International Journal of Auditing
Int. J. Audit. ••: ••–•• (2012)
doi:10.1111/j.1099-1123.2012.00458.x

Determinants of Effective Information Technology Governance

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This study examines relations between the overall level of effective information technology (IT) governance and five commonly advocated individual mechanisms of IT governance. It extends the examination of individual IT governance mechanisms to include a wider number of mechanisms, justifies the mechanisms investigated via agency theory, seeks to relate these mechanisms specifically to a perceived overall level of effective IT governance in organizations, and attempts to mitigate the problems of limited generalizability and selection bias by employing a survey and generalized sampling research methodology. The results from a survey of professional auditors reveal significant positive relations between the overall level of effective IT governance and three IT governance mechanisms: IT steering committees, senior management involvement in IT, and corporate performance measurement systems. Ex-post sensitivity analyses reveal that the primary findings are qualitatively similar across internal auditors and external auditors, as well as information systems auditors (IS) and non-IS auditors.

Key words: IT governance, IS management and control, IT steering committee, CIO position, IT balanced scorecard

SUMMARY

Recent corporate collapses have brought the attention of academics and practitioners to information technology (IT) and its impact on business value. An important part of the corporate governance mechanism is IT governance, which is a structure of relationships and processes to direct and control the enterprise in order to achieve the enterprise's goals. IT governance adds value to the enterprise while balancing risk versus return over IT and its processes. Prior research has provided little insight into the relationship between various IT governance mechanisms and effective IT governance.

In this paper, we examine relationships between the overall level of effective IT governance and five commonly advocated individual mechanisms of IT governance: (1) IT steering committee, (2) centralization of IT decision-making control, (3) involvement of senior management in IT, (4) position of the IT function within the organization, and (5) corporate performance

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ISSN 1090-6738

measurement system. A web-based questionnaire was developed and administered to the professional members of the Information Systems Audit and Control Association (ISACA) – Australia and the Institute of Internal Auditors (IIA) – Australia.

Our results suggest that the overall level of effective IT governance is influenced significantly by three IT governance mechanisms: (1) IT steering committees, (2) involvement of senior management in IT, and (3) corporate performance measurement system. In addition, our ex-post sensitivity analyses discover that the primary findings are robust across internal auditors and external auditors, as well as information systems auditors (IS) versus non-IS auditors.

This paper contributes to the auditing literature in several ways. First, it becomes the first empirical study to investigate which IT governance mechanisms contribute to an increased level of overall effective IT governance. Second, it develops a single measure which effectively allows for the assessment of IT governance mechanisms across a range of dimensions. Third, it provides empirical support for the implementation of corporate performance measurement systems as a mechanism for achieving higher levels of effective IT governance. Fourth, it mitigates the issues of external validity and selection bias by adopting a survey and a generalized sampling methodology.

INTRODUCTION

The recent corporate collapses, such as EBS International, Opes Prime, Petters Group Worldwide and Société Générale, have brought about renewed scrutiny into corporate governance mechanisms and the effectiveness of these mechanisms. Given the pervasiveness of information technology (IT) in many organizations, the examination of corporate governance mechanisms also includes IT governance mechanisms. IT governance is defined as 'a structure of relationships and processes to direct and control the enterprise in order to achieve the enterprise's goals by adding value while balancing risk versus return over IT and its processes' (ISACA, 2002: 5).

The importance of IT to business functions is well documented (McLean & Soden, 1977; Nolan, 1982; Brancheau & Wetherbe, 1987; Dixon & John, 1989; Niederman, Brancheau & Wetherbe, 1991; Davenport, 1993; Earl, 1993). IT, for so long having been considered an enabler of an organization's strategy, is now viewed as an integral part of an organization's strategy in facilitating the exploitation of information-based competitive advantage to maximize benefits, capitalize on opportunities, and promote organizational growth (Raghunathan & Raghunathan, 1990). In this regard, IT has progressed from being a separate function marginalized from the rest of the organization to an increasingly critical function in many organizations. As IT becomes an increasingly critical function in organizations, the need for effective governance of decisions, policies, and expenditures made in this area also becomes more critical.

The fundamental role of IT in corporate business processes results in organizational dependency on IT (Gelinas, Sutton & Fedorowicz, 2004). Auditors need to assess the effectiveness of IT controls as part of their audit assessments of the organization's internal control systems, confirming the importance of IT governance to the auditing profession (Shleifer & Vishny, 1997; Arens, Elder & Beasley, 2006; Bonner, 2008; IFAC, 2009; Stoel, Havelka & Merhout, 2012). In this study, IT governance is effective if it is perceived to contribute positively to the level of overall corporate governance within an organization. Effective IT governance will help mitigate within-firm fraud that was the basis of some of the notable corporate collapses (KPMG, 2010). IT governance reduces fraud by identifying various business risks and legal risks, by improving key internal control areas, and by predicting material accounting misstatements (IFAC, 2002; Kranacher, Riley & Wells, 2010; Dechow *et al.*, 2011), Indeed, such a situation would be more consistent with the term 'information systems (IS) governance', with IT governance representing a subset of IS governance. However, consistent with the existing literature, the use of the term 'IT governance' within this study is synonymous with that of IS governance.

In this paper, we define IT governance as a structure of relationships and processes to direct and control the enterprise in order to achieve the enterprise's goals.[1] In light of increased public awareness, professional bodies such as the Information Systems Audit and Control Association (ISACA) have undertaken a number of steps to provide guidance in the implementation of effective IT governance (ISACA, 2002). The approach taken by ISACA appears to be largely based upon two concepts. The first concept relates to increasing the awareness of issues and concepts relating to

IT governance in the public domain. The second concept involves the provision of guidelines and the identification of best-practice IT governance mechanisms. Interestingly, the effectiveness of these best-practice mechanisms in improving IT governance is largely based upon conceptual arguments. As such, it becomes important to ascertain if these best-practice mechanisms do impact upon the level of IT governance. This study addresses this issue by examining the views of auditors as to the effectiveness of these mechanisms in increasing overall IT governance. In line with this argument, this study explores the following research question: What mechanisms are perceived to positively influence the overall level of effective IT governance within organizations?

The work reported in this paper differentiates itself from previous studies in the IT governance area in that it utilizes the insightful findings from prior studies; it extends the examination of individual IT governance mechanisms to include a wider number of mechanisms; it justifies the mechanisms investigated via the theoretical basis of agency theory; it seeks to relate these mechanisms specifically to a perceived overall level of effective IT governance in organizations; and it attempts to mitigate the problems of limited generalizability and selection bias, as highlighted in the results of prior studies, by employing a survey and generalized sampling research methodology.

The paper proceeds as follows. The next section provides a review of related studies in the IT governance and IS management and control literatures. We follow this with the development of a theoretical framework for the formulation of the study's hypotheses. The research method is then described followed by the analysis and results. The paper concludes with the limitations of the study, directions for future research and a summary discussion of the study's contributions.

THEORY AND RELATED WORK ON IT GOVERNANCE MECHANISMS

Agency theory, corporate governance, and IT governance

Agency theory applies to the agency relationship ('principal-agent') that comes into being when one party (the principal) delegates work to another party (the agent) who performs that work (Eisenhardt, 1989). Berle and Means (1932) first pointed out the implications for a firm's shareholder wealth-maximization objective of the separation of management and control. Specifically, as Peirson *et al*. (1990) explain, the effective control that shareholders can exert over management is minimal because of factors such as the inability of shareholders to observe directly undesirable practices by management. Therefore, there is a possibility of management pursuing objectives more in its own interests than in the interests of shareholders – 'agency loss' (Jensen & Meckling, 1976). Accordingly, the principal-agent relationship gives rise to what are called 'agency costs'. As principals are aware of the possibility that managers (agents) may transfer wealth to themselves, principals have an incentive to limit the extent of such behavior. Accordingly, Peirson *et al*. (1990) go on to explain that principals will attempt to *monitor* the behavior of managers with the aim of discouraging such practices and institute mechanisms (e.g., contracts) designed to *bond* the interests of agents to those of the principal. The total agency costs are the sum of the costs of monitoring and bonding plus agency loss. The value of the company to its shareholders is reduced by an amount equal to its agency costs. Accordingly, principals tread a fine line in determining the extent of bonding and monitoring costs to incur while minimizing the effect of the resulting agency costs on the firm's value.

Fama (1980) makes the argument that there is an efficient market for managerial labour which ensures that managers are rewarded on the basis of their performances as perceived by the market. As such, decisions by managers that result in a transfer of wealth from the company to themselves will result in their future salary prospects (their market value) being reduced. Accordingly, Fama (1980) argued that agency losses attributable to the principal-agent relationship are likely to be small. While this situation may be the case on average across firms around the world, there have been some spectacular exceptions in recent years (e.g., EBS International, Opes Prime, Petters Group Worldwide, and Société Générale). These exceptions gave rise to an increased focus on corporate governance – 'the framework of rules, relationships, systems, and processes within and by which authority is exercised and controlled in corporations' (Owen, 2003: 33). Moreover, these exceptions were so spectacular as to cause politicians and regulators around the world to implement legislation (such as Sarbanes-Oxley and

CLERP 9) and regulations (such as the Principles of Good Corporate Governance from the Australian Stock Exchange) requiring companies to establish mechanisms aimed at reducing agency losses.

As IT escalates in terms of importance and pervasiveness in the operations of firms, it is inexorably tied to specific mechanisms that are prescribed for good corporate governance, most notably, a sound system of internal controls. Accordingly, effective IT governance – the decision rights and accountability framework for encouraging desirable behavior in the use of IT (Weill & Ross, 2004) and ensuring that IT goals and objectives are realized in an efficient and effective manner (ITGI, 2002a) – is a critical underpinning for a system of good corporate governance that minimizes agency losses for a firm. Indeed, the aim of this paper then is to determine those bonding and monitoring mechanisms for the governance of IT in a firm that appear to contribute effectively and efficiently to producing an overall high level of effective IT governance.

Related IT governance studies

Much of the early literature explored IT governance by adopting a holistic approach (Sambamurthy & Zmud, 1999; Peterson, O'Callaghan & Ribbers, 2000; Sohal & Fitzpatrick, 2002; Weill & Woodham, 2002), with the primary focus of such studies relating to the configurations and/or modes of IT governance (Sambamurthy & Zmud, 1999; Peterson *et al*., 2000; Weill & Woodham, 2002). For example, Sambamurthy and Zmud (1999) examine the relationship between organizational contingency factors and the mode of IT governance through case studies of eight firms in the United States. They find that a firm's IT governance arrangements are the outcome of specific interaction patterns.

More recent studies of IT governance have explored individual mechanisms and their influence on establishing an overall level of effective IT governance within organizations. For example, Weill and Ross (2004) surveyed Chief Information Officers (CIOs) from 256 enterprises in the United States and identified 15 of the most common IT governance mechanisms. Amongst them were a senior management committee (cf. IT steering committee[2]), an IT executive committee, an architecture committee, etc. However, their study did not relate these mechanisms to the overall level of IT governance in the organization. Ali and Green (2007) investigated individual governance mechanisms in public sector organizations. They found that an effective IT steering committee and a communication system that effectively disseminated policies and procedures both had a significant positive influence on the perceived overall level of effective IT governance. However, their work was limited to public sector organizations only. Bowen, Cheung and Rohde (2007) conducted an in-depth case study into one organization's attempts to implement an effective IT governance system. Responses to questions in the interview protocol indicated that more effective IT governance performance outcomes were associated with a shared understanding of business and IT objectives; active involvement of IT steering committees; a balance of business and IT representatives in IT decisions; and comprehensive and well-communicated IT strategies and policies. While this work lends good insight into the phenomenon of effective IT governance, its results are limited to the context of one organization.

De Haes and Van Grembergen (2008) investigated specifically the link between IT governance and business/IT alignment. Through a set of multiple research methods consisting of pilot case research, Delphi research, benchmark research, and extreme case research, they concluded that organizations with more mature IT governance practices were likely to obtain a higher degree of business/IT alignment maturity. Again, their conclusion is limited to the context of the participants/organizations involved in the research methods employed. Finally, Robb and Parent (2008) investigated IT governance at two financial mutuals – one in Australia and the other in Canada. They used a case study methodology. They found that, as opposed to the Australian cooperative approach where directors, managers, auditors, and service providers all appear to work together to achieve good governance of the IT function, the Canadian coercive approach was more reliant on the ability of the CIO to devise organizational arrangements – structures, processes, and staffing – to successfully manage the interdependencies. However, again, while providing useful insight, their findings are limited to the context of the two case studies reported.

The efficacy of IT governance on fraud examination has been documented by prior research (e.g., Hall & Singleton, 2005; Hopwood, Leiner & Young, 2008; Albrecht *et al*., 2010). The increased adoption of IT in business practice is closely related with some risks, including legal risk,

IT infrastructure risk, IT application risk and IT business process risk (IFAC, 2002). As a strong governance mechanism, IT governance is essential for enterprises to detect fraud by reducing such risks (Cohen, Krishnamoorthy & Wright, 2002; Kotb & Roberts, 2011). Specifically, IT governance can manage and improve control activities in an IT environment. The integrity of digital information is enhanced when IT governance monitors and tests various areas pertaining to IT risks. An IT steering committee, together with senior management and a performance measurement team, examines the following key control areas to prevent fraud: (1) IT operations, (2) data management systems, (3) new software development, (4) systems maintenance, (5) backup, (6) electronic commerce, and (7) control over computer operations (Kranacher *et al*., 2010). From an auditor's perspective, a solid IT governance mechanism facilitates audit risk assessments, and identifies fraud and irregularities during audit planning (Bedard & Johnstone, 2004). Such a mechanism is also directly relevant to several prevailing categories of fraud, such as theft of cash using electronic funds transfer (EFT) or theft of IT assets (KPMG, 2010).

Specific mechanisms of this study

We will now justify the individual IT governance mechanisms studied in this work.

IT steering committee

The practitioner literature advocates the use of an IT steering committee as an effective IT governance mechanism (IT Governance Institute, 2002a, 2002b). Indeed, the existence and effective operation of this committee, particularly in its planning and business alignment responsibilities, are fundamental to such modern governance frameworks such as CobiT 5.0 (ISACA, 2011). Critical to the contribution of this mechanism to effective IT governance is that such a committee must have representation from business and IT executives, senior management representation, report to senior management, and have regular meetings. Such a constituted committee mitigates agency losses by providing incentives to employees to act in the manner required by the organization with regard to the IT systems, and it monitors that the organization's IT plans and objectives are being achieved.

Prior literature suggests empirical support for the implementation of an IT steering committee, with representation from both business and IT functions, is associated with several positive IS outcomes. These effects include effective coordination and integration of IS planning activities (Gupta & Raghunathan, 1989; Raghunathan & Raghunathan, 1989; Bowen *et al*., 2007; De Haes & Van Grembergen, 2008), advanced IS budget and planning practices (Doll & Torkzadeh, 1987), and increased managerial support and funding (Doll & Torkzadeh, 1987; Torkzadeh & Xia, 1992).

Another study of the effects of IT steering committees (Karimi *et al*., 2000) departs from the studies highlighted above in that it explores the effects of these committees and their roles on the overall level of IT management within firms. The results of this US study provide a positive relationship between the presence and roles of IT steering committees and the level of IT management sophistication. Given that the concepts associated with IT management sophistication bear considerable similarity to IT governance concepts, the Karimi *et al*. (2000) study provides empirical support for the effectiveness of IT steering committees in raising overall IT governance. The approach adopted by this study in examining IT steering committees is similar to that of Karimi *et al*. (2000). However, this study differs from the prior study in several ways. First, this study selects auditors rather than IT executives to participate in the survey. In light of their professional training, it is expected that auditors would be more aware of the concepts relating to governance issues and its mechanisms, and as such, provide a better assessment of the effectiveness of these mechanisms. Second, this study adopts a more direct measure in assessing the effectiveness of IT steering committees in relation to IT governance given that the dependent factor measured is perceptions of effective IT governance.

Centralization of IT decision-making control

The issue of centralization is well documented in the early IS management and control literature and it predominantly entails three separate focal points: control, physical location, and function (King, 1983).

In addressing the issue of control, King (1983) suggests that by placing decision-making authority within centralized management, an organization is better able to ensure the quality of systems management and maintain organizational integrity

in operations that are dependent on computing. However, King (1983) only provides conceptual support for centralizing IT decision-making control in improving IT governance. Agency losses are mitigated significantly by centrally controlling large expenditures such as IT resource acquisitions because these large expenditures can be easily monitored. Accordingly, this study empirically examines the relationship between centralized IT decision-making control and IT governance.

Involvement of senior management in IT

Prior literature has consistently emphasized the importance of senior management support and involvement for the success of any organizational activity (Rockart & Scott-Morton, 1984; Jackson, 1986; Raghunathan & Raghunathan, 1990; Luftman, Papp & Brier, 1999; Bowen *et al*., 2007). A study by Luftman *et al*. (1999), involving a questionnaire survey of 500 business and IT executives with the objectives of determining enablers and inhibitors to the alignment of business and IT strategies, revealed that senior management support for IT was considered to be the most important enabler of business and IT alignment. Given that a critical aspect of IT governance revolves around the alignment of business and IT strategy (De Haes & Van Grembergen, 2008), the findings of the study reflect the importance of senior executive support for IT in the implementation of effective IT governance.

Despite providing empirical support for the incorporation of senior management involvement in IT as a mechanism for effective IT governance, the focus adopted by these prior studies differs from that of this study. This study is concerned with the impact of senior management support in IT on the overall level of effective IT governance rather than a particular aspect of IT governance (e.g. planning, or alignment of IT and business strategies). The importance of the involvement of senior management in the operational use of IT in a company is fundamental to such governance frameworks as CobiT 5.0 (ISACA, 2011). Moreover, senior management in an organization provides the incentives to employees to act in a particular manner. Accordingly, agency theory would suggest that agency losses would be minimized by the bonding influence of the support and involvement of senior management in IT activities.

Position of the IT function

The position of the Chief Information Officer (CIO) or other senior IS executives within the organizational hierarchy provides an indication of the power of the IT function within the organization. The effectiveness of the IT function in light of IT governance is based on the strategic influence of the CIO/senior IT executive within the organization (e.g., Robb & Parent, 2008). This authority is often based on the distance between the CIO/senior IT executive and the Chief Executive Officer (CEO), with a shorter distance between the two suggesting more influence for the IT function. Support for examining the reporting relationship as a measure of the formal organizational level of authority associated with the CIO/senior IT executive position is provided by prior research (Benjamin, Dickinson & Rockart, 1985; Raghunathan & Raghunathan, 1989; Applegate & Elam, 1992; Robb & Parent, 2008).

Prior studies provide empirical support highlighting an increasing trend toward a shorter relationship between CIO/senior IT executives and the CEO (Benjamin *et al*., 1985; Raghunathan & Raghunathan, 1989; Applegate & Elam, 1992). These studies suggest that the positioning of the IT function within an organization, if placed amongst the higher levels of the organizational hierarchy, renders sufficient influence to the IT function, allowing it potentially to impact positively upon the levels of IT governance within an organization. However, the evidence provided only suggests that the IT function can improve overall IT governance but does not provide any indication whether this influence is actually effective in increasing overall IT governance. By contrast, Zarrella (2005) reports the KPMG survey finding that more and more CIOs are reporting to Chief Financial Officers (CFOs). Such an organizational strategy would mitigate agency losses by allowing strict monitoring of expenditure on high profile (high cost) IT projects. This study differs from prior literature on this topic in that it examines the effectiveness of a highly placed IT function on the overall level of effective IT governance.

Corporate performance measurement system

Miller and Israel (2002) tell us that performance measurement systems present management with a means to help improve governance and accountability for various stakeholders. Since the

mid-1990s, conventional business management literature has advocated the use of a balanced scorecard (BSC). The literature suggests that this performance management system should allow organizations to drive their strategies on measurement and follow-up (Kaplan & Norton, 1992).

In light of the development of the BSC in the 1990s and the support for it in other disciplines, the IS literature has advocated the use of a balanced IT scorecard (Willcocks, 1994; Van Grembergen & Van Bruggen, 1997; Van der Zee & De Jong, 1999). Given that the concept of a balanced IT scorecard is relatively new, there is little published literature associated with the balanced IT scorecard (e.g., Van Grembergen & Van Bruggen, 1997; Van der Zee & De Jong, 1999; Stewart & Mohamed, 2001). Moreover, the approach taken by such authors (Van Grembergen & Van Bruggen, 1997; Van der Zee & De Jong, 1999) tends to focus on the development of a framework for the effective implementation of such a scorecard. The use of such a performance measurement system for IT operations would be supported by agency theory as a mechanism to reduce agency losses through clear monitoring of the IT operations. Only most recently, however, has any empirical evidence of the influence of the use of the IT balanced scorecard on effective IT governance levels been forthcoming (Ali & Green, 2007; Bowen *et al*., 2007; De Haes & Van Grembergen, 2008). However, these findings are limited to their contextual settings. Indeed, CobiT 5.0 (ISACA, 2011) recommends the use of a performance measurement regime such as the balanced IT scorecard. However, it provides no evidence that the balanced IT scorecard does indeed lead to effective overall IT governance. The work reported here examines empirically the use of corporate performance measurement systems as a significant influence on effective IT governance.

HYPOTHESIS DEVELOPMENT

The overall model of the study is depicted in Figure 1.

IT steering committee

Weber (1999) suggests that improper planning in the information systems function undermines the controls that safeguard the assets and resources of the firm. In view of the criticality of proper planning, Weber (1999) asserts that the IT steering committee should have ultimate responsibility for IS planning. This view is supported in part by prior empirical studies that provide evidence that the presence of IT steering committees has positive impacts on the quality of IS planning (Gupta & Raghunathan, 1989), planning processes (Doll & Torkzadeh, 1987; Earl, 1989), planning effectiveness (Premkumar & King, 1992), and alignment of business and IT strategy (McKeen & Guimaraes, 1985; De Haes & Van Grembergen, 2008).

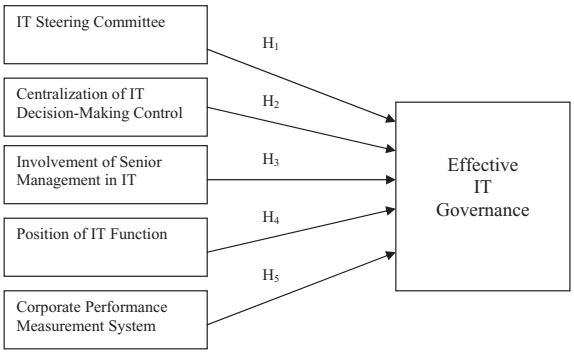

Figure 1: ***Determinants of effective IT governance.***

Reflecting the role of the IT steering committee in controlling the resources of the organization, Earl (1989) posits that one of the primary roles of IT steering committees is that of creating policies and procedures associated with IT control. By undertaking this role, the IT steering committee in effect provides organization-wide policies for the implementation of controls and procedures relating to the use of IT. In this manner, the promulgation of uniform controls reduces the likelihood of potential loopholes within the technology domain that would otherwise allow for the adverse exploitation of an organization's resources. Hence,

> **H1:** The existence of an IT steering committee is perceived to positively influence the level of effective IT governance.

Centralization of IT decision-making control

The centralization of IT decision-making control impacts upon senior management's ability to exercise control over the IT function and as such influences the level of effective IT governance within an organization.

In centralizing IT decision-making control, organizations place the authority for such decisions upon departments (IT department) or committees (IT steering committee) that collectively possess the relevant skills and expertise in the IT domain to ensure better decision making. Aside from the competency of these decision-making units, there are several other benefits associated with such practices. First, the representation of senior management within these units helps ensure that organizational goals and objectives are considered in the decision-making process. Second, centralized decision making results in the implementation of uniform controls and practices across the organization and as such 'allows for management to control adherence to organization standards' (King, 1983: 338). The promulgation of uniform controls reduces the likelihood of potential loopholes within the technology domain that would otherwise allow for the adverse exploitation of an organization's resources. Third, by explicitly assigning these responsibilities, accountability is provided within the organization for such decisions. The assignment of formal responsibility ensures that the respective parties are aware of their responsibilities and helps to ensure thorough decision making in light of being able to be identified and held accountable for poor decisions. In light of these reasons, it is expected that more effective IT governance is provided within a centralized decision making structure, relative to a decentralized structure. Thus,

H2: Centralization of IT decision-making control is perceived to positively influence the level of effective IT governance.

Involvement of senior management in IT

The IS literature has emphasized consistently the importance of top management support and involvement for the success of any organization activity (Jackson, 1986; Raghunathan & Raghunathan, 1990; Rockart & Scott-Morton, 1984). For example, Meador, Guyote and Keen (1984) found senior management involvement to be the most important factor in the project approval process. The salience of this factor in the IT governance context has been highlighted by Luftman *et al*. (1999), whereby senior management support for IT was found to be considered the most important enabler of business and IT alignment. Furthermore, this factor, involvement of senior management in IT, underlies the entire set of recommended processes in CobiT 4.1 (2007).

The involvement of senior management in IT provides management with an enhanced understanding of the IT domain, and as such allows management to better identify and address any potential weaknesses. The latter issue arises from the fact that, in view of the power and influence associated with its position, senior management can easily implement incentives to redress the sub-optimal activities. Jackson (1986) provides support for this position by positing that one of the reasons for top management involvement is that such involvement makes easier the implementation of organization-wide controls and policies. Moreover, the increased awareness of senior management in IT also allows for management to identify further possibilities for exploiting IT in line with business objectives, as well as to champion projects and policies that contribute to better IT governance (Ali & Green, 2007; Bowen *et al*., 2007). Thus the involvement of senior management in IT is expected to improve the overall level of effective IT governance within the organization. Accordingly,

H3: Involvement of senior management in IT is perceived to positively influence the level of effective IT governance.

Position of the IT function within the organization

The ability of the IT function's position within the organization to act as an IT governance mechanism is based on the ability and influence associated with the hierarchical position adopted by the IT function. In the context of this study, the IT function is represented by the senior IT executive/CIO, with the associated levels of authority based on the number of levels between them and the CEO. Prior IS research provides support for examining the reporting relationship as a measure of the formal organizational level of authority associated with the CIO/senior IT executive position (Rousseau, 1978; Hambrick, 1981; Benjamin *et al*., 1985; Raghunathan & Raghunathan, 1989; Applegate & Elam, 1992). Thus,

H4: A highly positioned IT function within the organization is perceived to positively influence the level of effective IT governance.

Corporate performance measurement system

Hardy (2002) posits that an integral part in implementing effective IT governance is through the use of a performance management system incorporating a set of metrics to provide management with a regular and accurate view of how IT is performing for current operations and new projects. In this regard, recent IS literature has advocated the use of a balanced IT scorecard (CobiT 4.1, 2007; Van Grembergen & Van Bruggen, 1997; Van der Zee & De Jong, 1999). Advocates of the balanced IT scorecard suggest that the benefits of this approach are that it goes beyond the traditional financial evaluation methods and extends them to include measures relating to customer satisfaction, internal processes, and the ability to innovate. In doing so, the balanced IT scorecard helps to drive the organization towards optimum use of IT (ISACF, 2003).

Furthermore, Van Grembergen (2000: 42) states that the balanced IT scorecard 'provides the board with crucial control measures on IT expenses, user satisfaction, efficiency of development and operations, expertise of IT staff and may compare these measures with benchmarking figures'. Accordingly,

> **H5:** The implementation of a corporate performance measurement system is perceived to positively influence the level of effective IT governance.

RESEARCH METHOD

In order to examine the five hypotheses forwarded in this study, a web-based questionnaire was developed and implemented. The questionnaire was developed purposefully to be compact, requiring 8–15 minutes to complete, in order to encourage a higher response rate and the complete attention of the respondent. The survey consisted of 33 items in total, with ten items collecting demographic and other background information. The whole questionnaire is attached as Appendix A. To ensure the development of reliable and valid measures, we employed well-established methods of instrument development. A pre-test was conducted involving four academics with extensive backgrounds in the audit and information systems discipline, and one IS auditor. These participants were chosen on a convenience basis and were selected to ensure a balance of expertise in regard to the administration of questionnaires and awareness of IT governance concepts. Based on their feedback, the scope and wording of the items were improved, and an initial online questionnaire was developed for pilot testing. Pilot testing of the questionnaire was undertaken using a randomly selected sample of six academics and six postgraduate students with audit and information systems backgrounds. Pilot testing was carried out individually and permission was sought to observe and manually record the individual responses as the survey was undertaken. Manual recording was undertaken in order to verify that the database was recording the responses accurately. Based on feedback provided during pilot testing, amendments were made to improve the clarity of a single item and the layout of the survey.

Sample selection

Members of the Information Systems Audit and Control Association (ISACA) – Australia and the Institute of Internal Auditors (IIA) – Australia, were selected to participate in the study. Their professional qualifications and experience in the implementation of IS control mechanisms, and their awareness and familiarity with the actual implementation and/or concepts associated with IT governance mechanisms made these people particularly suitable for this study.

Specification of the model and factors

The study's hypotheses consider the influence of the various IT governance mechanisms on the level of effective IT governance within organizations. In testing the hypotheses, this study measures the effectiveness of these mechanisms (i.e. the independent factors) as perceived by auditors. Effective IT governance (i.e. the dependent factor) is measured by perceived effectiveness, as data relating to objective measures of effectiveness in this context are unobtainable. Such an approach to examining the research issue has been validated within the IS literature, where the use of perceived measures of organizational factors have been incorporated in several prior information systems studies (e.g., Blanton, Watson & Moody, 1992; Grover *et al*., 1993; Goodhue & Thompson, 1995), as well as audit committee research (e.g., Shleifer & Vishny, 1997; Larcker & Richardson, 2004),

The study's model is formally defined as follows:

$$EFFECT = \acute{\alpha} + \beta_1 STEERCOM + \beta_2 CENTRAL + \beta_3 INVOLVE + \beta_4 POSITION + \beta_5 CORPSYS + \varepsilon$$

where:
EFFECT = perceived overall level of effective IT governance
STEERCOM = IT steering committee
CENTRAL = centralization of IT decision-making control
INVOLVE = involvement of senior management in IT
POSITION = position of IT function within the organization
CORPSYS = corporate performance measurement system
ε = error term

Twenty-three items, adapted to the IT context, were used to measure the six factors included in the research model. Where possible, measures were adapted from previous research. However, because of a lack of adequate measurement scales, it was necessary to develop and refine some measures specifically for this study. Appendix B summarizes the origins of scale items used in the questionnaire. With the exception of a single item (Position1), all responses relating to the independent factors are measured on a seven-point Likert scale ranging from 'Not at all' to 'To a great extent' (Position1 asks for the number of reporting levels separating the IT head and the CEO). In consideration of the possibility that some of the mechanisms may not be relevant to the context of some organizations, a 'not applicable' response value was included for all items relating to the independent factors. For the two items relating to the dependent factor (EFFECT), responses were measured on a seven-point Likert scale ranging from 'Strongly disagree' to 'Strongly agree'.

A series of items were included to collect general data. This data included demographic data. In the demographics, respondents supplied their professional background (i.e. IS auditor/non-IS auditor; internal auditor/external auditor), their level of experience (measured in years), and their familiarity with the concepts and/or implementation of IT governance mechanisms, and organization on which the responses were provided.[3]

Data collection

The data were collected at the end of 2003. This timing was relevant for the question of IT governance effectiveness in organizations as auditors were highly sensitized to the major corporate failures of Enron, WorldCom and, in Australia, HIH and OneTel. In particular, they were well aware of Justice Stewart's major finding in the HIH Royal Commission that it occurred principally due to a 'lack of stewardship'. Due to the increased importance of information technology on corporate governance and business performance, our control setting provides a relevant setting to test the research questions, and it is still timely in the current commercial environment.

A total of 650 ISACA and IIA members were contacted by their respective professional organizations via email to invite and encourage them to participate in an online survey. The email contained an invitational message containing background information to the study, the closing date and the URL to the survey's website. In line with the principles for conducting web surveys proposed by Dillman (2000), we ended up with a total sample of 80 usable responses (representing an overall response rate of 12.3%). This response rate is similar to or better than the response rates of similar recent studies in audit and information technology (see, for example, IIA, 2009; Stoel *et al*., 2012).

Table 1, Panel A presents a summary of the characteristics of the respondents and Table 1, Panel B presents a summary of the characteristics of the organizations that were used as the basis for their responses. The respondents comprised 66 (82.5%) internal auditors and 14 (17.5%) external auditors, of which 33 (41.25%) classified themselves as IS auditors. On average, each respondent had 11.4 years of audit experience with 3.91 years of IS audit experience. In addition, the average respondent considered him/herself to be fairly familiar with the implementation (or concepts) of IT governance (mean = 5.48).

The final sample covered a range of industries and organization sizes but was largely populated by government agencies ($n = 44$, 55%) and large organizations ($n = 43$, 53.75%).

RESULTS AND DISCUSSION

Preliminary analyses: factor analysis

Validation of the instrument was performed in two phases in an approach similar to Karimi *et al*.

Table 1: Sample characteristics ($n = 80$)

Panel A: Individual characteristics

Audit background	*(n)*	*Auditor type*	*(n)*
Internal auditor	66	IS auditor	33
External auditor	14	Non-IS auditor	47
Response time	***(Days)***	***CISA qualified***	***(n)***
Initial contact	51	Respondents	21
First reminder	16		
Second reminder	13		
Response rate	*12.30%*		

Experience and familiarity	*Mean*	*Std. dev.*
Audit experience (years)	11.4	6.64
IS audit experience (years)	3.91	5.13
Familiarity with IT governance[a]	5.48	1.48

Panel B: Organization characteristics

Industry	*(n)*	*Firm size ($ revenue)*	*(n)*
Chartered firm/Management consulting	5	< $50 Million	17
Education	9	$50–$250 Million	20
Finance, Banking and Insurance	6	>$250 Million	43
Government agencies	44		
Manufacturing and Processing	0		
Mining	3		
Transportation, Communication and Utilities	4		
Wholesale and retail	5		
Other	4		

[a]1 = Not at all, 7 = To a great extent

(2000): an exploratory factor analysis (EFA) to see if the dimensions of the different IT governance mechanisms could be uniquely identified, and a confirmatory factor analysis (CFA), where the remaining items loaded on the resulting factors only. In the EFA, items with poor or ambiguous factor loadings were deleted from subsequent analysis. Item deletion is based on Nunnally (1978) who suggests that a general rule of thumb in assessing construct validity is that individual items should have a factor loading of at least 0.6 on their hypothesized construct for convergent validity; and less than 0.3 loading on all other constructs for discriminant validity.

Based on *Kaiser's criterion*, an examination of the scree plot, and an inspection of the eigenvalues (Tabachnick & Fidell, 1996; Hair *et al*., 1998; Coakes & Steed, 2003), six factors were finally extracted from the EFA. Based on the six-factor extraction, three items (Central5, Involve4, Involve5) were found to have loadings greater than 0.3 on more than one factor. These items were subsequently deleted and the analysis was re-run. This stage of the analysis resulted in the extraction of six factors. The factor loadings for the six-factor solution are shown in Table 2 and indicates that requirements for convergent and discriminant validity have been met.

The first factor contains all five items relating to corporate performance measurement systems and is labeled CORPSYS. The second factor contains all four items relating to IT steering committees and is labeled STEERCOM. The third factor contains the three remaining items relating to senior management involvement in IT and is hereafter referred to as INVOLVE. The remaining four items relating to centralization of IT decision-making control unexpectedly load onto two separate components. By re-examining the wording of the items concerned, it appeared that the two items structured along the organizational level load onto the fourth factor, whereas the other two items

Table 2: Rotated factor matrix (pattern matrix) – independent factors

	Factor (Component)					
	1	**2**	**3**	**4**	**5**	**6**
CORPSYS1	0.791					
CORPSYS2	0.824					
CORPSYS3	0.802					
CORPSYS4	0.927					
CORPSYS5	0.828					
STERCOM1		0.856				
STERCOM2		0.905				
STERCOM3		0.912				
STERCOM4		0.792				
INVOLVE1			–0.815			
INVOLVE2			–0.725			
INVOLVE3			–0.842			
CENTRAL1					0.818	
CENTRAL2					0.864	
CENTRAL3				0.809		
CENTRAL4				0.900		
POSITION2						0.968

1. Absolute values less than 0.30 were suppressed.
2. Results indicate that requirements for convergent and discriminant validity have been met.
3. The six factors extracted explained 80% of the variance.

STEERCOM = IT steering committee
CENTRAL = Centralization of IT decision-making control
INVOLVE = Involvement of senior management in IT
POSITION = Position of IT function within the organization
CORPSYS = Corporate performance measurement system

based on the business unit level load onto the fifth factor. A plausible explanation for the observed split in items measuring centralization of IT decision-making control relates to the 'newness' of the technology that is used by the organizations. Weber (1999) suggests that, as new information technologies are introduced into the organization, there is a need for central management to relinquish some degree of decision-making authority in order to foster innovation and diffusion of the technologies. More control is subsequently exercised as the technology matures. As such, this view suggests that the centralization of IT decision making can occur at both levels: the business unit level and the overall organizational level. In view of this possibility and the exploratory nature of this study, both factors were retained. Centralization of IT decision-making control at the organizational level is hereafter referred to as CENTORG, while centralization of IT decision-making control at the business unit level is referred to as CENTUNIT. The sixth factor, POSITION, contains the single item relating to the position of the IT function. The six factors extracted explained 80.89% of the variance.

In the second phase, confirmatory factor analysis (CFA) was undertaken. In addition to this analysis, reliability calculations (i.e., calculations of Cronbach's alpha) were carried out on the measures and the item factor loadings reassessed. The results of this phase (presented in Table 3) returned a standard coefficient of 0.60 or higher for each factor thus suggesting that all six factors have an acceptable reliability level (Nunnally, 1978; Hair *et al*., 1998).

Non-response bias and common method bias

In examining the existence of non-response bias, we adopted Armstrong and Overton's (1977) method of comparing early and late respondents to assess non-response bias. For this study, responses that were received from the initial email contact and prior to the reminder email being sent out are

Table 3: Reliability calculations (Cronbach alpha)

Factor	*Cronbach alpha*	*Factor*	*Cronbach alpha*
EFFECT	0.9194	INVOLVE	0.8431
STEERCOM	0.9151	POSITION	Not Applicable*
CENTUNIT	0.6302	CORPSYS	0.9137
CENTORG	0.7163		

EFFECT = Perceived overall level of effective IT governance
STEERCOM = IT steering committee
CENTUNIT = Centralization of IT decision-making control at the organizational level
CENTORG = Centralization of IT decision-making control at the business unit level
INVOLVE = Involvement of senior management in IT
POSITION = Position of IT function within the organization
CORPSYS = Corporate performance measurement system

classified as early respondents ($N = 51$). Late respondents refer to responses that were received after the first email reminder was sent out ($N = 29$). Results of independent group's *t*-tests reveal no significant differences exist between both groups across all the factors. In addition, Pearson's chi-square tests for relatedness were conducted on key demographic details (IS auditor or non-IS auditor, internal auditor or external auditor, and organization size). The Pearson's chi-square across all the examined demographic details is not significant and as such this result indicates that there are no marked differences between early and late respondents in relation to the demographic details examined.

Common method bias can occur when a survey instrument that asks multiple questions around a single topic causes respondents to answer a sequence of questions in the same way to appear consistent. We used Harman's single-factor test (as reported in Podsakoff *et al*., 2003) to examine for common method bias. All the items were subject to an exploratory factor analysis (EFA). More than one factor emerged from the un-rotated factor solution, and more than one factor explained the majority of the variance, suggesting common method bias within our study was not a significant issue.

Ordinary least squares (OLS) regression

In testing the hypotheses, the study conducted multiple regression analysis using ordinary least squares (OLS). OLS regression was used to determine the impact of a single independent factor on perceived overall level of effective IT governance while holding the other independent factors constant. Pearson product-moment correlations were also used to examine the pairwise relation between each determinant and overall effective IT governance, and as a further check for multicollinearity between the factors. Based on the results of the factor analysis, the proposed model was re-specified to include the two factors relating to centralization of IT decision-making control: CENTUNIT and CENTORG. The former reflects centralization of IT decision-making control at the business unit level, whereas the latter reflects centralization of IT decision-making control at the organizational level. The regression model used for hypothesis testing is presented as follows (the other factors remain as specified earlier):

$$EFFECT = \alpha + \beta_1 STEERCOM + \beta_2 CENTUNIT + \beta_3 CENTORG + \beta_4 INVOLVE + \beta_5 POSITION + \beta_6 CORPSYS + \varepsilon$$

The scores used in hypothesis testing were the simple average of the respondents' responses for the items that had factor loadings of at least 0.6 on their associated factor (Jarvenpaa & Ives, 1991). Table 4 presents a summary of the items included in the calculation of each factor. For POSITION1, a score of 4 reflected a highly positioned IT function within the organization, whereas a score of 1 reflected a comparatively lower positioned IT function.

Descriptive statistics – OLS regression

An examination of the individual scores calculated for the model's dependent factor EFFECT was undertaken to examine the perceived overall level of effective IT governance within the organizations that were represented in the sample (see Table 5).

Table 4: Calculation of factor scores

Factor	*Calculation of factor score based on:*
EFFECT	EFFECT1, EFFECT2
STEERCOM	STERCOM1, STERCOM2, STERCOM3, STERCOM4
CENTUNIT	CENTRAL1 CENTRAL2
CENTORG	CENTRAL3 CENTRAL4
INVOLVE	INVOLVE1, INVOLVE2, INVOLVE3
POSITION	POSITION1, POSITION2
CORPSYS	CORPSYS1, CORPSYS2, CORPSYS3, CORPSYS4, CORPSYS5

The regression model used for hypothesis testing is:

$$EFFECT = \alpha + \beta_1 STEERCOM + \beta_2 CENTUNIT + \beta_3 CENTORG + \beta_4 INVOLVE + \beta_5 POSITION + \beta_6 CORPSYS + \varepsilon$$

EFFECT = Perceived overall level of effective IT governance
STEERCOM = IT steering committee
CENTUNIT = Centralization of IT decision-making control at the organizational level
CENTORG = Centralization of IT decision-making control at the business unit level
INVOLVE = Involvement of senior management in IT
POSITION = Position of IT function within the organization
CORPSYS = Corporate performance measurement system

Table 5: Overall level of effective IT governance within organizations

Level	*Number of organizations (n)*	*Proportion of sample (%)*
Low	22	27.50
Medium	33	41.25
High	25	31.25
Total	80	100

Individual score were calculated for the model's dependent factor EFFECT to examine the perceived overall level of effective IT governance within the organizations.
>5 = High
3.0–4.9 = Medium
<3.0 = Low

Given that responses to the two items measuring the EFFECT factor were based on a seven-point Likert scale, individual observations with calculated scores greater than 5.0 were classified as high. Observations between 3.0 and 4.9 were classified as medium, and observations with scores below 3.0 were classified as low. The results of this examination indicate that 31.25% ($n = 25$) of respondents perceived their organization to have a relatively high overall level of effective IT governance. In addition, 41.25% ($n = 33$) of respondents perceived their organization to have a medium level of overall effective IT governance, while 27.50% ($n = 22$) of respondents perceived their organization to have a low overall level of effective IT governance.

The findings of this examination bear some similarities with the Guldentops, Van Grembergen and De Haes (2002) study with approximately two-thirds of the sample indicating that they have less than optimized IT governance. However, a marked difference exists in the proportion of organizations that have a low overall level of effective IT governance. Only 3.7% of respondents in the Guldentops *et al*. (2002) study identified themselves as having a relatively low overall level of effective IT governance, whereas the results presented in Table 5 indicate that 27.50% of the present study's respondents have identified themselves as having a relatively low overall level of effective IT governance.

Results of OLS regression

Given that the sample data comprised 80 cases, this situation provided a ratio of approximately 13 cases per factor and hence exceeded the minimum requirement of at least five cases to one (Hair *et al*., 1998). Table 6 presents the results of the multivariate analysis incorporating the regression model as specified earlier.

The results provide support for Hypothesis 1 which proposes that the existence of an effective IT steering committee positively influences the level of effective IT governance. The sign for the STEERCOM coefficient is as hypothesized, with statistical significance at the five percent level. This result is to be expected given that IT steering committees represent the views of a diverse range of managers and as such allow for a realistic assessment of internal strengths and weaknesses. Also, given the authority and influence often associated with such committees, resulting from senior user and IT management representation within the committees, IT steering committees yield considerable influence in gaining top level support

Table 6: Results of OLS regression

Factor		*Predicted sign*	*Unstandardized coefficient (B)*	*Standard error*	*Standardized coefficient (Beta)*	*t-statistic*	*Sig. (2-tailed)*
STEERCOM	H1	Positive	0.237	0.113	0.206	2.096	0.040*
CENTUNIT	H2	Positive	0.084	0.095	0.080	0.884	0.380
CENTORG	H2	Positive	0.084	0.130	0.061	0.649	0.519
INVOLVE	H3	Positive	0.491	0.127	0.438	3.876	0.000**
POSITION	H4	Positive	–0.001	0.217	–0.001	–0.006	0.995
CORPSYS	H6	Positive	0.260	0.111	0.250	2.339	0.023*
R^2	0.566	Adjusted R^2	0.523				
F-statistic	13.242	Significance	0.000**				
Durbin-Watson	1.457						
Mahalanobis Dist.	Min: 0.470	Max. 16.981					
$N^{\#}$	66						

#N is reduced as missing cases are deleted listwise (i.e. the whole case is deleted from the analysis)
**Significant at the 0.01 level (2-tailed) *Significant at the 0.05 level (2-tailed)
Factor descriptions:
STEERCOM: IT steering committee
CENTUNIT: Centralization of IT decision-making control at the business unit-level
CENTORG: Centralization of IT decision-making control at the organizational level
INVOLVE: Involvement of senior mamagement in IT
POSITION: Position of IT function within the organization
CORPSYS: Corporate performance measurement system

for the introduction of policies and procedures directed at implementing effective IT governance.

Interestingly, the two factors (CENTUNIT and CENTORG) relating to centralized IT decision-making control are not significant at conventional levels ($p = 0.38$ and $p = 0.519$, respectively), although they both report the hypothesized positive sign. Thus, although these results indicate that centralization of IT decision-making control at the business unit and organization levels is positively related to increasing the level of effective IT governance, no support is provided for Hypothesis 2 at conventional levels.

Support is provided for Hypothesis 3. The result obtained in relation to the effect of the INVOLVE factor is statistically significant at the one percent level and is in the hypothesized direction. This result suggests that the involvement of senior management generally through their involvement in strategic IT matters, support for operational systems within the organization, and the level of knowledge that they possess about IT opportunities and possibilities within their organization as well as their knowledge of IT innovations developed by their major competitors, positively influences the level of effective IT governance. In particular, senior management support for IT is to be considered the most important enabler of business and IT alignment (Luftman *et al.*, 1999; Bowen *et al.*, 2007). This assertion is supported by the IT Governance Institute, and reflected heavily in its CobiT 4.1 framework for IT governance processes (IT Governance Institute, 2001; CobiT 4.1, 2007).

The results provide no support for Hypothesis 4 which proposes that a highly positioned IT function within the organization positively influences the level of effective IT governance. Although not statistically significant ($p = 0.995$), it is surprising that this factor returns a negative coefficient (although this is marginal at –0.001) given that it was expected that a positive relationship would exist between a highly positioned IT function and the level of effective IT governance. A possible reason for this outcome could be the manner in which the relevant survey items were worded. It is possible that these items, as they were included in the survey, only captured the existence of a shorter reporting relationship between the CEO and the IT head as opposed to the

resultant effects arising from these relationships. In particular, from a cost control perspective, it might be more effective to have the CIO report through the CFO to the CEO.

The result obtained in relation to the effect of the CORPSYS factor is statistically significant at the five percent level and is in the hypothesized direction, thus providing support for Hypothesis 5. This result indicates that the use of corporate performance measurement systems that incorporate a set of metrics to provide management with a regular and empirical view of how IT is performing for current operations and new projects, positively influences the level of effective IT governance. As such the results lend empirical support to previous research advocating the incorporation of similar corporate performance measurement systems.

In addition, an examination of the standardized coefficients for the three statistically significant factors suggests that INVOLVE (standardized coefficient = 0.438), then CORPSYS (standardized coefficient = 0.250), and then STEERCOM (standardized coefficient = 0.206) contribute the most toward the overall level of effective IT governance.

The model has considerable explanatory power with an R^2 statistic of 0.566 (adjusted $R^2 = 0.523$). This result indicates that 56.6 percent of the total variance of the overall level of effective IT governance is explained by the IT governance mechanisms examined (i.e. the six independent factors). In addition, the *F*-statistic (*F*-statistic = 13.242, $p = 0.00$) obtained by the model indicates that the model is significant in explaining the variation in overall level of effective IT governance. The relatively high R^2 statistic could be explained by management and auditor training on relevant IS management and organization practices spanning across the last three decades (Davis, 1974).

Now we present the regression model again, with the actual regression coefficients inserted:

$$\begin{aligned} EFFECT = {} & \alpha + 0.206\, STEERCOM \\ & + 0.080\, CENTUNIT + 0.061\, CENTORG \\ & + 0.438\, INVOLVE - 0.001\, POSITION \\ & + 0.250\, CORPSYS + \varepsilon \end{aligned}$$

Ex-post sensitivity analysis

An *ex-ante* consideration of the population sample highlighted the possibility of differences in responses arising from the audit background of the respondent (internal auditor or external auditor), the type of auditor surveyed (IS auditor or non-IS auditor), and the size of the organization. As such, we undertook additional analyses to determine if the primary findings of the hypotheses testing were robust to distinctive characteristics inherent within the sampled population.

We did not run an additional *ex-post* analysis on the type of organization (government vs. non-government) because we believe the three current *ex-post* tests adequately cover this point in the following ways. First, the government respondents are overwhelmingly internal auditors. So the result that audit background (internal vs. external auditor) does not drive the primary results gives us confidence that government respondents are not driving the results. Second, to a lesser extent, the result that large firm responses (in which most of the government respondents sit) are not driving the primary results again gives us a level of confidence that government responses were not driving the overall results. For these reasons, we believe our results are robust to the government vs. non-government split.

Internal and external auditors

In testing the robustness of the primary findings across internal and external auditors, the study incorporated dummy factors into the original regression model to test in an innovative fashion for differences in the intercept and all slope coefficients between the two groups. The following model was specified for the additional analysis undertaken:

$$\begin{aligned} EFFECT = {} & \alpha + \beta_1 STEERCOM + \beta_2 CENTUNIT \\ & + \beta_3 CENTORG + \beta_4 INVOLVE \\ & + \beta_5 POSITION + \beta_6 CORPSYS + \beta_7 D_E \\ & + \beta_8 D_E * STEERCOM + \beta_9 D_E * CENTUNIT \\ & + \beta_{10} D_E * CENTORG + \beta_{11} D_E * INVOLVE \\ & + \beta_{12} D_E * POSITION \\ & + \beta_{13} D_E * CORPSYS + \varepsilon \end{aligned}$$

The first six independent factors are as originally specified. D_E is a dummy factor that takes the value of 1 for external auditors and 0 for internal auditors, and the last six terms capture differences in the slope coefficient for the six independent factors. The results of this analysis are similar to that of the primary analysis with STEERCOM and INVOLVE, the only two factors to report coefficients at conventional levels of significance

(STEERCOM: $\beta = 0.251$, $p = 0.028$; INVOLVE: $\beta = 0.476$, $p = 0.001$). Conversely, the CORPSYS factor reported a marginally significant coefficient ($\beta = 0.215$, $p = 0.093$). This indicates that the audit background of the respondent does not drive the primary results.

IS auditors and non-IS auditors

A similar dummy encoding method was used to test for differences between responses of IS auditors and non-IS auditors. The results of this analysis are similar to that of the primary analysis with STEERCOM, INVOLVE, and CORPSYS the only three factors to report coefficients at conventional levels of significance (STEERCOM: $\beta = 0.225$, $p = 0.053$; INVOLVE: $\beta = 0.479$, $p = 0.004$; CORPSYS: $\beta = 0.391$, $p = 0.010$). The primary findings reported are qualitatively similar across IS and non-IS auditors, and the primary results are not driven by the type of auditor surveyed.

Organization size

In testing the robustness of the primary findings across organizations of different sizes, we compared large firms (annual revenues more than AUD$250 million) against small (annual revenues below AUD$50 million) and medium (annual revenues between AUD$50 and $250 million) firms. The results of this analysis revealed that none of the factors were significant in either stratum. A further analysis was also undertaken by re-running the primary regression model with a sample consisting only of large organizations. The results of this analysis also revealed that none of the factors were significant. A possible explanation for the absence of any significant findings for this analysis is that the sample, in light of the number of independent factors included in the regression model, is insufficient and thus lacks power. As such, no statistically significant inferences can be made in relation to the robustness of the primary findings across organizational size.

CONTRIBUTIONS, LIMITATIONS, AND FUTURE RESEARCH

This study constitutes quantitative empirical research into the relationship between multiple IT governance mechanisms and effective IT governance. Moreover, as opposed to qualitative or normative investigations, this study is one of a limited number of quantitative empirical pieces to question which IT governance mechanisms contribute toward an increased level of overall effective IT governance. We find that the use of IT steering committees, the involvement of senior management in IT, and the use of corporate performance measurement systems can influence positively the overall level of effective IT governance within an organization.

This study makes a contribution to existing academic and practitioner research relating to IT governance. It presents a single measure addressing IT governance as a whole, and it presents a more accurate measurement of the effectiveness of the IT governance mechanisms examined. Such a measure effectively allows for the assessment of these mechanisms across a range of dimensions (i.e. planning and organization; acquisition and implementation; delivery and support; and monitoring), all of which are important processes that contribute toward attaining effective IT governance (COBIT 4.1, 2007; Cobit Steering Committee and the IT Governance Institute, 2000).

This study provides empirical backing for the implementation of corporate performance measurements systems, such as balanced IT scorecards, as a mechanism for achieving higher levels of effective IT governance. From a practice viewpoint, the findings also provide guidance to IT practitioners. The findings suggest that for the type of firms represented in the sampled population, basic IT governance mechanisms that should be implemented within organizations include the use of active IT steering committees, the encouragement of senior management involvement in IT, and the use of corporate performance measurement systems that include a set of metrics capturing various dimensions relating to the use of IT within the organization. Most importantly, we suggest that if these mechanisms are to be effective in raising levels of IT governance, it is important that the usefulness of such mechanisms be recognized and that they are used consistently (Raghunathan & Raghunathan, 1989; Bowen *et al.*, 2007).

The primary limitations of the study flow from the small sample size examined. In particular, positive statements about whether the size of the organization was driving the results could not be made due to the limited sample size. In light of this and the large number of government agencies within the sample (55% of the total

number of organizations), the external validity of the findings is limited. Furthermore, as with all surveys, the results may be sample-specific and/or time-specific. As such the results are not generalizable to other time periods, organizations or countries.

A further limitation of the study is that it relies solely on a perceptual survey method. As such, the findings may be biased if there is a wide variance in auditors' perceptions. However, such a situation is inevitable given the use of a questionnaire and the unavailability of objective measures. We also acknowledge that the study's consideration of the individual IT governance mechanisms as separate components within the governance structure moderates the study's findings. In practice, there exist varying degrees of interrelationships between the components. For example, Doll and Torkzadeh (1987) and Raghunathan and Raghunathan (1989) reveal a significant positive relationship between the use of IT steering committees and the involvement of senior management. However, such an examination of potential interaction effects is beyond the scope of the present study and is left for future research.

A third limitation of this study is related to the representativeness of the sample. The surprise of a negative coefficient for 'highly positioned IT function' and 'the level of effective IT governance' could be as a result of the high percentage of government respondents. They have been shown to perceive that control of IT and other resources are in the hands of politicians and that public servants have little influence. We agree that government agencies' governance, agency, and stakeholder approaches are different from those in a profit-oriented company; however, our *ex-post* sensitivity analyses in total give us confidence in the robustness of our primary results. Moreover, as our data was gathered at the end of 2003, the phenomenon of pushing the IT function (and the position of the CIO) further away from the CEO and subjugating it to the CFO to ensure tighter control has shown itself to be a good explanation of the result. Readers need to be careful in interpreting the results in this regard.

Our work in this area continues in three principal directions. First, it would be interesting to see if the results still hold in light of the intensity with which IT is used within the respective organizations. On an organizational level, this aspect can be addressed by including a factor to capture the organization's IT intensity (Clarkson, Ferguson & Hall, 2003) or by categorizing firms according to their level of IT usage (Sohal & Fitzpatrick, 2002). Second, given that the model explains only 52.3% (adjusted R^2 statistic) of the variance in effective IT governance, a more comprehensive study including additional IT governance mechanisms would be particularly relevant. Anecdotal replies to an open-ended question on the survey suggest the following factors: the implementation of a board committee (like an audit committee) responsible for IT governance (e.g., IS strategy committee in Ali & Green, 2007); the extent of implementation of an IT governance framework such as CobiT 4.1; and, the extent of establishment of an organizational culture of ethical and compliant behavior (e.g., Weill & Ross, 2004). Finally, it would be useful to see if the mechanisms supported in this study do actually contribute towards reducing certain types of undesirable practices within organizations e.g., a decrease of within-firm fraud.

ACKNOWLEDGEMENTS

The authors are indebted to Jenny Stewart (Editor), two anonymous reviewers, participants at seminars at the Australian National University, the University of New South Wales, the University of Queensland, the Third Asia/Pacific Research Symposium on Accounting Information Systems (Brisbane, June 30, 2007), the Australian Institute of Internal Auditors (Queensland), and the Information Systems Audit and Control Association (Queensland) for their very helpful comments. This research was supported in part by an Australian Research Council (ARC) grant involving the University of Queensland and KPMG.

NOTES

1. Our definition is based on that provided by ISACA (2002: 5): 'a structure of relationships and processes to direct and control the enterprise in order to achieve the enterprise's goals by adding value while balancing risk versus return over IT and its processes.'
2. The definition of an IT steering committee is a high-level team of representatives from multiple divisions or functions that is assigned with the task of linking IT strategy with business strategy. It has representatives from business and IT executives, as well as senior management

representation. It reports to senior management, and holds regular meetings (Nolan, 1982).
3. When reporting the organization on which the responses were provided, respondents supplied the size of the organization (as measured by the annual revenue for the previous fiscal year) and industry to which the organization belongs.

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APPENDIX A

Survey instrument – (questionnaire)

Determinants of effective IT governance

	Not at all (1)	(2)	(3)	*To some extent* (4)	(5)	(6)	*To a great extent* (7)	*Not applicable*
(8) To what extent are you familiar with the implementation (or concepts) of IT governance mechanisms?	○	○	○	○	○	○	○	○
(9) To the best of your knowledge, how many reporting levels separate the IT head and CEO?	○	○	○	○	○	○	○	○
(10) To what extent does the IT steering committee provide strategic direction to IT projects that are in line with the strategic directions of the organization?	○	○	○	○	○	○	○	○
(11) To what extent does the IT steering committee provide a mechanism for coordinating IT practices?	○	○	○	○	○	○	○	○
(12) To what extent does the IT steering committee provide leadership in deriving benefits from IT?	○	○	○	○	○	○	○	○
(13) To what extent does the IT steering committee provide leadership in managing IT?	○	○	○	○	○	○	○	○
(14) To what extent does each organizational unit or function have the authority to make its own decisions relative to hardware acquisitions?	○	○	○	○	○	○	○	○
(15) To what extent does each organizational unit or function have the authority to make its own decisions relative to software development?	○	○	○	○	○	○	○	○
(16) To what extent is the responsibility for authorizing policies with regard to strategic hardware decisions made centrally?	○	○	○	○	○	○	○	○
(17) To what extent is the responsibility for decisions relating to the organization's future hardware acquisition held centrally?	○	○	○	○	○	○	○	○
(18) To what extent is the responsibility for decisions relating to the organization's software development held centrally?	○	○	○	○	○	○	○	○
(19) To what extent does senior management get involved in strategic matters related to the use of IT within the organization, outside of the IT steering committee?	○	○	○	○	○	○	○	○
(20) To what extent is senior management knowledgeable about IT opportunities and possibilities for the organization?	○	○	○	○	○	○	○	○
(21) To what extent is senior management knowledgeable about IT innovations that have been developed by major competitors?	○	○	○	○	○	○	○	○
(22) To what extent does senior management often endorse major IT investments that have not been endorsed by traditional justification criteria and procedures (such as the IT steering committee)?	○	○	○	○	○	○	○	○
(23) To what extent does senior management personally use IT in relation to business? (e.g., email)	○	○	○	○	○	○	○	○
(24) To what extent does the senior IT officer report directly to senior management?	○	○	○	○	○	○	○	○
(25) To what extent does your organization's corporate performance measurement system measure the degree to which the organization's IT strategy supports the business strategy?	○	○	○	○	○	○	○	○
(26) To what extent does your organization's corporate performance measurement system produce a concise model to assist managers in tracking the organization's progress?	○	○	○	○	○	○	○	○
(27) To what extent does your organization's corporate performance measurement system provide management with control measures on IT expenses?	○	○	○	○	○	○	○	○
(28) To what extent does your organization's corporate performance measurement system provide management with control measures on the efficiency of IT development and operations?	○	○	○	○	○	○	○	○
(29) To what extent does your organization's corporate performance measurement system allow for control measures to be compared with benchmarking figures for IT throughout the business operations?	○	○	○	○	○	○	○	○

APPENDIX A Continued

	Strongly disagree (1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*Strongly agree (7)*
(30) To what extent do you agree with the following: The current individual IT governance mechanisms within my organization's IT environment has a large, positive impact on the overall level of effective IT governance within the organization?	☐	☐	☐	☐	☐	☐	☐
(31) To what extent do you agree with the following: The current individual IT governance mechanisms within my organization are an important and valuable aid to implementing overall effective IT governance within the organization?	☐	☐	☐	☐	☐	☐	☐
(32) To what extent do you agree with the following: Overall, the IT governance mechanisms of my organization are important and valuable to the corporate governance of the organization?	☐	☐	☐	☐	☐	☐	☐

(33 Optional) To the best of your knowledge, list the TOP 6 mechanisms (or factors) implemented within your organization (or client organization) that contribute to effective IT governance? For example, these could relate to the control structure, role of strategic planning, or systems support within the organization. Please begin with the most important mechanism first. (If fewer than 6 mechanisms, leave the remaining entries empty).

Number 1 _____ **Number 2** _____ **Number 3** _____

Number 4 _____ **Number 5** _____ **Number 6** _____

APPENDIX B

Description of scales used to measure constructs in the study

Variable		*Scale items and response formats*	*No. of items and source*
A. Perceived overall effective IT governance	Q 30	To what extent do you agree with the following: The current individual IT governance mechanisms within my organization's IT environment has a large, positive impact on the overall level of effective IT governance within the organization.	Two items based on Goodhue and Thompson (1995).
	Q 31	To what extent do you agree with the following: The current individual IT governance mechanisms within my organization are an important and valuable aid to implementing overall effective IT governance within the organization.	
		1 = Strongly Disagree; to 7 = Strongly Agree	
B. IT steering committee	Q 10	To what extent does the IT steering committee provide strategic direction to IT projects that are in line with the strategic directions of the organization?	Four items based on Karimi, Bhattacherjee, Gupta, and Somers (2000)
	Q 11	To what extent does the IT steering committee provide a mechanism for coordinating IT practices?	
	Q 12	To what extent does the IT steering committee provide leadership in deriving benefits from IT?	
	Q 13	To what extent does the IT steering committee provide leadership in managing IT?	
		1 = Not at All; to 7 = To a Great Extent (Not Applicable response option = 0)	
C. Centralization of IT decision-making control	Q 14	To what extent does each organizational unit or function have the authority to make its own decisions relative to hardware acquisitions?	Five items; two based on Grover, Jeong, Kettinger, and Lee (1993) and the other three developed by the principal researcher
	Q 15	To what extent does each organizational unit or function have the authority to make its own decisions relative to software development?	
	Q 16	*To what extent is the responsibility for authorising policies with regard to strategic hardware decisions made centrally?	
	Q 17	*To what extent is the responsibility for decisions relating to the organization's future hardware acquisition held centrally?	
	Q 18	*To what extent is the responsibility for decisions relating to the organization's software development held centrally?	
		1 = Not at All; to 7 = To a Great Extent (Not Applicable response option = 0)	

APPENDIX B Continued

Variable		*Scale items and response formats*	*No. of items and source*
D. Involvement of senior management in IT	Q 19	To what extent does senior management get involved in strategic matters related to the use of IT within the organization, outside of the IT steering committee?	Five items based on Jarvenpaa and Ives (1991)
	Q 20	To what extent is senior management knowledgeable about IT opportunities and possibilities for the organization?	
	Q 21	To what extent is senior management knowledgeable about IT innovations that have been developed by major competitors?	
	Q 22	To what extent does senior management often endorse major IT investments that have not been endorsed by traditional justification criteria and procedures (such as the IT steering committee)?	
	Q 23	To what extent does senior management personally use IT in relation to business? (E.g., email)	
		1 = Not at All; to 7 = To a Great Extent (Not Applicable response option = 0)	
E. Position of IT function within the organization	Q 9	To the best of your knowledge, how many reporting levels separate the IT head and CEO? ^Response provided in a text box	Two items based on Jarvenpaa and Ives (1991)
	Q 24	To what extent does the senior IT officer report directly to senior management?	
		1 = Not at All; to 7 = To a Great Extent (Not Applicable response option = 0)	
F. Corporate performance measurement system	Q 25	To what extent does your organization's corporate performance measurement system measure the degree to which the organization's IT strategy supports the business strategy?	Five items; two based on Chan and Ho (2000) and the other three developed by the principal researcher
	Q 26	To what extent does your organization's corporate performance measurement system produce a concise model to assist managers in tracking the organization's progress?	
	Q 27	*To what extent does your organization's corporate performance measurement system provide management with control measures on IT expenses?	
	Q 28	*To what extent does your organization's corporate performance measurement system provide management with control measures on the efficiency of IT development and operations?	
	Q 29	*To what extent does your organization's corporate performance measurement system allow for control measures to be compared with benchmarking figures for IT throughout the business operations?	
		1 = Not at All; to 7 = To a Great Extent (Not Applicable response option = 0)	

Note: Each variable uses the same measurement scales across all its items (except Position of IT Function within the Organization)
^Responses to this item were provided in a text box.
*These items were developed by the principal researcher