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Abstract

The primary objective of this paper is to examine whether top management's IT knowledge and the firm's use of important IT governance mechanisms reliably contribute to a firm's financial performance. We found that IT knowledge at top executive levels and the board is associated with a company's use of IT governance mechanisms such as CIOs and IT strategy committees that lead to improved financial performance. These findings provide evidence-based support for normative prescriptions for addressing the so-called IT attention and IT knowledge deficits at the top executive and board levels of companies.

Key Words: IT Governance, IT knowledge, Financial Performance.

Introduction

IT governance focuses on adding value through effective investments in IT. The two key mechanisms by which such value can be realized is through the alignment of IT strategy with an entity's business strategy and effective management of the portfolio of an entity's IT investments. IT investments represent a significant portion (about 50%) of the capital investments made by today's business entities and public sector organizations, averaging 4% of revenues, according to Weill and Ross (2004). Therefore, effective IT governance is thought to be a critical factor in contributing to an entity's success as measured by its financial performance and, for public companies, their market value.

The primary objective of this research is to examine whether top management's IT knowledge and the firm's use of important IT governance mechanisms reliably contribute to a firm's financial performance. If they do, then normative prescriptions for addressing the so-called attention and knowledge deficits in company boardrooms would rest on more solid, evidence-based foundations. Business leaders could be more certain that investments in IT knowledge and IT governance mechanisms would pay off and would be spurred to remedy the IT knowledge and attention deficits documented in previous research.

Our main objective is to test the following proposition: ***Financial performance for companies whose top executives and board members have IT knowledge and who employ high level IT governance mechanisms will be higher than the financial performance of similar companies without these characteristics.***

Background

IT investments are known to affect capital market perceptions of an entity's future potential and hence the value that the capital markets places on companies making such investments. Indeed, several indicators of strategic use of IT by an entity have been found to impact investors' assessments of company value, including investments in ERP systems (Hayes et al. 2001; Ranganathan and Brown 2006), new appointments of CIOs (Chatterjee et al. 2001) and announcements of major outsourcing contracts (Hayes et al. 2000; Oh et al. 2006).

However, there is limited evidence in the public domain on the contribution of key IT governance factors to company value. Kambil and Lucas (2002) suggest that IT knowledge at the board level can make corporate management aware of technology trends and help integrate IT with corporate strategy. However, little research has focused on the value of top management and Board involvement in IT governance (Mahring, 2006). The extant literature portrays a deficit of IT knowledge at the top of companies and an absence of interest in IT governance (Burson-Marsteller 2005; Huff et al. 2006).

Our research aims to assess whether IT knowledge and IT governance mechanisms, where they exist, are associated with a firm's financial performance. If they do, then normative prescriptions would rest on more solid foundations. Business leaders could be more certain that investments in IT knowledge and IT governance mechanisms would pay off.

Hypotheses Development

Board level IT governance is prescribed by normative publications such as the IT Governance Institute's (ITGI 2003) *Board Briefing on IT Governance* (BBIG) and the Canadian Institute of Chartered Accountants *20 Questions Directors should ask about IT* (CICA 2004). These normative views see IT governance as a board level initiative that leads to the alignment of IT strategy with the firm's overall business strategy and effective management of the firm's portfolio of investments in IT. These two goals are achieved through a number of governance mechanisms including structures, processes and relational mechanisms (De Haes and Van Grembergen 2005). However, descriptive research on current practices suggests that IT governance practices at the board level are not nearly as well developed as the prescriptions imply.

Buckby et al. (2005) and Mahring (2006) summarize the literature on the role of boards in IT governance. The literature points to both a knowledge deficit (Burson-Marsteller 2005) and an attention deficit at the board level (Huff et al. 2006). CIOs seem to be interested in IT governance but their higher ups do not seem to share these convictions. Where CIOs do, they interpret IT governance as compliance with regulatory requirements and maintaining business continuity (PwC 2006; Huff et al. 2006).

Although the research on current practice paints a dismal picture of the state of IT governance, especially at the board level, at the same time, some companies have established IT governance mechanisms such as IT strategy committees (E&Y 2006). The ITGI (2003) views the IT strategy committee as a key mechanism for implementing board-level IT governance. Admittedly, the number of companies that have adopted such practices is small and the question is whether those that have adopted them have benefited. Another key mechanism is a high ranking CIO. Thus, we hypothesize that IT knowledge on the part of board members and top level executives facilitates the creation and effective use of such mechanisms.

A PricewaterhouseCoopers study on *IT Governance in Practice* (PwC 2006) notes that the benefits of IT Governance are often not measured and are difficult to quantify. Weill and Ross (2004) assert that IT governance is associated with significantly improved corporate performance in terms of Profitability, Asset Utilization and Growth. However, Weill and Ross do not provide empirical data to support their conclusions and their IT governance ratings are composites of numerous indicators, making it difficult to assess the impact of specific mechanisms. This study aims to investigate the performance improvements that are specifically associated with IT knowledge at the board level and the executive suite and the use of IT governance mechanisms such as the IT strategy committee and the CIO.

IT knowledge of board of directors

Board level IT governance has a poor chance of being implemented and being effective if board members don't pay attention to IT due to a lack of appreciation for its strategic significance. Some researchers have identified an attention deficit and a knowledge deficit at the board. For example, Huff et al. (2006) report on case studies of 17 Canadian companies in two different sectors where IT governance knowledge and activity are virtually absent at the board level. Jordan and Musson (2004) provide a similar set of findings in an Australian e-commerce context. Burson-Marsteller (2005) and PricewaterhouseCoopers (PwC 2006) provide similar findings for the US and internationally, respectively. De Haes and Van Grembergen (2005) note that the board works at a very high level and is not involved in IT governance. However, a Deloitte and *Corporate Board Member* (2006) survey reports that its respondent board members do pay attention to IT. Following the suggestion by Kambil and Lucas (2002) we hypothesize that IT knowledge at the board level is an antecedent of effective IT governance at the board level and lower levels in the organization.

IT knowledge of top executives

In this study, *top executive* refers to members of the top management team, including the Chief Executive Officer (CEO), the Chief Financial Officer (CFO), the Chief Operating Officer (COO), and other senior business executives responsible for key business or functional areas, but excluding the Chief Information Officer (CIO). Through a variety of rich case studies, McKenney et al. (1995) document the critical role of senior management in facilitating the use of IT in firms well-known for their IT governance success. An IT-literate business management is also regarded as vital (Keen 1991; Boynton et al. 1994). Some surveys suggest that many Boards view IT governance as a management function and leave this activity to management. We hypothesize that IT knowledge is an antecedent to effective IT governance/management by high ranking executives. Extending previous conceptualizations and definitions of the top management team (Wiersema and Bantel 1992), we define executive as the organizational collective team consisting of the firm's CEO, CFO, and other senior management officers, such as COO and other Executive Vice Presidents. Although the CIO is part of the executive team in many organizations, we exclude the CIO from this group in our study to avoid double counting. We view the presence of a CIO as an IT governance mechanism, as discussed next.

CIO

The CIO is uniquely positioned to devise and implement a vision of the role of IT in furthering business strategies. Earl (1989) suggests that the CIO's combination of technical and business knowledge, in particular, are essential to innovation success. One of the primary motivations for creating the CIO position is to establish an IT designated peer who is more likely to be accepted by the inner circle of the firm's leadership (Armstrong and Sambamurthy 1999; Earl 1996; Ross and Feeny 2000). The CIO is also the chief executive of the IT function and thus can fashion the IT management effectively. An effective IT management capability is positively related to a firm's extent of IT use (Boynton et al. 1994). Furthermore, the announcements of newly created CIO positions are likely to have a positive signaling effect on the market (Chatterjee et al. 2001). Since CIOs need to grasp the bigger picture including contract management, asset life cycles, and discretionary spending by IT staff, the more experienced the CIO, the more likely (s)he can better manage IT project priorities and IT governance. In essence, the experience of a

CIO may not only help ensure that IT strategy is aligned with the company's overall business strategy, but also efficiently and effectively help avoiding IT risks and maximizing benefits.

In addition, since the passage of the Sarbanes-Oxley Act of 2002 (SOX) in the U.S.A. and the mandatory internal control audit under SOX 404, CIOs have had to sub-certify IT controls over financial reporting to CFOs and CEOs to enable them to comply with their certification responsibilities. For organizations with CIOs, such certification would be much easier and less expensive than for organizations without such governance mechanisms; for example, Canada et al. (2006) show that audit costs for companies with IT weaknesses are dramatically higher than for companies without such weaknesses. CIOs and other IT governance mechanisms can contribute to the elimination of IT weaknesses and overall improvements in financial performance through the reduction of compliance and audit costs.

IT strategy committee

According to the IT Governance Institute, (ITGI 2003) the IT Strategy Committee is an essential element of an effective IT governance model. The IT strategy committee is a mechanism that contributes to the alignment of IT and business strategy and the prioritization and control of major IT projects. An effective IT strategy committee can contribute to both revenue growth and cost containment through effective IT strategy and avoidance of costly project failures. Nolan (2004) advocates the use of such committees to compensate for the IT knowledge and attention deficit at the board, while Nolan and McFarlan (2005) suggest that such committees help top management and the board drive technology decisions. However, De Haes and Van Grembergen (2005) find that the IT strategy committee did not enable more thorough and continuous involvement of the board in IT governance.

The following hypotheses flow from the above discussion:

Hypothesis 1: Firms with more top managers and board members with IT knowledge are more likely to have effective IT governance, in the form of (1a) an IT strategy committee and (1b) a CIO, than firms with less IT knowledge at the top executive ranks and board level.

Hypothesis 2: Firms with better IT governance (in the form of (2a) an IT strategy committee and (2b) a CIO have higher levels of financial performance (i.e., return on assets, return on sales, and growth rate) than firms without such governance.

Hypothesis 3: After adjusting for prior financial performance, the average financial performance of firms that have effective IT governance mechanisms are higher than the average financial performance of all other firms in the industry in subsequent years.

Method

Samples and test variables

We have identified a unique data set of 84 US public companies[1] that employed an important IT governance mechanism, the IT strategy committee in 2004. Following the recommendation of Srinivasan (2005) and Desai et al. (2006), we create a matched sample of 84 public companies based on industry membership (SIC industry code) and size (revenue) by using the Compustat database to identify such companies and financial data in 2004. We were able to match 58% of the firms with an IT strategy committee in the same four-digit SIC code, the rest are matched at the three- or two- digit SIC levels. The p-value for the mean difference of revenue is 0.543. The above procedures yield our final sample: 84 firms with an IT strategy committee *(ITSTRAT)* matched with 84 firms without an IT strategy committee *(NOSTRAT).*

[1] The Corporate Library conducted its analysis for Tapestry Networks on June 9, 2006, on a database of 2,143 public firms that it follows.

Table 1 summarizes the industry distribution of the 84 firms with IT strategy committee. As table 1 shows, some codes were overrepresented in the sample relative to others. The 84 firms with an IT strategy committee cover 25 codes in eight industry groups. Among them, the machinery, electronic, and other equipment industry has the highest number of companies with an IT strategy committee, followed by the construction and manufacturing industry, then by finance, insurance and real estate industry. The generalizeability of our findings may be limited to the codes actually represented in the sample.

[Insert Table 1]

For all 168 companies we obtained information on the IT knowledge possessed by top management by reading and coding the Form 10K and 8K proxy documents filed by the companies that contain information on their executives' backgrounds on the SEC's Edgar database and Lexis-Nexis searches. One of the authors and two research assistants independently categorized the IT knowledge of the executives and board members. We employ two criteria to measure IT knowledge: 1) whether the person has IT-related college degrees or 2) whether the person has previously worked in a public IT firm. For example, the proxy documents of Cadence Design Systems Inc. contained the following descriptions for two of its top five executives:

> Michael J. Fister has served as **President** and **Chief Executive Officer** of Cadence since May 2004. Prior to joining Cadence Design Systems Inc (CDNS), Mr. Fister spent 17 years at Intel Corporation, where he was most recently Senior Vice President and General Manager of the company's Enterprise Platforms Group. Mr. Fister is a graduate of the University of Cincinnati where he received a B.S. and M.S. in electrical engineering. Mr. Fister also serves as a director of Autodesk, Inc.
>
> WILLIAM PORTER has served as **Senior Vice President** and **Chief Financial Officer** of Cadence since May 1999. From 1994 to 1999, Mr. Porter served as Vice President, Corporate Controller and Assistant Secretary of Cadence. Prior to joining Cadence, Mr. Porter served as Technical Accounting and Reporting Manager and as Controller of Cupertino Operations with Apple Computer, Inc. Mr. Porter is a director of Onyx Software Corporation.

Each of the above two descriptions would have earned a point for the company's MGMTIT variable that is meant to measure the IT knowledge of top executives, excluding the CIO. Using this approach we created two test variables: MGMTIT, BOARDIT. MGMTIT is the percentage of top executives (except a CIO) with IT knowledge. BOARDIT is the percentage of independent directors with IT knowledge. A third variable, CIO, is set to 1 if a firm has a CIO position, 0 otherwise. At the end of the coding process, the three coders met to reconcile differences and arrived at a consensus. Inter-rater coding reliability, the percentage agreement between the three coders, was 94%.

Based upon recent studies of the determinants of internal control on financial performance, we control for the effects of known factors that are associated with financial performance of a firm: financial condition (LEVERAGE, LOSS, and ARINVEN) and business complexity (SEGMENT) (Doyle et al. 2005; Ashbaugh-Skaife et al. 2005; Li et al. 2006). In addition, we also include an indicator variable to capture governance effects related to having a CEO that also serves as the chairman of the board (CEOCHAIR), since prior studies provide evidence that CEO chairs negatively affect the board's monitoring function, although the results are not consistent (Alexander et al.1993; Dechow et al. 1996; Li et al. 2006).

[Insert Table 2]

Proposed models

Hypothesis 1: Benchmark for comparison

H1 tests for a positive association between the IT knowledge of top management (e.g. executives, board members) and the adoption of an IT strategy committee. We use two variables to proxy for the IT knowledge of top management: MGMTIT, BOARDIT. In addition, we include the IT governance variable CIO as a control. Other control variables are drawn from prior literature on determinants of internal control on financial performance (Doyle et al. 2005; Ashbaugh-Skaife et al. 2005; Li et al. 2006). The logistic regression model for testing H1 is:

$$ITSTRAT=\beta_0+\beta_1 MGMTIT+\beta_2 BOARDIT+\beta_3 CIO+\beta_4 CEOCHAIR+\beta_5 LEVERAGE+\beta_6 LOSS+\beta_7 ARINVEN+\beta_8 SEGMENT+e \quad (1)$$

In addition, for firms with an IT strategy committee, the difference between the performance of the sampling firm and the median performance of all firms with the corresponding (two and four digit) SIC codes is computed and

analyzed. Both the Wilcoxon signed-ranked test and the parametric t-test were used to test the significance of differences.

Hypothesis 2: Adjusting for prior financial performance (or self-selection bias)

Kambil and Lucas (2002) and Nolan and McFarlan (2005) state that the selection of IT experts is more likely in better managed firms which are less prone to IT problems. Hence, firms may appoint IT experts to their IT strategy committee to signal their better IT management and provide stakeholders with assurances about the firm's IT strategic capabilities. Indeed, we would expect that firms selecting to disclose their IT strategy committee would be most likely to experience the greatest gains from a self-selection bias. To mitigate this bias, we run a model predicting those that will most benefit from adopting (ADP) IT strategy committee in equation (1) below:

$$ADP\ (0,1) = \beta_0 + \beta_1 ROS_{-1} + \beta_2 SGA_{-1} + \beta_3 GR_{-1} + \beta_4 LNSIZE_{-1} + e$$

$$ADP\ (0,1) = \beta_0 + \beta_1 ROA_{-1} + \beta_2 SGA_{-1} + \beta_3 GR_{-1} + \beta_4 LNSIZE_{-1} + e \qquad \textit{equation (1)}$$

This analysis allows us to assess the extent that prior performance affects the adoption of IT strategy committee and generate the inverse Mills ratio (Heckman 1979) to control for self selection bias in the subsequent tests (Chaney et al. 2004; Santhanam and Hartono 2003; Hogan 1997; Brown and Perry 1994; Lim et al. 2007). The analysis suggests that firms that adopt their IT strategy committee have been previously profitable (ROA_{-1} and ROS_{-1}) and growing (GR_{-1}). Using these results and the inverse Mills ratio, we control for a firm's choosing to adopt the IT strategy committee with the variable IMR (inverse Mills ratio).

H2 specifically tests the effects of IT Knowledge on the form of IT Governance that eventually affects firm performance. Profitability is arguably the most important criterion for evaluating the performance of a firm. Our measure of firm profitability is *return on sales (ROS)* and *return on assets (ROA)*[2] (Dehning et al. 2007; Smith et al. 1998; Mitra and Chaya 1996). In addition, we use a direct measure of a firm's current growth rate (GR) that is measured as the percent change in sales from one year to the next calculated by dividing net sales by the inventory, accounts receivable, and total assets (Smith et al. 1998; Brown et al. 1995). The cross sectional regression model for testing H2 is:

$$FP = \beta_0 + \beta_1 MGMTIT + \beta_2 BOARDIT + \beta_3 CIO + \beta_4 CEOCHAIR + \beta_5 LEVERAGE + \beta_6 LOSS + \beta_7 ARINVEN + \beta_8 SEGMENT + \beta_9 IMR + e \qquad (2)$$

To provide further insight into the implications of the self-selection issue, we adopt two stage "treatment effects" procedure of Heckman (1979). In the first state, we use the parameter estimates from equation (2) to compute inverse Mills ratios (IMR). In the second stage, we construct a regression model that explains the variation in financial performance. The following analysis tests the change in the statistical significance among variables, with the inclusion of IMR because the significance of IMR itself would yield useful inferences on the importance of controlling for self-selection bias that examine the impact of IT strategy committee on financial performance.

Hypothesis 3: Testing for lag effects of IT governance mechanisms

To test hypothesis 3, data for the same set of firms including firms with an IT strategy committee and control firms were utilized. Researchers have emphasized that IT investments are made with long-term goals and there is a time lag in obtaining benefits (Brynjolfsson and Hitt 1996; Weill and Olson 1989). The lack of time-lagged studies could be one possible reason for the inconsistencies among studies linking IT investments to firm performance (Chan 2000; Devaraj and Kohli 2000; Hitt and Brynjolfsson 1996). Despite these assertions, very few studies test the sustained effects of IT investments (Nahmood and Mann 2000), IT capability (Santhanam and Hartono, 2003) and IT innovation (Lim et al. 2007). Using the same logic, we expect that firms with an IT strategy committee and a CIO that are identified as having top management (e.g. executives, board members) with superior IT knowledge in 2004, will provide evidence on the sustained effects of superior IT governance mechanisms when their performance is compared to their within-industry competitors for the period 2005-2006, after adjusting for prior performance

[2] ROA results not shown for brevity. All results are similar to ROS results.

(similar to the test for hypothesis 2).

Results

Descriptive Statistics and Univariate Analysis

Univariate statistics for all main and control variables used in empirical tests can be found in Table 3[3]. These support our first hypothesis H1: ***Firms with more top managers and board members with IT knowledge are more likely to have effective IT governance, in the form of (1a) an IT strategy committee and (1b) a CIO, than firms with less IT knowledge at the top executive ranks and board level.***

In other words, firms without an IT strategy committee have fewer executives with IT-related experience, have a lower number of board members with IT experience, and have fewer CIOs. However, firms with an IT strategy committee are more likely to have CEOs serving as the chairman of the board, are less leveraged, report less losses, and are less likely to have organizational restructuring.

[Insert Table 3]

Correlations between the variables employed in the empirical tests can be found in Table 4. The presence of an IT strategy committee is positively associated with MGMTIT, BOARDIT, CIO, CEOCHAIR, and negatively associated with LEVERAGE, LOSS, and RESTRUCTURE. None of the correlations are above 0.298, and the highest variance inflation factor (VIF) in our regression is only 1.981, which is well below the suggested multicollinearity problem threshold of 10 (Marquandt 1980; Gujarati 1995). Our examination of the standard errors and size of the coefficient also shows that they are not sensitive to the inclusion or exclusion of the highly correlated variables, indicating multicollinearity is unlikely to be problematic (Hosmer and Lemeshow 1989). Thus, the results of collinearity diagnostics (for models) indicate that multi-collinearity is unlikely to be a problem.

[Insert Table 4]

Test of Hypothesis 1: Logistic regression analysis for Models (1)

Table 5 summarizes the findings of our logistic regression analysis for hypothesis H1. Analyses are conducted based upon the full sample of 84 firms including 84 test (with IT strategy committee) firms and 84 control (no IT strategy committee) firms. The model (1) is highly significant (p-values < 0.001) with good explanatory power (pseudo R^2 = 0.592). The model (1) tests the impact of IT knowledge at the executive ranks, the board, and the existence of a CIO on the presence of an IT strategy committee. In model (1), with ITSTRAT as the dependent variable, all testing variables (MGMTIT, BOARDIT, and CIO) have positive coefficients, which are statistically significant at p=0.05. In other words, firms with more IT-knowledgeable top executives, board members, and employing CIOs are more likely to have an IT strategy committee, which supports our hypothesis H1. For control variables, firms with CEOs serving as the chairman of the board, with higher leverage, lower growth rates, and those experiencing restructures, are less likely to have an IT strategy committee.

[Insert Table 5]

Test of Hypothesis 2: Results from a single-stage and two-stage regression analyses

Table 6 summarizes the findings of our regression analysis for Model (2). Model (2) tests the net impact of IT governance mechanisms on financial performance after taking into account the impact of the IT knowledge factors. For ROA as the measure of financial performance, model (3) is highly significant (p-values < 0.001) with good explanatory power (adj. R^2 = 0.552; 0.547) for single-stage and two-stage analyses, respectively. Overall, Table 6 shows that financial performance as measured by *ROA, ROS* and *Growth* is associated with the presence of IT governance mechanisms at (p<0.10) compared to companies without such mechanisms, after taking into account the influence of the IT knowledge of executives and board members, and the presence of CIOs. The strongest effects in this analysis are those for CIO presence and top management's IT knowledge.

[3] This descriptive statistic is for untruncated data. When we truncate all variables at the 99th (1st) percentiles, the results of our hypotheses tests remain the same.

In Table 6, the first two columns list the independent variables for this analysis and the expected relationship of these variables with financial performance (FP). Table 6 first reports the results based on single-stage estimation of the financial performance model that does not control for the self-selection of IT strategy committee (Model 1). Consistent with the hypothesis 2, we find that MGMTIT, BOARDIT, and CIO are significantly and positively related to financial performance ($p=0.05$) in Model 2. Consistent with prior research, a large number of control variable are also significantly related to FP in the predicted direction. Next, we report the results from the regression of FP on the explanatory variables based on a two-stage estimation procedure (equation 1), which includes the IMR from stage one as a control for self-selection bias. The results indicate that IMR is positively related to FP (at the 10 percent level). Furthermore, under this model specification, the statistical significance of the relationships between all explanatory variables and FP is weakened after controlling for self-selection bias ($p<0.10$). These findings highlight the importance of controlling for self-selection bias when investigating the association between IT governance mechanism and financial performance as regressions that fail to account for the self-selection bias will yield biased results. The results for the control variables are similar to those reported for Model 1.

[Insert Table 6]

Test of Hypothesis 3: Results for lag effect

Table 7 presents the results of matched sample comparison procedures with control firms at the specific SIC code. The results indicate that the FP is significantly higher when compared to the industry averages in all cases when the regression analysis is used in 2005 and 2006, respectively. When industry average based on both four and two digit SIC code are used, the results indicate significantly better financial performance by firms with IT strategy committee during the two years after they employ an IT strategy committee. These effects are most pronounced in the second year (e.g. 2006) where significant effects are observed for performance measures. Similar to the results observed for current effects of IT governance mechanisms, the analysis for sustained effects also showed some variability depending on the benchmark firms used for comparison. In both cases, the results are generally stronger when control firms are matched with firms with IT strategy committee at the two digit level, which is consistent with Santhanam et al. (2003).

[Insert Table 7]

Conclusion

Discussion of results

We find that IT knowledge at top executive levels and the board is associated with a company's use of IT governance mechanisms such as CIOs and IT strategy committees. IT knowledge of executives is more strongly associated with these mechanisms and financial performance than board members' IT knowledge, but even so, the association that exists suggests that board member IT knowledge is valuable.

These results are noteworthy because articles in the business press have questioned the perceived value of CIOs and how welcome they are on boards (McCue 2005). Research by public relations company Burson-Marsteller (2005) indicates that only about eight percent of organizations have CIOs on the board. They label this a boardroom competency deficit. However, a Deloitte (2006) survey found that more than 50% of boards have three or more members knowledgeable in IT, with only 8% having no members with IT knowledge. Thus, our results suggest that CIO involvement at the board level may not always be required to have IT represented at the boardroom table. Consistent with the Deloitte (2006) survey, our findings indicate that non-CIO executives and board members often have IT expertise and that expertise is associated with better IT governance and better financial performance.

We also find that IT governance mechanisms such as CIOs and IT strategy committees are associated with better financial performance. CIO presence is more strongly associated with stronger financial performance, but the IT strategy committee is significant at ($p<.10$) for all three measures of financial performance for both 2004 and 2005.

The contingency view of the potential for such benefits would predict that not all companies' boards would need to be involved in IT governance. Therefore, not all companies would benefit equally from implementing board-level IT governance mechanisms. Nolan and McFarlan (2005) use a 2X2 grid to identify companies that would be most likely to benefit from board-level IT governance initiatives (i.e., those where IT serves a "strategic" role) and those least likely (i.e., those where IT serves a "support" role). Those where IT serves a "factory" role or a "turnaround" role would fall between those two extremes. We propose to test this contingency view in an extension of this study by using industry groupings as proxies for the four roles of IT proposed by Nolan and McFarlan (2005).

Limitations

A potential limitation of our study is that our sample is limited to industries with at least one company with an IT strategy committee. Other industry categories are omitted in our sample, resulting in a potential limitation in the generalizability of our findings. Another limitation of our study is that it demonstrates an association between IT knowledge, IT governance mechanisms and financial performance but not causation. Thus, it could be that companies with better financial performance can and do afford more effective IT governance, rather than more IT knowledge and more effective IT governance leading to better financial performance. However, why would companies invest in IT governance unnecessarily? Still another limitation is that we do not extend our tests to the impact of IT governance on the company's market value. Although there should be a positive relationship between better financial performance and market value, our investigation does not demonstrate this relationship. This is a project for future research.

Contributions

Our study examines whether IT knowledge and IT governance mechanisms, where they exist, are associated with an entity's financial performance. If they are, then normative prescriptions would rest on more solid foundations. Business leaders could be more certain that investments in IT knowledge and IT governance mechanisms would pay off, or at least would not undermine financial performance.

We have identified a unique data set of companies that employ an important IT governance mechanism, the IT strategy committee. We created a matched sample of companies based on industry membership and size. In addition, we obtained information on the IT knowledge possessed by top management by reading and coding the proxy documents filed by the companies that contain information on their executives' and board members' backgrounds. Once created, this data set could be used for additional future research. For example, in our sample companies IT knowledge on the part of management and the board and mechanisms such as the IT strategy committee and CIO play a significant role in connection with the companies' financial performance. Possible extensions of this study would include comparing all the companies in each of the industry groups in our sample and comparing our sample companies to companies in other SIC codes.

We find that companies in our sample have a comparatively small number of material internal control weaknesses and even fewer material IT control weaknesses identified by Sarbanes-Oxley 404 audits[4]. It would be interesting to investigate the reason for this and, particularly, the effects of IT governance mechanisms and IT knowledge on IT control weakness.

In summary, our findings for three different financial performance measures and two years show a significant positive association between IT knowledge on the part of top executives, the use of effective IT governance mechanisms such as an IT strategy committee and a CIO and better financial performance.

[4] The Sarbanes-Oxley 404 Act (SOX) has been enacted in the United States to improve corporate responsibility, through measures that strengthen internal controls and ultimately increase accountability.

Table 1 Distribution of Sample by 2-Digit SIC Code

Two-digit SIC	Industry	#	%	Two-digit SIC	Industry	#	%
10	Metal Mining	2	1.2	**50**	Wholesale Trade-durable Goods	1	0.6
13	Oil And Gas Extraction	4	2.3	**51**	Wholesale Trade-non-durable Goods	2	1.2
27	Printing, Publishing, And Allied Industries	1	0.6	**52**	Building Materials, Hardware, Garden Supply, And Mobile Home Dealers	1	0.6
28	Chemicals And Allied Products	16	9.4	**54**	Food Stores	1	0.6
33	Primary Metal Industries	1	0.6	**60**	Depository Institutions	7	4.1
35	Industrial And Commercial Machinery And Computer Equipment	8	4.7	**61**	Non-depository Credit Institutions	1	0.6
36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment	9	5.3	**62**	Security And Commodity Brokers, Dealers, Exchanges, And Services	1	0.6
37	Transportation Equipment	3	1.8	**63**	Insurance Carriers	1	0.6
38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks	8	4.7	**64**	Insurance Agents, Brokers, And Service	1	0.6
45	Transportation By Air	1	0.6	**67**	Holding And Other Investment Offices	1	0.6
48	Communications	3	1.8	**73**	Business Services	5	2.9
49	Electric, Gas, And Sanitary Services	2	1.2	**80**	Health Services	1	0.6
				87	Engineering, Accounting, Research, Management, And Related Services	3	1.8

Table 2 Variable Descriptions

Hypothesis	Variable	Expected Sign	Definition
	MGMTIT	+	Percentage of top executives (excluding CIO) with IT-related experience.
	BOARDIT	+	Percentage of independent directors with IT-related experience.
	CIO	-	1 If a firm has a CIO position, 0 otherwise.
Control	*CEOCHAIR*	?	1 if the CEO also chairs the board of directors.
Control	*LEVERAGE*	-	Total liabilities divided by total assets.
Control	*LOSS*	-	1 if net income is negative, 0 otherwise.
Control	*ARINVEN*	-	Total accounts receivables and total inventories divided by total assets.
Control	*SEGMENT*	-	Natural logarithm of the number of firms' reportable segments.

Table 3 Univariate Analysis

	ITSTRAT	NOSTRAT	t-statistics	p-value
	84	84		
MGMTIT	0.648	0.141	3.649	0.000**
BOARDIT	0.803	0.768	2.657	0.003**
CIO	2.321	0.936	3.986	0.000**
CEOCHAIR	0.603	0.497	1.997	0.042*
LEVERAGE	0.397	0.842	4.012	0.000**
LOSS	0.219	0.502	3.235	0.002**
ARINVEN	0.289	0.294	0.613	0.542
SEGMENT	2.45	2.789	1.326	0.149

P-values are for two-tailed tests of significance (** significant at the 0.01; * significant at the 0.05; $ significant at the 0.1)
ITSTRAT: Firms with IT strategy committee.
NOSTRAT: Firms without IT strategy committee.
IT Governance Characteristics and Control Variables defined in Table 2.

Table 4 Correlations

	1	2	3	4	5	6	7	8
ITSTRAT	1							
MGMTIT	0.277							
p-value	0.000**							
BOARDIT	0.056	0.208						
p-value	0.264	0.002**						
CIO	0.265	0.143	0.186					
p-value	0.000**	0.034	0.006**					
CEOCHAIR	0.145	-0.036	0.070	0.005				
p-value	0.031*	0.600	0.300	0.945				
LEVERAGE	-0.256	-0.008	-0.201	-0.115	0.046			
p-value	0.000**	0.904	0.003**	0.089$	0.495			
LOSS	-0.191	-0.116	0.009	0.030	0.006	0.052		
p-value	0.004**	0.085$	0.893	0.657	0.931	0.446		
ARINVEN	0.039	-0.117	-0.110	-0.094	-0.055	-0.021	-0.236	
p-value	0.564	0.082$	0.104$	0.165	0.415	0.757	0.000**	
SEGMENT	-0.101	0.002	-0.140	0.006	-0.076	0.068	-0.105	-0.072
p-value	0.135	0.975	0.038*	0.924	0.263	0.314	0.122	0.286

P-values are for two-tailed tests of significance (** significant at the 0.01; * significant at the 0.05; $ significant at the 0.1)

Table 5 Logistic regression analysis

$$ITSTRAT=\beta_0+\beta_1 MGMTIT+\beta_2 BOARDIT+\beta_3 CIO+\beta_4 CEOCHAIR+\beta_5 LEVERAGE+\beta_6 LOSS+\beta_7 ARINVEN+\beta_8 SEGMENT+e \quad (1)$$

	Model (1)	
	coefficient	p-value
CONSTANT	2.43	0.287
MGMTIT	1.319	0.027*
BOARDIT	1.014	0.038*
CIO	1.474	0.012*
CEOCHAIR	0.854	0.062$
LEVERAGE	-2.324	0.000**
LOSS	-0.405	0.582
ARINVEN	0.639	0.514
SEGMENT	-0.048	0.726
ITSTRAT predicted correctly		78%
NOSTRAT predicted correctly		76%
Model Chi-Square (sig.)		132.179
Pseudo R^2		0.592

P-values are for two-tailed tests of significance (** significant at the 0.01; * significant at the 0.05; $ significant at the 0.1)

ITSTRAT: Firms with IT strategy committee.
NOSTRAT: Firms without IT strategy committee.
IT Governance Characteristics and Control Variables defined in Table 2.

Table 6 Regression Analysis

$$FP = \beta_0 + \beta_1 MGMTIT + \beta_2 BOARDIT + \beta_3 CIO + \beta_4 CEOCHAIR + \beta_5 LEVERAGE + \beta_6 LOSS + \beta_7 ARINVEN + \beta_8 SEGMENT + \beta_9 IMR + e \quad (2)$$

2004		Single-stage		Two-stage		Single-stage		Two-stage		Single-stage		Two-stage	
	Predicted sign	ROA_04		ROA_04		ROS_04		ROS_04		GR_04		GR_04	
		Beta	t-stat.			Beta	t-stat.	Beta	t-stat.	Beta	t-stat.	Beta	t-stat.
CONSTANT			1.127		1.102		1.071		1.065		0.059		0.041
MGMTIT	+	0.549	2.256*	0.541	2.221*	0.514	1.957*	0.497	1.948*	0.499	1.881$	0.486	1.867$
BOARDIT	+	0.439	1.808$	0.426	1.786$	0.262	1.683	0.231	1.647	0.543	0.920	0.521	0.874
CIO	+	0.587	2.804*	0.573	2.786*	0.645	2.252*	0.633	2.147*	0.496	1.775$	0.491	1.770$
CEOCHAIR	Control	0.034	0.841	0.033	0.839	0.053	0.866	0.043	0.782	0.017	0.346	0.015	0.298
LEVERAGE	Control	-0.387	-4.132**	-0.379	-4.121**	-0.363	-3.996**	-0.341	-3.521**	-0.274	-2.675**	-0.264	-2.582**
LOSS	Control	-0.113	-2.478*	-0.102	-2.381*	-0.144	-2.165*	-0.136	-1.987*	-0.129	-1.879*	-0.113	-1.664$
ARINVEN	Control	0.035	0.694	0.031	0.682	0.053	0.566	0.047	0.523	0.068	0.797	0.051	0.821
SEGMENT	Control	-0.018	-0.461	-0.017	-0.457	-0.023	-0.486	-0.020	-0.479	-0.035	-0.344	-0.026	-0.289
IMR	Control			0.123	1.678$			0.116	1.548$			0.101	1.184
F-Stat. (sig.)		**25.542 (0.000)****		**24.891(0.000)****		**22.843 (0.000)****		**21.245(0.000)****		**18.512 (0.000)****		**17.982 (0.000)****	
Adj. R^2		**0.552**		**0.547**		**0.524**		**0.517**		**0.494**		**0.485**	

P-values are for two-tailed tests of significance (** significant at the 0.01; * significant at the 0.05; $ significant at the 0.1)

ITSTRAT: Firms with IT strategy committee.
NOSTRAT: Firms without IT strategy committee.
IT Governance Characteristics and Control Variables defined in Table 2.
IMR: inverse mill ratio from the estimation of equation (1).

Table 7 Test of Lag Effect: Regression analysis at the specific SIC Classification

		R-Square change	Prior year of financial performance	Category (1= ITSTRAT; 0= NOSTRAT
2005	**Model**			
ROA_05	**A**	0.564**	0.602**	
	B	0.005	0.576**	0.070$
ROS_05	**A**	0.537**	0.579**	
	B	0.007	0.557**	0.062$
GR_05	**A**	0.521**	0.564**	
	B	0.012	0.521**	0.058$
2006	**Model**			
ROA_06	**A**	0.028*	0.167*	
	B	0.113**	0.086	0.216**
ROS_06	**A**	0.031*	0.173*	
	B	0.041**	0.098	0.197**
GR_06	**A**	0.154*	0.167**	
	B	0.022	0.153**	0.134*

P-values are for two-tailed tests of significance (** significant at the 0.01; * significant at the 0.05; $ significant at the 0.1)

Model A: (Performance measure for year t) = f(performance measure for year t-1)
Model B: (Perforamnce measure for year t) = f(performance measure for year t-1, category: 1 if firms with IT strategy committee (ITSTRAT), 0 if Firms without IT strategy committee (NOSTRAT).

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