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DO COMPANIES ON THE LEADING EDGE OF IT INNOVATION HAVE A HIGHER RISK
OF MATERIAL WEAKNESS IN INTERNAL CONTROLS?

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ABSTRACT

This research investigates the linkage between IT innovative and non-IT innovative firms with regards to material weaknesses in internal controls. It was based on a call for additional research by Whitworth et al. 2015's paper "The Effects Of Information Technology Innovativeness On Audit Efficiencies" which desired a further investigation on the relationship between IT innovation and the accounting process. Overall, 100 firms in various SIC classifications were investigated and there was no significant evidence suggesting a difference between innovative and non-innovative with respect to material weaknesses in internal controls. This leads us to believe there is no inherent risk to being innovative in IT, at least regarding material weaknesses in internal controls. After further review, the types of material weaknesses and accounting rule application failures were categorized and compared. There was not enough data to compare statistically, but the data allows for a beneficial reference for any companies who are interested in becoming IT innovative.

CHAPTER 1: INTRODUCTION

As a result of the Sarbanes-Oxley Act of 2002 (SOX 404), all publicly traded companies with at least \$75 million public equity must report on the effectiveness of their internal controls regarding financial reporting (Klamm and Watson 2009). The SOX 404 implementation process has been costly for companies. On average, companies spend approximately \$1.5 million in annual SOX compliance costs. As a result, companies have tried to find efficiencies elsewhere, such as in the audit process (Whitworth, et al. 2015) and through IT innovation. Whitworth continues that information technology, especially strong information systems utilizing strong IT controls, can play a key role in improving audit efficiencies. As a component of the Statement of Auditing Standards (SAS) 94, the Auditing Standards Board (ASB) has focused on the centrality of systems in the reporting process and mandated that auditors understand a firm's IT systems and the potential risks that they impose on the reporting process. This includes evaluation of the security and control of the data and processes connected to the systems (Altschuller, Fried, Gelb. 2016). The stronger these systems are with sound controls, the easier it is for auditors to test and place some reliance on these systems and thereby reduce audit fees.

While prior researchers have explored the relationship between IT and the audit process, particularly concerning internal audit controls, this paper attempts to respond to the call by Whitworth et al. (2015) to expand research in the area of IT within the accounting process. The purpose of this study is to investigate whether companies identified as being on the leading edge of IT innovative are more likely or less likely to be found to have material weaknesses in internal control than companies that are not on the cutting edge of innovation. A similar study was done by Hermanson et al., (2020) where the researchers found that companies with internal audit

related material weaknesses were much more likely to have additional material weaknesses and were more likely to restate earnings (Hermanson, et al. 2020).

Sanusi Fasilat and Haslinda Hassan (2015) report that IT plays a key role in internal control system in various organizations in terms of maintaining records and other internal services. Companies utilizing innovative IT have had a direct impact on the efficiency of internal audits by reducing audit report times and cost of these audit reports when compared to companies not utilizing innovative IT (Whitworth et. Al 2015).

However, if a company has poor controls over IT, testing and reliance become harder, which drives up audit fees. In addition, if the controls are found to have a material weakness, this further drives up audit fees. Furthermore, to the extent that one or more material weaknesses are present and lead to an actual material misstatement of the financial statements, fees will be even higher, with the worst case being a material misstatement that affects multiple years and requires a restatement of the financial statements. On average, restatements cause companies to lose approximately one-fourth of their market value on average. In some cases, the market price of a company's stock following a restatement may decrease by over 50 percent (Hermanson, et al. 2020). The concern about poor controls with companies identified as innovative is that by staying on the cutting edge of technology, it may be harder to identify and address control weaknesses given the "newness" of the technologies. It is an argument analogous to the hotel or medical group that implements a new software system and find that the "bugs" in the new systems take a while to work out. In this context, companies identified as innovative may be more likely to have control weaknesses.

This paper is organized as follows. In section II, key terms are defined, background on IT innovation and internal control is presented, and hypotheses related to IT innovative companies

are developed. Section III discusses research methodology and data selection. Analysis and results are presented in section IV, followed by limitations and extensions in section V, with section VI having our conclusion.

CHAPTER 2: REVIEW OF LITERATURE

Key Terms

Prior to discussing relevant literature related to this study, important key terms are defined in order to facilitate the understanding of how IT innovation and internal controls are related and why material weaknesses in internal control may be important.

10-K Form

The annual report on Form 10-K provides a comprehensive overview of the company's business and financial condition and includes audited financial statements (SEC). The 10-K includes information such as company history, organizational structure, executive compensation, equity, subsidiaries, and audited financial statements, among other information. While this form started out as mostly just a formality and had little evidence of investor response, it became useful when companies distort their reported earnings; one such way being a company's decision to pay their employees in stock options rather than in cash (You, Zhang 2009). Expanding what firms needed to disclose on a form 10-K helped increase its usefulness to investors as did the requirement by the SEC to have firms file their 10-K forms electronically. This increased the availability of such forms for investors, making them even more beneficial. A study of 10-K forms between 1993 and 1995 found that cumulative excess stock returns on 10-K filing days are significantly associated with the following year's earnings change (Qi, Wu, & Haw 2000). Section 9A of the 10-K includes information related to internal controls and any material weaknesses present in internal controls.

Material Weakness

A material weakness is "a significant deficiency, or combination of significant deficiencies, that results in more than a remote likelihood that a material misstatement of the annual or interim financial statements will not be prevented or detected" (emphasis added), as defined by the Public Company Accounting Oversight Board (PCAOB 2004) under Auditing Standard No. 2.2. In practice, there is a wide array of possible material weaknesses. Some examples of these material weaknesses would be accounting documentation, policy and/or procedures; restatement or nonreliance of company filings; and untimely or inadequate account reconciliations. Appendix A outlines the weaknesses each firm had throughout the ten-year period of study.

Restatement of Earnings

If a material weakness leads to a material misstatement on the financial statements, sometimes an earnings restatement will be required. Earnings restatements are an admission that previously issued financial statements were not in accordance with GAAP (Palmrose and Scholz, 2004). An October 2002 General Accounting Office (GAO) report documents that the number of financial restatements has increased 145 percent from 1997 to 2001 and that publicly traded companies lost billions in market capitalization in the days and months following a restatement announcement. The GAO report further concludes that the increase in restatements has negatively impacted investor confidence (Mahoney, LaGore, & Scazzero 2008). The problem does not end with the passage of Sarbanes-Oxley Act (SOX) but its continuation has implications for lack of stakeholder confidence in financial markets (Donoher et al., 2007) as well as a firm's corporate social performance (CSP).

Role of Internal Audit

Following the large number of corporate scandals and the global financial crisis, corporate governance has received significant attention from regulators and the public. Given its unique position within the organization, the internal audit function (IAF) is well placed to provide assurance and is an integral component of the corporate governance mosaic (Soh, Martinov-Benie 2011). The roles of the IAF tend to include risk assessment, control assurance, and compliance work. While the IAF has so many financial implications, it also helps in analyzing cost and benefits, utilizing resources, and its implementation and effectiveness of the management (Pirzada, Kashan 2013).

Rahrovani, Addas, and Pinsonneult (2015) define IT innovation as an information technology-related idea, practice, or object that is perceived as new within the organization involved. Rai et al. (2006), report IT innovation as helpful in creating value in companies improving inter-organizational relationships. Other researchers add to the definition as: enhancing productivity (Hitt and Brynjolfsson 1996) and improving intermediate processes (Devaraj and Kohli 2003). Innovative IT is synonymous with IT excellence in that IT innovative companies have used IT to create competitive advantage, improve relationships with customers and suppliers, and optimize internal and external business process (Whitworth et al., 2015).

During preliminary investigations of the impact of IT innovation on performance, researchers would examine the impact of IT in facilitating the timely release of earnings reports and the impact of IT on internal controls. Whitworth et al, 2015 found that companies with innovative IT have lower audit fees than their matched peers. This means that companies that utilized cutting edge IT in their internal control process would have more reliable audit reports returned at a faster rate. Based on this finding, these companies would also be expected to have fewer material misstatements than non-innovative companies.

McAfee stresses the importance of IT investment, saying companies should spend as much on information technology each year as they do on offices, warehouses, and factories combined. He stresses this point with good reason. Companies that allocated about 70 percent of their innovation activity to core initiatives, 20 percent to adjacent ones, and 10 percent to transformational ones outperformed their peers (ERM Initiative Faculty 2016). Weak internal controls are recognized by the capital market in the form of a higher cost of equity (Ashbaugh-Skaife et al 2009). However, firms who have had their controls fail and security breached lost an average 2.1 percent of their market value within two days, resulting in a loss in market capitalization of over \$1.6 billion (Parent, Reich 2009), so a failure of IT controls can be quite costly.

Researchers see no sign that the pace and size of IT investments will abate, nor that IT-based risk will cease to be a problem (Parent, Reich). They also state that in review of general topics of corporate governance and IT governance, a gap exists between the two. While trying to produce innovative products or innovative services, companies run into problems finding an optimal means for effectively managing innovation risk (ERM Initiative Faculty).

It is important to understand the relationship between IT internal controls and material weaknesses in internal control. The function of IT internal controls is to mitigate the risks related to electronic processing and includes oversight of computer operations as well as access to data, and the development and change of the software programs (Altschuller et al. 2016). IT control weaknesses have been shown to potentially indicate less accurate forecasts and more misstatements (Altschuller et al. 2016). If a company has an increased chance at material weaknesses in internal controls, they also have an increased chance of their financial statements being unreliable. Prior research studies have shown that weaknesses in IT controls have been

associated with control weaknesses in other areas. Klamm and Watson (2009) have found that Firms with IT-related weak components report more material weaknesses and misstatements than firms without IT-related weak components, providing evidence on the pervasive negative impact of weak IT controls, especially in control environment, risk assessment, and monitoring. As a result, any material weakness in internal control will generally result in an increase in audit fees (Hermanson et al. 2020). Similarly, Michael Parent and Blaize Horner Reich state that when information systems or technology fail, they often cause significant impacts on shareholder value (Parent, Reich 2009).

Clearly, prior research in the areas of IT innovation and controls have found some conflicting results. On one hand, IT innovation, when done well, can lead to better internal control and lower audit fees. However, the innovation risk can also backfire by causing firms significant costs with data breaches and control failures. Based on this discussion of prior research, the hypotheses addressed in this study are discussed next.

Hypothesis Development

This paper expands on the request posed by Whitworth et. al.'s 2015 paper "The Effects of Information Technology Innovativeness on Audit Efficiencies" encouraging researchers to further investigate the relationship between IT innovativeness and other accounting-related processes. Specifically, this paper investigates whether or not IT innovation is associated with an increased (or decreased) likelihood of material misstatement. On one hand, Whitworth et al., found that IT innovation can lead to lower audit fees. Alternatively, Klamm and Watson (2009) found that companies with weak IT controls are more likely to have material weaknesses in other areas. As such, the first hypothesis related to IT innovative companies is non-directional:

Hypothesis 1 (null): There is no significant difference in the prevalence of material weaknesses between innovative and non-innovative companies.

Hypothesis 1 was tested two ways, first by comparing the total number of material weaknesses identified for all firms, and secondly by comparing the number of IT innovative companies identified with at least one material weaknesses to the number of non-innovative companies identified with at least one material weakness in our sample.

The second hypothesis is also non-directional and addresses question of whether there is a different likelihood of having to restate earnings between the two groups.

Hypothesis 2 (null): There is no significant difference in the number of restatements disclosed in a 10-K between innovative and non-innovative companies.

CHAPTER 3: METHODOLOGY

Sample Selection

The sample of interest in this study consists of 50 companies identified in the Forbes 2018 rankings of the 100 most innovative companies in the world. Of these 100 firms, only companies that were publicly traded companies based in the United States were deemed relevant since they are subject to SOX 404 reporting requirements. This left 51 innovative companies in the sample, but one was dropped due to lack of data availability. Therefore, the final sample included 50 US based companies identified as IT innovative.

To control for potential differences related to size and industry, the sample firms were matched with companies that were not on Forbes list via a match pair design controlling for size, industry, and time period. The methodology used in this paper is based on the research model used by Zhou Guoqiang and Yu Shuang (2009). However, rather than using a three-year period of study like Gouqiang and Shuang, this study utilizes a ten-year period to examine the differences between firms. The reason for the expansion in time period is that it may take companies several years to fully transition from a non-innovative IT strategy to an innovative strategy, so a ten-year window was deemed appropriate for capturing any transition period relating to the IT innovation designation.

For each of the IT innovative and non-innovative companies, the website Audit Analytics was utilized to obtain each financial statement data and internal control data for the years 2008 through 2018. These reports provided us with the data to determine average of revenue, average of earnings, average market cap, and the average of assets for both innovative and non-innovative firms. Demographic data for the sample of innovative and non-innovative firms is presented in Table 1.

Table 1 - Demographics

Financial Data	IT Innovative (n=50)	Non-Innovative (n=50)
Revenue	\$15,873,709,109	\$19,702,226,128
Earnings	\$1,577,789,497	\$2,773,173,524
Market Capitalization	\$43,430,721,852	\$43,670,153,292
Assets	\$19,881,843,233	\$27,729,892,463

Panel B: Industry Data

SIC Classification	IT Innovative (n=50)	Non-Innovative (n=50)
1000-1999 Mining and Construction	0	0
2000-3999 Manufacturing	26	26
4000-4999 Transportation, Communication	4	4
5000-5999 Wholesale and Retail	3	3
6000-6999 Financial, Insurance, Real Estate	0	0
7000-8999 Services	17	17

CHAPTER 4: RESULTS

To test the hypotheses, data related to material weaknesses and earnings restatements was also derived from the Audit Analytics database. More specifically, data obtained from Audit Analytics included the number of material weaknesses a firm had, as well as any internal control issues that contributed to the material weakness, which accounting rules were violated, and how the firm corrected (remediated) the weaknesses(es) in the following year. The Audit Analytics data on number of material weaknesses was used for making comparisons for hypothesis testing between the innovative and non-innovative firms.

Test of Hypothesis 1 (H1)

To test H1, first, the total number of material weaknesses in internal controls between innovative and non-innovative companies were compared. A two-tailed two-sampled equal variance T-Test was used to determine if any of these sets of data show statistically significant results. The total number of material weaknesses for innovative companies was used as our array 1, while the total number of material weaknesses for non-innovative companies was used as our array 2. As stated previously, our tests were all two tailed two sampled equal variance tests.

Table 2 shows the results of testing for the total number of material weaknesses between the two groups. As shown in the table, the total number of material weaknesses in internal controls for innovative companies was 15 while the total number of material weaknesses in internal controls for non-innovative companies was 18. Our T-Test on this data returned a p-value of .70, so our data lacks significance to reject the null of our first hypothesis.

Table 2 – Number of Weaknesses Identified

Panel A: Innovative number of weaknesses identified	
Row labels	Number weaknesses identified
Alexion pharmaceuticals, Inc.	2
Autodesk, Inc.	2
Constellation brands, Inc.	2
Edwards lifesciences Corp.	2
Estee lauder companies, Inc.	1
Hershey Co.	1
Marriott international, Inc. /MD/	1
Molson coors beverages Co.	1
Mondelez international, Inc.	2
Tesla, Inc.	1
Grand Total	15

Panel B: Non-innovative number of weaknesses identified	
Row labels	Number weaknesses identified
Agilent technologies, Inc.	3
Athenahealth, Inc.	1
Charles river laboratories international, Inc.	1
General motors Co.	1
Kraft heinz Co.	2
Staples, Inc.	2
Unisys Corp.	3
Waste connections, Inc.	1
Wex, Inc.	4
Grand Total	18

T-Test

p-value 0.702297

For the second test of H1, the unique count of companies with material weaknesses in internal controls between innovative and non-innovative companies was compared. Here, the count of material weaknesses for innovative companies as our array 1 while the count of material weaknesses for non-innovative companies was our array 2. The main purpose for this test was to

remove any outliers found in our previous test and make our data more robust and reliable. Here, as shown in Table 3, the unique count of companies with material weaknesses in internal controls for innovative companies was 10 while the unique count of companies with material weaknesses in internal controls for non-innovative companies was 9. The T-Test on this data returned a p-value of .80, so once again the data lacks significance to reject the null of the first hypothesis.

Table 3 – Number of Companies with Material Weaknesses

Panel A: Innovative companies with material weaknesses

Innovative company name	Number of innovative companies w/material weaknesses
Alexion pharmaceuticals, Inc.	1
Autodesk, Inc.	1
Constellation brands, Inc.	1
Edwards lifesciences Corp.	1
Estee lauder companies, Inc.	1
Hershey Co.	1
Marriott international, Inc. /MD/	1
Molson coors beverages Co.	1
Mondelez international, Inc.	1
Tesla, Inc.	1
Total	10

Panel B: Non-innovative companies with material weaknesses

Non-innovative company name	Number of non-innovative companies w/material weaknesses
Agilent technologies, Inc.	1
Athenahealth, Inc.	1
Charles river laboratories international, Inc.	1
General motors Co.	1
Kraft heinz Co.	1
Staples, Inc.	1
Unisys Corp.	1
Waste connections, Inc.	1

Wex, Inc.	1
Total	9
	T-Test
	p-value 0.80124

In both tests of H1, the results did not yield a statistically significant difference between the two groups. Therefore, there does not appear to be a penalty associated with IT innovation with respect to an increased likelihood of material weaknesses. This result would be more consistent with Witworth et al., who found that IT innovation was actually associated with stronger controls and more efficiencies in the audit process.

Test of Hypothesis 2 (H2)

The focus of H2 is on the number of restatements made by innovative and non-innovative companies in a ten-year period. The number of restatements for innovative companies was used as array 1 and the number of restatements for non-innovative companies was used as array 2. This data set did not have any outliers, thus allowing us to perform just a singular test on this set of data. As shown in Table 4, the total number of restatements disclosed in the 10-Ks for innovative companies was 3 while the total number of restatements disclosed in a 10-K for non-innovative companies was 2. Our T-Test on this data returned a p-value of .65, so the data did not show significance to reject the null of the second hypothesis. Once again, there does not appear to be a penalty for firms on the cutting edge of IT innovation. The implications of these results are discussed in the next section.

Table 4 – Restatement of Earnings

Panel A: Innovative companies with a restatement in earnings

Innovative Company Name	Count of Restatement of Earnings
Edwards lifesciences Corp.	1
Molson coors beverage Co.	1
Tesla, Inc.	1
Total	3

Panel B: Non-Innovative Companies with a Restatement in Earnings

Non-Innovative Company Name	Count of Restatement of Earnings
Athenahealth Inc.	1
Kraft heinz Co.	1
Total	2

T-Test

p-value 0.650332

Implications

There were no significant differences between innovative and non-innovative firms with respect to the number of firms with material weaknesses, or the number of material weaknesses or restatements. While at first this may seem like a non-result, the results are consistent with the premise that there is not a penalty imposed on innovative companies with respect to these metrics. There does not appear to be any overall penalty for being innovative in terms of material weaknesses. This is an overall good news story. If companies were reluctant to take risks in terms of investments in cutting edge IT due to fears of consequences related to internal control weaknesses, the results of this study should provide some assurance that such fears may be unfounded. Therefore, companies might feel more willing to innovate in the area of IT knowing that there does not appear to be a penalty in doing so.

After reviewing the studies, additional research was conducted to investigate if there were any significant differences between the two samples. To further analyze differences between the two samples, differences in the types of internal control issues were also investigated to shed light on whether there might be differences in the nature of material weaknesses between the two groups. When a company is determined to have a material weakness, Audit Analytics codes the types of internal control issues associated with that weakness as well as any accounting rule application failures related to each weakness. Specific examples of control issues were taken directly from each company's 10-K statements as listed on the Securities and Exchange Commission (SEC) EDGAR database website. Tables 5 and 6 present data related to the internal control issues identified for IT innovative firms with material weaknesses and their non-innovative counterparts, as well as this same comparison with respect to accounting rule application failures.

As shown in Appendix A, there are some differences in frequencies of internal control issues related to the identified material weaknesses, but the differences appear mostly minor. Both groups had the most internal control issues related to accounting documentation, policy and procedures, followed by accounting personnel resources, and auditor or year-end adjustments. Interestingly, the next most common control issue for non-innovative companies was IT related controls relating to IT software, security and access, whereas IT innovative companies had fewer issues in this area. It is encouraging that IT innovative companies had fewer (n=2) IT related internal control issues than non-innovative companies (n=6), as this result would further support the labeling of these companies as IT innovative and also be consistent with the idea that there is not a significant penalty associated with innovation in terms of internal controls.

Appendix B shows a comparison of accounting rule application failures between IT innovative and non-innovative companies. As shown in Appendix B, the most common type of accounting rule application failure for IT innovative companies was tax expense/benefit/deferral/other (FAS 109) rule failures. These failures apply to deficiencies in approach, understanding or calculation associated with various forms of income tax obligations or benefits. These can relate to foreign tax, local taxes, or tax planning issues. The accounts impacted can include expense, deferral, or allowances. With the change in goodwill accounting, a number of issues have arisen with the failure of companies to change the level of permanent differences in their FAS 109 calculations.

The second most common accounting rule application failure for IT innovative firms (and most common application for non-innovative firms) was unidentified/inapplicable FASB/GAAP issues. According to SOX, this specific flag is used when the 302 or 404 disclosure lacks sufficient information to identify what accounts or areas of financial reporting are being impacted by internal control deficiencies. It may also indicate that a GAAP/FASB effect is not applicable.

The two groups had minor differences in several other areas as well, but only balance sheet classification issues and cash flow classification issues had a difference of at least two. While a larger sample size would be needed to investigate these differences statistically, the only area that really stands out as a potential important difference in accounting application failures is in the tax expense, benefit, deferral area. Future researchers are encouraged to investigate whether IT innovative companies may be more likely to breach accounting rules related to taxes than non-innovative companies.

Overall, the findings of this research lead us to believe that it is not inherently more risky to be an IT innovative firm. If a firm wants to attempt to be more innovative, this paper can serve as a reassurance as well as provide some guidance on key controls and accounting rules to pay more attention to as part of their enterprise risk management approach.

CHAPTER 5: DISCUSSION

The sample size of the research study was limited, which only accounted for 50 IT innovative and 50 non-innovative firms. An expanded sample size most likely would have produced more firms with material weaknesses in internal controls, giving data to work with. While it is unlikely that the additional data would have changed our overall findings regarding hypothesis testing, it potentially would have provided more types of material weaknesses and more accounting rule application failures that would have allowed more detailed analyses in these areas.

Our testing relied solely on two-tailed two-sample equal variance T-Tests for our quantitative analysis and then a study on types of material weaknesses and types of accounting rule application failures for our qualitative analysis. A diversifying of analysis would benefit the results of this study.

Further, it is possible that there are other spectrums on which IT innovative and non-innovative firms differ in meaningful ways. Given the finding of this study that it does not appear IT innovation is penalized with respect to control weaknesses, future researchers may wish to evaluate other relevant factors that may provide a strategic advantage or disadvantage to firms that pursue innovation.

CHAPTER 6: CONCLUSION

Material weaknesses have a direct link to increasing the likelihood of financial misstatements and restatements. The goal for this paper was to investigate whether IT innovative firms were more at risk of having material weaknesses in internal controls than non-innovative firms. By conducting several two-tailed two sample equal variance T-Tests, we tested 50 innovative and 50 non-innovative firms to check if there was a significant difference between innovative and non-innovative firms regarding the number of material weaknesses in internal controls, the number of companies with material weaknesses, and the number of restated internal control reports. In each of these tests, the data was not statistically significant and could not reject the H₀ in any of our hypotheses. The findings suggest that being innovative is not inherently riskier than being non-innovative with respect to accounting controls and misstatements. Additional analyses performed on the types of internal control issues and accounting rule application failures associated with material weaknesses provided some insights into some potential differences between IT innovative and non-innovative firms. Future research would be needed to determine if any of these differences are significant as the sample size in this study was not large enough to statistically test the additional analyses factors. However, the study does provide awareness of the types of internal control issues and accounting rule application failures that may be associated with IT innovation. Companies that are aware of such issues may be able to reduce internal control issues and accounting failures associated with material weaknesses and thereby reduce the likelihood of both material weaknesses and accounting misstatements, resulting in lower audit fees and less chance of earnings restatements.

CHAPTER 7: LESSONS LEARNED

I chose to pursue this topic because it blended my two undergraduate degrees of accounting and management of information systems into a challenging and interesting subject that could be beneficial for me in my future career. The research process allowed me to reinforce the accounting knowledge I had gathered during my undergraduate career, as well as learn new skills that will help me in the future. Working closely with the Audit Analytics database showed me the breakdown of accounting financial statements, especially section 9A of form 10-K. I was able to learn how companies document their material weaknesses, the categories that these weaknesses fall into, and how companies plan on correcting these issues in the future. As someone going into public accounting as a career, familiarizing myself with all this new information will allow me to perform my job at a higher degree than before.

My second lesson I have taken from this experience is that in order to conduct a truly worthwhile study, you need to truly invest as much time and energy as you can making sure your data is reliable. My first iteration of data did not have a match pair design, and thus led me to results that showed statistical significance. There was a massive bias between my two datasets that I had not realized before taking a second look at the suggestion of one of my committee members. Using companies that were in the same field was not enough. By having such a drastic difference in revenue, earnings, assets, and market capital, my non-innovative dataset had fewer material weaknesses in internal controls simply because they could afford to invest as much money as they wanted into that area of business.

My final, and most important, lesson from this thesis was to ask questions as soon as possible. I was struggling in a lot of my research and writing, but instead of reaching out to my

committee for help I tried to complete the thesis on my own. By not reaching out, I performed poor testing and research practices, leading me to redo my work and extending the amount of time needed to complete my thesis. I have learned it is always better to consult with someone who is more knowledgeable as soon as I start struggling. I know when I get into my career there will be an entire world of tasks that I will be unfamiliar with completing, and I will not make this same mistake twice.

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Appendixes

A. Comparing Types of Material Weaknesses

Type of Internal Control Material Weakness	Innovative Number of Occurrences	Non-Innovative Number of Occurrences	Example from section 9A
Accounting documentation, policy and/or procedures	11	10	The control designed to monitor compliance with the Company's hedge documentation did not operate as designed during the third and fourth quarters of fiscal 2015. As a result, instances of non-compliance with our hedging program related to cocoa derivatives occurred and were not detected timely and, therefore, we did not meet the technical requirements to qualify for cash flow hedge accounting treatment under ASC 815. (Hershey Co, 2015)
IC - Accounting personnel resources, competency/training	6	8	Our risk assessment procedures over Technology revenue did not adequately identify risks and consider changes in business operations and the demands on personnel created by the efforts required to adopt the new revenue accounting pronouncement that will impact future financial reporting. As a result, the company had missing process level controls and insufficient trained personnel to operate process level controls over the measurement and recognition of multiple-element arrangements within Technology revenue. (Unisys Corp., 2017)
IC - Material and/or numerous auditor /YE adjustments	5	6	The material weakness contributed to material post-closing adjustments and restatement of prior period financial statements, which have been reflected in the financial statements for the three years ended December 31, 2009. (Athenahealth, Inc., 2009)
IC - Restatement or nonreliance of company filings	3	2	This control deficiency resulted in a restatement to the Company's unaudited consolidated condensed balance sheets as of March 31, June 30, and September 30, 2011 to correct the misclassification of short-term investments incorrectly classified as cash equivalents, and the restatement of the Company's unaudited consolidated condensed statements of cash flows for the periods ended March 31, June 30, and September 30, 2011 to appropriately present the activity related to short-term

			investments resulting from the aforementioned classification error and to correct the amount presented as excess tax benefit from stock plans as a component of cash flows from operating and financing activities. (Edwards Lifesciences, 2011)
IC - Inadequate disclosure controls (timely, accuracy, completeness)	3	1	The Company did not maintain effective controls over the completeness and timeliness of information impacting classification and disclosures related to financial reporting. Specifically, effective controls were not in place with respect to communication to appropriate financial reporting personnel from other departments of changes to information impacting classification and disclosures in the financial statements. (Edwards Lifesciences, 2011)
IC - Senior management competency, tone, reliability issues	3	1	We did not maintain an effective control environment as our senior management failed to set an appropriate Tone at the Top. Specifically, senior management failed to reinforce the need for compliance with the Company's policies and procedures, which resulted in inappropriate business conduct. (Alexion Pharmaceuticals, 2016)
IC - Information technology, software, security & access issues	2	6	Management has identified a material weakness in its internal control over financial reporting related to information technology general controls in the areas of user access and program change management. (Wex, Inc., 2016)
IC - Segregations of duties/ design of controls (personnel)	2	3	We identified a material weakness in internal control over financial reporting related to ineffective general information technology controls in the areas of user access and program change management over certain information technology systems that are relevant to the Company's financial reporting processes and system of internal control over financial reporting. As a result, our business process automated and manual controls that are dependent on the affected general information technology controls were also ineffective because they could have been adversely impacted. (Estee Lauder Companies, Inc., 2016)

IC - Untimely or inadequate account reconciliations	2	2	Specifically, the reconciliation and review controls for vineyard farming costs and bulk inventory at the Australian operations did not include identifying cost accumulation, and subsequent release to finished goods, by respective vintage year. (Constellation Brands, 2009)
IC - Ethical or compliance issues with personnel	1	0	Management is engaged in remedial activities to address the material weakness described above. The Board of Directors, together with management, is evaluating certain Company practices and procedures, including those related to compensation, planning and forecasting, as well as the Company's organizational structure, to determine which practices and procedures should be modified or terminated, and management is assessing roles and responsibilities to enhance controls and compliance. (Alexion Pharmaceuticals, 2015)
IC - Restatement of previous 404 disclosures	1	0	Management subsequently concluded that the material weakness described above existed as of December 31, 2015. As a result, management has concluded that we did not maintain effective internal control over financial reporting as of December 31, 2015 based on the framework in Internal Control-Integrated Framework (2013) issued by the COSO. Accordingly, management has restated its report on internal control over financial reporting. (Alexion Pharmaceuticals, 2015)
IC - Journal entry control issues	0	1	This ineffective process resulted in a significant number and magnitude of out-of-period adjustments to Old GM's consolidated financial statements. Specifically, controls were not effective to ensure that accounting estimates and other adjustments were appropriately reviewed, analyzed and monitored by competent accounting staff on a timely basis. Additionally, some of the adjustments recorded related to account reconciliations not being performed effectively. (General Motors, 2009)

B. Comparing Types of Accounting Rule Application Failures

Accounting Rule Failure	Number of Innovative Firm Failures	Number of Non-Innovative Firm Failures	Example from Section 9A
Acc - Tax expense /benefit /deferral /other (FAS 109) issues	5	2	Based on this evaluation, the CEO and CFO concluded that, due to a continued material weakness in our internal control over financial reporting related to the accounting for income taxes, our disclosure controls and procedures were not effective as of December 31, 2014. (Mondelez International, 2013)
Acc - Unspecified/unidentified/inapplicable FASB/GAAP issues	4	5	This inability to conclude is largely due to the challenging accounting environment associated with the combination of the Chapter 11 Proceedings, the related application of fresh-start reporting at a mid-month date, and the need for concurrent preparation of U.S. GAAP financial statements for multiple accounting periods during the six month period after the completion of the 363 Sale. As such, it is reasonably possible that our consolidated financial statements could contain a material misstatement or that we could miss a filing deadline in the future. (General Motors, 2009)
Acc - Balance sheet classification of asset issues	2	0	The underlying control deficiencies resulted in inconsistent reconciliation of account balances, errors in the calculation of certain deferred tax balances, inaccurate information used to assess uncertain tax positions, and incorrect balance sheet classification of certain balances. (Mondelez International, 2013)
Acc - Cash flow statement (FAS 95) classification errors	2	0	Specifically, we did not design effective controls to determine and review the total unpaid amounts

			related to capital expenditures that should have been excluded from operating and investing activities in the cash flow statement and disclosed as non-cash items. (Tesla, Inc., 2012)
Acc - Financial derivatives/hedging (FAS 133) accounting issues	1	1	Specifically, the control designed to monitor compliance with the Company's hedge documentation did not operate as designed during the third and fourth quarters of fiscal 2015. As a result, instances of non-compliance with our hedging program related to cocoa derivatives occurred and were not detected timely and, therefore, we did not meet the technical requirements to qualify for cash flow hedge accounting treatment under ASC 815. (Hershey Co., 2015)
Acc - Accounts/loans receivable, investments & cash issues	1	0	This control deficiency resulted in a restatement to the Company's unaudited consolidated condensed balance sheets as of March 31, June 30, and September 30, 2011 to correct the misclassification of short-term investments incorrectly classified as cash equivalents, and the restatement of the Company's unaudited consolidated condensed statements of cash flows for the periods ended March 31, June 30, and September 30, 2011 to appropriately present the activity related to short-term investments resulting from the aforementioned classification error and to correct the amount presented as excess tax benefit from stock plans as a component of cash flows from operating and financing activities. (Edwards Lifesciences, 2011)
Acc - Capitalization of expenditures issues	1	0	Our management concluded that our internal control over financial reporting was ineffective as of December 31, 2012 because a

			material weakness existed in our internal control over financial reporting related to the presentation and disclosure of non-cash capital expenditures in our consolidated statements of cash flows. (Tesla, Inc., 2012)
Acc - Inventory, vendor, and cost of sales issues	1	0	A material weakness related to the Company's reconciliation and review of inventory accounts at its Australian subsidiary has been identified and included in management's assessment as of February 28, 2009. (Constellation Brands, 2009)
Acc - Liabilities, payables, reserves and accrual estimate failures	1	0	Management is currently evaluating our policies and procedures related to the accounting for income taxes and plans to design and implement adequate internal controls to ensure that ... (ii) the resulting investment in partnership deferred income tax assets and liabilities are assessed and reconciled periodically to the book-tax differences in the underlying assets and liabilities within the partnership to determine whether any adjustment is necessary. (Molson Coors Beverage Co., 2018)
Acc - Foreign, related party, affiliated and/or subsidiary issues	1	3	Specifically, certain controls activities over the completeness and accuracy of our accounting for (i) U.S. taxes on foreign earnings, (ii) international provision for income taxes and (iii) reconciliation of income taxes payable were not performed on a timely basis or at the appropriate level of precision. (Agilent Technologies, 2015)
Acc - Acquisition, merger, disposal or reorganization issues	1	1	Specifically, we did not design appropriate controls to identify and reconcile deferred income taxes associated with the accounting for acquired partnership interests. This material weakness resulted in

			material errors in connection with our step acquisition of MillerCoors that were corrected through the restatement of the consolidated financial statements as of and for the years ended December 31, 2017, and December 31, 2016, and the correction of the unaudited quarterly financial information for fiscal years 2018 and 2017. (Molson Coors Beverage Co., 2018)
Acc - Revenue recognition issues	0	2	These control deficiencies resulted in errors in the calculation of cost reimbursement revenue and reimbursed expenses in our previously issued financial statements for the 2018 first, second, and third quarters. (Marriott International, 2018)
Acc - PPE , intangible or fixed asset (value/diminution) issues	0	2	We did not design and maintain effective controls to reassess the level of precision used to review the impairment assessments related to goodwill and indefinite-lived intangible assets as changes in our business environment occurred. (Kraft Heinz Co., 2018)