are either difficult or for whom digitization is difficult to justify." As a result, automate IT strategic role at the industry level is associated with less frequent IT deployments, such that developing and structuring of IT capabilities occur in an incremental manner (Kobelsky et al., 2008). Contrary to this, *transform* IT strategic role portends a less stable business environment where business processes, products, or services are dynamic and highly digitizable. In such business environment, because of greater competitive opportunities and pressures, firms are engaged in frequent IT deployments, which are emerging and innovative in nature (Sambamurthy, Bharadwaj, & Grover, 2003). In transform IT strategic role at the industry level, IT deployments assist firms to regularly reinvent their IT capabilities to advance in new product market niches or to bring radical changes to existing IT-enabled business processes (Dehning et al., 2003). In between these two extreme scenarios, *informate* IT strategic role at the industry level includes those firms that operate in 'moderately' dynamic business environment, but exhibit greater opportunities for digitization of their business processes, products, or services (Zmud et al., 2010). Informate IT strategic role at the industry is primarily focused on the use of IT to create flexible business processes that in turn would help firms to archive, analyze, and distribute digitized data and information for efficient decision making (Zmud et al., 2010). Col-

lectively, the dissemination of information and data flow about business activities to senior management (*informate-up*) and to employees (*informate-down*) using IT creates "decision-making and decision-taking structure at, respectively, higher and lower firm levels" (Dehning et al., 2003, p. 640).

The current information systems research has extensively employed the IT strategic role construct to examine the business value of IT both at the industry (Anderson et al., 2003; D. Chatterjee et al., 2002; Debabroto Chatterjee et al., 2001) and the firm levels (Armstrong & Sambamurthy, 1999). In this study, we employ the construct at the industry level using the typology suggested in Chatterjee et al. (2001). A number of studies have linked strategic role of IT to the information disclosure behavior of firms. Zmud et al. (2010) have noted systematic differences in IT information signaling across industry-level strategic roles of IT, such that transform industries are engaged in higher IT signaling when compared to informate and automate industries. In their study on the value relevance of announcement of IT investments, Dehning et al. (2003) observed that investors react more positively to IT investment disclosure in transform industries in comparison to informate and automate industries.

The existing empirical evidence therefore suggests that firms operating in a more dynamic and less stable environment, and for whom IT deployments posit a dominant role in (re)designing business processes, products, or services are more likely to engage in greater IT signaling than firms in a stable business environment. In other words, firms in transform industries are likely to show higher IT information dissemination when compared to firms in informate and automate industries. In addition, the results show that external stakeholders certainly acknowledge value implications of IT-enablement in relation to the strategic role of IT.

From a theoretical perspective, these findings can be explained using signaling theory, which suggests that managers use information disclosures to mitigate information

asymmetry between the firm and its stakeholders (e.g. firm and investors) (Connelly, Certo, Ireland, & Reutzel, 2011; Spence, 1973). In the context of IT governance, signaling theory suggests that firms for which IT is an important resource are more willing to invest in costly information disclosures to signal their superiority in handling IT-related issues (i.e. investments and processes) over firms who lack such initiatives. To exemplify this, Higgs, Pinsker, Smith, & Young (2016), also using signaling theory, show how the creation of a board-level technology committee as part of the firm's IT governance practices signals the firm's ability to detect and respond to security breaches. Furthermore, prior research indicates that signaling of IT-related information is higher in more "dynamic industries structures, larger in size, and greater propensities for risk, and seen as leaders in their industries by the stakeholders" (Calantone & Schatzel, 2000; Zmud et al., 2010, p. 152).

Building on the aforementioned literature as the theoretical framework, we expect that the propensity of IT governance disclosure for firms in dynamic and less stable environments (i.e., transform industries) as well as moderately dynamic environments (i.e., informate industries) will be greater than firms that operate in a relatively stable business environment (i.e., automate industries). Also, from a value implication perspective (Davis et al., 2003; Dehning et al., 2003), we assume that investors would expect higher IT governance disclosure from firms who face more competitive pressure and opportunities through IT deployments (i.e., transform and informate industries). This discussion leads to the following hypothesis:

H2: The level of IT governance disclosure differs across industries, depending on the strategic role of IT in the respective industry.

2.4. Moderating effect of industry-level strategic role of IT

Building on the prediction that a higher level of IT governance maturity will be associated with more disclosure in their external reporting practices, we postulate that this relationship will be moderated by the strategic role of IT. Various existing studies and reports have suggested that IT governance maturity and the strategic role of IT are intertwined (e.g., Armstrong & Sambamurthy, 1999; Sohal & Fitzpatrick, 2002). More specifically, these studies suggest that firms for which IT is an important competitive resource are adopting and implementing IT governance practices more proactively as compared to automate industry firms. Managers within these firms have high incentives to signal the relevance and performance of these IT-related resources to external stakeholders. However, in order to have this information available in sufficient diversity and detail, these firms heavily depend on their IT governance processes. Only when such processes are in place at a sufficiently adequate level of maturity, can these firms actually meet their ambition to publish this information to external stakeholders.[14]

Drawing on this discussion, we therefore expect that firms with higher IT governance maturity in transformative industries will have an enriched IT governance information environment. As a result, firms will not only have the potential to benefit from these disclosures due to its value implications in the competitive arena, but also are in a position to generate and disclose such information. Additionally, we also expect a similar relationship for firms in the informate industry group for whom higher IT governance maturity will induce efficient and effective IT processes monitoring. This will potentially result in an improved information environment not only for better decision

[14]The fifth version of COBIT actually supports this premise by including a separate process termed as “Ensure Stakeholder Transparency” under a domain called Evaluate, Monitor, and Direct (EDM) to improve external reporting practices (ISACA, 2012).

making and taking environment at different levels of the firm, but also for external communication practices. On the basis of these arguments, we state following research hypothesis:

H3: The relationship between IT governance maturity and IT governance disclosure is moderated by the industry-level strategic role of IT.

3. Research Method

3.1. Sample, data, and variable measurement

This research study draws on two data sources: 1) survey data on the self-assessment of IT governance maturity by executives and managers of firms; and 2) annual reports in a cross-sectional setting from the same period. We acquired the survey data from a study conducted by De Haes & Van Grembergen (2010) to assess the implementation level of 34 COBIT processes (see Appendix D).[15] This survey included 538 responses from the members of the Information Systems Audit and Control Association (ISACA) who were registered as CxO and were working in an organization with more than 150 employees. From this survey data, we considered only those responses where we could identify their firm affiliation and obtain the firm annual report to measure the level of IT governance disclosure. This important condition resulted in a final sample of 124 observations where we were able to retrieve their firm's annual report. Respondents provided their assessment of the implementation status of 34 COBIT processes on a five-point Likert scale (1 = not implemented, 5 = fully implemented). Each process was briefly explained by some of its key activities and a "Don't know" option was provided to enhance the quality of the as-

[15]In addition to COBIT proceseses, this survey also includes data on IT goals, business goals, and VALIT faremwork. As this study exclusively focuses on COBIT, we exclude all other data of this survey. See De Haes & Van Grembergen (2010) for a detailed discussion and descriptive analysis on the survey data.

sessments. Given that field survey data are susceptible to self-reporting bias, we conducted univariate analysis by categorizing the respondent's functional department (IT or business) and job-related expertise (IT, business, and audit). The results suggest that there is no significant difference in maturity assessment across functional department and job expertise. These results do not indicate any evident concern for self-reporting bias. Next, each of the sample firms was coded to the industry-level strategic role of IT using Chatterjee et al. (2001) typology. According to this typology, we assign each sample firm into one of the three categories, namely: transform, informate, and automate. The industry segment indicated by the respondent in the survey and the firm's annual report was used as an additional source to perform this classification. The description of this analysis is presented in Table 1. Of 124 firms, financial and banking firms represent 32% of the total sample, followed by governmental organizations at 18%. The manufacturing industry represents 8% of the total sample.

Data on IT governance disclosure are collected from the annual reports of the 124 sample firms. We recognize that beside the annual report, firms' voluntary IT governance disclosure is made through various disclosure channels, for example, corporate governance report, press releases, website, newsletters, firms' presentations to investors, and corporate social responsibility report. The choice of the annual report as a preferred medium for data gathering was based on two main reasons. First, the annual report is easily accessible through firms' websites. It is also noted that firms treat the annual report as a most preferred medium when voluntarily disclosing on IT activities (Joshi et al., 2013). In addition, the study by Zmud et al. (2010) shows that firms communicate a greater number of IT signals through annual reports indicating that a more realistic portrayal of a firm's IT deployment may be provided by annual

reports. Acknowledging prior literature (e.g. Adams, 1997; Arndt & Bigelow, 2000; Elsbach, 1994; Gibbins, Richardson, & Waterhouse, 1990; Lev, 1992), the authors suggest that annual reporting practices are mandated, likely influenced by institutional forces, and technically oriented arguments have been shown to be particularly effective in annual reports. Based on the study findings, the authors recommend (Zmud et al., 2010, p.171), "We encourage information systems scholars to consider the use of annual reports as a source of data for IT-related activities, especially if the sampling intent is to capture realistic portrayals of firms' IT activities." Second, in many countries, annual reports are audited; therefore, voluntary disclosed information on IT in the annual report is more credible compared to other mediums of reporting, which are mostly non-audited.

To codify data on IT governance from the annual report, we used the IT governance disclosure framework developed by Joshi et al. (2013). This framework is developed on the four key focus areas of the COBIT framework that include ITSA, ITVD, ITRM, and ITPM. Each of these focus areas is represented as a disclosure category in the IT governance disclosure framework with a list of key disclosure items relevant to each of the categories (see Appendix A). The disclosure items of this framework are originally developed through an extensive literature review and a pilot study.

3.2. Dependent, independent, and control variables

Using content analysis (Weber, 1985), we examined whether or not each item on the IT governance disclosure framework is reported (1 = reported, 0 = not reported). Next, we estimated the disclosure index score for each category of the IT governance disclosure framework as well as an overall IT governance disclosure index (ITGDI), which is simply an average score on all the items disclosed by a firm. ITGDI is the dependent variable to test H1a and H2. For testing H1a and H1b, we comput-

ed category-level index scores ITSA and ITPM as dependent variables. The interest of this paper lies in investigating the association of IT governance maturity and the industry-level strategic role of IT to the level of IT governance disclosure. To capture IT governance maturity (ITG_MATURITY) as an independent variable, the COBIT framework is used to assess the firm's maturity on IT governance-related processes. ITG_MATURITY score for a firm is computed as the average score on all the 34 COBIT processes from the survey data (Cronbach's alpha = 0.97).

Next, average maturity scores for all COBIT domains, PO, AI, DS, and ME, are also estimated. The variable PO and ME maturity scores are used as independent variables to test hypotheses H1a and H1b, respectively. Besides ITG_MATURITY, the other independent variable of the study is the industry-level strategic role of IT. Consistent with prior literature (e.g., Debabroto Chatterjee et al., 2001; Dehning et al., 2003), we classify sample firms in one of the three categories and create three indicator variables, namely, TRANSFORM, INFORMATE, and AUTOMATE to represent a distinct industry-level strategic role of IT. Further, we include firm size as a control variable. Previous literature has documented mixed evidence of firm size on firm's information disclosure propensity (Zmud et al., 2010). The firm size measure in this study is based on firms' employee number information indicated by participants from 8 different firm employee size categories. Using this information, we created three indicator variables—SMALL, MEDIUM, and LARGE to capture the firm size effect. As the sample is drawn from an international survey, we employed a dummy variable (US) to control the potential country differences noted in Joshi, Bollen, & Hassink (2013). We further include an indicator variable—GOV to control for the difference between public and private firms. In addition, we used LIST as a control variable to account for the difference between public-listed and non-listed firms. Table 2 pro-

vides a description of the dependent, independent, and control variables used in this study.

3.3. Regression models

OLS multiple regression analysis is used to test the proposed hypotheses. Several OLS models were specified to test the main effects and the interaction effect of IT governance maturity and the industry-level strategic role of IT on the level of IT governance disclosure. The following functional model indicates the approach for the empirical analysis:

ITGDI = *f (*IT governance maturity, Industry level strategic role of IT, control variables). (1)

Specifically, we estimate the coefficients of the following regression analysis:

$$ITGDI = ß_0 + ß_1 * ITG\_MATURITY + ß_2 * TRANSFORM + ß_3 * INFORMATE * + ß_4 * AUTOMATE + ß_5 * MEDIUM + ß_6 * LARGE + ß_7 * SMALL + ß_8 * US + ß_9 * GOV + ß_{10} * LIST + \varepsilon \quad (2)$$

$$ITSA = ß_0 + ß_1 * PO + ß_2 * TRANSFORM + ß_3 * INFORMATE + ß_4 * AUTOMATE + ß_5 * MEDIUM + ß_6 * LARGE + ß_7 * SMALL + ß_8 * US + ß_9 * GOV + ß_{10} * LIST + \varepsilon \quad (3)$$

$$ITPM = ß_0 + ß_1 * ME + ß_2 * TRANSFORM + ß_3 * INFORMATE + ß_4 * AUTOMATE + ß_5 * MEDIUM + ß_6 * LARGE + ß_7 * SMALL + ß_8 * US + ß_9 * GOV + ß_{10} * LIST + \varepsilon \quad (4)$$

$$ITGDI = ß_0 + ß_1 * ITG\_MATURITY + ß_2 * TRANSFORM + ß_3 * INFORMATE + ß_4 * AUTOMATE + ß_5 * (ITG\_MATURITY \times TRANSFORM) + ß_6 * (ITG\_MATURITY \times INFORMATE) + ß_7 * MEDIUM + ß_8 * LARGE + ß_9 * SMALL + ß_{10} * US + ß_{11} * GOV + ß_{12} * LIST + \varepsilon \quad (5)$$

The aforementioned functional and regression models represent the specification to test the main effect, interaction effect, and accounts for testing all the hypotheses. Model 2 is specified to test H1a and H2. We estimate the coefficients of models 3 and 4 to test the impact of PO and ME domains of the COBIT (H1b and H1c). To examine hypothesis H3, we estimate the coefficients of model 5.

4. Results

4.1. Descriptive statistics

Table 3 shows the descriptive statistics for all variables. Panel A shows that on average 16% of items of the IT governance disclosure framework are publicly disclosed by the sample firms in their annual report. On the basis of a theoretical maximum score of 1, the maximum score is 0.56, which indicates that the firm scoring highest on the IT governance disclosure framework has reported on 22 items out of 39 disclosure items. At the category level, disclosure scores vary significantly. The disclo-

sure on ITVD is found to be the highest compared to other categories. Table 3 also indicates that the average IT governance maturity score (ITG_MATURITY) is 0.67. This implies that on average firms have scored 114 points out of a theoretical maximum of 170 points. From the point of view of COBIT implementation, the results show that on average 23 of 34 COBIT processes are fully implemented by the sample firms. In panel B, the frequencies of the dichotomous variables employed in the study are tabulated.

4.2. Univariate analysis

Table 4 offers a correlation table for the dependent, independent, and control variables included in the study. This analysis indicates that the level of IT governance maturity (ITG_MATURITY) is positively and significantly correlated with the level of IT governance disclosure (ITGDI). The correlation between the PO sub-domain of the maturity framework and the level of disclosure on ITSA also is positive and significant, indicating that firms with higher process maturity on the PO domain of COBIT have more extensive disclosure related to ITSA. Similarly, we find a positive and significant correlation between the maturity in the COBIT sub-domain ME and the level of disclosure on ITPM. This implies that firms that have achieved a high maturity on monitoring and evaluating their IT processes, show greater propensity in signaling IT performance issues in their annual report. Finally, the association between

the strategic role of IT within the industry (TRANSFORM) and IT Governance disclosure (ITGDI) is found to be positive and significant. Summarizing, the results of the correlation analysis provide some initial and preliminary support for our expectations as framed in hypotheses H1 (a, b, and c) and H2.

We have conducted a series of *t*-tests to facilitate a comparison between the level of IT governance disclosure and its sub-categories, and the independent variables. Table 5 reports the *t*-test for IT governance maturity groups (panel A), the strategic role of IT in industries (panel B), and firm size (panel C).

In panel A, we investigated the influence of IT governance maturity on the level of IT governance disclosure. We divided our sample into three equal groups on the basis of their IT governance maturity scores (Low ITG_MATURITY < 0.63; 0.63 < MEDIUM ITG_MATURITY < 0.75; High ITG_MATURITY >0.75). In the *t*-test, we compared High ITG_MATURITY firms with Low ITG_MATURITY firms. The results indicate that firms with higher IT governance maturity show higher propensity in disclosing IT governance information on an overall level. The results also show that higher IT governance maturity leads to better information disclosure on ITSA, ITRM, and ITPM.

Panel B of Table 5 analyzes the impact of the strategic role of IT at the industry level on the level of IT governance disclosure. In this analysis, the focus is on industries where the strategic role of IT is high (TRANSFORM) versus industries where the strategic role of IT is low (AUTOMATE). The results indicate a significant difference between the TRANSFORM and AUTOMATE industry groups on the overall level of IT governance disclosure (ITGDI), ITVD, and ITRM. In summary, the results of this analysis provide further preliminary support for our expectations as framed in hypotheses H1 (a, b, and c) and H2.

In panel C of Table 5, we explore the impact of firm size on the level of reporting on IT governance issues. Here, we generally find similar disclosure levels for large and small firms, with the exception of the disclosure of ITVD issues.

The *t*-test results show that the industry-level strategic role of IT and firm size do not present statistically significant results on the ITSA and ITPM categories. In panel B, the TRANSFORM industry group has shown higher propensity in disclosing IT governance-related information than AUTOMATE group. Similarly, panel C shows a higher—though insignificant—disclosure propensity for the LARGE firm group when compared to the SMALL firm group except for the ITRM and ITPM categories. This suggests that the results are mainly driven by disclosures in the ITVD category. A plausible reason for the low mean score and insignificance of the ITSA category can be based on the extant literature on board-level IT governance, which suggests that there is a substantial IT attention deficit at the board level (Andriole, 2009; Huff, Maher, & Munro, 2006). Drawing on this literature, we assume that firms in our sample are still developing ITSA structures, and thereby deficient in information generation on the ITSA topics. Acknowledging this plausible reason, our results show a relatively low mean score and insignificance on this category irrespective of the industry-level strategic role of IT and firm size. The ITRM and ITPM mean scores in panel C exhibit that smaller firms are providing more information on risk and performance measurement topics. Although the results are not statistically significant, a plausible explanation is that the financial and risk information generation and reporting for smaller firms are relatively less complex when compared to larger firms.

4.3. Multivariate analysis

Table 6 presents the multivariate regression results of the four different OLS models employed for hypotheses testing. For all the regression models in the analysis, we controlled for the multicollinearity among all the independent variables. The variance inflation factor (VIF) statics was well below the threshold value (VIF=10), which confirms that the analysis does not suffer from a multicollinearity problem. Next, the regression coefficients and *t*-statistics for all models in the table are reported after adjusting for standard errors for heteroskedasticity. Models 1 and 4 use the ITGDI as dependent variable. ITSA is used as dependent variable in Model 2. For Model 3, ITPM is employed as dependent variable.

Model 1 (column 1 in Table 6) shows the test of hypotheses H1a and H2. ITG_MATURITY indicates a significant positive coefficient of 0.165 (p<0.01). As expected, the level of IT governance maturity is positively associated with IT governance disclosure, hence H1a is supported.

We also find significant and positive regression coefficients for INFORMATE (0.045, p<0.10) and TRANSFORM (0.064, p<0.01). Consistent with our expectation, we find that the industry-level strategic role of IT is associated with the disclosure propensity on IT governance. Both the INFORMATE and TRANSFORM category firms provide higher disclosure compared to AUTOMATE industry firms. The findings clearly indicate that information dissemination on IT topics is industry sensitive. Firms that are highly IT-enabled in conducting and achieving their business and governance objectives are likely to engage more in IT governance reporting. Considering the magnitude of the regression coefficients, the result shows that this behavior is likely to be observed more distinctively in TRANSFORM industries (0.064) when compared to

INFORMATE (0.045) industries. Thus, hypothesis H2 is supported. The results also indicate that larger firms are more inclined to disclose on IT topics as the coefficient of LARGE is positive and significant (0.043, p<0.05). Model 1 explains approximately 12% of the overall IT governance disclosure.

Model 2 (column 2 in Table 6) shows that maturity on the PO domain, which primarily focuses on establishing tactics and strategy on IT topics through appropriate IT-business alignment, has positive and significant association (0.133, p<0.01) with the level of ITSA category. This estimate is consistent with hypothesis H1b.

The results in Model 3 (column 3 in Table 6) indicate a positive and significant coefficient on ME (0.181, p<0.05). Consistent with hypothesis H1c, this suggests that firms with higher process maturity score on the ME domain are associated with a higher level of disclosure on ITPM. This result is in line with the recommendations of COBIT, which encourages higher communication transparency to stakeholders under this specific domain. The results in models 2 and 3 also show that the industry-level strategic role of IT do not exert any specific influence on the level of disclosure of ITSA and ITPM, as both the INFORMATE and TRANSFORM variables yield equal but insignificant coefficients.

Next, the findings in model 3 shows that smaller firms, when they achieve a higher level of maturity on the ME domain, increase their disclosure on ITPM compared to large firms. We test hypothesis H3 in Model 4 (column 4 in Table 6). The results indicate that both interaction term coefficients are insignificant. Thus, we do not observe any moderating effect of the industry-level strategic role of IT on the association between IT governance maturity and the level of disclosure. Therefore, H3 is not supported. However, the coefficient on ITG_MATURITY is positive and significant (0.297, p<0.10). This implies that the level of IT governance maturity is the single best predictor of the disclosure level in the model. The model explains approximately

11% of overall IT governance disclosure. It is essential to note that the strategic role of IT operates at both firm and industry levels (Dehning et al., 2003).

In this study, we are focusing only on IT strategic role at the industry level, and the firm-level IT strategic role is not examined. While noticing a significant and positive coefficient on the level of IT governance maturity in the interaction term in model 4, it could be argued that a higher level of IT governance maturity might also imply a dominant IT strategic role at the *firm* level. In other words, it might be plausible that the level of IT governance maturity together with unobserved firm-level IT strategic role have overshadowed the findings for the interaction term model.

4.4. Additional analysis

As mentioned in the univariate analysis section, there is no standard cut-off point for the specification of IT governance maturity. Thus, we include some additional analysis to test the sensitivity of the association between IT governance maturity and the disclosure on IT governance. To perform this additional analysis and develop further insights into the association between IT governance maturity and the disclosure on IT governance, we split the sample at the median value of ITG_MATURITY into two groups: high and low IT governance maturity. Table 7 reports the results of OLS regressions for the two subsamples. The coefficient of ITG_MATURITY in the high IT governance maturity group (column 1 in Table 7) is significant and positive (0.289, $p<0.05$). In the low IT governance maturity group (column 2 in Table 4.8), the result shows a significant and positive coefficient estimate for ITG_MATURITY (0.369,

p<0.01). When comparing the magnitude of the ITG_MATURITY coefficients in the two regression models, we find that the firms below median value of IT governance maturity achieve a larger impact on the level of disclosure. The low IT maturity group also shows positive and significant coefficients for the INFORMATE (0.105, *p*<0.01) and TRANSFORM (0.150, *p*<0.01) industry groups. This suggests that firms in the below median level of IT governance maturity group from these two industry groups present a higher propensity for disclosure compared to the AUTOMATE group.

4.5. Robustness test

We specify two additional types of regression models: the negative binomial count model and generalized linear model, to provide additional robustness to the OLS regressions. A count regression model is specified as the dependent variable can be computed as a count variable. For this, a count-dependent variable ITGD is computed as the sum of the number of IT governance items disclosed by a firm. Using this method, we also compute ITSA_SUM and ITPM_SUM as two dependent variables to verify hypotheses H1b and H1c. To estimate regression coefficients, we then use the negative binomial count model, as the count dependent variable ITGD is over-dispersed (Zmud et al., 2010). The results are presented in columns for models A, C, and E of Table 8. The findings from this statistical approach are consistent with the main OLS results in terms of sign and significance.

The dependent variables ITDGI, ITSA, and ITPM are fractional variables ranging between zero and one. For such type of variable, Papke and Wooldridge (2008) have specified a special generalized linear model. This model provides a fractional logit solution, which overcomes any possible arbitrary limit imposition problems by independent variables in an OLS model (B. Hadden, Hermanson, & DeZoort, 2003). The results are presented in columns for models B, D, and F of Table 9. Consistent

with the main analysis, the results of this model also suggest similar statistical significance and direction for all the independent variables.

5. Summary and Conclusion

The primary objective of this study is to examine if IT governance maturity and the industry-level strategic role of IT are systematically related to the variation in the level of IT governance disclosure. This study aims to better understand the role of IT governance framework, such as COBIT, in improving the public disclosure of IT-related information.

The study shows that IT governance maturity at the firm level is positively associated with the dissemination of IT-related information in the annual report. That is, the level of implementation of the COBIT IT governance framework enhances the information environment on IT governance topics. This improved IT-related information environment is utilized by firms to improve the level of transparency in their external reporting practices, thus confirming the mechanistic relationship between IT governance maturity and IT governance transparency.

These results show that the impact of the adoption of IT governance frameworks goes beyond the fundamental premise of COBIT to provide a robust and efficient governance framework to control and monitor IT processes and IT resources that in turn, contribute to the achievement of firms' business goals. Our findings show a broader and overreaching role of IT governance framework such as COBIT in stimulating accountability and transparency via external reporting of relevant IT information to external stakeholders.

Consistent with existing findings (L. Gordon et al., 2006; Gordon et al., 2010) our study shows that firms might be using IT information signaling as a strategic instru-

ment to exhibit their intended IT actions to external stakeholders to improve firm value. Where existing studies have shown the impact of regulatory measures (L. A. Gordon, M. P. Loeb, W. Lucyshyn, & T. Sohail, 2006) or market pressures (Gordon et al., 2010) on the reporting of IT-related information, our study demonstrates how their effects can be explained by the level of adoption of IT governance frameworks within firms. Our study not only provides clear empirical evidence that the adoption of an IT governance framework is associated with external communication practices on IT governance at an overall level, it also demonstrates such an association at a more detailed level, revealing the impact of various domains of COBIT on specific areas of IT governance disclosure. Specifically, we show that the level of disclosure on ITSA matters and ITPM is systematically correlated with the maturity of sub-domains of the COBIT framework. Firms with better IT process maturity on the planning and organization sub-domain have shown a positive inclination in signaling ITSA topics in their annual report. Similarly, a higher disclosure propensity is noted on IT performance matters for those firms that have established and achieved a greater degree of IT monitoring and evaluation maturity on the ME domain of COBIT. These findings further demonstrate that a higher level of maturity in specific COBIT domains leads to more extensive external information that is specifically generated within those domains. Overall the findings in this study present the first empirical support to link IT governance disclosure with the adoption of an IT governance framework.

The study also shows that the strategic role of IT in the industry plays a crucial role in the disclosure of IT-related information, thus confirming the mechanistic opportunistic relationship between IT governance maturity and IT governance transparency. This finding is consistent with prior studies (e.g. Davis et al., 2003; Dehning et al., 2003; Zmud et al., 2010), which have demonstrated that the strategic role of IT can explain how IT investments might affect the firm's competitive position and ultimately

firm value (Dehning et al., 2003, p.648). Our study, however, adds to existing findings as it demonstrates the opportunistic relationship between IT governance maturity and IT governance transparency holds when we take into account the amount of relevant information that is available within firms (i.e. the mechanistic relationship between IT governance maturity and IT governance transparency). We find that the mechanistic and the opportunistic relationship between IT governance maturity cannot be considered as two sides of the same coin. Our results show that the level of IT governance maturity is the most influential explanatory variable to explain the level of disclosure when analyzed together with the strategic role of IT across industries. The rejection of moderating effects suggested in hypothesis H3 indicates the importance of IT at the firm level rather than the industry level. That is, the strategic role of IT can also vary at the firm level, which is unobserved in the analysis of this study.

This study offers several contributions to the information systems literature. First, it contributes to the current body of IT information disclosure literature by examining the role of the IT governance framework in influencing the external information environment of firms. In this way, the study extends our understanding of the role of IT governance frameworks beyond that of improving IT-enabled business processes and thereby business value of IT. More specifically, our understanding of IT governance frameworks like COBIT is limited to its contribution to improve IT processes; however, little is known about how it might improve the overall information environment with regard to IT. With this study, we suggest that firms with superior IT governance maturity are associated with external communication practices on IT topics. Second, the study provides a significant contribution by showing how the maturity of IT governance and the strategic role of IT at the industry level drive the propensity toward information dissemination on IT governance-related topics. The results of this

study corroborate and contribute to the extant academic literature that examines the association between IT information disclosure and the strategic role of IT in different industries, indicating that in order to explain IT governance disclosure, voluntary disclosure theory may provide relevant insights beyond those provided by signaling literature. Furthermore, while it is challenging to examine IT-related phenomena due to limitations in the availability of archival data (Zmud et al., 2010), our research design contributes to alleviate this issue by providing a disclosure framework that is well grounded in existing qualitative and empirical IS literature. Researchers can employ this framework to capture and tabulate publicly available IT governance information more comprehensively and study IT-related phenomenon in cross-sectional as well as in event-based settings. In sum, the results of this study help to serve and stimulate future theoretical development in the area of IT governance and related frameworks.

In terms of practical relevance, we identify three potential contributions, respectively, from the perspective of investors, the perspective of a company, and the perspective of policy makers and regulators. First, this paper started from the premise that investors might benefit if more and transparent information on IT topics is available. As this study demonstrates a positive association between IT governance maturity and IT governance disclosure, investors who are savvy about the results from this study can use IT governance-related disclosure in the assessment of IT governance practices of firms. Second, this study builds on and uses an IT governance disclosure framework that can be employed by practitioners to enhance the dissemination of IT-related information. While recognizing that the identification of relevant topics for reporting on intangible assets like IT is difficult, the proposed framework for disclosing IT governance can guide firms in developing their competence in financial and non-financial sections of corporate disclosure. In addition, managers might leverage

their IT governance practices to improve their formal communication on IT through public disclosure. Such external reporting can aware stakeholders on: firms' various IT initiatives to improve customer products or services; on-going IT-related planning and project(s) updates that might add significant value to the existing business model; overall IT governance achievement by signaling information on operational efficiency and functional effectiveness. Third, we assume that policymakers can utilize such a disclosure framework to move toward more standardized benchmarks on IT-related practices, which can be compared in a longitudinal way against different outcome factors. From a regulatory perspective, such a standardized reporting approach on IT governance could also result in automated tools, which allow for each access and search capabilities on IT governance-related matters.

We recognize that this study has some limitations. We use the COBIT implementation status as a proxy to measure IT governance maturity. Although this proxy variable is widely employed in IT governance literature, it should be interpreted with some caution. In our research design, we assume the implementation status of the process as a maturity status of COBIT processes. This assumption is different from the proposed general maturity model concept within the COBIT framework.[16] Next, the data on IT governance evaluation are collected through self-assessment survey of IT governance. Although we have conducted reliable univariate tests to account for self-reporting bias, we do not rule out the possibility of a common method variance with respect to the explanatory variables employed in the study. The dependent variable ITGDI is an index variable based on the coding of items of the IT governance disclosure framework. Although we validated the reliability of items through measur-

[16]In the COBIT framework, maturity modeling of IT-related processes is based on a 0–5 scale. A process can be evaluated from a level of non-existent (0) to optimized (5). This maturity model concept is based on the Software Engineering Institute's maturity model for software development capability. For further explanation and details, refer to COBIT 4.1.

ing inter-coder agreement on a limited sample of data, it is important to note that the process of coding data from public disclosure is inevitably subjective. Although the industry-level strategic role of IT classification is widely used in prior literature, it, however, does not account for IT strategic role at the firm level. For instance, it is plausible that a strategic role of IT within automate industry might be transformative or informate. Therefore, the findings of the study might impose some limitations.

The study results suggest several topics for future research. First, this study looks at the cross-sectional impact of IT governance maturity, which provides a status of the adoption level. Nevertheless, IT governance in a firm is not stationary in terms of its process implementation and maturity status. In other words, the sample firms in the study have different timelines for the adoption of COBIT. In this view, it would be worthwhile to conduct a study in a longitudinal setting to better understand the relationship between the level of IT governance maturity and the level of disclosure over time. Second, future research might assess consequences of higher IT governance maturity on firm value. For example, the impact of IT governance maturity on stock returns of a firm. Further studies can also include other available frameworks such as VALIT or the newly released COBIT 5.0 as a more sophisticated research design to measure IT governance maturity and its subsequent impact on disclosure, as well as business value of IT.

References

Adams, M. (1997). Ritualism, opportunism and corporate disclosure in the New Zealand life insurance industry:Field evidence *Accounting, Auditing and Accountability Journal, 10*(5), 718-734.

Anderson, M., Banker, R. D., & Hu, N. (2003). *The Impact of Information Technology Spending on Future Performance* Paper presented at the Proceedings of the International Conference on Information Systems, Seattle, USA December 2003. Association for Information Systems.

Andriole, S. J. (2009). Boards of Directors and Technology Governance: The Surprising State of the Practice. *Communications of AIS, 24*(Article 22), 373-394.

Armstrong, C. P., & Sambamurthy, V. (1999). Information Technology Assimilation in Firms: The Influence of Senior Leadership and IT Infrastructures. *Information Systems Research, 10*(4), 304-327.

Arndt, M., & Bigelow, B. (2000). Presenting Structural Innovation in an Institutional Environment: Hospitals' Use of Impression Management. *Administrative Science Quarterly, 45*(3), 494-522.

Bowen, P. L., Cheung, M.-Y. D., & Rohde, F. H. (2007). Enhancing IT governance practices: A model and case study of an organization's efforts. *International Journal of Accounting Information Systems, 8*(3), 191-221.

Buckby, S., Best, P., & Stewart, J. (Eds.). (2008). *IT Governance and Service Management: Frameworks and Adaptations*: Hershey, PA: Idea Group Publishing.

Calantone, R. J., & Schatzel, K. E. (2000). Strategic foretelling: Communication-based antecedents of a firm's propensity to preannounce. *Journal of Marketing, 64*(1), 17-30.

Chatterjee, D., Pacini, C., & Sambamurthy, V. (2002). The shareholder-wealth and trading-volume effects of information-technology infrastructure investments. *Journal of Management Information Systems, 19*(2), 7-42.

Chatterjee, D., Richardson, V., & Zmud, R. (2001). Examining the Shareholder Wealth Effects of Announcements of Newly Created CIO Positions. *MIS Quarterly, 25*(1), 43-70.

Chiasson, M. W., & Davidson, E. (2005). Taking Industry Seriously in Information Systems Research. *MIS Quarterly, 29*(4), 591-605.

Connelly, B. L., Certo, S. T., Ireland, R. D., & Reutzel, C. R. (2011). Signaling Theory: A Review and Assessment. *Journal of Management, 37*(1), 39-67.

Crowston, K., & Myers, M. D. (2004). Information technology and the transformation of industries: three research perspectives. *The Journal of Strategic Information Systems, 13*(1), 5-28.

Damianides, M. (2005). Sarbanes–Oxley and it Governance: New Guidance on it Control and Compliance. *Information Systems Management, 22*(1), 77-85.

Davis, L., Dehning, B., & Stratopoulos, T. (2003). Does the market recognize IT-enabled competitive advantage? *Information & Management, 40*(7), 705-716.

De Haes, S., Huygh, T., Joshi, A., & Van Grembergen, W. (2016). Adoption and Impact of IT Governance and Management Practices: A COBIT 5 Perspective. *International Journal of IT/Business Alignment and Governance (IJITBAG), 7*(1), 50-72.

De Haes, S., & Van Grembergen, W. (2004). IT governance and its mechanisms. *Information Systems Control Journal, 1*, 27-33.

De Haes, S., & Van Grembergen, W. (2008). An Exploratory Study into the Design of an IT Governance Minimum Baseline through Delphi Research. *Communications of AIS, 22*(Article 24), 443-458.

De Haes, S., & Van Grembergen, W. (2009a). An Exploratory Study into IT Governance Implementations and its Impact on Business/IT Alignment. *Information Systems Management, 26*(2), 123-137.

De Haes, S., & Van Grembergen, W. (2009b). An Exploratory Study into IT Governance Implementations and its Impact on Business/IT Alignment. *Information Systems Management, 26*(2), 123-137.

De Haes, S., & Van Grembergen, W. (2010). Analysing the Impact of Enterprise Governance of IT Practices on Business Performance. *International Journal on IT/Business Alignment and Governance, 1*(1), 14-38.

De Haes, S., & Van Grembergen, W. (2015). *Enterprise Governance of Information Technology* (2 ed.): Springer International Publishing.

De Haes, S., Van Grembergen, W., & Debreceny, R. S. (2013). COBIT 5 and Enterprise Governance of Information Technology: Building Blocks and Research Opportunities. *Journal of Information Systems, 27*(1), 307-324.

Dehning, B., Richardson, V. J., & Zmud, R. W. (2003). The value relevance of announcements of transformational information technology investments. *MIS Quarterly, 27*(4), 637-656.

Diamond, D. W., & Verrecchia, R. E. (1991). Disclosure, Liquidity, and the Cost of Capital. *The Journal of Finance, 46*(4), 1325-1359.

Elsbach, K. D. (1994). Managing Organizational Legitimacy in the California Cattle Industry: The Construction and Effectiveness of Verbal Accounts. *Administrative Science Quarterly, 39*(1), 57-88.

Gibbins, M., Richardson, A., & Waterhouse, J. (1990). The Management of Corporate Financial Disclosure: Opportunism, Ritualism, Policies, and Processes. *Journal of Accounting Research, 28*(1), 121-143.

Gordon, L., Loeb, M., Lucyshyn, W., & Sohail, T. (2006). The impact of the Sarbanes-Oxley Act on the corporate disclosures of information security activities. *Journal of Accounting and Public Policy, 25*(5), 503-530.

Gordon, L. A., Loeb, M. P., Lucyshyn, W., & Sohail, T. (2006). The impact of the Sarbanes-Oxley Act on the corporate disclosures of information security activities. *Journal of Accounting and Public Policy, 25*(5), 503-530.

Gordon, L. A., Loeb, M. P., & Sohail, T. (2010). Market value of voluntary disclosures concerning information security. *MIS Quarterly, 34*(3), 567-594.

Grant, G. H., Miller, K. C., & Alali, F. (2008). The effect of IT controls on financial reporting. *Managerial Auditing Journal, 23*(8), 803 - 823.

Hadden, B., Hermanson, D. R., & DeZoort, F. T. (2003). Audit Committees' Oversight of Information Technology Risk. *Review Of Business Information Systems, 7*(4), 1-12.

Hadden, L. B., & Hermanson, D. R. (2003). Is your audit committee watching IT risks? *Journal of Corporate Accounting & Finance, 14*(5), 35-39.

Hardy, G. (2006). Using IT governance and COBIT to deliver value with IT and respond to legal, regulatory and compliance challenges. *Information Security Technical Report, 11*(1), 55-61.

Healy, P. M., & Palepu, K. G. (2001). Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. *Journal of Accounting and Economics, 31*(1), 405-440.

Higgs, J. L., Pinsker, R. E., Smith, T. J., & Young, G. R. (2016). The Relationship between Board-Level Technology Committees and Reported Security Breaches. *Journal of Information Systems, 30*(3), 79-98.

Huang, S.-M., Shen, W.-C., Yen, D. C., & Chou, L.-Y. (2011). IT governance: Objectives and assurances in internet banking. *Advances in Accounting, 27*(2), 406-414.

Huff, S. L., Maher, P. M., & Munro, M. C. (2006). "Information Technology and the Board of Directors:Is There an IT Attention Deficit?". *MIS Quarterly Executive, 5*(2), 55-68.

Im, K. S., Dow, K. E., & Grover, V. (2001). A Reexamination of IT Investment and the Market Value of the Firm—An Event Study Methodology. *Information Systems Research, 12*(1), 103-117.

ISACA. (2012). COBIT 5 Enabling Processes. Retrieved from http://www.isaca.org/COBIT/Pages/COBIT-5-Enabling-Processes-product-page.aspx

ITGI. (2003). Board Briefing on IT Governance. *IT Governance Institute, 2nd Edition, www.itgi.org, consulted on 1/11/2007*.

ITGI. (2005). *IT governance domain practices and competencies: Governance of outsourcing*. IT Governance Institute.

ITGI. (2007). "Control objectives, management guidelines, maturity models in CobiT 4.1",Rolling Meadows,IL: IT Governance Institute.

ITGI. (2011). *Global Status Report on the Governance of IT (CGEIT)—2011*. Retrieved from Rolling Meadows, IL 60008 USA:

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3*(4), 305-360.

Jordan, E., & Silcock, L. (2005). *Beating IT Risks*: John Wiley & Sons Inc.

Joshi, A., Bollen, L., & Hassink, H. (2013). An Empirical Assessment of IT Governance Transparency: Evidence from Commercial Banking. *Information Systems Management, 30*(2), 116-136.

Karimi, J., Bhattacherjee, A., Gupta, Y. P., & Somers, T. M. (2000). The Effects of MIS Steering Committees on Information Technology Management Sophistication. *Journal of Management Information Systems, 17*(2), 207-230.

Kerr, D. S., & Murthy, U. S. (2013). The importance of the CobiT framework IT processes for effective internal control over financial reporting in organizations: An international survey. *Information & Management, 50*(7), 590-597.

Kim, J. W., & Lim, J.-H. (2011). IT investments disclosure, information quality, and factors influencing managers' choices. *Information & Management, 48*(2–3), 114-123.

Kobelsky, K., Richardson, V. J., Smith, R. E., & Zmud, R. W. (2008). Determinants and Consequences of Firm Information Technology Budgets. *Accounting Review, 83*(4), 957-995.

Lainhart IV, J. W. (2000). COBIT™: A methodology for managing and controlling information and information technology risks and vulnerabilities. *Journal of Information Systems, 14*(s-1), 21-25.

Lev, B. (1992). Information Disclosure Strategy. *CALIFORNIA MANAGEMENT REVIEW, 34*(4), 9-32.

Li, C., Lim, J.-H., & Wang, Q. (2007). Internal and external influences on IT control governance. *International Journal of Accounting Information Systems, 8*(4), 225-239.

Li, C., Peters, G. F., Richardson, V. J., & Weidenmier Watson, M. (2012). The Consequences of Information Technology Control Weaknesses on Management

Information Systems: The Case of Sarbanes_Oxley Internal Control Reports. *MIS Quarterly, 36*(1), 179-204.

Lunardi, G. L., Becker, J. L., Maçada, A. C. G., & Dolci, P. C. (2014). The impact of adopting IT governance on financial performance: An empirical analysis among Brazilian firms. *International Journal of Accounting Information Systems, 15*(1), 66-81.

Martin-Oliver, A., & Salas-Fumas, V. (2012). IT assets, organization capital and market power: Contributions to business value. *Decision Support Systems, 52*(3), 612-623.

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

Mauldin, E., & Richtermeyer, S. (2004). An analysis of ERP annual report disclosures. *International Journal of Accounting Information Systems, 5*(4), 395-416.

McFarlane, G. J. (2005). Management memo: A model for CIO success, CIO Canada(30 June, 2005).
Retrieved from http://www.itworldcanada.com/news/management-memo-a-model-for-cio-success/111646

Merhout, J. W., & Havelka, D. (2008). Information Technology Auditing: A Value-Added IT Governance Partnership between IT Management and Audit. *Communications of AIS, 23*(Article 26), 463-482.

Narayanan, V. K., Pinches, G. E., Kelm, K. M., & Lander, D. M. (2000). The influence of voluntarily disclosed qualitative information. *Strategic Management Journal, 21*(7), 707-722.

Nolan, R., & McFarlan, F. W. (2005). Information technology and Board of Directors. *Harvard Business Review, 83*(October), 96-106.

Papke, L. E., & Wooldridge, J. M. (2008). Panel data methods for fractional response variables with an application to test pass rates. *Journal of Econometrics, 145*(1–2), 121-133.

PCAOB. (2007). *Auditing Standard No. 5: An Audit of Internal Control over Financial Reporting That Is Integrated with an Audit of Financial Statements,Public Company Auditing Oversight Board, New York*. .

Peterson, R. (2004). Crafting Information Technology Governance. *Information Systems Management, 21*(4), 7-22.

Premuroso, R. F., & Bhattacharya, S. (2007). Is There a Relationship between Firm Performance, Corporate Governance, and a Firm's Decision to Form a Technology Committee? *Corporate Governance: An International Review, 15*(6), 1260-1276.

Raghupathi. (2007). Corpoarte Governance of IT: A framework for development. *Communications of the ACM, 50*(8), 94-99.

Reznik, S. (2007). Back to business with IT governance. *Journal of Corporate Accounting & Finance, 18*(5), 57-64.

Ridley, G., Young, J., & Carroll, P. (2008a). Studies to Evaluate COBIT's Contribution to Organisations: Opportunities from the Literature, 2003–06. *Australian accounting review, 18*(4), 334-342.

Ridley, G., Young, J., & Carroll, P. (2008b). Studies to Evaluate COBIT's Contribution to Organisations: Opportunities from the Literature, 2003–06. *Australian accounting review, 18*(4), 334-342.

Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms. *MIS Quarterly, 27*(2), 237-236.

Sambamurthy, V., Venkataraman, S., & Desanctis, G. (1993). The design of information technology planning systems for varying organizational contexts. *European Journal of Information Systems, 2*(1), 23-35.

Schein, E. H. (1992). The role of the CEO in the management of change: The case of information technology: In T.A. Kochan and M. Useem (Eds.), Transforming Organizations. Oxford: Oxford University Press.

Simonsson, M. r., Johnson, P., & Ekstedt, M. (2010). The Effect of IT Governance Maturity on IT Governance Performance. *Information Systems Management, 27*(1), 10-24.

Sohal, A., & Fitzpatrick, P. (2002). IT governance and management in large Australian organisations. *International Journal of Production Economics, 75*(1-2), 97-112.

Spafford, G. (2008). *The Governance of Green IT: The Role of Processes in Reducing Data Center Energy Requirements*: IT Governance Publishing Ltd.

Spence, M. (1973). Job market signaling. *The quarterly journal of Economics*, 355-374.

Takemura, T., Ukai, Y., & Nagaoka, H. (2005). Disclosure and Circumstances Concerning Information System Assets *Economic Analysis of Information System Investment in Banking Industry* (pp. 107-125): Springer Tokyo.

Trites, G. (2004). Director responsibility for IT governance. *International Journal of Accounting Information Systems, 5*(2), 88-99.

Tuttle, B., & Vandervelde, S. D. (2007). An empirical examination of CobiT as an internal control framework for information technology. *International Journal of Accounting Information Systems, 8*(4), 240-263.

Van Grembergen, W., & De Haes, S. (2009). *Enterprise Governance of Information Technology :Achieving Strategic Alignment and Value*: Springer US.

Weber, S. (1985). *Basic content analysis*: Beverly Hills: Sage Publications, CA.

Weill, P., & Ross, J. (2004). *IT Governance, How Top Performers Manage IT Decision Rights for Superior Results*. Massachusetts Harvard Business School Press Boston.

Wonseok, O., Michael, J. G., & Joung, W. K. (2006). The Market's Perception of the Transactional Risks of Information Technology Outsourcing Announcements. *Journal of Management Information Systems, 22*(4), 271-303.

Wu, S. P.-J., Straub, D. W., & Liang, T.-P. (2015). How information technology governance mechanisms and strategic alignment influence organizational performance: Insights from a matched survey of business and IT managers. *MIS Quarterly, 39*(2), 497-518.

Zhang, P., Zhao, K., & Kumar, R. L. (2016). Impact of IT Governance and IT Capability on Firm Performance. *Information Systems Management, 33*(4), 357-373.

Zmud, R. W., Shaft, T., Zheng, W., & Croes, H. (2010). Systematic Differences in Firm's Information Technology Signaling: Implications for Research Design. *Journal of the Association for Information Systems, 11*(3), 149-181.

Zuboff, S. (1988). *In the age ofthe smart machine*: Basic Book, New York.

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Table 1. Strategic Role of IT at the Industry Level

Industry	Number of observations	Percentage of the total sample	Industry IT strategic role
Financial/Banking	40	32%	Transform
Government/Military—National/State/Local	22	18%	Informate
Insurance	14	11%	Transform
Manufacturing/Engineering	10	8%	Automate
Retail/Wholesale/Distribution	7	6%	Informate
Education/Student	6	5%	Informate
Mining/Construction/Petroleum/	6	5%	Automate
Health Care/Medical	5	4%	Informate
Utilities	3	2%	Automate
Pharmaceutical	3	2%	Informate
Transportation	2	2%	Automate
Telecommunications/Communications	2	2%	Transform
Public Accounting	1	1%	Transform
Aerospace	1	1%	Transform
Legal/Law/Real Estate	1	1%	Informate
Advertising/Marketing/Media	1	1%	Transform
Total	124	100%	

The classification of the strategic role IT across industries is based on the typology suggested by Chatterjee et al. (2001). However, their classification does not include the following industries: aerospace, government/military, legal/law/real estate, and education. We assigned the industry strategic role of IT to these industries in agreement with other two strategic information system researchers.

Table 2. Variable Definitions

Variable	*Variable Code*	*Description*
Dependent Variable		
IT governance disclosure index	ITGDI	Average score for all items of IT governance disclosure framework.
IT strategic alignment disclosure index	ITSA	Average score for IT strategic alignment category items.
IT value delivery disclosure index	ITVD	Average score for IT value delivery category items.
IT risk management disclosure index	ITRM	Average score for IT risk management category items.
IT performance measurement disclosure index	ITPM	Average score for IT performance measurement category items.
Independent Variable		
IT governance maturity	ITG_MATURITY	Average maturity score on all the 34 COBIT processes.
Plan and Organize	PO	Average maturity score on the Plan and Organize domain processes.
Acquire and Implement	AI	Average maturity score on the Acquire and Implement domain processes.
Decision and Support	DS	Average maturity score on the Decision and Support domain processes.
Monitor and Evaluate	ME	Average maturity score on the Monitor and Evaluate domain processes.
Automate	AUTOMATE	1 if the firm has membership in an industry characterized as having an automate IT strategic role, 0 otherwise.
Informate	INFORMATE	1 if the firm has membership in an industry characterized as having an informate IT strategic role, 0 otherwise.
Transform	TRANSFORM	1 if the firm has membership in an industry characterized as having a transform strategic role, 0 otherwise.
Control Variable		

Small firm group	SMALL	Indicator variable taking value 1 if the total number of employees is equal or less than 1499, 0 otherwise.
Medium firm group	MEDIUM	Indicator variable taking value 1 if the total number of employees is greater than 1,500 and less than 9,999, 0 otherwise.
Large firm group	LARGE	Indicator variable taking value 1 if the total number of employees is greater than 10,000, 0 otherwise.
US	US	1 if the firm is located in USA, 0 otherwise.
Gov	GOV	1 if the firm is operating in government/military—national/state/local/education/legal/law industry, 0 otherwise
Listed	LIST	1 if the firm is public listed, 0 otherwise

Table 3. Descriptive Statistics

Panel A: Descriptive Statistics

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Dependent Variables					
ITGDI	124	0.1606	0.1126	0	0.56
ITSA	124	0.0980	0.0960	0	0.45
ITVD	124	0.2002	0.1928	0	0.77
ITRM	124	0.1760	0.2090	0	1
ITPM	124	0.1676	0.1449	0	0.63
Independent Variables					
ITG_MATURITY	124	0.6794	0.1542	0.23	1
PO	124	0.6605	0.1615	0.18	1
AI	124	0.7011	0.1745	0	1
DS	124	0.6874	0.1581	0.18	1
ME	124	0.6629	0.1727	0.15	1

Panel B: Frequency tabulation for binary variables

Variable	*N*	Frequency (if value =1)	(%)	Frequency (if value = 0)	(%)
Independent variable					
AUTOMATE	124	21	16.94	103	83.06
INFORMATE	124	44	35.48	80	64.52
TRANSFORM	124	59	47.58	65	52.42
Control Variables					
SMALL	124	40	32.26	84	67.74
MEDIUM	124	42	33.87	82	66.13
LARGE	124	42	33.87	82	66.13
US	124	48	38.71	76	61.29
GOV	124	29	23.39	95	76.61
LIST	124	73	58.87	51	41.13

Table 4. Pearson Correlation

		1	2	3	4	5	6	7	8	9	10
1	ITGDI	1.00									
2	ITSA	0.51***	1.00								
3	ITVD	0.89***	0.33***	1.00							
4	ITRM	0.74***	0.17*	0.55***	1.00						
5	ITPM	0.48***	0.11	0.22**	0.19**	1.00					
6	ITG_MATURITY	0.25***	0.20**	0.16*	0.17*	0.22***	1.00				
7	PO	0.23**	0.24***	0.11	0.14	0.25***	0.94***	1.00			
8	AI	0.27***	0.22**	0.20**	0.19**	0.18*	0.91***	0.82	1.00		
9	DS	0.25***	0.14	0.16*	0.19**	0.21**	0.96***	0.83***	0.84***	1.00	
10	ME	0.16*	0.17*	0.11	0.03	0.18*	0.90***	0.81***	0.74***	0.87	1.00
11	AUTOMATE	−0.13	0.02	−0.15	−0.10	−0.05	0.19**	0.20**	0.20**	0.14	0.18**
12	INFORMATE	−0.11	−0.13	0.01	−0.22	−0.03	−0.28***	−0.26***	−0.27***	−0.26***	−0.26***
13	TRANSFORM	0.20**	0.10	0.11	0.29***	0.07	0.12	0.10	0.11	0.14	0.11
14	SMALL	−0.05	0.04	−0.12	−0.08	0.14	0.07	0.10	0.06	0.07	0.00
15	MEDIUM	−0.08	−0.06	−0.10	0.00	−0.04	−0.14	−0.10	−0.16*	−0.14	−0.16*
16	LARGE	0.13	0.02	0.22	0.07	−0.09	0.07	0.00	0.10	0.08	0.15*
17	US	−0.24***	−0.06	−0.17*	−0.23**	−0.18**	−0.03	0.02	−0.04	−0.07	0.06
18	GOV	−0.13	−0.15*	−0.005	-0.23***	−0.07	−0.31***	−0.32***	−0.29***	−0.28***	−0.27***
19	LIST	0.16*	0.14	0.05	0.23***	0.07	0.38***	0.35***	0.39***	0.36***	0.31***

Statistical significance: *$p < 0.10$, **$p < 0.05$, ***$p<0.01$

Table 5. *t*-statistics for Group Differences

Variable	***Panel A: IT Governance Maturity***				***Panel B: Industry-Level Strategic Role of IT***				***Panel C: Firm Size***			
	Group	*N*	Mean	*t*-statistics	***Group***	*N*	Mean	*t*-statistics	***Group***	*N*	Mean	*t*-statistics
ITGDI	LOW ITG_MATURITY	42	0.133	−2.3517**	TRANSFORM	59	0.184	−1.8748*	SMALL	40	0.153	−1.1933
	HIGH ITG_MATURITY	40	0.190		AUTOMATE	21	0.129		LARGE	42	0.180	
ITSA	LOW ITG_MATURITY	42	0.083	−1.8333*	TRANSFORM	59	0.108	−0.2322	SMALL	40	0.103	0.1269
	HIGH ITG_MATURITY	40	0.126		AUTOMATE	21	0.102		LARGE	42	0.100	
ITVD	LOW ITG_MATURITY	42	0.177	−1.0665	TRANSFORM	59	0.221	−1.7262*	SMALL	40	0.167	−2.1920**
	HIGH ITG_MATURITY	40	0.222		AUTOMATE	21	0.135		LARGE	42	0.260	
ITRM	LOW ITG_MATURITY	42	0.135	−1.9636**	TRANSFORM	59	0.239	−1.9813**	SMALL	40	0.196	−0.9835
	HIGH ITG_MATURITY	40	0.224		AUTOMATE	21	0.130		LARGE	42	0.149	
ITPM	LOW ITG_MATURITY	42	0.121	−2.4512***	TRANSFORM	59	0.178	−0.7349	SMALL	40	0.197	1.4896
	HIGH ITG_MATURITY	40	0.196		AUTOMATE	21	0.150		LARGE	42	0.148	
ITG_MATURITY					TRANSFORM	59	0.699	1.3174	SMALL	40	0.695	0.0654
					AUTOMATE	21	0.744		LARGE	42	0.693	

The significance levels for $^{**}p < 0.05$ and $^{*}p < 0.10$ (two-tailed). See Table 2 for variable definitions. Based on average ITG_MATURITY score of the firm, it is classified in one of three IT maturity groups: (Low ITG_MATURITY < 0.63; 0.63 < MEDIUM ITG_MATURITY < 0.75; High ITG_MATURITY >0.75).

Table 6. Impact of IT Maturity on IT governance disclosure				
	Model 1	Model 2	Model 3	Model 4
	ITGDI	ITSA	ITPM	ITGDI
INTERCEPT	0.009	0.016	0.064	-0.091
	(0.172)	(0.417)	(0.866)	(-0.721)
ITG_MATURITY	0.165***			0.297*
	(2.860)			(1.881)
PO		0.133***		
		(2.871)		
ME			0.181***	
			(2.400)	
TRANSFORM	0.064***	0.010	0.032	0.182
	(2.623)	(0.455)	(0.871)	(1.236)
INFORMATE	0.045*	0.004	0.048	0.140
	(1.508)	(0.139)	(1.183)	(1.031)
AUTOMATE	Baseline	Baseline	Baseline	Baseline
ITG_MATURITY x INFORMATE				–0.125
				(–0.711)
ITG_MATURITY x TRANSFORM				–0.160
				(–0.832)
MEDIUM	0.014	–0.007	–0.027	0.014
	(0.555)	(–0.327)	(-0.823)	(0.559)
LARGE	0.043**	0.003	–0.047	0.044*
	(1.764)	(0.145)	(–1.396)	(1.717)
SMALL	Baseline	Baseline	Baseline	Baseline
US	–0.060***	–0.013	–0.053**	–0.060***
	(–3.268)	(–0.762)	(–2.010)	(–3.245)
GOV	–0.012	–0.012	–0.003	–0.012

	(–0.351)	(–0.399)	(–0.079)	(–0.340)
LIST	0.001	0.004	0.021	0.003
	(0.048)	(0.204)	(0.590)	(0.099)
Adj.R^2	0.124	0.005	0.03	0.111
F	4.194***	1.712*	1.679	3.309***
Statistical significance: *p < 0.10, **p < 0.05, ***p<0.01 (One tailed). *t*-statistics is in parentheses. See Table 2 for variable definitions.				

Table 7: Split Sample Analysis

	High IT Governance Maturity	*Low IT Governance Maturity*
	ITGDI	ITGDI
INTERCEPT	–0.070	–0.166*
	(–0.537)	(–1.750)
ITG_MATURITY	0.289**	0.369***
	(1.784)	(3.016)
TRANSFORM	0.024	0.150***
	(0.818)	(3.202)
INFORMATE	0.022	0.105**
	(0.604)	(2.155)
AUTOMATE	Baseline	Baseline
MEDIUM	0.015	0.037
	(0.417)	(0.894)
LARGE	0.049*	0.048
	(1.523)	(1.070)
SMALL	Baseline	Baseline
US	–0.075***	–0.046
	(–3.207)	(–1.541)
GOV	–0.038	–0.005
	(–0.764)	(–0.104)
LIST	0.006	–0.031
	(0.173)	(–0.760)
Number of Observations (*N*)	62	62
Adj.R^2	0.123	0.110
F	2.47**	2.58***

Statistical significance: *p < 0.10, **p < 0.05, ***p<0.01 (One tailed). *t*-statistics is in parentheses.

High and low IT governance maturity sample groups are formed on the basis of median split.

Table 8. Robustness Test

	Model A	Model B	Model C	Model D	Model E	Model F
	ITGD	ITGDI	ITSA_SUM	ITSA	ITPM_SUM	ITPM
Intercept	0.693**	–2.894***	–0.823*	–3.226***	–0.374	–2.394***
	(1.836)	(–6.894)	(–1.949)	(–6.906)	(–0.851)	(–4.530)
ITG_MATURITY	1.239***	1.355***				
	(2.886)	(2.948)				
PO			1.364***	1.512***		
			(2.614)	(2.621)		
ME					1.012**	1.224**
					(2.207)	(2.196)
INFORMATE	0.331**	0.365*	0.034	0.039	0.264	0.328
	(1.602)	(1.569)	(0.117)	(0.121)	(1.072)	(1.122)
TRANSFORM	0.421***	0.468**	0.093	0.105	0.17	0.211
	(2.577)	(2.440)	(0.447)	(0.454)	(0.751)	(0.783)
AUTOMATE	*Baseline*	*Baseline*	*Baseline*	*Baseline*	*Baseline*	*Baseline*
MEDIUM	0.033	0.09	–0.059	–0.067	–0.155	–0.199
	(0.207)	(0.480)	(–0.283)	(–0.287)	(–0.864)	(–0.913)
LARGE	0.253**	0.310**	0.034	0.038	–0.276	–0.332
	(1.737)	(1.849)	(0.157)	(0.156)	(–1.422)	(–1.424)
SMALL	*Baseline*	*Baseline*	*Baseline*	*Baseline*	*Baseline*	*Baseline*
US	–0.348***	–0.444***	–0.137	–0.153	–0.315*	–0.376*
	(–2.903)	(–3.242)	(–0.798)	(–0.798)	(–1.930)	(–1.946)
GOV	–0.085	–0.125	–0.18	–0.193	–0.048	–0.052
	(–0.341)	(–0.446)	(–0.527)	(–0.517)	(–0.190)	(–0.172)
LIST	–0.014	–0.017	0.03	0.035	0.09	0.114
	(–0.072)	(–0.080)	(0.139)	(0.145)	(0.440)	(0.467)
Log pseudo-likelihood	–333.657	–38.767	–162.180	–29.638	–183.841	–40.850

Wald χ2	32.66***	35.70***	11.95	11.96	14.60*	14.11*

Statistical significance: *p < 0.10, **p < 0.05, ***p < 0.01 (One tailed). Z-statistics is in parentheses. Models A, C, and E are negative binomial count models. Generalized linear model is employed in models B, D, and F Note: ITGD = Total disclosure count for overall disclosure, ITSA_SUM = Total disclosure count for ITSA category, ITPM_SUM = Total disclosure count for ITPM category.