

## **DAWN OR DOOM: TECHNOLOGY, TECHNOLOGIST, AND THE FUTURE OF THE ACCOUNTING PROFESSION**

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### **ABSTRACT**

This research looks at the possibility of technology replacing accountants and the possibility technologists will replace accountants. The current era of accounting is dominated by mobile devices, big data, cloud technologies, and improved accounting systems. The problem is accounting firms have been slow to fully use these new technologies. To stay competitive, firms need to employ these technologies. Researchers interviewed high profile accounting technology leaders from professional organizations in the accounting industry including managers, partners at accounting firms, and data scientists. Researchers used white papers, peer-reviewed materials, and personal interviews to collect data. The findings provide an overwhelming realization that technology can aid accounting. Researcher's found technologists cannot replace the profession's most valued skills.

**Keywords:** technology, technologists, accounting, profession, strategy

### **INTRODUCTION**

The development and use of new technologies has created, destroyed, and changed countless industries. Using business analysis grew with increasing Excel capabilities, and because of outlier increases in the data, new techniques and programs arose to once again fill voids in demand. Like all others, the accounting profession is not immune to changes brought by developing better, more automated systems. Similarly, the skills and knowledge needed by modern accountants are changing while companies employ these new technologies (Johnson & Steed, 2018; Stanciu & Gheorghe, 2017). Now more than ever, accountants, both budding and veteran, must remain aware of the technological changes to preserve their relevance, efficiency, and competitiveness in the industry (Pacurari & Nechita, 2013).

The accounting software is the most widely recognizable technologies in the accounting profession. This software can come in multiple forms of varying complexity. On the less complex end of the spectrum, accounting software can automate the processes of bookkeeping. Software use aids recording financial transactions, performing arithmetic operations, and producing reports (Tóth, 2012). Larger firms incorporate comprehensive Enterprise Resource Planning (ERP) systems into operations (Momoh, et al., 2010). Sternad, Gradisar, and Bobek

(2011) defines a “integrated, all-encompassing, complex mega packages designed to support key functional areas of organizations.” Thus, ERP systems support the countless functions of businesses in many different industries. Further, within these broad systems are "Accounting Information Systems," sub-systems used to aid the accounting processes (Tóth, 2012).

Another advance in business follows processes performed via the Cloud. Cloud computing is a method of running programs, storing information, and performing tasks on a computer without needing to use local memory such as a hard drive, flash or install programs on a computer (Prantosh, et al., 2013). As a result, procedures are performed over the Internet. This allows companies to store information and maintain and upgrade systems through an outside firm. This is important for smaller firms, which historically do not have the capacity to afford a large capital investment in technologies. Firms can now use superior technologies to achieve enhanced efficiencies, improved security, and cost savings without the need for excessive investment (Cleary & Quinn, 2016). Cloud computing can serve many processes in financial management and accounting. Cleary and Quinn (2016), found small and medium-sized enterprises (SMEs) increase performance through cloud computing. Therefore, agreeing with common belief, their research suggests the proper use of cloud technology has an overall benefit for SMEs. According to research by Drew (2015), CPA firms have been slow to use cloud technologies in their practice.

Third, using mobile devices has been steadily becoming more prevalent in the accounting profession. Mobile accounting applications allow employees to input information and produce reports from their device (Tribunella & Tribunella, 2016). Other mobile applications have more specific tasks. For example, Deloitte uses a mobile application called Icount to collect and consolidate inventory count results (Raphae, 2017). According to research by Stanciu and Gheorghe (2017), using mobile devices in the accounting profession offers a series of benefits including portability, connectivity, and flexibility. However, these devices also come with certain disadvantages. The downsides include security and unauthorized or unproductive use of devices for personal activities. Despite the disadvantages, using mobile devices in the accounting profession continues to rise because of the possible benefits (Stanciu & Gheorghe, 2017).

Finally, big data is recognized as one technological idea changing the accounting profession. In a basic sense, "big data" refers to the collection, manipulation, and analysis of large datasets to reveal certain patterns, trends, or other useful information (Hajirahimova & Aliyeva, 2017). The increased capacities of computer systems have allowed for analyses of increasingly larger datasets. Because of the useful information produced from big data, analysis techniques have been adopted by many businesses in different industries. According to a review of the literature by Gepp, Linnenluecke, Terrence, and Smith (2018), firms in the auditing profession have been slow to employ big data analysis techniques. This is strange since the research continues to point out many opportunities for its use in financial distress modeling, financial fraud modeling, stock market prediction, and quantitative modeling (Gepp, Linnenluecke, Terrence, & Smith, 2018). Bloomberg is an example of this change. Bloomberg is a large financial firm specializing in financial data for stocks, bonds, currencies, fixed income securities, and Exchange-Traded Funds

(Bloomberg, 2019). It is natural to assume the firm has a large need for finance and accounting students. However, at the Industrial Roundtable college career fair hosted by Purdue University, researchers viewed that Bloomberg wants to recruit Information Technology majors instead. The campus recruiter's reaction was "we can teach an IT major finance, but we cannot teach finance and accounting majors programming."

From this, one can see business, in general, is undergoing a transition to a new technological era. Specifically, this era is governed by the implementation and use of mobile devices, big data, cloud technologies, and improved accounting systems. Although these advancements provide a multitude of potential benefits for accounting firms, research has shown these firms have been slow to embrace these new technologies. This is especially true for using big data and cloud (Drew, 2016; Gepp et al., 2018; Newquist, 2014). These firms will eventually need to employ these technologies to stay competitive in their field. This, however, brings about an important concern for many accountants. As technology continues to advance, automation becomes more prominent. As previously stated, accounting information systems and ERP systems have the capacity to automate many of the accounting processes, theoretically removing the need for accountants in some aspects (Tóth, 2012). This leaves many to wonder if technologists could replace accountants. Also, research has found the skills demanded by accounting employers are changing with technology advancements (Stanciu & Gheorghe, 2017). This leads theorists to wonder what new skills would be needed to remain competitive in the workforce. The following questions drive this research:

- *Do technologists have the potential to replace accountants? and*
- *Is the accounting profession positioned to withstand an ever-changing environment of new technology and the threats they pose?*

The balance of this work is organized into the following four sections. First, a literature review looking at prior literature that informs this study. The next section includes methodology, including both the research question and experiment design. The third section includes the research findings. Finally, the research ends with conclusions, including limitations, implications, and future research.

## **LITERATURE REVIEW**

To begin piecing together an answer to the research question, one must begin with an understanding of the technological environment surrounding the present-day accounting profession. As previously stated, four main technological advancements within this analysis: ERPs (containing accounting information systems), mobile technologies, cloud technologies, and big data techniques. A review of relevant literature finds each of these offer important benefits. For example, mobile device use offers portability, connectivity, and flexibility (Stanciu & Gheorghe, 2017). Prior research, however, has also shown that accounting firms have been slow to use cloud technologies and big data techniques (Drew, 2015; Gepp et al., 2018). Despite this,

these advancements were recognized as the future of the accounting profession (Drew, 2016; Newquist, 2014).

This brought up an important question regarding whether technology can replace accountants. It is important to see the possibilities for automation in the accounting profession. According to research by Galarza (2017), mundane tasks in the accounting profession, such as number crunching and process-driven auditing, are the most susceptible to automation. This research continues to state that Artificial Intelligence (AI), which follows Machine Learning, might eventually have the potential to automate more critical activities (Galarza, 2017). Despite this potential, the literature suggests there are skills technology cannot replace. For example, the auditing profession requires practitioners to render judgment on various subjects. Although technology may automate the supporting activities of the judgment process, it cannot replace rendering judgment (Lombardi, Bloch, & Vasarhelyi, 2014). In another study, Brands and Smith (2016) recognize automation is disrupting the traditional managerial accounting reports, but not the decision making typically done by humans. Their research continues to state the “human touch” cannot be replaced. Managerial accountants, unlike machines, bring about a dynamic familiarity to the context and history of the businesses they work for (Brands & Smith, 2016).

Previous literature consistently agrees that many processes can replace humans, a decision-making capacity is necessary in the accounting profession. This agrees with research by Boylan, Philipp, and Latini (2018), which concluded technology could replace many of the tedious, mundane activities related to accounting. This research also found it could not replace the higher-level decision making and contextual understanding unique to the human mind. Thus, the technology could not, in a sense, replace accountants (Boylan et al., 2018). New technology is leading to a change in the skills demanded by employers. Research by de Villiers (2010) shows the future of the accounting profession will need “soft skills.” These include non-accounting skills such as interpersonal skills and self-management. Also, professionals will need to uphold a growth mindset, constantly learning and developing themselves to keep up with the ever-changing profession (de Villiers, 2010). Stanciu and Bran (2015) note some specific generic skills, which include:

- *learning and thinking skills; the ability to be a reflective learner*
- *interpersonal skills*
- *creativity skills*
- *research and inquiry skills*
- *work habits (adapting to the workplace environment and work requirements)*
- *ethical leadership*
- *IT skills (because of the large use of information technology in all domains).*

Therefore, the literature suggests technology will lead to less of a need for technical and data entry accounting skills. In return, employers will want their employees to have more analytical and "soft skills," which will make them far more adaptable in the changing business atmosphere (DeloitteVoice, 2017).

The trend toward a drop in data entry skills allows the profession to focus on providing a high-level of service on more analytical skills. Also, "soft skills" are becoming more important. This could potentially suggest that although technology cannot replace accountants, perhaps technologists can. Immediately, a few factors that must be considered before analyzing this possibility. Certain tasks Information Technology (IT) professionals cannot do. For example, only a Certified Public Accountant (CPA) can perform the external audits required for public firms (AICPA, 2019). But, research by Coyne, Coyne, and Walker (2017) identifies accounting professionals' lack of IT knowledge. Thus, these firms usually need to hire IT professionals to perform even the most mundane technological tasks. IT professionals work side-by-side with accountants. However, the research continues to state if accountants do not learn the IT skills they need, IT professionals may begin to learn accounting skills and eventually replace accountants (Coyne, et al., 2017). This threat has also caused many accountants to strive to learn IT skills and earn certifications that will allow them to qualify as forensic accountants and IT auditors (Kearns, 2014). Therefore, it seems from the literature the threat of replacement from IT professionals is significant.

Finally, although it was concluded technology could not replace accountants, one must know about the threat of partial automation. In this situation, the technology could eliminate some roles which would otherwise be completed by humans. For other roles, however, technology would not have the capacity to offer a substitute for the "human touch," as explained in research by Brands and Smith (2016). As shown by Boylan et al. (2018), companies will often use technological options to obtain cost benefits. This is a result of a worthwhile cost-benefit in favor of software costs over long-term labor costs. Similarly, Schoenfeld, Segal, and Borgia (2017) explain in their research using machinery over accountants can have other, accuracy-related benefits. Thus, this situation becomes a balance of costs versus benefits. Here, the rational company will replace a human with a machine if benefits outweigh costs.

The main benefit of technology is cost savings. These can be both tangible and intangible. For example, they may include monetary costs, but they can also include concepts such as range of ability, flexibility, efficiency, and many other reasons. It is impossible to replace a partner's intellectual capacities with a machine. Replacing a bookkeeper is easier to achieve. In fact, one qualitative study showed cloud technology could eventually perform bookkeeping and accounting without the need for human interaction (Howell, 2015). This means companies can choose between technology and humans in certain situations. To make this decision, a company would have to consider the value and responsibility of their human capital (Davenport, 2016).

The typical framework for an accounting firm. At the low-end several "entry-level" accountants are hired at the "staff accountant" or "audit associate" level. As time progresses, successful employees will move up through an accounting organization via a normal progression: "senior accountant," then "manager," to "senior manager," then finally the "partner" level at the high-end. As this career progression continues, the number of professionals dwindles at each rung. The shrinkage is significant as only about 3-5% of "staff accountants" will achieve "partner"

status (Armitage, 1992; Wilson & Remer, 2009). This is because few professionals can survive both the demands of the firm and the ability to achieve professional certifications to become a partner. Thus, the overall structure of the firm represents a "pyramid" shape (Malancon, 2016).

This structure is the opposite of the Inverted Triangle of Responsibility in this format, as an accountant moves up in an accounting firm, the responsibility also increases. Young professionals entering the profession normally perform basic accounting and clerical roles. Conversely, partners have a significantly larger responsibility level, which includes dealing with clients and researching changes in laws, tax codes, and accounting principles. Only a CPA can issue an opinion regarding financial statement accuracy. Added tasks include administrative decisions (Nihill, 2018).

Educating accountants is another challenge. In general, instructors are still teaching accounting the same way they were thirty years ago. Several issues cause this. These include lack of resources, aging faculty, cost of "add on" materials to supplement textbooks, and lack of knowledge on business needs. An added concern is that schools do not see a need to modernize their curriculum (Schoenfeld, et al., 2017).

Overall, the literature shows changes brought about by technology are vast. Thus, accountants must remain aware of technological trends in the business realm and the trends affecting their profession. Otherwise, they may find themselves becoming obsolete, susceptible to replacement by IT professionals or the technology itself. Therefore, there exists great pertinence in analyzing the technological trends and interpreting this information to discover the substitutability threat to accountants.

## **METHODOLOGY**

This study stems from the need to explore and explain trends in data analytics and how they impact the accounting profession. Technology and the possibility of it causing radical industry change and job loss has always been a concern (Morris, 2017). Recent changes to the dynamics of the accounting profession have heightened this awareness. Also, data science has become a formidable competitor for decision making (Mickhail, 2017). This study takes the present form of the accounting firm and applies environmental influences to predict the firm of the future. Specifically, this research looks at the possibility of technologists replacing accountants. The research includes combining the top concerns of CEOs with a review of analytical skills. The research also looks at how accounting and data science professions are organized and positioned for the future.

### **Participants**

This was a qualitative analysis that interviewed high profile leaders in the accounting industry. First, the accounting professional representing the AICPA was Barry Melancon. Mr. Melancon serves as the AICPA's President. Additionally, researchers interviewed partners in accounting

firms and leaders in the data science industry. Researchers engaged participants multiple times during this study. When possible, these interview results were verified by second party sources such as “white papers” and peer-reviewed articles.

Researchers compiled all data from those interviewed and created many figures that were later confirmed for accuracy with the participant. This often included the participants writing the figure description and reviewing researcher work to ensure accuracy.

**Table 1**

*Survey Participants*

Firm	Participants	Firm Location
Deloitte	5	New York City, Denver (2), Austin, Portland
EY	5	San Diego, Seattle, Atlanta, Cleveland, Dallas
PwC	5	New York City, Indianapolis, Chicago, Philadelphia, Miami
KPMG	5	Stamford, Philadelphia, New York City, Minneapolis, Denver
Regional Firms	10	Fort Wayne, Philadelphia, Atlanta (2), St. Louis, Pittsburg, Houston, Columbus, Little Rock, Dallas
Total	30	

Table 1 list the firms and their location of the participants as well as the number of people participating. The total number of participants was 30. One can see there were 5 participants from each of the Big 4 firms while there were 10 participants form regional firms. Researchers purposely inquired from a larger population or regional firms to see if there would be a difference in the findings.

**Materials**

The analytical materials using in the study include various peer-reviewed, accounting industry, university, and data science materials. The AICPA provided many materials on the accounting profession and the anticipated future. Also, a survey on the top concerns of the world's CEOs was documented. Researchers also noted where data science degree programs reside in various universities. This was completed by reviewing several university websites. On completion of this information gathering, all materials were organized in a logical format to communicate findings and develop conclusions.

**Table 2**

*Survey Questions asked of Participants*

Question
What are technologies your firm is using?
What are technologies your firm is looking to use in the future?
Are there any IT services you need to outsource because of firm lack of knowledge?
What are the technologies you expect from new hires?
What technologies are you looking to hire trainers for?
Can you name technologies you consider vital for competition?

## FINDINGS

In the fast-paced environment of business, entrepreneurs continue to need analysis of information. Technology often has a slower pace in analysis due to programming needs and can be inferior to human wisdom. These are listed in Table 3:

**Table 3**

*List of Areas and Expertise where Human Wisdom is Superior to Technology*

Areas
Assurance that systems are programmed well and work as intended
When a business owner needs someone to communicate with them including interaction
When new information is needed on demand (that has not been previously programmed)
When data is complex and needs experienced interpretation
When business owners need to feel they have received value for money spent

Table 3 displays the area of expertise where human decision making and knowledge is superior to technology. Organizations can cut budgets by performing services such as bookkeeping and payroll independently or by using products freely available on the open market. While software may be cost-effective, risks still exist. One of these risks is input errors. Though daily transactions may be entered into the system correctly, the possibility of user error exists. This is a result of users being unable to grasp various underlying concepts and procedures of programming accounting software. Unskilled users may not know what correct data looks like (Schiff & Szendi, 2014). Common mistakes include having multiple income and expense accounts, repeat names in vendors and customers, and overstated balances in non-deposited funds. Any error in business information resulting from programming errors could be detrimental

to the business owners. The checks and balances provided by an external accounting firm can mitigate this challenge. It has been found “external accountant use is positively related to sales growth” (Barbera & Hasso, 2013). In this case, technology has started to replace the need for accountants but hasn't erased the need for them completely. Also, when business owners seek value, they often are looking at the soft skills the professional can provide.

The world’s CEOs also have concerns about several issues. CEOs will need to develop decision-making skills on various topics. Those topics can be seen in Table 4 below:

**Table 4**

*Top Concerns for the World’s CEOs Including Percent Saying the Item is an Issue*

Concern	Percent Responding
Over-regulation	79%
Geopolitical uncertainty	74%
Exchange rate volatility	73%
Availability of key skills	72%
Government response to fiscal deficit and debt burden	71%
Increasing tax burden	69%
Social instability	65%
Cyber threats	61%
Shift in consumer spending and behaviors	60%
Lack of trust in business	55%
Climate change and environmental damage	50%

Table 4 above shows the top concerns CEOs have for the future. These include the percentage of CEOs felt an issue was important. The table shows the largest concern is regulation and uncertainty and exchange rate volatility with rates of 79%, 74%, and 73% respectively. Each of these concerns would require significant data to be strategically analyzed. These decisions will need to be made by humans with the aid of technology rather than a technologist with the aid of analytical skills. Technology is not currently advanced enough to make these decisions given the possibility of errors; the negative consequences of those errors could be disastrous to an organization (Melancon, 2018).

**Do technologists have the potential to replace accountants?**

Accountants are now able to “step away from the drudge of data entry and exercise their advisory talents much more freely” (Baker, 2016). Efficiency benefits everyone. It means lower costs to customers but higher quality of work. Using software has some risks because of data being stored in the clouds. Security over data, reliability and performance issues, vendor lock,

data portability, and dependence/lack of control are just a couple of issues encountered when using cloud-based programs. To lower the chances of having problems, accountants "need to be sure they have the latest product versions and patches and they are being diligent in terms of password" (Drew, 2016).

Even though using cloud-based software has its risks, accountants should keep current to be competitive. Younger clients now expect high-tech relationships and value pricing from their accountants. Those clients are looking for advice, frequent communication, and collaboration, which is discouraged by hourly billing. Accounting professionals who can provide proactive business advice based on real-time client data will be desired (Newquist, 2015). Frequent communication is becoming a key factor in client retention, which is why value pricing is becoming more and more important. "The cloud is simply an enabler to help professionals meet and exceed the expectations of today's client" (Drew, 2015). Using software makes accountants more efficient, which gives them extra time to be of value to their clients.

Competence in cloud-based software allows accounting professionals to continue to improve their high-tech relationships with their customers. Accountants must also learn various technical skills, should they hope to compete with software packages. To be as technically proficient as desired by a client, professionals may have to branch outside the field of accounting to prevent potential obsolescence. The software desired by clients is cheaper than hiring a professional, but a professional with extensive knowledge of this software may have a competitive advantage over the traditional CPA.

There are various categories of technology needed in accounting. These include spreadsheets skills; technology and analytics skills; and research and data science skills. Some spreadsheet skills accountants need include "if statements," "Vlookup," "pivot tables," "advanced analytics in Excel," and creating "macros." These skills are commonly used by professionals in human resources, sales & marketing, finance, and accounting. Technology and analytics skills include SQL, VBA, data mining, Internet of Things (IoT), and the R programming language (Stodder, 2018). Professionals with these skillsets include technology consultants, business intelligence, business analytics, and marketing analytics. Research and data science skills include: matrix algebra, gradient descent, abstract math, Machine Learning, Artificial Intelligence, and linear optimization, to name a few. Professionals with these skills include applied research and internal data science centers of excellence use these skills (Hunter, 2018; Stodder, 2018).

### **Is the accounting profession positioned to withstand an ever-changing environment of new technology and the threats they pose?**

The accounting profession has many strategic tools at its disposal. First, is creating data science Centers of Excellence (COE). These are organizations dedicated to using data-driven information in innovative and unique ways. Often, this information is complementary to audit services and has a large revenue-producing ability because of client need for a competitive advantage. Table 5

shows a sample of various Data Science COEs and the organization they are affiliated with (Kobielus, 2012).

**Table 5**

*Business Community's Data Science Center of Excellence*

Organization	Data Science COE
McKinsey	New Ventures
Boston Consulting Group	Gamma
KPMG	Data Analytics Lighthouse
EY	PI Advanced Analytics
PwC	Data & Information Analytics
Deloitte	Advanced Analytics Enablement
ZS Associates	Advanced Data Science Group (ADS)
Saama	Various
Oliver Wyman	Oliver Wyman Labs

Table 5 shows several organizations and their Data Science COE offshoot. All four of the Big 4 accounting firms are represented. These include KPMG, EY, PwC, and Deloitte. Five other reputable organizations are represented. This includes McKinsey, Boston Consulting Group, ZS Associates, Saama, and Oliver Wyman. One of these organizations, Saama, is a leading pure-play data and analytics solutions and services company. Their COE, Various, was designed specifically to enable business units and IT groups to leverage big data and data science to build valuable action insights quickly and expertly. This collaboration makes it possible to deliver in a three-month time-frame results for business solutions. These solutions include churn analytics, patient engagement analytics, fraud analytics, service analytics, clinical operations analytics, and customer buying pattern analytics (Lombardi, et al., 2014). Skills are inverted in each profession, and the skills are much more technical in nature give data analysts a competitive advantage that accounting professionals do not have. Should this trend of divided skillsets continue, accountants may have a hard time staying relevant due to both software and the emerging field of data analytics (Cegielski & Jones-Farmer, 2016; Hunter, 2018).

Little consistency in the curriculum of IT degree programs among universities exists. Taking a quick look at the various degree programs and the typical departments administering those degrees finds there is many areas offering degrees related to business decision-making technologies. Table 7 shows various university programs.

**Table 6**

*List of Various Names Universities have used to Define Various Technology Areas*

Program	Typical Department
Informatics	Technology
Business Analytics	Business
Applied Sciences	Computers
Information Technology	Computers or Business
Information Systems	Computers or Business
Computer Science	Technology
Electrical and Computer Engineering	Engineering
Human-Computer Interaction	Psychology
Interactive Media	Communications

From Table 6, it can be seen the various programs and departments where technology degrees are issued. These programs range from Informatics to Interactive Media and are embraced by at least six different areas within universities. These areas include technology, business, computers, engineering, psychology, and communications. One difficulty with this discipline is the lack of focus in one area or advocacy group. In fact, no widely accepted certification such as the CPA licensure exists. The most recognizable certification is probably the Microsoft Certification offered by the Microsoft Corporation.

**Table 7**

*List of Red Flags for Analytics Programs*

Red Flags for Analytics Programs
The executive team lacks a clear vision for its advanced-analytics programs
No one has determined the value the first use cases can deliver in the first year
There's no analytics strategy beyond a few use cases
Analytics roles - present and future - are poorly defined
The organization lacks analytics translators
Analytics capabilities ineffective analytics organization structure
Analytics operations are isolated
Data-cleansing efforts are done in masse
Analytics platforms aren't built to purpose
Nobody knows the quantitative impact that analytics is providing
No one is hyper-focused on ethical, social, and regulatory implications of analytics initiatives

Table 7 identifies ten red flags of analytics programs. In general, the research found that analytics programs face barriers because they lack a vision. As a result, there is an inability to

define value and quantify impact. These issues are further diminished as analytics initiatives often lack a focus on ethical, social, and regulatory implications (Fleming, et al., 2018).

For any profession to withstand possible competition, it must be trustworthy and generate satisfaction (Groşanu & Răchişan, 2010). Table 8 below shows how the accounting profession, as defined by both CPAs and non-CPA accountants, fare compared to other professions.

**Table 8**

*Trust of Professionals in Various Business Decision-Making Positions*

Profession	Percent
Certified Public Accountants (CPA)	93%
Physicians	90%
Commercial Bankers	80%
Attorneys	72%
Business Executives	62%
Marketers	41%

From Table 8, one can see the comparison of professions based on trust. Certified Public Accountants were the highest rated group while Marketers were the lowest with a trust of 93% and 41% respectively. Though physicians have traditionally been the highest rated profession, the COVID-19 pandemic impacted their ratings with a lowered trust rating of 90%. Commercial Bankers, and Business Executives had trust levels of 80%, 72%, and 62% respectively (Daily Briefing, 2023). As can be seen, data analytics professionals were unable to be measured because of the lack of ability to define the profession.

Accountants also fared well on satisfaction. Both business decision-makers and investors responded with high marks on satisfaction. Table 10 below shows the results.

**Table 9**

*Overall Satisfaction with CPA Performance*

Type of Decision Maker and CPA	Satisfaction Percent
Business Decision Maker - Internal CPAs	93%
Business Decision Maker – External CPAs	90%
Investors – overall CPA profession	97%

Table 9 shows the overall satisfaction with the CPA profession. Both business decision-makers and investors had satisfaction levels at or above 90%. Investors had the highest marks at 97%

while external CPAs had the lowest scores among business decision makers with a 90% satisfaction level (AICPA, 2019).

**Table 10**

*Initiatives by the AICPA to Expand the Base*

Initiative	Style of Support
Center for Plain English Accounting	Education
Fair value measurement credentials	Education
Not-for-profit Support	Education
Lighting the Fire (strategies for future learning)	Firm Strategy
Firm in Motion (strategies for firm success)	Firm Strategy
Developing and maintaining a new workforce	Recruitment
Maximizing talent through inclusion	Recruitment
Advancing women	Recruitment

Table 10 shows eight initiatives the AICPA has carried out to strengthen the profession for the future. Three of these initiatives deal with educating users. These include using plain English accounting, credentials for fair value measurement, and support for not-for-profits. Two initiatives involve the AICPA's continued effort to evolve the competency of CPAs by leveraging technology to heighten learning experiences and encouraging firm success through the Firm in Motion program. This program recognizes four factors' firms need to be successful in the future. These reasons include the firm's business model, technology use, client relationship building, and staff development and culture. The last three initiatives involve enhancing the profession, being engaging, and welcoming diversity with a focus on young people, minorities, and women (AICPA Key Initiatives, 2017).

**Table 11**

*Professional Certificates Offered by the AICPA*

Certificates offered by the AICPA:
Personal Financial Planning
Forensic Accounting
Not-for-Profit Accounting
XBRL US GAAP
Cybersecurity
COSO Internal Controls
IFRS

Table 11 lists seven professional certificates available through the AICPA. Each of these certificates expands on the eight credentials by offering the ability for professionals to specialize in various areas of systems and analytics. These include personal financial planning, forensic accounting, not-for-profit accounting, the taxonomy of XBRL for US GAAP, cybersecurity, COSO framework, and International Financial Reporting Standards (AICPA Specialty Credentials, 2018).

## CONCLUSIONS

The research goal was to see if technologists could replace accountants. The motivation was to examine if accountants are still relevant and vital to an organization or if technologists could fill their role. Skills of technologists have advanced and become commonplace in organizations and professional firms. Today, data scientists lack a professional advocate, a storied history, and an assertive focus on preparing the profession for the future.

Researchers were guided by a major and subsidiary question:

- Do technologists have the potential to replace accountants?
- Is the accounting profession positioned to withstand an ever-changing environment of new technology and the threats they pose?

### **Do technologists have the potential to replace accountants?**

This research found that technologists will not replace accountants. However, the structure of a typical accounting firm is expected to change in the future. The new expected future structure of a typical accounting firm will include both outsourced and data analytics professionals at the lower end of the organizational chart. This means some entry level accountants will no longer be needed. These individuals will not progress up the organizational chart as they will perform routine functions such as data entry and clerical work. Typically, those functions are needed, but they offer little value to the firm when compared to accounting and data analytics. The data analytics area will enhance the firm with new, further analysis, and consulting will improve the organization with additional skill sets. As time progresses, because only a CPA can issue an accounting opinion, outsourcing and data analytics will be limited in their upward mobility. This leaves most upward mobility to the accounting professionals that will need to sign off on the work done by the lower levels.

Although CPA certifications are not necessarily restricted to career accountants, it is unlikely for an IT professional to receive one because of the high-level of accounting technical understanding required. So, an IT professional without certification cannot replace a CPA if the certification is required for the job. Despite this, accounting jobs that do not require certification are more susceptible to replacement and are more difficult to conclude.

When adding this firm structure and the Inverted Triangle of Responsibility one understands that even though outsourcing and data analytics may be done by non-accountants, the decisions at the top cannot be made by those at the lower levels of the accounting firm. One strong example of this is data analytics professionals will never provide an opinion on the financial statements unless they are CPAs. This fact limits, to some degree, their upward mobility (Nihill, 2018).

Technology professions are valuable contributors to the business community. Technologists provide a compliment to the accounting profession by adding value through data mining, data analysis, and performing complex functions where accountants are not normally skilled. Thus, technologists are increasingly important in accounting firms, and they are becoming heavily integrated into the lower levels of the accounting structure. However, they do not have the ability to completely replace the accountant side. The executive levels of an accounting firm must be predominately held by accountants.

### **Is the accounting profession positioned to withstand an ever-changing environment of new technology and the threats they pose?**

The accounting profession has a storied history. Not only is the AICPA a recognized brand, their keystone licensure, the CPA, is widely recognized and respected. This research found the accounting profession is indeed positioned to withstand the ever-changing environment of new technology and their related threats. This is a result of several factors.

First, the AICPA oversees a well-defined profession. The organization has many roles, including the issuance and administration of important licensures and compliance structures. Within the AICPA is the existence of a centralized profession that trains in policies, procedures, and skills needed by the industry. Traditionally, these dictate the design of information systems, GAAP, and professional ethics. From the history of the profession, these concepts have been continually built on and enhanced. Contrary to this, technologists do not have a centralized college degree. The systems used, such as Machine Learning, experience consistent upgrades, but new upgrades often overlay previous versions rather than building on them. Further, the profession lacks the standardized set of rules and ethical standards the accounting profession benefits from.

Second, accountants have an assertive focus on preparing the profession for the future. This is accomplished by expanding skills firms possess through acquiring data analytics firms and the profession adding certification and licensure programs. The profession is also recruiting young professionals and minorities to match the business climate.

Third, the accounting profession has a curriculum, developed by a centralized group, that is focused on developing professionals for the future. The AICPA provides Continuing Professional Education to continue developing and maintaining professionals in the field. Also, the aggressive actions of accounting firms in moving into the data science field provide a competitive positioning to the rise in data analytics firms. These acquisitions enhance the firm by expanding their capabilities beyond the audit practice. Alternatively, the data analytics

profession lacks the focus to expand the profession beyond the technology realm into other aspects of a business. The skillsets flip between data analysts and accountants. Accountants are more proficient in Excel-related skills such as Vlookup and If statements, and data analysts are more proficient in skills such as abstract math and linear optimization. However, they both struggle with processing large quantities of data, which refers to the dip in skills such as R programming language and data mining.

### **Implications for the Accounting Profession**

Information processing is increasing in importance in the future. In the future, there will be friction between those controlling technology and those with the professional competence. Today, accounting “owns” this function. But, for the skillset to remain in accounting the profession must “assume ownership” of data and remain competitive by providing superior outcomes. One implication of this study is understanding the weaknesses of technologists. Several issues exist when considering if technologists can replace accountants. These include being effective with data, the temporary nature of system releases, the inability to offer opinions on financials, and the lack of a centralized educational framework and a formalized oversight body. The research also shows the accounting profession of the past will be significantly different and simple compared to the firm of the future.

Organizations not “digitized” will be at a competitive disadvantage in the future. Accounting firms should seek to enhance their digital and technology positions. This should include encouraging existing employees to engage in technology and acquiring technological skills through acquisition. It also means companies should select new hires that embrace technology. This should include technological competency criteria as part of the hiring process.

### **Limitations**

This study has several limitations. First, there was minimal quantitative data comparing different accounting software. Second, there was a lack of data from accounting firms regarding how they use and work with new technological advancements. Third, the effect of performing Blockchain technology is unknown. Finally, there was no existing survey of business owners asking to see if they preferred to complete daily accounting tasks by software or with advice from professionals.

### **Future Research**

This study has many opportunities for future research and should proceed full steam ahead. One study could focus on the rate of change of technology and the impact of a business environment where consulting revenues outpace traditional accounting fees as major revenue. Thus, it could analyze whether this structure is upended by progressing technology. Another study can research whether data science firms start to buy accounting firms as inroads to future clients. Typically, the audits generated consulting revenue for accounting firms. This possible study could examine whether technology firms acquire accounting firms for the same reason.

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