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# The Effects of Emerging Technologies on Data in Auditing

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The Effects of Emerging Technologies on Data in Auditing

Honors College Senior Thesis

University of South Carolina

Submitted in partial fulfillment of  
the requirements for graduation with  
Honors from the South Carolina Honors College

By

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Columbia, SC  
April 25, 2016

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## **Thesis Summary**

My name is Matt Oldhouser. I am currently a senior undergraduate student attending the University of South Carolina in Columbia, SC, majoring in Accounting and Finance in the Moore School of Business. This paper serves as my Senior Thesis, a requirement to graduate from the Honors College.

In this paper, I examine the current status of the uses and implementation of technology in the external auditing profession. For purposes of this paper, an auditor refers to a Certified Public Accountant working at a large (national and international) accounting firm. Internal auditors, those that work either internally for the client or are hired on a consulting basis by the client, are mentioned specifically when I am trying to highlight their differing approaches and practice. In addition to surveying the current status of business technology, I investigate the drivers of the present state, and try to predict what will happen in the near future with regards to technology use by external auditors.

The majority of the information in this paper is a compilation of various organizational publications and scholarly articles. I began preliminary research in July 2015 that served as background knowledge of the topic before later examining the material at a greater depth. This paper was written in February through April 2016.

Another portion of the analysis in this paper comes from personal experience. I completed an audit internship with an international accounting firm from January through March of 2016. Although this was only a few months, it gave me valuable insight into the current status of the auditing profession, and helped me identify technological trends that

will continue into the future. I learned an immense amount during the internship, which has helped me develop a number of the ideas presented in this paper.

Although I have taken an in-depth look at the auditing profession and their reliance on technology, there are still many more topics to be researched to further explain the current situation. If I had the opportunity to continue my research, I would further examine the potential opportunities for research that include the use of Big Data Analytics in auditing.

## **Abstract**

This paper, written to fulfill the University of South Carolina Honors College Senior Thesis requirement, is an examination of the current status and future outlook of the implementation of technology, more specifically advancing technology, in the auditing profession. Accounting firms have always been considered conservative in their practices, and this stereotype certainly applies to adopting technology. Audit teams, while analyzing the financial statements of their modern and technologically savvy clients, are relying on outdated technologies and processes. This paper helps to provide an explanation for the technology gap that exists between auditors and their clients by investigating various possible causes. In addition, this paper attempts to predict the future direction that auditors may take in regards to technological advancements.

## **Introduction**

In the technology-driven world that exists today, the world is moving faster and more connected than ever before. Companies conduct their business limitlessly across the world, with meetings taking place with participants located in separate countries and even continents. Cars are becoming self-driven, artificial intelligence is not that far-fetched of a concern, and tourists have begun buying tickets to visit outer space. In the global business environment, companies are acquiring every bit of new technology they can get their hands on, hoping it will provide them with a competitive advantage, no matter how slight.

Although these companies are progressing at ever-increasing rates, the spotlight of this paper lands on the accounting firms auditing their financial statements. The technology revolution has affected all aspects of the business world, but not necessarily in equal amounts. With accountants and auditors being stereotyped as “technology laggards” in recent decades, the recent technology revolution is expected to come slightly later for these auditors. In the following sections, an examination is made into the advancements that have been made in business technology, the level of acceptance of said technology within large accounting firms, and the future outlook for these firms in regards to their technology systems, processes, and knowledge.

## **I. Background**

Audit and attestation services are performed by accounting firms for their client companies, both public and private. Public companies are required, by regulators such as the SEC, to have audits performed to ensure their financial statements are not materially misstated.<sup>1</sup> Private companies hire auditors for a variety of reasons, the most common being to ensure their financials are not materially misstated for creditors. This paper will examine the auditing profession as a whole, not going into detailed specifics in regards to the difference between audits of public and private companies, but instead as it relates to the technology used during these audits.

Audits are performed throughout the year, but the largest number of and most labor-intensive engagements occur soon after the client's year-end, with most being December 31<sup>st</sup>, June 30<sup>th</sup>, or September 30<sup>th</sup>. It is during these engagements that the auditors analyze and test the year-end financial statements of their clients. With the highest percentage of companies having December 31<sup>st</sup> year-ends, January through April is considered the "busy season." During this time, auditors work more hours than any other time of the year due to the high volume of engagements.

The idea of auditing has existed since the beginning of human history, and it began to take on an important role in the business world beginning in the late 1800s as people began to invest money in large corporations. It is considered the "backbone" of a complicated business environment, bridging the divide between revenue driven management and fact-seeking investors (Lee, 1988, 3). Staub (2012, 17) commented that "the Stock Market crash of 1929 and various scandals made auditors realize that their

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<sup>1</sup> Materiality is a measure of error, if a difference is material, then it is concluded that this difference would alter the opinion of someone reading the financial statements.



roles in society were very important.” Scandals and crashes such as this revealed deficiencies in audits, which have generally been quickly corrected. The job of the auditor became more difficult as businesses and economies grew, but became easier after the implementation of internal controls (Lee, 1988, 5). Now, with technology progressing at a rate never before seen in history, auditors are facing a new challenge.

The technological advances the world has seen over the past few decades have been astonishing. Today, the average person holds more technology in their pocket than what was used to first put a man on the moon. Consumer products are what most people think of when talking about the technological advancement, yet it is the corporations around the world, especially in the most highly developed countries, that are leading the technological progression. The computers, software and robotics utilized on a daily basis are already threatening the need for human personnel. Paper, the item most commonly found in offices throughout the 20<sup>th</sup> and beginning of the 21<sup>st</sup> century, is being phased out. The idea of a “paperless” workspace, where every file, document, memo, and report is only viewable on a screen, has become the epitome of a modern office. Accounting firms are adopting many of these advancements, but overall, they seem to frequently lag behind their clients in adoption of technology.

Accounting firms have always been considered conservative companies, and this stereotype certainly applies to technological advancement. For the past few decades, these firms have been following, rather than keeping pace, in regards to updating their resources and processes, namely technology. Audit teams, while analyzing the financial statements of their modern and technologically savvy clients, are relying on outdated technologies and processes.

One of the staples of an audit is the continuity from one year to the next. Staff auditors look at the process that was performed in the prior year to determine what steps to take during the current year. In theory, this seems as though it should be efficient and an easy way to mitigate risk from year to year; however, if the client's processes are changing year over year, then looking at the prior year might not be that helpful or relevant. For example, if a client previously invoiced transactions by hand, which the invoice was then passed to a manager for approval, then an audit approach might involve observing the invoice being prepared and tracing the chain of custody on its way to the manager. But if it is now the current year and the client has made changes to their software, so that a paper invoice is no longer generated. In the now common paperless office, the invoice is simply entered into the system by one employee's account, and then the manager must log in through his/her account to approve it. Under this scenario, the prior year audit strategy would be outdated. Upon arriving at the client, the auditor would be able to adjust, but the level of efficiency is already gone, and time must be wasted to create a new test. This is a simple example to illustrate the ever evolving, and increasingly evolving, business world that auditors now find themselves.

Another capacity where audit teams are lagging behind is in the idea of a "real-time economy." Companies' systems are being updated in literal real-time: shipments equipped with tracking tags get scanned immediately upon departure and arrival, payments are almost entirely electronic, and orders can be placed and received online. Having all of these different systems in electronic form, and more importantly connected to a company's internal system, meaning that a company always has an exact image of its current status. Packages can be tracked in real-time, for both internal purposes as well as

keeping customers and suppliers informed. More significantly management can track their company's revenues on a minute-by-minute basis, and are able to make quicker, more informed decisions as a result.

Audits, on the other hand, are performed without considering the real-time economy. They look at the income statement on a yearly basis, and simply analyze the balance sheet at a point in time. If a company has a December 31<sup>st</sup> year-end, the audit team would typically arrive at the client site sometime in late January, perform tests for a month or two, and potentially be able to issue an opinion by late March. This means that an investor analyzing this company's financial statements, who wants to alter his strategy based on the company's prior year performance, isn't given the auditor's opinion until after the 1<sup>st</sup> quarter of the current year is already complete. The number of transactions, acquisitions, dispositions, gains and losses since the time frame the financial statements reference is potentially quite large. If audit teams were able to adopt the idea of real-time analysis, they could be performing their tests in December, being plugged in to the client's system, examining all transactions up to the December 31<sup>st</sup> year-end, and would only have to be around at the beginning of January to follow-up with some post year-end testing. However, this follows the same theme of auditors simply looking to the past to decide how to conduct the current year audit.

The auditors' emphasis on a backward looking audit is an outdated philosophy (Byrnes et al., 2012). Not only do audit teams frequently use the prior year workpapers to evaluate how to test the current year, but also they look back at the financial statements. Audits performed in January and February are related entirely to business processes that took place in the past, sometimes looking at transactions that took place over a year ago.

The adoption of real-time solutions in most of today's economy is what needs to transition into auditing.

One of the biggest factors in an audit is cost. Both the price an accounting firm charges a client, typically on an hourly basis, and the cost incurred by the accounting firm. As with any business, the goal is to maximize revenue by having a large gap between price and cost. In auditing, this a balancing act. Audit teams want to be sure to provide enough certainty that a company's financial statements are not materially misstated, but only to a certain point. The more testing that is performed, the more certainty the auditors have that the financial statements are not materially misstated. Over-testing is to be avoided as much as possible, as this increases the cost to the accounting firm while the price remains the same. The advancements in technology that most companies have seen should allow for accounting firms to have more efficient testing, meaning they would be able to provide a higher level of certainty at the same or lesser cost than before. Or it could even provide a higher level of certainty at a lower cost (Byrnes et al., 2012). This is not how many accounting firms understand it, though. Most accounting firms would prefer to provide the same level of certainty at a reduced cost, increasing margins while freeing up time and employees to commit to other clients. The integration of more technology in the audit process could reduce the number of false positives<sup>2</sup> and provide more effective fraud protection (Byrnes et al., 2012). By reducing the amount of testing actually performed by humans, you can reduce the amount of potential error. This would benefit auditors on multiple fronts: their costs would be reduced, their certainty would be increased, and the number of errors would be reduced.

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<sup>2</sup> A false positive is any normal or expected behavior or trend that is identified as anomalous or irregular.

All of the ideas and situations mentioned here are specific examples that draw attention to a complex problem: auditors are significantly lagging behind their clients in regards to technology. The remainder of this paper will go into greater detail regarding the technological advancements already utilized by auditors, the advancements that they should be using, as well as looking forward to provide guidance that should be followed by firms looking to stay competitive and relevant in this ever-increasingly technology-driven business world.

## **II. Recent Advancements**

With technology advancing faster today than at any other time in history, one would assume that people, more specifically businesses, would be very engaged to stay up to date in their progressive environments. And a large majority of companies do just that, continuously updating their technology capabilities to stay out in front of their competition. However, accounting firms are not in the majority. They do continuously update their technology, but there is a significant lag between the auditors and their clients in regards to technology implementation. Although large accounting firms have seemingly incredibly deep pockets, it is surprising to quantify the amount of technology that they have not purchased and utilized to this point. This section will focus on some of the recent technological advances that have been made in the business world, and will describe which areas are and are not currently utilized by auditors. This is by no means a comprehensive list; it merely highlights some of the specific technologies that help identify the trends in the industry.

Customer relationship management (CRM) is technology that companies use to manage and analyze customer interactions and data throughout the customer lifecycle (Johnston, 2005, 95). This technology is used with the intent of improving existing business relationships with customers, assisting in customer retention and driving sales growth. CRM technology is designed to compile information on customers across different channels which could include the company's website, telephone, live chat, direct mail, marketing materials and social media. Auditors currently use this technology to assist in maintaining client relationships and help recruit potential new clients (Johnston, 2005, 95).

Voice over Internet Protocol is a category of hardware and software that enables people to use the Internet as the transmission medium for telephone calls. This allows for meetings to take place through people's computers, meaning these meetings do not have to take place in a physical location. Auditors can conduct status meetings when the team is in different locations, even if they are spread across the globe. The technology also allows for "screen-sharing", where one person can allow the other meeting participants to view their computer screen for demonstrations.

XBRL (Extensible Business Reporting Language) is a type of XML (extensible markup language) that is a specification that is used for organizing and defining data (Johnston, 2005, 96). Basically, XBRL is a standard that was developed to improve the way in which financial data is communicated, making it easier to compile and share this data. This technology allows auditors to convert a set of financial statements on a website into a spreadsheet, which can be edited for analysis (Johnston, 2005, 96).

RFID (Radio Frequency Identification) is a technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum to uniquely identify an object (Rouse, 2007). In common terms, an antenna is able to identify the unique transmission that is given off by an object. Although auditors do not directly use this technology, their clients, mainly those with inventory, use it. RFID is coming into increasing use in industry as an alternative to the bar code, and allows management to keep real-time data of their shipments, orders, and overall status of the company (Rouse, 2007).

Audit Data Analytics (ADA) refers to the analytical processes by which auditors extract insights from operational, financial, and other forms of electronic data (Murphy

and Tysiac, 2015). The types of tools associated with ADA are spreadsheets, databases, and generalized auditing software. These are used every day by accountants performing audit procedures, and are the primary technology that they rely on. These tools are able to handle large data sets efficiently, possess a wide array of analytical and statistical functions and procedures, are programmable, are able to log every procedure performed on data, and are easily re-run to perform the same analysis with minor changes (Murphy and Tysiac, 2015).

The use of data analytics has advanced much more rapidly in internal auditing, where many organizations use continuous auditing and continuous monitoring of data that enables them to identify risks as part of their system of internal control (Murphy and Tysiac, 2015). The power of data analytics could allow external auditors to test complete sets of data rather than samples, assess risk through the identification of anomalies and trends, and provide audit evidence through comprehensive analysis of an organization's general ledger system (Murphy and Tysiac, 2015). Data analytics, combined with traditional auditing techniques, will give auditors a more thorough understanding of their clients than previously.

Audit applications that are not used extensively include digital analysis, expert systems, database modeling, continuous transaction monitoring (Janvrin et al., 2008, 14). As mentioned previously and again later in this paper, database modeling and continuous transaction monitoring are two of the most important areas that auditors must improve and advance.

Another area where auditors are lagging is that of IT audits. An IT audit is the examination and evaluation of an organization's information technology infrastructure,



policies and operations (Alles, 2015, 441). Typically, auditors will focus on the controls that are in place for security and to prevent fraud opportunities from arising. However, advanced technology use and risks are outpacing IT audit capabilities (Alles, 2015, 441). These controls now extend far beyond limiting physical access to files or computers. In a world where everything is quickly becoming wireless, a security breach could happen at any time from any location. Controls must be in place to restrict entry to the client's information systems and technologies, in addition to limiting physical access to their documents.

Similarly, the opportunities for fraud are evolving. Segregation of duties and supervisor reviews can still be effective, but must be molded to fit in the new paperless enterprise. User access controls and signoffs are effective means to deter fraud, but are becoming too advanced for auditors to test on paper. With technology exposure at levels below their clients, auditors do not have the technology or processes to identify all risks.

There have been a number of recent technological advancements that are assisting auditors in their daily work, but there is still a long way to go for firms to match the technological capabilities of their clients. If recent trends continue, these firms will continue to invest in updated technologies. One of the more exciting advancements is the increasing influence of Big Data Analytics, which is discussed in the following section.

### **III. Big Data**

Baseball, the sport known as America's pastime, is a somewhat simple game. The pitcher throws a pitch, the batter tries to hit the ball, and the fielders try to get him out. A team wins if they have scored more runs than their opponent at the end of nine innings. After a game, players will analyze their performance in terms of data collected, such as the number of at-bats to get one hit, and the number of errors made in the field. But baseball statistics go much deeper; more complicated than potentially any other sport. Pitchers analyze their pitch count relative to their walks and hits per inning pitched (WHIP) and fielders are valued based on their wins above replacement (WAR). These statistics tie in many seemingly random correlations to potentially identify causation. These techniques, although more complex, are taking place in the global business environment.

Doug Laney of Gartner (Staub, 2012, 15) defined Big Data ten years ago as the three V's: Volume, Velocity, and Variety. This is the most simplistic definition with which to understand Big Data, but it extends far beyond these three words. Big Data is described as "a company's massive portfolio of data that is unstructured and machine generated, as well as data that resides outside of corporate boundaries" (Ernst & Young, 2015). Essentially, Big Data could include any and all data, although a company's access to data is limited. The ability to analyze this immense amount of data by combining and contrasting datasets to uncover hidden patterns, customer patterns, market trends, unknown correlations, and other useful business information could be crucial to a firm seeking a competitive advantage.

Auditing is an area that holds a load of potential for Big Data and analytics. These processes are transforming the audit by enabling auditors to more efficiently and accurately identify financial reporting, fraud and operational business risks, and alter their methods and approach to deliver a more relevant audit (Ernst & Young, 2015). The implementation of these analytics will also lead to better forecasts of estimates, going concern fraud, and other variables that are of concern to external auditors. Both the efficiency and effectiveness of an audit would be greatly enhanced with the prevalent application of data analytics. However, the widespread adoption and implementation of data analytics in audit is a time-consuming process, and the cost-benefit trade-off must be evaluated.

There are multiple obstacles, none that are insurmountable, that must be overcome before big data and analytics are successfully integrated into the audit. The first is the accessibility of the data. Companies invest significantly in protecting their data, and auditors must go through a lengthy process to gain approval, which in many cases is denied with companies citing security concerns (Ernst & Young, 2015). Clients will need to grant auditors greater access to their data, a task much easier said than done. Another concern is the vast variety of accounting systems that exist. Auditors encounter hundreds of different accounting systems and multiple systems with the same company, all containing different sets and types of data (Ernst & Young, 2015). A key advantage of data analytics is the combining and contrasting of multiple sets of data. The ability to do so, and still understand and be able to analyze the resulting data will take some time to figure out. The final obstacle to be mentioned here is that of auditor reliance. Auditors will need to be able to find a balance between relying on the results of these analytics and

applying their own auditor judgment (Ernst & Young, 2015). This may not be an issue that can be resolved currently, as it may require experience to find the delicate equilibrium. Although these are very prevalent barriers to the successful integration of big data and analytics into the audit, they are by no means insurmountable, and will not prevent future auditors from relying on this technology.

As mentioned previously, auditing is gradually becoming synonymous to IT auditing, which is yet another reason for the push for Big Data analytics. The widespread adoption of enterprise resource planning (ERP) systems over the past twenty years has enabled and made inevitable IT-based auditing (Alles, 2015, 440). This trend is seen again, but with all data. Big Data analytics will soon become as important to the operation of businesses as ERP systems did in the past (Alles, 2015, 440). When this inevitably takes place, auditors will have no choice but to embrace and implement data analytics.

Due to the progressive nature of big data and analytics, the information produced and processes undertaken will be unique from previous data, which can create problems in regards to auditing standards. The audit profession is one that holds itself under strict standards and regulations, a reputation that many will not want to tarnish. Regulators will argue that current standards will not be relevant for big data and analytics, and that new standards will take too long to formulate. As such, the “application of Big Data has a greater likelihood of rapid acceptance if it is seen as a means of more effectively or efficiently satisfying existing standards, rather than depending on new or modified standards” (Alles, 2015, 447). By taking this approach, audit progressives will have a much higher chance of overcoming an additional barrier to integration.

There has been substantial growth in the volume of data generated by machines, partly attributable to the increase in cell phone and other mobile devices. The Internet is evolving from a network of PCs to a network of things: cell phones, tablets, appliances and more (ISACA, 2014). In fact, because the amount of data has grown so much in the past decade, an additional V has been added to the original 3 in the definition of big data: Veracity. Big data is now sourced from many different places, and the veracity and quality of the data must be tested before being used (Sharma, 2015). This only helps the campaign aimed at integrating this technology. Data is growing at such rates that big data and analytics will become essential if an audit team hopes to even scratch at the surface of analyzing relationships between different sets.

In today's increasingly complex business environment, data-driven risk governance and controls are critical (Sharma, 2015). The benefits of big data and analytics are immense, and the top-level management of accounting firms must adopt this technology to continue to progress and compete. The next section will analyze the various motives accounting firms have for failing to stay up to date with their information technology, many of which are additional reasons that big data and analytics are still in their infant stages in the auditing landscape.

#### **IV. Reluctance**

A consistent theme observed throughout the research of this topic is the reluctance of accounting firms to adopt technology, which has led to external auditors persistently lagging behind their clients in the adoption of technological advances. This section will examine the various explanations as to why accounting firms are slow to get on board with the rapid technology evolution, and the resulting disparity and inequality between organizations that have kept up with updating their technology and the auditors who analyze their financial statements.

A common rationalization for this reluctance is the heightened risk that would certainly follow the increased technology. Security is a large area in which the risk would certainly be impacted. Protection of their clients' private information is something that accounting firms take very seriously, and for good reason. If some of the information that auditors analyze daily were to get into the wrong hands, it could potentially affect stock prices, competitors' strategies, and overall would almost certainly lose their client money, as well as damage the reputation of the individual auditors, their firm, and the profession as a whole. Accounting firms work very hard to find methods and strategies that effectively protect this information, so it is understandable that firms would be very careful about adopting technology that could potentially threaten this security. But this most certainly does not make it excusable. Firms must take a proactive approach to security, ensuring the correct precautions are in place ahead of time. By initially getting out in front of potential risks, accounting firms should be able to invest and embrace new technology and methods.

Another major factor contributing to the escalation of risk that accompanies the heavier reliance on technology is the increased emphasis that will be placed on providing relevant financial statement information (Watkins, 2007, 6). The quicker an accounting firm can make a judgment on the financial statements of a company, the sooner the company can release these statements. If a company is doing well, it will want to release these financial statements as soon as possible to increase its investors' contributions and overall improve its reputation. With the client understanding that the audit team is utilizing more advanced technology, the audit team will feel more pressure to complete audits in shorter time spans. This could easily open up the potential for auditors to perform this work too quickly and miss errors that they previously could have potentially spotted.

A result of advances in technology has helped promote global economies, which also bring additional risk with them (Watkins, 2007, 6). Clients are operating various parts of their businesses in different parts of the world, and have begun competing in markets full of geopolitical and regional condition risks. For example, a client could have its headquarters in North Carolina, with factories in China, offshore processes in India, suppliers in South America, and buyers in Europe. The complexity of operating in global markets has exposed companies to greater uncertainty and risk, a risk that accounting firms are hesitant to take on (Watkins, 2007, 6). But seeing as though their clients are all over the world yet seamlessly connected, accounting firms auditing these companies must also undertake this transformation.

Computer technology threatens the profitability of the auditor's core business, and thus it is reasonable to see why it would be rejected as much as it is. Audits are a service

product; auditors are selling their reputations and work. Anybody qualified to do so could perform an audit, but it is the person the client must deal with on a daily basis combined with the quality of work performed that separates auditors from one another. Audits can drag on for months at a time, and the management staff at the client would much rather communicate with someone they like and enjoy spending time with, rather than an irritating or bothersome auditor. It is the relationships between clients and the firm that clients are willing to pay extra for. In fact, most accounting firms charge their cheapest rates the first year of auditing a client, and increase the rate every year (Chan et al., 2012). So unlike most businesses that give repeat customers a discount, accounting firms charge repeat customers more and more. This is for the sole reason that relationships are the most valuable aspect of an audit, an aspect that accounting firms are desperate to hold on to.

The introduction of technology as a mainstay in audits would threaten the relationships that provide a large percentage of an accounting firm's revenue. If all audits become more and more computerized, then they will essentially be indifferent from one firm to another. More time would be spent sitting at a desk reviewing computerized work instead of physically interacting with the client, and would start to phase the human element out of the audit. The actual face-to-face contact would be significantly reduced (Perry, 2015, 3). This in turn will allow clients to no longer care about previous relationships, and simply hire the auditors that present the lowest price. Revenues for all accounting firms across the board would decrease as a result, but only initially. The implementation of advanced technology in the audit would cause other services to increase in efficiency, namely that of consulting. Consulting is much more profitable for



accounting firms than the audits they perform, so increasing the efficiency of this work would actually dramatically increase the revenues for the firm, significantly outweighing the lost revenues from a more computerized audit. However, the addition of consulting services for a client brings along moral and regulatory constraints, as it could be seen as a breach in independence of an audit when value-added services are performed.

An argument could be made however that more computerized audits could actually help client interaction and relationships. Auditors spend a lot of time at the client site working through tests and processes, where they are not actually speaking to the client. This is more negative than positive, as the auditors are taking up space at the client site while not actively improving the relationship or asking questions. More computerized audits would enable these auditors to spend less time working on these processes, and instead they can be fully informed due to the tests already have been completed and when on-site can spend the majority of their time interacting with the client.

A similar threat to the profitability of auditors is the increased timesaving that computer technology would provide. Timesaving is both a necessary good and a necessary evil for auditors, as they want to work as efficiently as possible to free up time to work on other clients, yet charge their clients on an hourly rate. “Simple but immensely laborious tasks, such as the planning and initiation of the circularization of debtors’, can now be done in hours rather than weeks” (MacErlain, 1990, 24). The ability to reduce these mundane tasks seems as though it should help auditors, but not when they are charging their services by the hour. The development of computer technology does indeed threaten the profitability of the traditional audit, although it also liberates auditors to develop more sophisticated and higher-margin areas, such as pursuing new clients and

maintaining those relationships that provide increased profitability year over year (MacErlain, 1990, 24).

Although it seems as though all accounting firms are reluctant in their adoption of various technologies, they are not all doing so to the same degree. Big 4 Firms (PriceWaterhouseCoopers, Ernst and Young, Deloitte, and KPMG) are ahead of large international, national and smaller firms in their use and acceptance of computer-related audit procedures. This disparity is mainly a result of the disparity in human and financial capital. The Big 4 have an incredibly large advantage in the amount of money they can spend on investments. Because of this, they are only limited in their own reluctance to adopt technological advancements, while smaller firms face financial obstacles as well (Janvrin et al., 2008, 18). The Big 4 have begun to spend money to advance their technologies, and are doing so at increasing rates. For example, KPMG just announced a new partnership with IBM to apply IBM's Watson cognitive computing technology to KPMG's professional services offerings. (KPMG) Other firms are making similar investments, and could be signaling change in the perceived technology laggard stereotype that auditors have been labeled.

The disparity between financial assets between large and small accounting firms in essence creates an economic barrier to entry for the smaller accounting firms (Janvrin et al., 2008, 2). They do not have the resources to pay for the most cutting-edge technology to keep up with their clients, and are in turn losing their clients to firms that can. The lack of technology diminishes the audit effectiveness and efficiency of these small firms. Big 4 firms have higher quality audits due to spending more money on IT

and IT specialists that smaller firms simply cannot afford (Janvrin, Bierstaker, and Lowe, 2008, 4).

Despite continuously lagging behind their clients' technological capabilities, accounting firms chose to, at least in the recent past, disregard the advantages that could come with overhauling their IT. The risks associated with increased technology, including increased pressure from clients, the need for new security measures, and the integration of global economies, combined with the threat of decreased profitability are more than enough to give accounting firms pause. Although many of the largest firms are starting to catch up, as evidenced by KPMG and other large firms investing in partnerships with cognitive computing technology companies, they still do so at rates far slower than their clients. The future of auditing is bright if accounting firms are able to maneuver in ways that allow them to utilize the most cutting-edge technology while maintaining their greatest assets and profitability.

## **V. Future Outlook**

The future of auditing is an exciting one, if firms can continue to build momentum on their recent adoption of advancing technology and technological processes. This section discusses both the specifics as well as the general direction that firms need to take in order to keep pace with their competition in this ever-evolving business environment.

Accounting firms are beginning to utilize the benefits offshoring their daily work tasks to international employees based outside of the United States. A large portion of an audit must be performed physically at the audit's client site, but there remains still a great deal of testing and procedures that do not need to be completed on site, or even necessarily by the direct engagement team. This work, including the detailing large accounts receivable details and testing the completeness of journal entries, can be monotonous and time-consuming (Bostwick and Byington, 1997, 88). Not only that, but the majority of the work exported involves a standardized methodology (Bostwick and Byington, 1997, 88). This means the processes can easily and efficiently be trained to workers. By delegating this work to offsite or offshore employees, it reduces costs on two fronts. Not only does it allow on-site auditors to focus on tasks that can only be completed on-site, therefore reducing the number of hours worked, but also the offshore employees' wages may be lower, sometimes due to national regulations, but more so because it is simply easier and less skilled work. The multiple benefits of this strategy are causing auditors to follow the business plans of customer support, manufacturing, and data entry companies by outsourcing the work overseas, most commonly to India, and focusing on higher-level tasks (Dee et al., 2012, 14).

By off-shoring various pieces of an audit, accounting firms are able to save money by reducing costs and allows them to free up their domestic employees to perform work for other clients, or put a greater emphasis on client relationships. There are times during an audit that the audit team is taking up space at the client site but not physically interacting with the client. During these times, the audit team is working to complete tasks for which they've already gathered information, but must go through the steps of actually testing. This work is an example of assignments that could be delegated to offshore employees not on the client site. This helps client relationships because the time spent at the client site is more heavily reliant on face-to-face interaction instead of consuming space.

The recruiting of new hires is another accounting landscape that will certainly change in the near future, if not already. Although hiring accountants (either college accounting majors or professionals with previous accounting experience) is important for a firm, this qualification could very easily become a second requirement. As larger percentages of everyday business tasks become more technology driven, firms must also adapt by hiring personnel with IT backgrounds (McCabe, 2015, 30). As clients move more towards completely integrated systems, auditors will need to have an increased understanding of these complex networks. Accounting, more specifically auditing, is quickly transitioning from a focus on reporting to a focus on analytics (McCabe, 2015, 30). Technical skills that are needed in the near future include “advanced Excel skills, data analytics expertise, advanced modeling techniques, the use of Standard Query Language, and knowledge of large enterprise resource planning systems” (McCabe, 2015, 30). It is the combination of these skills, as well as an accounting background and

good people skills, that make for the well-diversified candidate firms are and will be looking to hire.

The application of cloud-based storage systems is another recent technological innovation that will become much more common for accounting firms in the coming years. Currently, an extremely large number of files are still physically stored in an accounting firm's office or on the firm's office servers. Keeping the server in the firm's office significantly increase the office's electricity bill, takes up physical space that could be used for offices or would not necessarily need to be rented, and demands employees dedicated solely to its upkeep and well-being. The trend going forward will be to move towards relying on storing these files in the "cloud." This term essentially refers to an off-site server managed by a third-party, effectively a contractor. The accounting firm can store their information in the cloud by sending it, through a secure Internet network, to the third-party to be stored on its servers (Tech News, 2014, 40). A number of accounting applications will also be run from the cloud. By implementing cloud storage, the accounting firm saves money by not having to invest in its own advanced servers, and allocates this process to a company whose only focus is to store information, which is an afterthought of an accounting firm focusing on their auditing processes. The use of cloud storage also increases the security of the data. One analyst writes about the increased security threat, arguing that firms and clients are "more at risk than ever for a data breach," which is caused by "the reluctance of some to upgrade to newer, comparatively secure systems" (Tech News, 2014, 40). The increased security of the data lies in the fact that it is physically located with neither the client nor the firm, and sometimes neither party actually knows the physical location of the server (Tech News, 2014, 40). This

makes it nearly impossible for a third-party to access the information. The cost and security benefits will prove to be more than enough reason for accounting firms to outsource their data storage to an outside contractor.

The necessity for 24/7 auditing protocol is going to become essential if firms intend to compete for scarce resources and succeed in the current and evolving real-time global economy (Vasarhelyi and Romero, 2014, 356). The landscape of competition between accounting firms is already fierce, with these firms offering basically the same service, but relying on lower prices and better client relationships to win business. However, as technology is implemented more in audits, competition will turn to who can offer the better service. And the best service will soon be continuous monitoring of all transactions, error reporting, and immediate responses (Byrnes et al., 2012, 4). The evolution of a real-time economy requires real-time monitoring and analysis of business processes. This will reduce the time needed to identify and mitigate risks. The will also allow external auditors' to rely more heavily on internal auditors because the data will be based on automation and continuous monitoring (Byrnes et al., 2012, 4).

Some of the most significant adjustments that will have to be made for audits to continue to be successful include changes in the timing and frequency of the audit, increased education in technology and analytic methods, adoption of full population examination instead of sampling. 24/7 monitoring and auditing protocols, a new breed of technologically experienced hires, and the increased reliance on outsourcing work will all allow accounting firms to shorten the technology gap that continues to separate auditors and their clients.

## **Conclusion**

Despite a somewhat deserved reputation of being “technology laggards,” accounting firms have begun to make significant progress towards gaining ground on their technologically savvy clients. The auditing of the financial statements of a technologically up-to-date client by auditors with lesser technology at their disposal presents many obstacles and constraints. However, the implementation of recent technology advancements will allow auditors to perform audits with greater accuracy, more efficiency, and fewer costs. The widespread evolution and adoption of big data and analytics by auditors will be the most significant and influential change that will come to the profession in the near future, and possesses the capability to completely transform the audit. Auditors must overcome their reluctance to invest in these advanced accounting and information systems. The financial costs and necessity to reevaluate evolved risks such as security are nothing in comparison to the improved efficiency and effectiveness with which auditors will be able to work. The introduction of 24/7 continuous monitoring and real-time audits will be the next technology pursuit of accounting firms looking to remain competitive, and will soon become a necessity for audit teams. The prevalence of advancing technologies in auditing is increasing slowly but significantly, and will certainly continue in the coming years.



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