

IT Control Weaknesses UNDERMINE THE Information Value Chain

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Although information technology (IT) specialists are responsible for IT, everyone in a company, including management accountants, needs to know about IT—the backbone of the information value chain. Specifically, management accountants have a major role in sustaining the information value chain, and they need knowledge about IT and potential IT material control weaknesses (MWs) to help fulfill that role. In this article, we analyze IT control weaknesses to help management accountants identify them and understand their impact on corporate performance.

To do this, we'll provide empirical evidence about IT material control weaknesses to assist management accountants in fulfilling their role as strategic business partners who develop and support their firm's information value chain. Our analysis of Sarbanes-Oxley Act (SOX) Section 404 reporting looked at IT MWs in relation to MW type, audit fees, and firm performance. The research provides a basis for determining the cost and benefit of IT controls so management accountants can evaluate the effectiveness of their company's IT systems. Let's start with the five Ws—who, what, when, where, why—and one H—how—of information technology material control weaknesses.

Why Care about IT Control Weaknesses?

Although IT specialists are responsible for IT, the fact that it's the backbone of most, if not all, organizational units makes each unit leader along with senior managers responsible for its effectiveness. With a strong IT backbone, a company can collect data and provide information to conduct its business efficiently and effectively. The bottom line? Everyone should care about IT, including management accountants.

In 2008, IMA released a new definition of management accounting that reflects an evolving role, which is to: (1) provide the conceptual framework for converting data into information and (2) fulfill the role of enabler and strategic business partner along the entire information value chain. Given the pervasiveness of IT to process business transactions, IT control weaknesses can affect all facets of the information value chain. Thus, they can impede the process of building knowledge and making effective decisions.

Research shows that if managers lack proper information because IT is inadequate, their company's and potentially their own livelihood may be adversely affected.

Although research hasn't established cause-and-effect relationships, it has determined important associations. Firms reporting IT MWs in their SOX reports have less-accurate earnings forecasts and higher levels of CEO, CFO, and CIO turnover (see "The Consequences of Information Technology Control Weaknesses on Management Information Systems" by Chan Li, Gary Peters, Vernon J. Richardson, and Marcia Weidenmier Watson forthcoming in *MIS Quarterly* and the 2010 working paper by Adi Masli, Vernon J. Richardson, Marcia Weidenmier Watson, and Robert W. Zmud, "The Disciplinary Effects of Sarbanes-Oxley Information Technology Weaknesses on CEOs, CFOs, and CIOs: Implications for Information Technology Governance").

Where Are IT Control Weaknesses Reported?

SOX requires firms to report all internal control MWs, including IT-related ones, in the "Management's Report on Internal Control over Financial Reporting" section in their annual 10-K report. We first used Audit Analytics to identify firms reporting at least one IT-related MW, and then we read the "Management's Report" to identify the specific types of IT MWs firms reported. Our analysis revealed 28 key phrases (see Table 1) to describe IT MWs.

When Are IT Control Weaknesses Reported?

SOX required large firms (accelerated filers with more than \$75 million in public float) to report MWs begin-

Table 1: IT Control Material Weakness Types

Based on 387 Firms Reporting IT Control Material Weaknesses

November 2004 – December 2009

IT MW Type/ • Phrase used in Management's Internal Control Report	% of observations reporting						
	Overall	2004	2005	2006	2007	2008	2009
Access/Security	59%	72%	68%	63%	47%	38%	24%
<ul style="list-style-type: none"> • Logical access issues • Security issues • Segregation of duties not properly implemented 							
Inadequate System	47%	54%	51%	48%	37%	40%	33%
<ul style="list-style-type: none"> • Decentralized systems • Disparate (nonintegrated) systems • Inadequate system to support business processes (i.e., manually intense process) • (Too) functionally complex system 							
Nonspecific	35%	45%	39%	40%	29%	11%	19%
<ul style="list-style-type: none"> • Lack of IT controls • Lack of IT controls over subsidiary/foreign operations • Lack of system documentation, policies, procedures • Relying on systems of others • Weak general controls 							
Change Management	34%	32%	45%	33%	29%	29%	24%
<ul style="list-style-type: none"> • Program changes lack user review/approval/authorization/testing • Inadequate development and maintenance • Program change controls missing or inadequate • Programming errors 							
Data Integrity	33%	29%	38%	38%	24%	33%	38%
<ul style="list-style-type: none"> • Did not properly maintain master files (e.g., vendor, price, inventory) • Integrity of computer data not verified (e.g., accuracy, validity, completeness) 							
Spreadsheet	29%	24%	34%	38%	31%	16%	24%
<ul style="list-style-type: none"> • Lack of controls over spreadsheet 							
Other IT General Controls	18%	25%	16%	19%	16%	13%	10%
<ul style="list-style-type: none"> • Inadequate IT support staff • Inadequate records storage and retention • Insufficient training on system • Lack of disaster recovery plan for systems • Lack of IT experience (inadequate skills) 							
Application	12%	19%	22%	8%	3%	2%	0%
<ul style="list-style-type: none"> • Ability to change closed periods • Ability to delete (used) accounts • Weak application controls 							

ning on November 15, 2004. Management annually reports all MWs, including IT MWs. External auditors also provide their own opinion and report on internal controls.

Who Is Reporting IT Control Weaknesses?

After eliminating firms with missing audit fee data, our sample consisted of 387 companies reporting one or more IT MWs during the period of 2004 through 2009 and receiving an external auditor's adverse opinion on the effectiveness of their internal controls. Table 2 describes our sample. Of our five main industry categories, most firms are either in the service (36%) or manufacturing industry (36%), and the remaining are in financial services (12%), merchandising (8%), or other (8%) industries. Thus, the table shows that companies in manufacturing as well as nonmanufacturing industries with different levels of business process complexities report IT MWs.

The table shows that, on average, the firms report 4.15 (non-IT and IT) material weaknesses, with an average of 1.71 IT MWs. In addition, the firms average more than \$13 billion in assets, spend an average of \$4.9 million a year on audit fees, and have low performance measures based on returns on assets, investment, and equity (ROA, ROI, and ROE). Although market conditions may also affect performance measures, we should note that the S&P 500 had an average return on assets of 6.49% during this time period. Thus, the poor performance of our sample could indicate an inadequate information value chain unable to support a company's business activities and managerial decision-making needs.

What Types of IT Control Weaknesses Are Reported?

To categorize the IT MWs, we worked with a chief technology officer (CTO) of an international firm to group them into eight types. Given the CTO's background in IT auditing, security, and configuration, the types reflect an IT auditor's viewpoint. Table 1 shows the eight types of IT MWs.

Overall

Table 1 reveals that the most frequently reported IT MWs during the six-year period are access and security (59%) followed by inadequate system (47%), nonspecific IT problems (35%), change management (34%), data integrity (33%), spreadsheet (29%), other IT general con-

Inadequate system issues threaten the information value chain. It isn't possible to have a strong backbone if the systems aren't sufficient.

trols (18%), and application problems (12%). Logical access and security issues threaten the data's confidentiality and integrity, as does the lack of proper segregation of duties, and these provide an opportunity for fraudulent activities. Inadequate system pertains to systems that don't meet the company's needs and/or a system that's too complex, threatening data integrity and making it difficult for employees to complete their tasks efficiently. Moreover, inadequate system issues threaten the information value chain. It isn't possible to have a strong backbone if the systems aren't sufficient.

More than 30% of the firms report IT MWs in change management, and nearly 30% report weaknesses in spreadsheets, both of which affect data integrity. This is in addition to the firms that explicitly report lack of data integrity by not verifying or maintaining data properly. Change management and spreadsheet problems also potentially require a large amount of employee time to identify and correct. Thus, all of these problems appear to negatively affect data integrity, firm efficiency, and the

Table 2: Descriptive Statistics
 387 Firms Reporting IT Control Material Weaknesses
 November 2004 – December 2009

	SERVICE FIRMS	MANUFACTURING	FINANCIAL SERVICES	MERCHANDISING	OTHER	TOTAL
Number of firms (percent of sample)	139 (36%)	140 (36%)	47 (12%)	30 (8%)	31 (8%)	387 (100%)
Means:						
Number of Total Material Weaknesses Reported	4.57	3.96	4.09	4.70	2.65	4.15
Number of Information Technology Material Weaknesses Reported	1.85	1.59	1.77	1.83	1.35	1.71
Size (Total Assets)	\$1,602M	\$1,489M	\$99,241M	\$773M	\$773M	\$13,288M
Audit Fees	\$5.1M	\$4.1M	\$10.1M	\$3.1M	\$1.64M	\$4.9M
Audit Fees/Total Assets	0.81%	0.83%	0.20%	0.68%	0.38%	0.70%
Return on Average Assets (ROA)	-8.25%	-9.05%	1.00%	-2.66%	-10.49%	-7.16%
Return on Average Equity (ROE)	-16.21%	-16.00%	-4.16%	-9.27%	-17.97%	-14.27%
Return on Average Investment (ROI)	-18.01%	-21.20%	-0.33%	-5.75%	-16.69%	-15.99%
M = Million						

information value chain, and all are detrimental to a firm's decision-making process as the firm strives to maintain a competitive advantage.

Some Trends

Two of the types show a downward trend: Access/security and inadequate system show a decrease over time in the percentage of firms reporting the IT MWs. For some types, the trend is mixed: nonspecific, change management, application, other IT general controls, and spreadsheet problems illustrate percentage increases from 2004 before declining in subsequent years. The fluctuation may be attributed to the firms' learning curves—i.e., difficult at first to identify all IT MWs, followed by improvement in the MW identifying process. Once the weaknesses are identified, firms may have remediated them, leading to the decline in MWs.

But for data integrity and spreadsheets, the percentage in 2009 (38% and 24%, respectively) is higher than or equal to the percentage in 2004 (29% and 24%, respectively). These increases may reflect the difficulty of main-

taining controls over data in the information system. Moreover, these MW types could result in management using incomplete or even inaccurate information when making decisions.

To better understand how firms are affected collectively by the MW types, we examined the correlations between the IT MWs. Correlations (positive relations) among certain types of IT MWs could further weaken the information value chain, thus decreasing the quality of information used in decision making.

How Are the IT Control Weaknesses Related?

Table 3 presents correlations that are significant at the 10% level or higher. Panel A shows that total MWs are negatively related to firm profitability but positively related to audit fees whether measured in total or scaled by asset dollars, and, hence, as the number of MWs increases, ROA, ROE, and ROI decrease. The same basic relations hold for IT MWs with respect to profitability and audit fees scaled by total assets. Thus, MWs, IT-related or

Table 3: Correlations among IT Control Material Weaknesses
 387 Firms Reporting IT Control Material Weaknesses

Panel A: Overall Relationships ($p < .05$ percent significance)

	ROA/ROI/ROE	TOTAL AUDIT FEES	AUDIT FEES/TOTAL ASSETS
Total MW*	-/-/	+	+
IT MW*	-/-/		+

*Correlation results are the same for both “count” and “presence” perspectives.

Panel B: Breakdown by IT MW Type ($p < .10$ percent significance), where upper diagonal represents the “presence” of IT MW and the lower diagonal represents the “count” of specified IT MW types.

IT MW TYPE	ACCESS/ SECURITY	APPLICA- TION	CHANGE MANAGEMENT	DATA INTEGRITY	INADEQUATE SYSTEM	NON- SPECIFIC	OTHER IT GC	SPREAD- SHEET	TOTAL AUDIT FEES
Access/Security			+		-	+	+		
Application			+	+	+	+			
Change Management		+		+		+	+		
Data Integrity		+	+		+			-	
Inadequate System	-	+		+		+			+
Nonspecific	+	+	+				+		-**
Other IT General Controls	+		+	+		+			-**
Spreadsheet				-					
Total Audit Fees				+	+	-**	-**		

**Correlations are significantly positive for audit fees/total assets.

not, appear to be associated with lower firm profitability, partially because of increased audit fees. Other additional potential explanations for decreased profitability include MWs’ negative effect on data integrity, efficiency, and the information value chain.

Panel B’s correlations examine the IT MW types from two different perspectives—a “presence” perspective and a “count” perspective. Reported on the upper diagonal, a “presence” perspective captures the correlation between IT MW types using a dichotomous IT MW variable—a specific IT MW reported (“1”) or not reported (“0”). Reported on the lower diagonal, a “count” perspective provides insights about the correlations between the number of IT MWs within a type. For example, for access/security, there are three phrases corresponding to weaknesses in this type: logical access issues, security issues, and segregation of duties. If the firm’s “Management Report on Internal Control” mentions two of these

problems, the “presence” perspective is set equal to “1,” and the “count” perspective is set equal to “2.”

Table 3 also shows that firms experiencing one type of IT MW are likely to experience other IT MWs, with the exception of spreadsheet issues, which is least correlated. Spreadsheet problems have a negative correlation with data integrity, so firms with spreadsheet problems are unlikely to have other data integrity problems (from both a “count” and “presence” perspective). The data is coded in such a way that a spreadsheet issue includes any spreadsheet-specific problem, such as data integrity, change management, and access. Thus, a firm with spreadsheet issues may have change-management issues related only to spreadsheets, not the entire information system. Therefore, the negative relation makes sense if firms rely on spreadsheets for consolidations and don’t use other systems to generate their financial statements or if firms use spreadsheets to support certain calculations

and accounting entries, such as depreciation. In each case, any weaknesses would be coded as spreadsheet, not data integrity.

Examining the other categories reveals that firms are likely to report change management problems with all other IT MW problems except spreadsheet issues. Data integrity problems correlate with application, change management, inadequate system, and other IT general control problems, which seems reasonable given that these reported weaknesses could realistically lead to data problems. An examination of the material weaknesses in these nonspecific and other IT general control types (see Table 1) reveals that weaknesses such as lack of IT controls, weak IT general controls, and inadequate/inexperienced IT support staff can lead to a host of other problems, including access/security, application, change management, inadequate system—all of which can affect information quality in decision making. Thus, this evidence supports the need for a strong IT support staff who can implement effective IT (general) controls.

Turning to the financial aspect, IT MWs in data integrity, inadequate system, nonspecific, and other IT general control problems are positively correlated with audit fees (or audit fees divided by total assets)—most likely because of the pervasive effect of these MWs on the firm's information value chain. Specifically, these companies would not only struggle to provide information via inadequate systems, but they would also face problems maintaining financial records, as well as personnel problems related to inadequate staff, training, and skills. All of these problems would increase the audit effort and lead to higher audit fees.

Putting It All Together

The management accountant plays an important role in both the design and effectiveness of the information system—a role that requires an understanding of IT MWs and the effect of those MWs on firm profitability. We have presented evidence that IT material control weaknesses are associated with additional IT MWs, higher audit fees, and lower firm performance. This information is valuable to management accountants for two main reasons as they develop and support the company's information value chain. First, if the company has one IT MW,

it's likely that other IT MWs exist. Thus, this warrants a thorough investigation of all IT MWs, particularly in the areas of change management and data integrity, which appear to have a pervasive impact. In addition, weaknesses related to lack of system documentation, training, IT staff experience, and problems with subsidiaries and others' systems (i.e., nonspecific and other IT general controls), as well as inadequate system, should also be thoroughly investigated because of their negative correlation with audit fees.

Second, the survey results provide evidence of costs associated with IT MWs—increased audit fees and decreased firm performance. Because of IT's pervasiveness and the importance of information to management accountants to make decisions, management accountants need to be competent in IT as they maintain and strengthen their firm's information value chain. That competency includes an understanding of their firm's information system and of the IT MWs and their effect. Specifically, management accountants can champion expanding their firm's evaluation of IT controls beyond the financial reporting controls SOX requires. By evaluating financial and operational controls, data integrity and the resulting information should improve, which in turn should better support managerial decision making and ultimately improve firm performance. **SF**

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