Moving Beyond Excel: A Student's Perspective on Understanding Emerging
Technologies in the Accounting Field

by
Alexia Grogan

Under the Direction of
Dr. Sarah Garven

A thesis presented to the Honors College of Middle Tennessee State University in partial
fulfillment of the requirements for graduation from the University Honors College

Spring 2020

Moving Beyond Excel: A Student's Perspective on Understanding Emerging
Technologies in the Accounting Field

by
Alexia Grogan

Under the Direction of
Dr. Sarah Garven

APPROVED:

_____

Dr. Sarah Garven
Accounting

_____

Dr. Jeannie Harrington
Accounting

_____

Dr. Ennio Piano
Economics and Finance

Acknowledgments

First, I would like to thank the lovely Accounting Department professors for assisting me in my educational journey. I would also like to tremendously thank my thesis advisor, Dr. Sarah Garven, for assisting me which such a gregarious task and encouraging me to tackle this project head-on. I would also like to thank my Mom who encouraged me to work on this project early and helped with my other responsibilities so I could focus on my research. I would also like to thank my Senior Manager at Deloitte, Patrick Rice, for continually encouraging me throughout my academic career, being a mentor to me in my early professional life and offering endless assistance with this project with such enthusiasm.

Abstract

   The central focus and purpose of the research conducted for this project are to determine how technology is impacting the accounting field as a whole and to create an accounting technology guide or road map to assist current and future accounting students. The past, present, and future uses of technology in the accounting field will be examined to demonstrate the strides that have been achieved and those that may be achieved in the future. The specific concepts of blockchain, artificial intelligence, and data visualization will be examined on a deeper level to understand the overall effects that these developing concepts may have on the accounting field. Students will be able to use the findings of this research to gain an awareness of the current and emerging technologies that will impact their accounting careers, both now and in the future.

Table of Contents

List of Figures

I: Introduction

This project will examine the evolution of technology within the accounting field, starting with past technologies used, moving on to present concepts and technologies currently in use, and finally moving forward to what technological advancements are on the horizon. Additionally, three emerging areas of technology central to the accounting field will be examined in greater detail.

Current accounting students often do not know how to develop the most marketable version of themselves to present to accounting recruiters, firms, and companies, especially with respect to showcasing their knowledge of current and emerging technologies in the accounting field. The research conducted over the duration of this project is being performed with the intent of creating a useful resource for future accounting undergraduate students at Middle Tennessee State University and other institutions as well. Ultimately, the final goal of the project is to have a shortened version of this research submitted to and published in either the *CPA Journal* or the *Journal of Accountancy* as a resource for not only accounting students but also accounting practitioners needing a primer or refresher on the current state of technology in the accounting field.

The background of this project is based on the timeline of emerging technology in the field. Technologies are developing at an almost exponential rate, but in order to better understand where the accounting field is today and how it has evolved, one must first understand its history with technology. Beginning as early as 1966, the American Institute of Certified Public Accountants (AICPA) was examining the uses of technology and the implications it could have on the accounting field. It pulled together a collection

of articles published in the *Journal of Accountancy* regarding the uses and potential effects that modern computerization could have on both the field and its clients. The collection discusses topics such as simulation, speed, storage capacity, and programs. In the early stages of technology, many accountants feared that technology would result in the depletion of accounting staff. Above that fear, however, rose the possibilities of the power that technology could bring if the science was understood and even mastered (American Institute of Certified Public Accountants, Inc., 1966). Understanding where technology stood and what the accounting profession thought about it in the past is important for a better understanding of the present use of technology in today's profession.

Today, uses of technology have vastly increased and developments of technology are occurring at lightning speed. So much so, that it is difficult for an accountant to keep up in an everchanging world dominated by technology unless he or she makes an effort to stay involved and educated. Many popular technological concepts and applications are either new to the accounting field or are developing at extremely fast rates and morphing into new uses. Presently, many accounting firms and departments have moved beyond using basic spreadsheet programs like Microsoft Excel and are using more advanced applications and concepts such as SAP, Teammate, blockchain, Tableau, Idea, Sage 50, Python, Microsoft Power BI, and artificial intelligence (AI).

The future of technology and its implications in the accounting field can be hard to predict, but what is on the horizon in terms of technology must still be examined in order for practitioners and students to have a better understanding of where the profession is heading in the coming years and specifically how technology may impact their careers.

Developments in areas such as blockchain, AI, and data visualization are important factors in examining the possibilities of the future. The predictions for increased application of AI within the industry to assist with "evaluating financial and accounting records", along with blockchain creating the possibility for a "record that is self-auditing and immutable" hold promise of improvements in terms of time, effort, and difficulty levels in the world of accounting (Walsh, 2018). Accounting firms and companies need to budget their funds correctly and strategically in order to be able to afford the newest and most effective technologies for their employees. Additionally, working virtually is expected to increase as employees' capabilities grow with technology (Walsh, 2018).

In order to complete the research for this project, I first examined the past, present, and future uses of technology in the accounting field by reading articles from accounting practitioner journals. Examining the past leads to a better understanding of the rapid developments that have taken place in the accounting field and the increased role technology has played. I placed more focus, however, on the present, by demonstrating how the accounting profession is currently utilizing various technologies, and the future, by examining a fraction of the countless possibilities that technology could have on the profession. Next, I examined three quickly developing areas involving technology that are particularly relevant in today's accounting field. The first main area I focused on was blockchain as it is an area that is growing extremely fast but not many students are well educated on its uses and purposes. Blockchain is the concept of a system of records for "peer-to-peer" relations in which transactions can be completed without having to go through a third party, such as a bank or financial institution. In other words, it is the implementation of direct transactions between two parties (Panda, Dhameja, & Singhal,

2018). Blockchain is a complicated and growing concept, and a thorough understanding of it could be pivotal to an accounting student's success in his or her professional life.

Next, I examined artificial intelligence or AI. AI is the concept of computers and technology becoming more intelligent and useful, while simultaneously being able to operate more independently. It allows for technology to function in ways that humans previously had to do manually. Since AI has arrived and is an important aspect in terms of competitive advantage, accounting firms are developing a huge niche for the use of it (Ovaska-Few, 2017a). Potential developments these firms can capitalize on include "advanced technology that can…slash the amount of time accountants spend on complex audits and asset estimates" (Ovaska-Few, 2017a). Knowing how these developments will affect the accounting profession along with understanding the value of learning how to use these audit tools is vital to student success in the accounting profession. By researching AI and educating MTSU accounting students of this growing field in technology, it not only sets a baseline level of knowledge for students to go into interviews with but also demonstrates an educated and well-versed technological background.

Finally, I examined data visualization tools. Data visualization is the concept of presenting data in a way that humans can process and understand more easily. Interpreting raw data allows the results to derive value from the origin, giving the data a purpose in an otherwise almost meaningless pit of information (Microsoft, 2019). The use of simple data visualizations, such as charts and graphs, can help a person make a decision more easily based on the story the visual tells. As the world becomes more data-driven and oriented, the use of data visualization is becoming a central focus in the

business world. Presenting a color-coded, interactive, and trend-driven visual of the data will help users identify significant results (Microsoft, 2019). I examined two data visualization tools, Tableau and Microsoft Power BI, commonly used by large accounting firms and accounting departments.

A thorough examination of blockchain, AI, and data visualization will help determine what I feel students need to know about these concepts while in college in order to market themselves to potential employers. My research could also be kept and maintained at MTSU within the Accounting Department and used as a resource for future accounting majors. This would assist students with learning (1) what types of technology they need to become familiar with, and (2) what types of technology may be desirable to list on their resumes outside of the typical Microsoft Office functions that they are expected to know already (e.g., a student may have used Tableau at their previous internal auditing internship but not realize that it is important to include this software on his/her resume).

The research conducted is a representation of the viewpoints of the accounting field, rather than strictly data-based research. This is due to the practicality of the project itself, as accounting students should have some background knowledge of technology when going into an interview. By being aware of modern advancements in the field, students may gain a competitive advantage in the interview process. My expectation is that MTSU accounting students have heard of at least some of the programs and concepts that will be explored in this project but lack detailed knowledge about them or firsthand experience with using them. My hope is that by researching and learning about the uses and purposes of some of the aforementioned programs and concepts, I can help educate

students on how to speak intelligently about them on a basic level in order to be more

marketable to potential employers. Thus, the goal of this project is to create an

accounting technology guide to assist current and future accounting students.

II: Past Technologies

In order for accounting students and practitioners to understand where technology is today and the possibilities it holds for the accounting profession in the future, they must first understand the history behind the use of technology in the industry, including the introduction of new technologies many years ago for the first time. As previously mentioned, the American Institute of Certified Public Accountants (AICPA) is documented as reviewing the possible implications and impacts that recently introduced technology at the time could begin to have on the accounting industry as early as 1966.

The collection of articles from the *Journal of Accountancy* that was published that year touched on many critical topics related to the beneficial effects that modern computerization could have on not only the accounting field but also on the firms' clients. The collection addresses a multitude of topics, such as simulation, speed, storage capacity, and programs. It also addresses the developing fears of many accountants who were unsure of how technology would affect their career paths. Practitioners were fearful that with the new possibilities that technology posed, it would diminish the need for professionals to perform the services they had previously been offering to clients. The possibilities that could arise if technology was leveraged to improve the profession, however, gave accountants hope for a stronger and technology-based future (American Institute of Certified Public Accountants, Inc., 1966). In the 1966 collection of articles published by the *Journal of Accountancy* about the effects that technology was beginning to have on the profession, the concerns of practitioners about technology taking over the industry and diminishing the need for human involvement in accounting and auditing was very apparent. Edwin T. Boyle, CPA, made this abundantly clear when he pointed out his

fear that "if we don't master the computer, it could destroy us", referring to the accounting profession as a whole (American Institute of Certified Public Accountants, Inc., 1966, p. 41). He continued on voicing his concerns that companies, once they realized how reliable and detailed the data was that their own computers were capable of producing, may no longer be interested in hiring firms to complete audit or general accounting work such as preparing financial statements that were fully backed up and included specifics such as aging details of various accounts (American Institute of Certified Public Accountants, Inc., 1966, p. 42). An abundance of previously manual tasks performed by accountants were at risk of becoming automated due to the development of computer functions, such as payroll, budgeting, inventory, purchasing choices, cash flow, estate services, and annual financial statements (American Institute of Certified Public Accountants, Inc., 1966, pp. 44-54).

Despite this fear of technology, Boyle pointed out to his colleagues that "unless we overcome the threat of the computer, we shall never have a chance to realize its opportunities" (American Institute of Certified Public Accountants, Inc., 1966, p. 41). This was a pivotal point in the industry's opinion of and desire to embrace emerging technologies.

By 1974, accountants were beginning to understand and embrace the possibilities that came with the implementation of technology into the profession. Practitioners knew that if they did not take advantage of technology and attain a deeper understanding of the effects that it could have, they would essentially jeopardize their own careers, rather than technology being to blame for the outsourcing of their responsibilities. The point was made that an "…accountant must have a more than superficial knowledge of data

processing and an awareness of its potential, limitations, and difficulties [should]

become[] a vital part of a good accountant's knowledge" (Clifton & Lucey, 1974, p. 2).

Additionally, accounting practitioners began to realize that if they were not willing and

actively working to "assimilate" the newly developing technology, they would inevitably

be forced to "relinquish their position[s]" (Clifton & Lucey, 1974, p. 2). The threat of

losing their careers if they did not comply with the implementation of technology was

enough to outweigh their resistance, so accountants began to give in to and accept

technology at this point.

 By 1995, all of the largest accounting firms at the time were implementing the use

of AI into most of their services, including audit, tax, and consulting (Vasarhelyi, 1995b,

p. 151). At this point in time, the profession was comfortable accepting the increased uses

of technology for services such as evaluations of a client's internal controls, analyzing

risk, accounting for accruals of taxes, compliance with financial statement disclosure

requirements, and many other services. The use of these technologies was noted to

"exceed…most individual auditors' capabilities" and therefore be beneficial to both the

firms and the clients by allowing the auditing profession to truly seize the opportunity of

leveraging the implementation of technology into the field (Vasarhelyi, 1995a, p. 215).

III: Current Technologies

The uses and developments in technology are growing at an almost exponential rate in today's world because accounting is becoming a tech-powered profession. Because of this rapid growth, it is extremely difficult for accountants to ensure they are current on present trends in technology unless they make a targeted effort to stay involved in the conversation of new developments. A wide array of current developments and applications in the accounting field are relatively new and are changing the way professionals perform their services. Because of this, many accounting firms are changing the way they approach technology. They are moving past just using simple and known technologies, such as Microsoft Excel, and onto more difficult and productive applications and programs. By implementing these new technologies, firms will continue to be able to optimize the services offered for their clients and remain competitive.

At this time, there are many new and developing technologies that an accountant would need to be familiar with in order to be aware of their current implications in the accounting field. Several topics, which will be discussed in further detail later, include blockchain, AI, and data visualization. Additionally, there are many other technologies that are widely used today with which accountants need to be familiar. The changes caused by technology advancements are going to continue to affect the way accountants "crunch the numbers, analyze data, deal with clients — and spend their time" (Meyer, 2020b).

To demonstrate the vast changes that have occurred between past and present accounting practices, the *Journal of Accountancy* asked several CPAs about technology changes they have seen in the profession over the years. Many of the participants noted

that presently almost everything is stored in electronic files. CPA Charlie Metzig

mentioned that in the past, when visiting clients, auditors had to physically carry large

binders full of all the audit files (Meyer, 2020b). This made finding specific data or files

difficult for auditors when speaking to their clients, whereas with current technology, an

auditor can quickly switch between files or documents on their laptop. Additionally, with

the speed of the internet, clients can now send digital files directly to their auditors.

Clients' recordkeeping abilities have also increased dramatically, due to the development

of real-time data and the ability to track the aging of accounts, along with other account

improvements, such as accounts payable due dates all being accounted for digitally.

     One CPA interviewed, Susan Landauer, recounted the beginning of her career as a

forensic auditor over thirty years ago. Back then, in order to see if the transactions listed

on her clients' books had in fact actually occurred with certain companies, she had to flip

through a physical phone book to find the companies' numbers and then call them. She

discussed how her forensic auditing procedures today involve using online services and

the internet to research the existence of proof for certain transactions (Meyer, 2020b).

     Presently, uses for blockchain, AI, and data visualization are continuing to expand

and affect the accounting profession. Another new technology that is beginning to have

huge effects on the industry is that of robotic process automation, also known as RPA.

RPA is a new technology that can "watch a human perform a multistage process and then

repeat that process…across multipole applications" (Drew & Tysiac, 2019). RPA has

recently become a reality that many large businesses are able to use in order to maximize

their productivity. Many lengthy and repetitive processes that were previously completed

manually by humans are now moving towards an automated process thanks to RPA.

Additionally, RPA also has the capability of performing tasks that require the use of multiple systems and, in turn, is able to incorporate functions from each of those systems in order to successfully perform process tasks (Drew & Tysiac, 2019).

Another growing area of technology currently impacting the industry is that of 5G technology. This technology realizes significant improvements in professionals' abilities to communicate with their clients. The most noteworthy effect this causes is that of "real-time data sharing" since the new networks have "virtually no lag time" (Drew & Tysiac, 2019). Another improvement that 5G brings to the table is the ability to handle "40 times" more overall processing capabilities than the 4G model (Amato, 2019). With this comes the ability for devices and technology to communicate among themselves, without ever needing human interaction to transmit data. A newer version of wireless networking capabilities, known as "Wi-Fi 6", is marketed as becoming available to the public later this year. This new Wi-Fi version will improve file sending and communication efforts between accountants and clients, as larger data amounts will be able to be transferred at a faster rate than currently available given the Wi-Fi version in use at this time (Drew & Tysiac, 2019).

Due to the continual disruption the industry is seeing as a result of the constant developments from new and improving technologies, the Certified Public Accountant (CPA) exam is also beginning to need changes now more often than it previously did. According to a study conducted by the AICPA Examinations team, "advances in technology, data analytics, and process automation have led to changes in the skills required of newly licensed CPAs"; this, then, is requiring the exam to be updated to

reflect that newly licensed CPAs are meeting the current criteria needed to be a

competent CPA in the industry today (Tysiac, 2019).

IV: The Future of Accounting Technologies

Although it is difficult to predict what effects new technological developments will have on the accounting field, the possibilities must still be examined so that both professionals and students have an awareness of where their careers may be heading in the future. In particular, professionals and students show be aware of how specific technologies may impact their job responsibilities. In order for accounting firms to be able to keep up with the newest technologies in the field as they develop, they must ensure they are budgeting appropriately to stay ahead of their competition. Technological developments, such as blockchain, AI, and data visualization, are major areas in the industry that can disrupt the way firms practice their client services. As developments continue to improve, the possibilities of the future are improving in terms of time, effort, and difficulty for practitioners (Walsh, 2018).

The future of the accounting industry could go in many different directions. Technologies such as RPA, blockchain, AI, and data visualization will continue to have great effects on the profession as each is used more frequently. The impact of technology on CPA certification is already becoming apparent, as a newly proposed "CPA licensure model", which was developed by the National Association of State Boards of Accountancy (NASBA) and the American Institute of Certified Public Accountants (AICPA) demonstrates (Tysiac, 2020). The new licensure model would require those sitting for the CPA exam to have a strong competency of not only "core skills," but would also additionally require them to "choose a discipline in which to demonstrate deeper knowledge and abilities" (Tysiac, 2020). The typical path options of either tax or audit would be present, but in addition, a third option of "information systems and

controls" would now be available in order for accountants to develop a deeper

understanding of the technological side of accounting (Tysiac, 2020).

One thing the accounting profession can almost certainly expect to see becoming

more popular in the future is the use of advanced data analytics. By increasing and

changing the way auditors apply analytical understandings of clients' data sets, the

approach of sampling a limited data set will continue to move towards using technology

to test all of the data available (Shannon, 2019). This is an extremely beneficial and

advantageous way to audit clients' data sets, as it will decrease the risk associated with

the failure of detecting a material misstatement or possibly even a fraud. Additionally, as

auditors begin to rely more on AI to complete the mundane and repetitive tasks that they

were having to do previously themselves, they will be able to conduct a deeper analysis

of the risk-prone areas in an audit.

Professionals can expect to see major changes in the future involving the

opportunity and ability to analyze risk-prone areas on a more in-depth level due to the

increased uses and applications of "cognitive technology," which is a form of technology

that imitates the functionality of the human brain (Shannon, 2019). Also, as blockchain

uses increase and therefore create an "immutable record of transactions," auditors may

have to approach their testing procedures from a different perspective due to the new

possibilities and opportunities the use of blockchain could create, in terms of creative

fraud and differential risks that previously did not exist prior to blockchain's existence

(Shannon, 2019).

One last development that is certain to change the way things operate in the

accounting industry is the amount of assurance that technology such as 5G may be able to

bring. With the instantaneous data sharing that 5G is capable of allowing and performing, transactions can be flagged to be examined as they are recorded, in the instance of irregularities, variances, abnormalities, inconsistencies, or high-risk factors, rather than flowing all the way through a company's reporting cycle and appearing in a financial statement balance. This allows for the data to be reviewed and either corrected or determined to be acceptable, prior to anyone auditing the financial statements or trusting the data (Amato, 2019). This will have a significant effect on the future of accounting and auditing practices.

V. Blockchain

In order to understand the uses and implications of blockchain, first one must have a basic understanding of what blockchain is. Blockchain is the concept of a system of records for "peer-to-peer" relations in which transactions can be completed absent of being required to go through a third party, for example, a bank or financial institution (Panda, Dhameja, & Singhal, 2018). In other words, it is "the implementation of direct transactions between two parties" (Panda, Dhameja, & Singhal, 2018). Because blockchain is a complex and newly developing concept, an in-depth understanding of its uses and implications could prove to be extremely useful to an accounting student transitioning into his or her professional life in the near future.

According to the Internal Revenue Service (IRS), blockchain is a form of virtual currency that is "a digital representation of value" (Internal Revenue Service, 2014). In many areas of the world, virtual currency functions much like physical currency. It has value, legal tender, and is sometimes even able to be converted into real cash. In the United States, however, it lacks the feature of having legal tender. Additionally, virtual currencies may serve multiple purposes, such as being used for payment purposes or being held onto as an investment (Internal Revenue Service, 2014). The IRS understands the increased uses and benefits of virtual currencies such as blockchain and treats income along with any gains or losses related to virtual currency as taxable. As seen in

Figure 1 below, Schedule 1 of Form 1040 (above Part I) specifically asks taxpayers "At any time during 2019, did you receive, sell, send, exchange, or otherwise acquire any financial interest in any virtual currency?"

Figure 1

SCHEDULE 1
(Form 1040 or 1040-SR)

Department of the Treasury
Internal Revenue Service

Additional Income and Adjustments to Income

▶ Attach to Form 1040 or 1040-SR.
▶ Go to *www.irs.gov/Form1040* for instructions and the latest information.

OMB No. 1545-0074

2019

Attachment
Sequence No. 01

Name(s) shown on Form 1040 or 1040-SR

Your social security number

At any time during 2019, did you receive, sell, send, exchange, or otherwise acquire any financial interest in any virtual currency? . . . . ☐ Yes ☐ No

Part I   Additional Income

1	Taxable refunds, credits, or offsets of state and local income taxes	1
2a	Alimony received	2a
b	Date of original divorce or separation agreement (see instructions) ▶	
3	Business income or (loss). Attach Schedule C	3
4	Other gains or (losses). Attach Form 4797	4
5	Rental real estate, royalties, partnerships, S corporations, trusts, etc. Attach Schedule E	5
6	Farm income or (loss). Attach Schedule F	6
7	Unemployment compensation	7
8	Other income. List type and amount ▶	
		8
9	Combine lines 1 through 8. Enter here and on Form 1040 or 1040-SR, line 7a	9

Part II   Adjustments to Income

10	Educator expenses	10
11	Certain business expenses of reservists, performing artists, and fee-basis government officials. Attach Form 2106	11
12	Health savings account deduction. Attach Form 8889	12
13	Moving expenses for members of the Armed Forces. Attach Form 3903	13
14	Deductible part of self-employment tax. Attach Schedule SE	14
15	Self-employed SEP, SIMPLE, and qualified plans	15
16	Self-employed health insurance deduction	16
17	Penalty on early withdrawal of savings	17
18a	Alimony paid	18a
b	Recipient's SSN . . . . ▶	
c	Date of original divorce or separation agreement (see instructions) ▶	
19	IRA deduction	19
20	Student loan interest deduction	20
21	Tuition and fees. Attach Form 8917	21
22	Add lines 10 through 21. These are your **adjustments to income.** Enter here and on Form 1040 or 1040-SR, line 8a	22

For Paperwork Reduction Act Notice, see your tax return instructions.   Cat. No. 71479F   Schedule 1 (Form 1040 or 1040-SR) 2019

Source: (Internal Revenue Service, 2020).

Specific tax treatment of the virtual currency depends on many factors. If the virtual currency is received as a payment, the fair market value of the virtual currency must be included in a taxpayer's ordinary income on Form 1040. The fair value can be determined by comparing the current market values on an exchange or market in order to arrive at the fair value in U.S. dollars. If the virtual currency was sold, any gain or loss calculated as the difference between the adjusted basis and the proceeds received are reported as either a short-term or long-term capital gain or loss and taxed accordingly (Internal Revenue Service, 2019). Additionally, if virtual currency is exchanged for other

property, the previous owner must recognize a gain or loss based on the difference between the fair market value and its "adjusted basis". In addition to these general laws, there are many more specific laws for the treatment of particular situations involving virtual currencies, along with penalties the owners must abide by if they fail to comply with the guidelines provided for the treatment of virtual currencies (Internal Revenue Service, 2014).

The new implications that are coming with blockchain are creating an opportunity for the accounting profession to evolve alongside this new technology. According to the *Journal of Accountancy*, the increased uses of transactions involving virtual currencies and ownership of virtual currencies will "evolve" the world of audit as accountants know it. Accountants should immerse themselves in the new developments because firms must ensure they are in compliance with virtual currency tax laws for blockchain purposes (Drew, Asgeirsson, & Quaranta, 2020). Because blockchain is an area in which the accounting profession has been anticipating huge changes in the near future, there are many questions looming in the minds of CPAs such as "How does the profession go about accounting for blockchain?", "How should the valuation of virtual currency be determined for financial statements?", and "What are the tax laws on blockchain?" Each of these questions can be answered by researching new rulings from the IRS. Accountants should ensure they have regular amounts of time scheduled to research and keep up with these new developments.

Cory Ng, an assistant professor and undergraduate program coordinator for the Accounting Department at Temple University, explains blockchain as "a sophisticated accounting system that keeps track of digital or physical assets in a distributed ledger"; as

a result, there are many important developments and implications to consider (Meyer, 2020a). By implementing the use of blockchain processing in systems, users are essentially able to link together databases, which will then allow computers in a shared network to "view and confirm (or reject) transactions" (Meyer, 2020a). Once data is transmitted and stored in a block format, and then linked together through technology, it is "virtually impossible to alter" (Meyer, 2020a). Essentially, blockchain's purpose is to track and process transactions, and then store them after the technology has decided how to treat that block of data.

It is believed blockchain will become so vital to the profession in the future that it will eventually be the only process used to deal with transactions, which makes it comparable to other vital technologies today, such as the internet. This is because "blockchains have the ability to provide an immutable audit trail" (Meyer, 2020a). Additionally, blockchain has the potential to significantly reduce the amount of manual exertion required from humans on audits, as it can drastically reduce the amount of time spent on "verifications, confirmation, and analyses of specific accounts" (Smith, 2017). Because of the likelihood that blockchain will make all other recording technologies obsolete, students need to ensure they understand the basic operations and risks involved with blockchain technologies (Meyer, 2020a).

An understanding of the risks associated with using blockchain technology is important for professionals that audit clients that have implemented blockchain technology into their recording procedures and processes. The processes that companies typically use before switching to blockchain involve the use of "centralized servers" to store information, which creates an opportunity for transactions to be altered after they

have been recorded. This can cause a serious problem in the maintenance and reliability of transactions recorded on these servers (Meyer & Solanki, 2019). Because blockchain is a "distributed ledger", the transactions that occur are kept across several computers that are all related due to a common network connection. Each time there is new data entered, the entry is transmitted across all the connected computers rather than being communicated to a central server. After this, the transaction is verified using a "consensus protocol built into the program" (Meyer & Solanki, 2019). After consensus has been reached, the final version is subsequently then updated and stored across the connected computers and protected from any changes with a "cryptographic signature called a 'hash'". At this point, changes cannot be made to the entry (Meyer & Solanki, 2019).

Due to the newness of blockchain and the uncertainty that comes with its implementation, its use will create difficulties for accountants. Ensuring the completeness for each blockchain is essential to the function of the technology. The only way to do this would be for accountants to "drill down into the code level to see if the coding is working properly", which will result in firms needing another skillset (Meyer & Solanki, 2019). The need for professionals who understand how this type of technology works will be essential for ensuring that blockchains are functioning properly.

VI: Artificial Intelligence

Artificial intelligence, or AI, is the increased functionality of technology by becoming more intelligent and useful, all while being able to operate without human interference (Ovaska-Few, 2017a). The use of AI allows for technology to complete tasks that humans have completed in the past. Because AI is increasing the competition between large firms, to remain relevant, firms are ensuring they are each developing a niche for its uses (Ovaska-Few, 2017a). By implementing the use of AI, firms will potentially be able to decrease the amount of time spent on difficult and in-depth audit procedures and estimates that are used to determine account balances (Ovaska-Few, 2017a). Being aware of how the developments in AI can affect the future of the accounting profession, along with knowing how AI will change the way audits are conducted, is extremely important for students emerging from their educational careers into their professional lives. Educating MTSU accounting students about the possibilities that AI holds for the future of the accounting profession potentially gives our students a competitive advantage when going through the interview process.

AI is capable of being utilized in many ways and in many areas. According to the *Journal of Accountancy*, "machine learning, deep learning, natural language processing, speech recognition,… image recognition, and robotics" are all areas in the accounting field in which AI is now able to be applied and used beneficially (Patrick & Williams, 2020). Additionally, the *Journal of Accountancy* explains that there are two subcategories in which AI can be further broken down: artificial general intelligence, also known as AGI, and narrow artificial intelligence, which is known as NAI. AGI applies to AI that can function and process thoughts on its own, much like a human brain does. It does not

require any sort of human interaction to function, nor does it rely on the use of "inputs" from sources exterior to itself (Patrick & Williams, 2020). Additionally, it is able to acclimate itself to and develop within its environment as both internal and external factors affect its processing functions. Currently, in the real world, AGI has yet to be created. As of right now, it is simply a concept in the world of AI. Although the world of technology has advanced significantly in recent years, experts who are involved in the research and timeline of AGI doubt that its true existence is anywhere in the relatively near future, saying the existence of true AGI could even be "decades away" (Patrick & Williams, 2020).

NAI, on the other hand, is the AI most people are familiar with, and it is all around us in the world today. NAI is the type of AI that is able to complete a particular task or group of tasks it is programmed to do. An NAI function is typically specialized in one of a few narrow areas, and can even "outperform humans" in regard to that particular area of technology and functionality (Patrick & Williams, 2020). NAI is the subcategory that encompasses all of the aforementioned areas of AI that could affect the accounting field, such as machine learning and image recognition.

A lot of the subareas within NAI involve algorithmic functions. Perhaps one of the most innovative subcategories that could strongly affect the accounting field is that of image recognition. For example, image recognition could have a beneficial effect for inventory counts during an audit of a company's inventory records, as the AI is able to recognize what each item is and subsequently categorize the item accordingly, possibly saving auditors hours of manually counting inventory in a warehouse. Thus, rather than

the auditors physically walking through a warehouse, AI technology is now capable of performing the inventory count itself using image recognition.

Another beneficial effect the accounting industry could see due to the increased use and implementation of AI is that of "robotic process automation" (RPA). RPA is able to perform repetitive processes that were formerly completed manually and repeatedly by accountants, which consumed numerous amounts of effort, work hours, and energy from the professionals assigned to those tasks. According to the *Journal of Accountancy*, implementing RPA can "streamline operations, increase efficiency, and improve quality" (Mezzio & Stein, 2019). As RPA seeps into practice, the process of "accessing and manipulating source financial data for analysis, reporting, compliance, and improving controls", which formerly involved tasks that were manually completed by CPAs for their clients, will see major changes (Mezzio & Stein, 2019). Letting a programmed bot perform these tasks, rather than humans, provides many benefits such as the decreased likelihood of possible manual errors, additional time availability, and more work completed. The regular use of RPA in the accounting industry will be a revolutionary change that will improve the operations and productivity of the profession significantly, as it has been noted so far to decrease performance times by up to 70% (Mezzio & Stein, 2019).

Another type of AI that is disrupting the accounting industry is that of machine learning. One way to describe machine learning is "machines will learn how to look at a dataset and predict likely business outcomes" which will improve "predictive analytics" (Drew, 2019). One important thing to note in relation to the implementation of machine

learning is that machines must be given time to perform these functions correctly before they can be relied on in the accounting profession.

Overall, it is vital for today's students to learn both in the classroom and independently some of the functions that AI can perform, as accounting is quickly moving towards becoming a more technology-based profession. By beginning their careers with an understanding of the implications that AI can have for their clients and the accounting profession, students will be better equipped to serve their clients and optimize their own productivity.

VII: Data Visualization Tools

Data visualization is the presentation of numerical data and information in an easily interpretable way so humans can see, understand, and process the data they are attempting to understand (Microsoft, 2019). It provides a more meaningful way for users of the data to interpret trends and key points. Raw data can be interpreted in a more useful way in order to give the data more value; otherwise, it would typically be meaningless to users attempting to interpret the meaning behind the data and numbers. Simple data visualizations, such as charts and graphs, can help users make a useful decision by reducing the amount of time and effort needed to determine the meaning behind the data. As the world becomes more driven and powered by data, the importance of data visualizations will continue to become vital to the way the business world operates. By being able to interact with a color, size, and trend-driven visual, users will be able to reach stronger conclusions and improve their decision-making abilities (Microsoft, 2019).

To be more competitive when on the job market, students need to become familiar with common data visualization tools, as these tools are frequently used by accounting firms and companies. According to Ovaska-Few, students entering the workforce with only an understanding of accounting are no longer as beneficial to the profession (Ovaska-Few, 2017b). Thus, accounting graduates who have proficient knowledge in data visualizations may be more heavily recruited than graduates who do not.

Since many accounting processes and segments are now moving towards a technology-based approach, becoming familiar with data visualization tools, such as Tableau and Microsoft Power BI, will enable professionals to improve the way they

present data to their clients and managers. Additionally, if students leave college with a basic understanding of the application of data visualization, they will be more likely to provide significant and relevant conclusions and analyses to their future clients.

Tableau, a popular data visualization tool, has a "Beginner's Guide" on its website for anyone interested in learning about its basic concepts and functionalities. The accounting profession works with huge amounts of data, but the numbers alone are not sufficient to communicate what the data actually means. This is where Tableau (as well as other data visualization tools), with its interactive graphics, becomes beneficial as it helps decision-makers understand the story the data is telling in order to make better-informed decisions. According to Tableau's website, "effective data visualization is a delicate balancing act between form and function," meaning that it is possible that a data visualization set can be too bland to mean anything to a user, but conversely, it is possible to overdo a data visualization to the point of overwhelming the user (Tableau, 2020).

Below is an example of Tableau. Using Tableau, one can manipulate data in order to view different results. The Tableau visualization in Figure 2 shows Tennessee college graduation rates (using a four-year basis for private schools and a five-year basis for public schools).
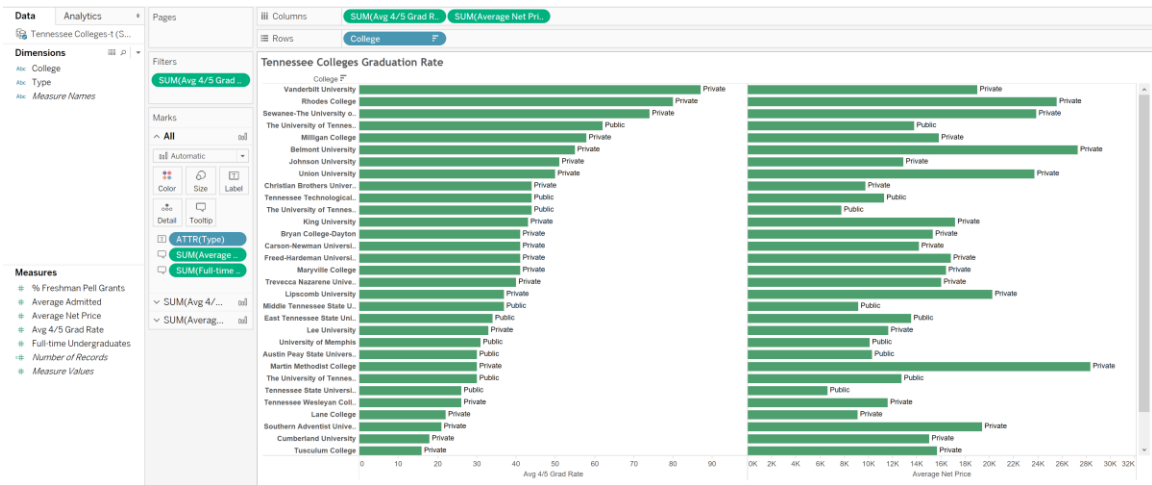
Figure 2
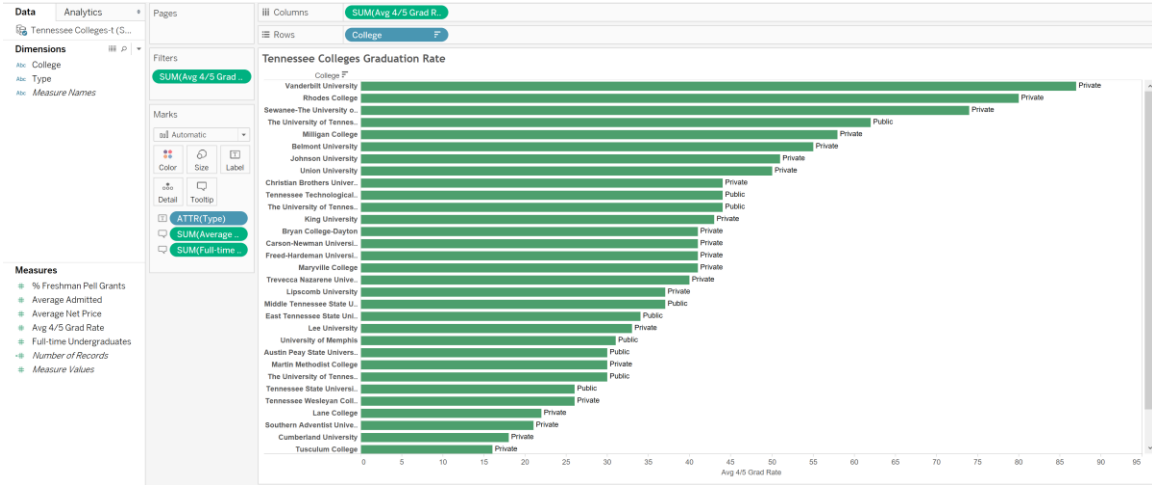
Source: (Kretzschmar, 2014).

Additionally, the underlying data set can easily be manipulated to show more information, such as the cost to attend each university in relation to the graduation rate. Figure 3 below demonstrates this.

Figure 3

Source: (Kretzschmar, 2014).

Another example of a powerful data visualization tool, Microsoft Power BI, is

shown below. The data set used in this data visualization is the enrollment of Middle

Tennessee State University students over time, ranging from the Fall 2010 semester to the

Fall 2019 Semester. As seen in Figure 4, users have the ability to select data viewing

options between the classification of the student by hours, degree type, part-time versus

full-time, gender, above or below the age of 25, nationality, classification of in- or out-of-

state students, first-generation versus non-first-generation students, etc., all along the left

side of the data set. Figure 4 also demonstrates the difference and impact of data

presentation that selecting just "Fall" (shown in top half) versus "All" (shown in bottom

half) for the "Semester" option can make.

Figure 4

Source: (Middle Tennessee State University, 2020).

Across the top of the visualization, users can select a specific semester,

classification of degree type, college within MTSU, department, major, and

concentration. To demonstrate how to manipulate data to view specific sets of data,

Figure 5 shows Fall semester enrollment data for undergraduate students classified as seniors in the Jones College of Business who are in the Accounting Department and majoring in Accounting. As seen by the trend of the data over time, enrollment of these specific types of student classifications has decreased since the Fall 2010 semester, which is information that may be useful for various stakeholders and can serve in helping these stakeholders make decisions.

Figure 5

Source: (Middle Tennessee State University, 2020).

VIII: Conclusion

Changes and developments in technology areas, including blockchain, AI, and data visualization, will not only change the responsibilities of accountants and the way accountants perform their work, but will also affect what employers expect from accountants in terms of performance and capabilities. Therefore, it is apparent that for accounting students to successfully market themselves to potential employers, they need to begin taking steps now to differentiate themselves from their peers in terms of technological skills. One way accounting students can do this is by selecting a technology-focused minor or taking classes that cover such topics as data analytics, AI, a risk-based approach to analysis, and blockchain and virtual currency, or classes that emphasize just an overall understanding of new technologies and the implications that go with implementing each of them in the accounting industry (Shannon, 2019).

Another way for students to differentiate themselves from other students is to budget personal time to study various programs and technologies. Once the programs or technologies are mastered, continual learning is also important, as new or improved technologies and applications are constantly being developed and used in the accounting field. Lastly, students should be sure to add technologies or programs in which they are proficient to their resumes to catch potential future employers' attention (Meyer, 2019).

 The degree of importance and impact that emerging technologies such as blockchain, data visualization, and AI will have is difficult to predict, but it is apparent that the effect will be beneficial to the accounting field. It is important for students to understand not only the past and present implications of technology on the industry, but also the future possibilities that these emerging technologies may bring. In addition, it is

vital that students learn the basics of these emerging technologies as they prepare for their

professional careers. My hope is this paper will serve to educate students about various

emerging technologies used in the accounting field, to enable them to become more

marketable to potential employers.

IX: Definitions

Artificial Intelligence – Computers and technology becoming more intelligent and useful, while simultaneously being able to operate more independently (Ovaska-Few, 2017a).

Blockchain – Transactions occur directly through two parties, therefore eliminating the use of a third party, such as a bank or financial institution. In other words, it is the implementation of direct transactions between two parties (Panda, Dhameja, & Singhal, 2018).

Data Visualization – Presenting data in a way that humans can process and understand more easily by displaying it in a simpler way (Microsoft, 2019).

Bibliography

Amato, N. (2019, November 9). *The Tech Trends We'll See in 2020 and Beyond*.

    Retrieved from journalofaccountancy.com:

    https://www.journalofaccountancy.com/podcast/accounting-technology-trends-

    2020-and-beyond.html

American Institute of Certified Public Accountants, Inc. (1966). *Accounting & The*

    Computer. New York: The Journal of Accountancy and Management Services.

Clifton, H. D., & Lucey, T. (1974). *Accounting and Computer Systems.* New York:

    Petrocelli/Charter, div. of Mason/Charter Publishers, Inc.

Drew, J. (2019, July 1). *Why Patience is Important with AI*. Retrieved from

    journalofaccountancy.com:

    https://www.journalofaccountancy.com/issues/2019/jul/artificial-intelligence-

    technology-roundtable.html

Drew, J., & Tysiac, K. (2019, December 1). *What to Expect in 2020*. Retrieved from

    journalofaccountancy.com:

    https://www.journalofaccountancy.com/issues/2019/dec/cpa-accounting-issues-

    for-2020.html

Drew, J., Asgeirsson, E., & Quaranta, R. (2020, February 3). *Where Accounting Really*

    Stands With Blockchain. Retrieved February 8, 2020, from

    journalofaccountancy.com:

    https://www.journalofaccountancy.com/podcast/blockchain-accounting.html

Internal Revenue Service. (2014, April 14). *Internal Revenue Bulletin: 2014-16*.

    Retrieved from IRS.gov: https://www.irs.gov/irb/2014-16_IRB#NOT-2014-21

Internal Revenue Service. (2019, December 31). *Frequently Asked Questions on Virtual*

    Currency Transactions. Retrieved from IRS.gov:

    https://www.irs.gov/individuals/international-taxpayers/frequently-asked-

    questions-on-virtual-currency-transactions

Internal Revenue Service. (2020, February 8). *Schedule 1*. Retrieved from IRS.gov:

    https://www.irs.gov/pub/irs-pdf/f1040s1.pdf

Kretzschmar, M. (2014, September 11). *Tennessee Colleges Graduation Rate*. Retrieved

    from public.tableau.com:

    https://public.tableau.com/profile/diy.college.rankings#!/vizhome/TennesseeColle

    geGraduationRates/TennesseeCollegesGraduationRate

Meyer, C. (2019, September 10). *What Your Students Need To Know About Tech*. (C.

    Vien, Editor, & American Institute of Certified Public Accountants) Retrieved

    September 12, 2019, from Journal of Accountancy:

    https://www.journalofaccountancy.com/newsletters/extra-credit/technology-in-

    accounting-

    education.html?utm_source=mnl:extracredit&utm_medium=email&utm_campaig

    n=10Sep2019&SubscriberID=111014308&SendID=225403

Meyer, C. (2020a, February 11). *Get Started Teaching Blockchain*. Retrieved from

    journalofaccountancy.com:

https://www.journalofaccountancy.com/newsletters/extra-credit/teaching-

blockchain-accounting-education.html

Meyer, C. (2020b, January 27). *Interesting CPA Stories of How Tech Has Transformed*

Accounting. Retrieved from journalofaccountancy.com:

https://www.journalofaccountancy.com/newsletters/2020/jan/cpa-stories-tech-

transformed-accounting.html

Meyer, C., & Solanki, J. (2019, August 1). *What I've Learned Building a Blockchain*

Business. Retrieved from journalofaccountancy.com:

https://www.journalofaccountancy.com/issues/2019/aug/blockchain-services-

jagruti-solanki-cpa.html

Mezzio, S., & Stein, R. (2019, December 1). *Robotic Process Automation for Tax*.

Retrieved from journalofaccountancy.com:

https://www.journalofaccountancy.com/issues/2019/dec/robotic-process-

automation-for-tax.html

Microsoft. (2019). *Microsoft Power BI*. Retrieved September 22, 2019, from What is

Data Visualization? A Beginner's Guide: https://powerbi.microsoft.com/en-

us/data-visualization/

Middle Tennessee State University. (2020, February 11). *Enrollment Over Time*.

Retrieved from app.powerbi.com:

https://app.powerbi.com/view?r=eyJrIjoiODg2N2Y2MGUtM2U2Yi00YmJhLWI

4MzItMTlkMDZhZTBkNDNiIiwidCI6Ijc2MmViZjQwLTgwYjItNDBiYS04Nm

ZlLTZkZDQwOWFjYjQ5OSIsImMiOjN9

Ovaska-Few, S. (2017a, October 10). *How Artificial Intelligence is Changing*

Accounting. Retrieved September 22, 2019, from journalofaccountancy.com:

https://www.journalofaccountancy.com/newsletters/2017/oct/artificial-

intelligence-changing-accounting.html

Ovaska-Few, S. (2017b, December 12). *Prepare Accounting Students for Working with*

Data Analytics. Retrieved from journalofaccountancy.com:

https://www.journalofaccountancy.com/newsletters/extra-credit/prepare-students-

data-analytics.html

Panda, P. S., Dhameja, G., & Singhal, B. (2018). *Beginning Blockchain: A Beginner's*

Guide to Building Blockchain Solutions. Apress.

Patrick, B., & Williams, K. (2020, February 1). *What is Artificial Intelligence?* Retrieved

from journalofaccountancy.com:

https://www.journalofaccountancy.com/issues/2020/feb/what-is-artificial-

intelligence.html

Shannon, E. (2019, August 29). *Five Types of Courses to Help Students Land Their*

Dream Job. Retrieved September 16, 2019, from AccountingToday:

https://www.accountingtoday.com/opinion/five-types-of-courses-to-help-

university-students-land-their-dream-job

Smith, S. S. (2017, November 14). *Integrating Blockchain and Artificial Intelligence into*

the Accounting Curriculum. Retrieved from journalofaccountancy.com:

https://www.journalofaccountancy.com/newsletters/extra-credit/blockchain-

artificial-intelligence-accounting-curriculum.html

Tableau. (2020). *Data Visualization Beginner's Guide: A Definition, Examples, and Learning Resources*. Retrieved March 30, 2020, from Tableau: https://www.tableau.com/learn/articles/data-visualization

Tysiac, K. (2019, November 1). *CPA Exam Topics Undergoing Change for Digital Age*. Retrieved from journalofaccountancy.com: https://www.journalofaccountancy.com/issues/2019/nov/cpa-exam-topics-changing.html

Tysiac, K. (2020, February 1). *A Future-focused Path for CPA Licensure*. Retrieved from journalofaccountancy.com: https://www.journalofaccountancy.com/issues/2020/feb/new-cpa-licensure-model-201922573.html

Vasarhelyi, M. A. (1995a). *Artificial Intelligence in Accounting and Auditing: Knowledge Representation, Accounting Applications and the Future* (Vol. Volume 3). Princeton: Markus Wiener Publishers.

Vasarhelyi, M. A. (1995b). *Artificial Intelligence in Accounting and Auditing: Using Expert Systems* (Vol. Volume 2). Princeton: Markus Wiener Publishers.

Walsh, J. (2018, March 2). *Future Trends in Accounting Technology: Be Ready*. Retrieved September 22, 2019, from Right Networks: https://www.rightnetworks.com/blog/future-trends-accounting/