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The Impact of Blockchain Technology on Business, Financial Auditors, and Accounting Professionals

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Brandon Kuhn

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Student Name (print or type) ____ Brandon Kuhn

Faculty Supervisor (print or type) ____ Dr. Chih-Chen Lee

Faculty Approval Signature

Department of (print or type) ____ Accountancy

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ABSTRACT:

Background. Blockchain technology is a disruptive technological advancement allowing communication to extend beyond company enterprise resource systems with their stakeholders. Blockchain is currently the exchange platform of cryptocurrency transactions, and businesses are beginning to experiment with proof of concept designs for transactions.

Objective. The objective of this study is to determine the potential impact of blockchain implementation on businesses and auditors. The study concludes with how auditors and current students are preparing for this drastic transition to automated auditing and fully electronic communication with external business shareholders.

Method. Exploratory, qualitative research was performed to gain an understanding of blockchain technology and impacts of its integration. Accountancy journals and firm whitepapers were reviewed to form a base understanding of the technology. Three accounting professionals and two academic professionals were interviewed to gain an insight to the future uses and operating practices of blockchain.

Conclusion. Blockchain is predicted to engulf industries and revolutionize business transactions within the next five years. Accounting firms are beginning to experiment and train staff on the technology, and businesses are seeking ways of integrating blockchain into their existing business practices. There are no current global standards for the use of blockchain, which will allow for rapid software innovation and adaptability.
Table of Contents

INTRODUCTION ...................................................................................................................... 4
METHODOLOGY .................................................................................................................... 4
LITERATURE REVIEW ......................................................................................................... 6
BUSINESS IMPLEMENTATION ............................................................................................ 15
TRANSACTIONS .................................................................................................................. 21
AUDITS ............................................................................................................................... 29
CONTINUED TRAINING .................................................................................................... 42
FUTURE ACCOUNTANTS .................................................................................................... 45
CONCLUSION ..................................................................................................................... 50
REFERENCES ..................................................................................................................... 51
Introduction

Technological advancements are changing the dynamics of business. Blockchain technology is beginning to enter industries, allowing for secure and automated processes. Blockchain uses advanced encryption technology to perform transactions across general ledgers shared with both internal and external parties. The technology is integrated into the main ERP system of all stakeholders. The accounting profession must adapt to these changes, and the operational and financial report impacts must be determined. This report analyzes the potential impacts of blockchain technology integration into businesses.

Methodology

The goal of this research study is to determine how the accounting profession may be impacted by the implementation of blockchain technology into businesses transactions. An underlying assumption present thorough this examination is that this technology will be adopted by companies in future years. The study plans on gaining a timeline of when this implementation may occur and how businesses and auditors may be impacted.

To determine an area within accounting to concentrate the research study on, a comprehensive review of current accounting, blockchain, and cryptocurrency publications current business periodicals, articles, and firm white papers were examined. The Big Four Accounting Firms – Deloitte, PwC, EY, and KPMG – have detailed publications on blockchain technology. In addition, many accountancy journals have detailed how the technology works and benefits to the accounting profession should the technology become adopted.
The type of research used in this study is qualitative research through the examination of existing publications to form inquires directed towards current accounting professionals. A questionnaire was produced to guide the interviews and discussion with three accounting professionals, a partner and senior auditor from separate big four accounting firms and a director of internal audit from a multi-national company. The research was obtained in this way because blockchain technology is a recently new venture accounting firms and businesses are exploring, and the source of the education and implementation knowledge resides within large accounting firms. In addition to interviewing practicing accounting professionals, two academic professionals were interviewed from Northern Illinois University regarding how the College of Business will be modifying the programs and course offerings to better prepare students for the increased technological demands of the accounting profession.

The accounting firms were chosen from viewing current research initiatives published on the firm’s website. Since this is a relatively new technology, the larger accounting firms have departments dedicated to the research of blockchain. Using information available on the firm’s website, emails were sent to the firms to set up an interview with an expert in this field. During this interview, the questionnaire guided the discussion, which aided in the development of the following portions of this research paper. The academic professionals were chosen based on involvement in course development for Northern Illinois University accountancy students.

The study concludes by inquiring how collegiate accounting programs will be adapting their programs to ensure their future graduates are prepared for the technological advancements the industry may be seeking in future years. For convenience, a professor
for the Operations Management & Information Systems and department chair of Accountancy at Northern Illinois University were interviewed, and the contents of the research obtained were discussed to see how programs will be modified in the future years. This may be a limiting factor, as some universities may have already incorporated these technologies into their programs, and some universities may not have blockchain on their radar.

The research obtained was consolidated and organized into six sections: (1) literature review, (2) business implementation, (3) transactions, (4) audits, (5) continued training, and (6) future accountants. The analysis of the study is outlined in this order. These relevant areas were identified by viewing current research and publications, then were summarized by a main general business activity.

Literature Review

With today’s current technology capabilities, many data systems use the concept of a centralized database, including almost all currently used accounting systems. A centralized database is a closed system database that has one sole administrator. 1 The information resides in one main server, even though the data is collected through multiple sources and locations. This allows the company to have high control over their data systems, including access points and high data governance. Companies have chosen to operate with centralized databases due to the added benefits of this information technology infrastructure. These benefits include: fast searches since the data is usually pinged at only one centralized location, decreased IT costs due to a relatively simple

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1 Jamie Smith, *There is more to Blockchain than moving money. It has the potential to transform out lives – here’s how* (WeForum) para. 6.
infrastructure, accurate information since the data governance controls can be stronger which allows for high data integrity, and shared data access across the company. ²

Since the inception of the cryptocurrency Bitcoin by Satoshi Nakamoto in 2009, ³ blockchain technology has become increasingly known. Cryptocurrencies are a form of digital currency that have no physical means of exchange and all transactions occur electronically. This idea has been around for many years in the form of electronic funds transfers between banks, credit card payments, and even dating back to writing physical checks for payment. ⁴ An issue that will be discussed in detail later in this paper, is the fact that cryptocurrencies are currently not regulated by the government. Although blockchain has caught the eyes of regulators, there is no oversight by any accounting regulations in the United States. The US Dollar, for example, is printed and regulated by the United States government and the government has full control over the currency circulation. With a cryptocurrency, computer algorithms control the transactions and digital circulation. The algorithms are verified by data miners who hold a copy of the general ledger containing all transactions on their computer, as well as the miner’s server should they have one configured. ⁵ This system of verification allows the cryptocurrency to be exchanged without regulation by banks, as the verification is performed by a third-party data miner prior to the cryptocurrency being released for payment. To aid in ensuring the integrity of this payment system via a blockchain network, miners receive a

² Stephen Jeske, *The Benefits of Streamlining Data Centralization* (Data Science Central) para. 3-8
³ Bitcoin, *Who Created Bitcoin* (Bitcoin) para. 2
⁴ Martin Tiller, *What Is A Cryptocurrency* (Nasdaq) para. 5
⁵ Tiller para. 7-8
commission for each transaction that is verified and when the miners close the transaction block every ten to fifteen minutes.  

The simple diagrams below illustrate a centralized and decentralized accounting system. Within a centralized system, there are many documents that are exchanged for each transaction between companies. These documents include purchase orders, invoices, and payment receipts. If an electronic funds transfer is initiated, the initiator’s bank will send the funds to the recipient’s bank. The recipient will then confirm the payment with the initiator. The decentralized system allows the transaction to take place on the blockchain network, and data miners will verify and process the transaction if all conditions are satisfactorily met.

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6 Todd Briggs, et. al, *Understanding Cybersecurity and Operational Risks of Cryptocurrency* (RSM) para. 6
Cryptocurrencies are beginning to slowly gain traction among the general population, but is still not thought of as a valid currency by a general consensus. The financial services industry is beginning to experiment with the currency, and this may be the first large industry to venture into cryptocurrencies. Sue VanSickle, Director of Internal Audit at a large multi-national company, stated her financial advisor does not discuss cryptocurrencies during the planning process. 7 Cryptocurrency is still in its infancy, and there are many unknowns. Similar to cryptocurrencies, when the internet was first designed, it was a world of unknowns, and today the world would not be able to function without it. Cryptocurrencies are in the same stage as the internet first was, and there may be little use for cryptocurrencies until the financial world grabs a hold of it.

One risk of cryptocurrencies is there is no physical asset backing up or providing the value, and this makes the currency inherently risky. When asked out what may be preventing cryptocurrencies from becoming a widely-used currency, VanSickle said it is probably due to the population demographic. A large portion of the population were children of the depression-era, and even with the great recession recently, people prefer to hold onto readily available cash since they have confidence it will be available to use should they need it. Wages today are not comfortably supporting the cost of living and individuals need to be sure their wages are not disappearing or significantly dropping in value over a relatively short period of time. 8 For cryptocurrencies to become widely accepted, it needs to gain the general public’s trust. The millennial generation may be the first generation to make this happen.

7 Sue VanSickle. (2018, April 6). Personal Interview
8 Sue VanSickle
Should cryptocurrencies gain the public’s trust, it will only be a matter of time before they are accepted as a form of payment in the business world. Since payments directly affect the financial statements, auditors are going to scrutinize the transactions involved in cryptocurrencies. Companies are thinking about cryptocurrencies on a very high-level, but have not progressed developed plans on accepting it as a form of payment. We may be years away from this from occurring, and internal audit departments cannot plan for its usage if companies are not close to adopting a non-regulated digital currency as a form of payment.

Straying away from the traditional centralized databases, accounting systems on blockchain are decentralized. Blockchain’s method of using a decentralized database architecture is having an independent third-party validate that the transaction is agreed upon by both parties and the services are completed before initiating the payment. This third-party verification can be performed by anyone with an internet connection throughout the world.  

Blockchain uses a distributed ledger where all parties on the blockchain network have access to view in real-time and transact on. After a transaction occurs, the data is sent to all other computers that contain the ledger and that are connected to the internet. This differs from a traditional centralized ledger because in a centralized ledger, there are only a select few individuals who record and monitor the transactions within the closed accounting system. Trust is put in the hands of the verifier to ensure the transactions are legit for both the sending and receiving parties and to perform the validation.

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9 Andreas Adriano, Hunter Monroe, *The Internet of Trust* (International Money Fund) para. 8
10 Ernst & Young, *Building blocks of the future* (Ernst & Young)
As with nearly all uses of technology, there are both many benefits and risks that are present. Outlined below are some of the perceived benefits and risks of blockchain technology implementation and uses:

**Potential Benefits:**
- Increased speed in transactions\(^{11}\)
- Real time auditing\(^{12}\)
- Reduced need for sampling\(^{13}\)
- Cost savings from increased efficiency\(^{14}\)
- Unchangeable records\(^{15}\)

**Potential Risks:**
- Vehicle for money laundering\(^{16}\)
- Vehicle for terrorist funding\(^{17}\)
- Vehicle for tax evasion\(^{18}\)
- Vehicle for fraud\(^{19}\)
- No current standardization or regulation\(^{20}\)
- Privacy issues\(^{21}\)
- Heavy power consumption\(^{22}\)

Blockchain is a relatively new technology, but the technology has potential for growth in many areas. These potential uses include:
- Financial transactions (accounts receivable and accounts payable)
- Smart contracts
- Supply chain tracking
- Automated audit processes
- Authentication of transactions
- Tracking ownership of assets

\(^{11}\) Fernando D. Nikitin, *Will Blockchain Disrupt the Lives of Governance and Assurance Processionals?* (ISACA) para. 5
\(^{12}\) A. Michael Smith, *Auditing blockchain: A new frontier* (PricewaterhouseCoopers) para. 3
\(^{13}\) Smith para. 5
\(^{14}\) Nick Martindale, *How blockchain will impact accountants and auditors* (Economia) para 17
\(^{15}\) Ernst & Young
\(^{16}\) Nikitin para. 5
\(^{17}\) Nikitin para. 5
\(^{18}\) Nikitin para. 5
\(^{19}\) Nikitin para. 5
\(^{20}\) Smith para. 6
\(^{21}\) Ernst & Young
\(^{22}\) Ernst & Young
When transactions are performed on blockchain, a hash file is created. This hash file contains critical information regarding the transaction, such as who the transaction is between, how much currency is exchanged, the conditions met, and the time of the transaction.\(^{23}\) This is an important basis of this technology, which will aid in the auditing function of both the blockchain network and the individual transactions since the transaction file hash can be compared to the information stored on the blockchain.

Blockchain obtained its name from the simple method it uses to ensure the integrity of the data. For every transaction that occurs, the hash file created is chronologically sorted within the block. When the time comes to complete the block, data miners solve an algorithm to seal the block and attach the completed block to the previous completed block. \(^{24}\) Figure 3 below illustrates the linking of the blocks to form the chain of transactions that have ever occurred on the blockchain network.

Figure 3

In theory, the blockchain is a secure means of exchanging data and is difficult to compromise. The idea behind this system not being hackable is since all computers contain a copy of the general ledger, every single computer that contains information relating to transactions on the blockchain would need to be compromised at the same time.

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\(^{23}\) Deloitte, *Blockchain Technology: A game-changer in accounting?* (Deloitte) page 3

\(^{24}\) Tim McCollum, *Bring on the Blockchain* (Internal Auditor) para. 4
exact time. If all ledgers are not changed at the same exact time, then the data on the blockchain will become unaligned which will show the time and evidence of a hack. Thus, a hack on the blockchain is nearly impossible due to the large magnitude of coordination and energy required to compromise all computers at once.

In Deloitte’s article, *Blockchain: A Game Changer for Audit Processes*, a simple illustration was outlined demonstrating the information flow of blockchain transactions:

> “With the help of the below infographic [on the following page], let us take an example where Peter in the United States wants to pay 10 bitcoins (BTC) to Jane in Australia. In order to accept this transaction, the nodes on the network (the miner) are required to authenticate Peter’s transaction (using cryptographic hash functions). In this process, miners will use their ledger (the blockchain) to determine whether he has the 10 BTC required for payment. The blockchain contains information about all the recorded transactions since genesis, the first transaction ever recorded. In order to derive Peter’s balance, the miners will go through every transaction in the ledger - add up the ones where Peter was a recipient and subtract the ones where Peter was a sender. Once all the validation processes are successful, the miners will add the verified transaction to blockchain and link it to the previous verified block (block 53).”

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25 Lou Carlozo, *Why CPAs need to get a grip on blockchain* (Journal of Accountancy)
Adopted from Blockchain: A Game Changer for Audit Processes by Deloitte

The example illustrates the architecture and processes built into the blockchain network. Both the sending and receiving parties are connected via blockchain. When Peter initiates a payment to Jane, the data miners on the network begin to validate the transaction. Since all parties on the blockchain network, including the miners, have access to the ledgers, the miners are able to confirm Peter’s account balance prior to sending a payment to Jane. This is an important step in the validation because if no funds are available from Peter’s account, then Jane will not receive any funds. When the transaction conditions are met, in this case available funds, then the miners perform the transfer of funds from Peter to Jane. Jane will then verify she has received the funds.

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Psalia Figure 1
During this process, additional miners are solving an algorithm to complete the transaction block, which contains all transactions and verifications over the past ten to fifteen minutes. This block of transaction will be linked to the previous block of transactions, adding to the string of blocks on the blockchain network.

**Business Implementation**

Blockchain can be designed to best suit the organization needs. There are four main categories of blockchain options companies can choose to adopt, each with its own benefits.

**Consortium**

A consortium blockchain is a type of permissioned blockchain that is controlled by a group. This group can be any group of entities, and most commonly will be a group of similar companies having a similar supply chain. With permissioned blockchains, the read and transact access can be limited to individuals invited into the blockchain or open to anyone wishing to view and/or transact on. According to SAP, the consortium blockchain “is best suited for use in business” applications.  

**Semi-Private**

The semi-private blockchain is similar to the consortium blockchain design. This blockchain design is in between permissioned and permissionless when comparing the amount of controls established. Criteria for entry into the network is established by one company, and as long as the criteria is satisfied, the user is allowed to view and transact.

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28 SAP, *Blockchain and Distributed Ledger Technology*.
on the network. According to SAP, this type of blockchain is “appealing for business-to-business use cases and government applications.”  

Private

A private blockchain is comparable to an internal centralized ERP system. It can be controlled and governed by an administrator that gives the permissions to the users. Users can be given either a read-only view or an edit view that allows them to transact on the blockchain. According to SAP, this type of blockchain is not practical in production environments. Since this is a centralized database, allowing external organizations to transact and view the ledger is not possible unless they are able to connect to the organization’s network remotely. This defeats the purpose of blockchain since many of the benefits gained from connecting externally are not able to be utilized.

Public

The public blockchain is the most well known blockchain since cryptocurrencies, such as bitcoin, use this type of blockchain for their peer-to-peer network. Anyone who has access to the internet and a server can operate on the blockchain and can read the transactions and transact themselves. There is no governing body involved with this type of blockchain, which leads it to a permissionless setting. Due to the architecture of this network, all users can remain anonymous in their transactions.

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29 SAP, *Blockchain and Distributed Ledger Technology.*
30 SAP, *Blockchain and Distributed Ledger Technology.*
31 SAP, *Blockchain and Distributed Ledger Technology.*
Businesses, especially large multi-national companies, are constantly undergoing operational improvements. In today’s technological world, software and technology advancements are substantially involved with the operational improvements. Management, internal auditors, and external auditors need to critically analyze the software to ensure there are no segregation of duties risks.

From an external auditor’s perspective, segregation of duties conflicts pose a huge risk. In a conversation with a Senior Auditor at a Big Four Accounting Firm, while analyzing the segregation of duty risks, it needs to be verified that only the appropriate users have access to modify any aspect of the company’s ERP system. Any conflicts discovered must be mitigated as soon as practical to ensure there is no unauthorized use of the system.

With any software implementation, a question external auditors must seek the answer to is how this new system plays into the overall financials. During a financial audit, the objective is to give an opinion as to how the financial statements are presented. There needs to be an understanding of all systems linking to the company’s main ERP system, and how financial data flows from data entry to the financial statement line that the data is presented in.

A company’s enterprise resource system is the brain of the organization. In order to obtain the benefits of using blockchain with business, it must be fully integrated into the ERP system. If it is not integrated into the ERP system, the technology will serve no purpose to the organization. One large company developing solutions for ERP systems is

32 Senior Auditor at Big Four Accounting Firm. (2018, April 3). Phone Interview.
33 Senior Auditor at Big Four Accounting Firm.
SAP. SAP’s 378,000+ customers rely on their ERP system for their day-to-day operations. Blockchain technology must be able to communicate and exchange information with the ERP system to gain the full benefit of using a blockchain network versus only the company’s own centralized database.

In an effort to continuously advance available technologies, SAP is developing SAP Leonardo Blockchain and SAP Cloud Platform. SAP Leonardo is integrating “future-facing technologies and capabilities into the SAP Cloud Platform” that allows for rapid innovations, scalability, and continuous improvement to aid in data driven decision making. The SAP Cloud Platform combines six key areas that are important to the operations of the business: big data, internet of things, analytics, data intelligence, blockchain, and machine learning. The benefit of integrating SAP Leonardo into an existing ERP system, is if the company already utilizes the SAP platform, the integration is not as extensive as implementing an entirely new ERP system. This extension is able to use the data already available in the existing SAP platform and the integration allows for continued data flow and analytics between external parties. The below diagram outlines the communication capabilities with existing SAP ERP systems and integrations with SAP Leonardo.


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34 SAP, SAP: The World’s Largest Provider of Enterprise Application Software.
35 SAP, Blockchain and Distributed Ledger Technology.
36 SAP, SAP Leonardo Digital Innovation System Capabilities & Success Stories.
Having a solid foundation and functional ERP system is the first step in a successful blockchain implementation. Blockchain cannot survive on its own. It is not a software package that acts as a ERP system. In order for it to function appropriately, it needs to be integrated into existing ERP systems that will use the internal data to communicate and interact both internally and externally using a multitude of different technologies. 37

In order for blockchain to be successful for the business, it needs to be integrated with all of the stakeholders of the transaction. This means that all the stakeholders need to collaborate via the blockchain to provide and exchange their information. 38 If there is no collaboration between stakeholders, then there are no benefits achieved from implementing and using blockchain, and blockchain would make no impact on the industries. The purpose of distributed ledgers is to “allow external consistency across organizations,” 39 so if data is not communicated externally to all pertinent parties, then data inconsistencies will still result. During the implementation phase, there needs to be an agreement outlined between all participating parties called the majority consensus. The majority consensus "defines the governance, performance and security protocols of the blockchain, replacing the role of a single designated central authority." 40

The timeline of implementation differs from traditional ERP system implementations. Depending on the complexity and scale, traditional ERP systems can take a few months to several years to fully integrate into the business. On the other hand, blockchain’s implementation timeline does not currently have a solid foundation for

37 Senior Manager at a Big Four Accounting Firm (2018, April 16). Phone Interview.
38 Senior Manager at a Big Four Accounting Firm (2018, April 16). Phone Interview.
39 ACCA 11
40 ACCA. Divided We Fall, Distributed We Stand (ACCA) 11
estimated timelines. Since the technology is relatively new, and many companies have not integrated the technology into their businesses to the point where the stakeholders are communicating via the blockchain, it is hard to estimate an industry average. Another difficulty is there are no industry standards or global standards, so if a company is interested in blockchain, they are adapting it to fit only their business needs. This can cause an issue when integrating with other stakeholders, as the architecture that was implemented may not work with others in future business practices, causing a redesign or modification of the system. The companies that are experimenting with blockchain a typically have a proof of concept design that take roughly 8-12 weeks to develop. As with traditional ERP system implementations, the timing and costs will vary widely due to the complexity and size of the implementation.  

Companies are beginning to become interested in and explore the capabilities of blockchain. Since the inception of bitcoin, the cryptocurrency’s public blockchain allowed users to start to build concepts and prototypes of their own uses for blockchain. Currently, the financial services sector is most interested in the technology, although still a relatively small percentage. According to PwC’s emerging technology survey, only a total of three percent of 2,216 surveyed business and IT executives are exploring this technology. This number is expected to rise to about eleven percent within the next three years.  

Until recently, blockchain could not be easily be integrated into existing enterprise resource systems. With continued advancements in technology, blockchain

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41 Senior Manager at a Big Four Accounting Firm (2018, April 16). Phone Interview.  
42 PricewaterhouseCoopers, *Briefing: Blockchain*. 
networks have increasingly become enterprise friendly, which will help increase the number of companies exploring this technology option.

Education on blockchain technology resides within large accounting and consulting firms. Companies are starting to initially self-educate themselves on the technology, and are reaching out to their auditors and consultants to gain a deeper understanding of how the technology may impact their business. Many companies have internal research and development departments within their information technology departments who are generating blockchain proof of concept designs. This technology is a very new concept when compared to existing technologies that connect businesses, and as a result, there will naturally be very high learning curve.  

In an interview with a Senior Manager at a Big Four Accounting Firm, the Senior Manager believes the industry will begin seeing a large increase in the number of businesses implementing blockchain over the next three to five years. The architecture blockchain uses is not going away. It will continuously be developed for many years. Blockchain has the potential of disrupting not only many industries, but the entire global economy. If suppliers and customers begin implementing this technology, businesses may be forced into adopting it in order to participate in commerce.

Transactions

Traditional accounting systems use the concept of double entry accounting. This method books all transaction amounts to two accounts, always keeping the sum of assets

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43 Senior Manager at a Big Four Accounting Firm (2018, April 16). Phone Interview.
44 Senior Manager at a Big Four Accounting Firm (2018, April 16). Phone Interview.
45 ACCA 32
and liabilities equal to the sum of all equity accounts. Double entry accounting allows for consistency and confidence of correct records within the organization. This method can miss entries booked to incorrect accounts, whether by error or fraud, since the accounting records may still be balanced between the assets, liabilities, and equity accounts. A benefit to using blockchain is the introduction of triple-entry accounting. This new method results from the use of distributed ledgers. The consistency and confidence of correct transactions is now extended beyond internal records, as external parties now have access to view transactions and can confirm the accuracy of the transactions. In addition to access extended beyond the internal systems, transactions on the blockchain are encrypted. This encryption allows for restrictions to be placed within the network and deter unauthorized use of the ledgers.

A current problem large multi-national firms face is data integration across multiple ERP systems. In an ideal business environment, the entire company would be using the same ERP system. However, there may be a delay in ERP implementation and standardization between all business units due to acquisitions and mergers, where the other company does not have their business activities on the same platform. Even if they were on the same platform, the data would still need to be migrated to the company’s main server. This is where a major benefit of blockchain comes into play. Blockchain acts as a “medium to store information across the systems and across the stakeholders.” The technology is a broker that is integrated between the ERP systems globally. In the case of intercompany transactions, the transaction can easily be entered into both the

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46 Senior Manager at a Big Four Accounting Firm (2018, April 16). Phone Interview.  
47 Senior Manager at a Big Four Accounting Firm (2018, April 16). Phone Interview.
sending and receiving party’s ERP system in one transaction through the use of the blockchain.

Companies do not need to be on the same systems to integrate blockchain. Since blockchain is integrated into their existing ERP system, limited additional technologies will need to be implemented. Currently, large well-known ERP systems, such as SAP and Oracle, are among the many software companies working on increased integration in their systems. As more companies begin to implement blockchain, some of the smaller ERP systems may begin to see integration benefits of blockchain, allowing their customers to use blockchain seamlessly.

Using the example of using SAP Leonardo, consolidation will relatively be no different than it currently is without blockchain integration. Blockchain acts as a means to transfer information, and this information, when coded correctly, ends up in the same place in the ledgers on the company’s ERP system. This is a benefit because since not all companies are using blockchain technology, some customers are able to utilize a blockchain between their supplier and customer, while others care able to continue to conduct business on their centralized accounting systems not on the blockchain.

Current databases, which are mostly centralized databases, have a high risk of data manipulation. The architecture of centralized databases typically allows users to read and write, of which are in the current and future times, but can allow access to manipulate historical data. One would hope internal and external auditors would be able to catch this occurring in the past, but it may be possible these transactions do not appear in the testing samples. With increased auditing technology integration, coupled with blockchain’s
permanent record, the architecture of blockchain allows it to deter fraud. This is due to using the concept of the immutable database.

Another issue with current databases are they do not communicate with other companies. This can cause an imbalance between the two company’s accounting records. While there is an underlying assumption that both company’s record the exact same transaction amount, error and fraud can easily occur. For example, company A sends company B a payment for $100. Company B can do one of three entries:

- Record payment of $100 from company A
- Record payment of more than $100 from company A
- Record payment of less than $100 from company A

Of course the correct way the payment should be recorded is to record $100, but company A will have no idea how company B recorded the transaction. If the transaction occurred on the blockchain, then company A can dispute any amount recorded other than $100 since they will have visibility in the other company’s system. This adds a second set of eyes on all transactions and gives the ability to flag or deny transactions.

One of the benefits of recording transactions on the blockchain is the payment record cannot be changed. This allows all parties involved in the transaction to have assurance of a correct transaction, at least from a dollar amount perspective. Even though amounts are confirmed, the other company does not have any control as to where the company books the amount to in their general ledger, and accountants need to be sure the transaction resides in the correct general ledger accounts.

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48 Senior Manager at a Big Four Accounting Firm (2018, April 16). Phone Interview.
Transactions within a blockchain are similar to those in an ERP system. Any transactions that occur are immediately distributed to the ledger after a transaction confirmation has occurred. This immediate update allows all parties operating on the blockchain can see the most recent version of the ledger. 49 A similar concept of centralized databases is still present, except this is a completely digitalized, cloud based ledger that can be extended beyond the company’s internal database and network.

Current centralized database systems typically do not communicate with other external database systems. To describe this system, let’s assume company A has contracted with company B to perform a service. As illustrated figure 4 below, the current payment cycle is long and complex. During each step of the process, both company A and company B are manually entering items into their respective ERP systems. On the other end of the spectrum, connecting through a blockchain system will significantly reduce the number of overall transactions since once a transaction is entered in for one company. The transaction will replicate to the other company via the distributed ledger and await approval from the other company. Once approval is made and all terms specified in the contract have been complete, then the blockchain system will initiate payment to the other party, as illustrated in figure 5 below.

A new area getting integrated within transactions is the concept of smart contracts. These contracts are built into the blockchain and attached to a transaction with an arranged agreement. Once the agreement is fulfilled, the transaction gets validated and is then posted to the ledger. 50 This area has potential growth in vendor payments. The contract of a purchase is tied to the financial transaction that involves money transfer, and

49 ACCA 8
50 ACCA 16
once the contract is fulfilled, such as when the goods are delivered or services performed, then the transaction is initiated and the funds are transferred to the appropriate party. This is illustrated in figure 5. Other areas this may be useful in are with the stock market and brokerages.

To illustrate the idea behind blockchain’s transaction cycle, below is a comparison of the current exchange of funds between two companies and the exchange of funds between two companies on a blockchain network.

**Current Payment Cycle (Figure 4)**
Humans are prone to error. Having one decentralized database that automatically communicates with other computers on the network will reduce entry errors, reduce reconciliation time between multiple databases, reduce time entering in the same data twice, and reduce the possibility of fraud.”

Reconciliations between systems are not going away any time soon, but this process can be automated and reduced by sharing databases and transaction blocks, such as those on a blockchain network. This allows for company resources to be allocated to more value-added items and removes inefficiencies in both companies that result from duplicated efforts.

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51 ACCA 9
One of the greatest features of the blockchain is once a transaction is recorded, it cannot be “removed for changed in any way.” This feature alone increases the reliability of a transaction and immediately begins a transaction audit trail. Some may argue a downside to this is if a transaction was incorrectly recorded, it cannot be amended. Although it cannot be later amended, another reversing entry can be made to correct the ledger. Items such as these may cause a red flag to auditors if transactions like these are occurring frequently within the same account.

As with any technological system, fraud can occur since every “design will have points of weakness which unscrupulous attackers could try to exploit.” The architecture discourages fraud since more than one party is viewing the transaction data. If another party does not agree with the transaction amount, in the case of a monetary transaction, then the transaction can be rejected. Accounts receivable is a high risk account where fraudulent transactions can take place to inflate a company’s assets on the balance sheet. This will be more difficult to do since an increase in a receivable on one company’s balance sheet would result in a payable on the other company’s balance sheet, and the other company will most likely not accept the transaction if the liability was not valid. Manipulating transactions in the past is also nearly impossible. The power necessary to overpower the system is extremely great. In order to modify blocks, all blocks on all computers and servers housing the blockchain must be modified at the same exact time. This alone is a great fraud deterrent since it is highly unlikely this computing power will occur.

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52 ACCA 13
53 ACCA 15
Transactions on a blockchain also allow for full supply chain tracking of goods and services. Individuals can trace exactly where the items originated and can authenticate the history of where the goods have been. An example of tracing goods can be with electronics. All components of a smart phone can be traced back to where the raw materials for all the smart phone components were produced. This would involve a comprehensive blockchain where all suppliers used would need to have access to. Companies can then share this data with consumers, as well as at ports of entry into a country, to validate where the goods are being shipped from. Another industry where this may be even more critical is in pharmaceuticals. The FDA can have complete assurance where the drugs were manufactured, who has access to the drugs, where they are located, and where they are distributed. It allows for full visibility of the drug’s supply chain history. This allows for “evident not just of shipping but also of freedom of tampering.”

Audits

The internal audit function is a critical aspect of a company’s development and continued support for governance and assurance of both financial and non-financial business practices. During times of technological changes, businesses will often integrate technology advancements into their operations. Blockchain implementation will not only provide additional tools for the company to use, but it will change the data interactions within the company’s ERP system. One of the first questions an internal auditor will inquire about is whether a financial statement impact may occur with the new system. Any impact that will be made against the financials, or whether a system or process will

54 ACCA 21
utilize financial data, should be reviewed by internal audit to ensure data integrity, governance, and assurance.

A division of internal audit is internal control. For publically traded companies, the internal control department assists management with governmental compliance and ensuring the controls in place are effective. Internal control, as defined by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) is “a process, effected by an entity’s board of directors, management, and other personnel, designed to provide reasonable assistance regarding the achievement of objectives relating to operations, reporting, and compliance.” 55 Many areas on the company’s operations are underneath internal control’s umbrella.

The internal controls department follows the COSO framework of controls. This framework provides companies with a roadmap to setting up a control environment. There are three main objectives of the internal control function are formed around operations, reporting, and compliance. Operations objectives look at the effectiveness and efficiency of the organization. The goal of reporting objectives is to ensure integrity of all internal and external reporting in both financial and non-financial measures. Compliance objectives seek to ensure laws and regulations are followed. 56

Underneath the three goals of the internal control framework, five components of internal control form the basis of the control environment. These components are the control environment, risk assessment, control activities, information and communication, and monitoring activities. 57 Every main business process must be formed and

55 Committee of Sponsoring Organizations of the Treadway Commission. Internal Control - Integrated Framework Executive Summary (COSO) 3
56 Committee of Sponsoring Organizations of the Treadway Commission 3
57 Committee of Sponsoring Organizations of the Treadway Commission 6
continuously evaluated around these activities. For new technology implementations, such as blockchain systems, the internal control department needs to ensure all components of the internal control framework are satisfied.

The below chart outlines potential changes to the five control components due to the implementation of blockchain into a company’s business practices.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Environment</td>
<td>The control environment outlines the internal control process used by the business. Since management is responsible for internal control practices, they also set the tone at the top. The stronger the controls and tone at the top, the more effective the internal control environment will be. With blockchain implementation, a new control environment will need to be formed and integrated into the existing environment since business processes will be changing. The control environment will need to be integrated with the company’s external shareholders on the blockchain network.</td>
</tr>
<tr>
<td>Risk Assessment</td>
<td>All aspects of business are susceptible to risk, and with increases in technology, information technology controls will need to be strong to prohibit the possibility of a system being compromised. Opening up a company’s ERP system to external users via a blockchain will create a new risk for companies. Although blockchain is said to be highly encrypted and secure, no technology is 100% risk-free from attack. Management will be tasked with mitigating an increased risk of an unauthorized external party gaining access to internal ERP data.</td>
</tr>
<tr>
<td>Control Activities</td>
<td>Control activities can be constructed to be either preventative or detective. Control activities may not drastically change when compared to current control activities established in ERP systems today. An addition to the control activity is it will be extended out to external parties. Since blockchain allows external parties to communicate with both company’s ERP systems, verification and reconciliation items may be automated and maintained in the blockchain. As with current ERP systems, blockchain will be able to respond to segregation of duties in a similar manner. Detective controls need to be inherently built into the systems and process. This allows management to monitor unauthorized use with the company’s data. Once a system has been validated by the internal audit team, key control reports are periodically reviewed to view all system and user changes since the last time the system and process was validated.</td>
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<tr>
<td>-------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Information and Communication</td>
<td>Information and communication will have a drastic change. Blockchain is a broker between two or more company’s ERP systems. It removes the manual entry into all companies involved in a transaction, since one party enters the transaction information, and it is replicated to all ledgers and ERP systems once the transaction has been approved and validated.</td>
</tr>
<tr>
<td>Monitoring Activities</td>
<td>Monitoring activities will be expanded beyond internal monitoring. Since all parties connected via the blockchain can see the ledger and all transactions, more than one party is able to monitor the same exact data. Any data inconsistencies or discrepancies can be brought to the attention of all parties involved with a transaction and decide any corrective action needed. Automated monitoring activities can also be built into blockchain network to ensure data is transmitted within regulations set by the participating organizations and external parties.</td>
</tr>
</tbody>
</table>

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58 Committee of Sponsoring Organizations of the Treadway Commission 4
59 Sue VanSickle
When companies adopt blockchain networks into their operating practices, internal audit, information technology, finance, and other applicable process owners will be heavily involved. The process will begin with the information technology project manager working with the process owners and the developer to ensure the new system meets the requirements of the business and the users. Once the developer has the initial product connected to the company’s ERP system, the information systems department will begin testing the system to ensure the product performs as expected. This process will continue until the information systems team believes the system is performing as expected. The technology is then moved into a quality state in the ERP system, where the users will begin testing the system. Any errors that are found will then be sent back to the information technology team, who will either correct the issue themselves or work with the developer to troubleshoot the error. Once the end users and the information systems team decide all systems are performing as expected, then internal audit needs to perform a comprehensive review of the system and the processes users are following. The developers have their own validation process that they use throughout the implementation. Internal audit will begin by reviewing their validation and pinpoint areas that should be re-validated. A systems development lifecycle review will break out the system processes from start to finish to ensure integrity of the data exists. During this review, calculations are checked for completeness and accuracy. If there are any abnormalities discovered during the review, then the internal auditors will dissect the process to locate any points where the data abnormality occurs. For publicly traded

60 Sue VanSickle
companies, internal audit will also need to review SOX compliance with management and update any documentation necessary due to process changes.

Internal audit will typically combine a mixture of finance and information systems personnel to determine the impact of financial reporting and if the new tool will solely be used internally with no data transmitted externally. Even if data will not be public knowledge, auditors need to know if the business will be relying on the data for making analytical decisions. If the business will be using the tool to drive business and operational decisions, then internal audit needs to be involved in the implementation and continuous monitoring of the tool. Data integrity is an important aspect of the internal audit process. In order for the business to operate effectively and efficiently, all data in the ERP system needs to be maintained, whether within the main ERP system or with external systems. The data going into the system must be the same in the outputs.

A new internal reporting trend rapidly increasing is the use of custom reports through business intelligence (BI) tools. Since these tools are directly linked into the company’s ERP system, data integrity must be maintained. Using blockchain with ERP systems, such as SAP Leonardo, reporting options will drastically increase. With the rise of the amount of data flowing through ERP systems, it is becoming more important for internal auditors to verify the completeness and accuracy of the systems and reports. This is important because the business will be using this data to drive decisions.

One of an auditor’s main tasks is testing the transaction assertions. Blockchain will make checking the transaction assertions during the audit program more systematic.

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61 Sue VanSickle
62 Sue VanSickle
<table>
<thead>
<tr>
<th>Assertion</th>
<th>How Blockchain Aids in Assertion Auditing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy</strong></td>
<td>A benefit of using blockchain is allowing multiple parties to view and approve transactions. Should a processing error occur regarding a transaction amount, another party involved in the transaction can flag it and correct the entry via a correcting journal entry. Due to the nature of the architecture not allowing any deletions, the original entry will remain, and the correcting entry will offset the original entry to reflect the correct amount between the two transactions.</td>
</tr>
<tr>
<td><strong>Classification</strong></td>
<td>Classification testing may not drastically change. Since ERP systems allow for manual coding of items, even on a blockchain, there is still a risk of misclassifying transactions. An added benefit is the auditor will be able to see all account movements of the transaction on the blockchain from inception to the final account balance.</td>
</tr>
<tr>
<td><strong>Completeness</strong></td>
<td>The completion assertion is partially improved with a blockchain. Since blockchain allows for ledger communication across multiple parties, both internal and external to the company being audited, may see a reduction in missing transactions due to human error. However, off-the-record transactions not flowing through the ERP system can still be taking place, and this assertion should be thoroughly investigated.</td>
</tr>
<tr>
<td><strong>Cutoff</strong></td>
<td>All transactions are time stamped and recorded in a permanent block on the distributed ledger. Since the transaction block is not able to be edited for transactions that have already occurred, the auditor can have assurance the transaction was recorded in the proper period based on transaction date.</td>
</tr>
<tr>
<td><strong>Occurrence</strong></td>
<td>A transaction is validated by multiple parties. For example, a payment sent from Company A to Company B via a blockchain would be validated by Company A (they agree to the terms of Company B), Company B (they set the terms), and an independent validator. If these validations do not occur, then a transaction cannot exist on the blockchain. If the validations do occur, the auditor can have confidence that the transaction occurred.</td>
</tr>
</tbody>
</table>

The internal audit department needs to be involved in almost all aspects of the business, especially in implementation of new systems. VanSickle discussed several projects where the business decided to implement a new system and expected it to be rolled out without any review by internal audit. One example was using a new reconciliation software. The finance team adopted and began testing a new reconciliation software that would help automate the month-end account reconciliations. When internal
audit discovered this new process was about to go live without their knowledge, the
department needed to perform an in-depth look at the process and the system. Internal
audit needs to help the developers and the process owners understand the process and
systematic changes to determine the impacts of the change. Typically, the main ERP
system has very tight controls and do not need to be reviewed as extensively during this
part in the process. However, if a new system is being integrated into the ERP system or
using the ERP system’s data in any way, it is crucial that the data is being validated to
ensure no data is lost or manipulated when being transferred between systems. A key
question in this stage of the implementation is how does the data get transferred from the
ERP system to the new system? Auditors prefer automatic transfers since there is less risk
of data manipulation during the transfer. If it is a manual transfer, then the person
performing the manual reconciliation needs to ensure no data is added or lost. This
individual needs to be identified and the entire process needs to be thoroughly
reviewed. If there is a lack of data integrity, then the data cannot be relied upon.

During the validation process, it is important to understand and document who is
performing the data validation. The documentation is important to ensure consistency in
procedures. As with many system changes within public companies, SOX documentation
will most likely need to be modified. It is management’s responsibility to ensure any
changes are documented by internal audit. This simple example follows the same
concepts of integrating blockchain into an ERP system. The business needs to remember
that a new system cannot go-live without involvement from the internal audit team.

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63 Sue VanSickle
Due to technological advancements, the audit profession is beginning to change. The days of manual auditing are quickly fading. As part of the audit program, software is being relied upon more, which is allowing for more comprehensive audits. Data analytics software is allowing auditors to analyze full data sets and pinpoint abnormalities. Programs such as ACL allow audit teams to further vet their data to look for fraud and transaction abnormalities. Reports can be run to view only the data that may pose a risk and more testing can be completed on the high risk transactions versus randomly choosing samples from the entire data set. Technology has evolved to the point where accounting firms are able to analyze the entire data sets and perform analyses that pull out the outliers to be analyzed further. The days of picking random samples are dying, since sophisticated software can target anomalies in the data. The move internal audit departments are making is trying to get an automated audit and automated monitoring process. At an AICPA conference, Kimberly Ellison-Taylor, chairman of the AICPA, believes "that a world where all transactions for a company occur on the blockchain would enable auditors to verify large amounts of routine data automatically, allowing them to focus instead on more complex transactions and controls." 64 Once the business units see that they have the ability to perform these tasks using advanced technology, the business units should be given access to use the technology to audit and monitor the activities.

Management is already in charge of ensuring the control activities are performing correctly, so they should be given the tools to complete this task more efficiently. 65

64 Ken Tysiak. *Blockchain Considerations for Management and Auditors* (Journal of Accountancy).
65 Sue VanSickle
Internal audit’s role would shift to monitoring management’s process and to ensure the process is still working. There is also a shift in the type of auditing from mostly financial audits to more operational audits. Management does own the process, so it is feasible to let them do the automated auditing and monitoring. They are already doing it manual anyways, so why not given them the tool to do it in a more efficient matter. VanSickle believes this shift in operations will occur within the next three years. 66 As with any change, a plethora of resources will be required both internally and externally. SOX testing and compliance should be put on management’s plate and internal audit should be providing the second opinion. This will allow internal audit departments to be able to perform more governance, assurance, and compliance audits, and well as more fraud risk assessments that add value to the business.

One of the internal audit group’s tasks is reviewing management’s internal control testing. Management owns SOX and they are responsible to ensuring compliance. Management is required by the Securities and Exchange Commission to issue a report that contains “a statement of management’s responsibility for establishing and maintaining adequate internal control over financial reporting, a statement identifying the framework used, [and] management’s assessment of the effectiveness of the company’s internal control over financial reporting.” 67 Since financial blockchains contain transactions that will directly affect the financial statements, internal audit’s role is to ensure these tests are being completed properly and efficiently.

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66 Sue VanSickle
A challenge companies are currently facing are the extent external auditors rely on internal auditor’s testing and work papers. There is a use of others practice, where if the external auditors determine the work of the internal auditors is complete and accurate, then the external auditors can rely on this to an extent. 68 If a blockchain system is integrated into a company’s ERP system, the use of others work will be limited in the beginning since the process and system is new to the external auditor. During a blockchain implementation and the year immediately following, companies can expect an increase in audit fees. Due to many process changes and potential automations, the overall yearly audit fee may stay relatively the same. This will force auditors to add value through other tools, and the firm as a whole will need to potentially expand their consulting practices. In an ideal world, the external auditors will give the internal audit team the list of samples they wish to test, internal audit will complete the testing, and the external auditors will rely on the testing. It will be hard to get the external auditors beyond about 20% reliance at the corporate level and about 70% at the business unit level. 69 This is mainly due to testing external financial reporting, which typically are published from corporate.

Auditing the financial reporting and financial statements will continue to include heavy testing for external auditors. Since blockchain involves transactions that affect the financial statements, this technology will be heavily vetted by the external auditors.

68 Sue VanSickle
69 Sue VanSickle
According to the PCAOB Accounting Standards Extent of the Effect of the Internal Auditors’ Work AU 322.19:

“The responsibility to report on the financial statements rests solely with the auditor. Unlike the situation in which the auditor uses the work of other independent auditors, this responsibility cannot be shared with the internal auditors. Because the auditor has the ultimate responsibility to express an opinion on the financial statements, judgments about assessments of inherent and control risks, the materiality of misstatements, the sufficiency of tests performed, the evaluation of significant accounting estimates, and other matters affecting the auditor's report should always be those of the auditor.” 70

For most companies, the external financial statement reporting is generated and published by the corporate office, thus many of the items tested involving financial statements will not be able to be relied upon at all. Companies are beginning to put heavy pressure on the external auditors to reduce auditing costs by allowing more reliance on internal testing. This will not only drive cost savings for the company, but it will force the external auditors to find other ways of adding value to their audits and offer more services to continue to enhance the client relationship.

Comparing today’s business practices to those of the 1980s, 1990s, and even early 2000s, computer programs and ERP systems have allowed companies to begin reducing the amount of printing and using more electronic documents. The idea of companies going paperless is becoming more common. Using only electronic files to conduct business will reduce many costs for a business, such as printing, mailing, and storage.

70 Public Company Accounting Oversight Board. AS 2605: Consideration of the Internal Audit Function (PCAOB) AS2605.19
costs. Blockchain may aid in the ability to move to a paperless platform since within a financial blockchain all billing and payments take place electronically after contract terms are met.

Moving to a paperless platform creates a new issue for both internal and external auditors. Many of the processes auditors review involve the auditor verifying the document was reviewed for accuracy and approved. Typically, with a physical paper copy of a document, notes, tick marks, and a signature will be present on the document that will be proof of review for the auditor. In addition to the evidence of review, should there be any questions or concerns the auditor brings to the reviewer, the reviewer is able to read the notes and tick marks to help recall his or her memory. In an electronic revision of a document, there is a lack of tools to prove the electronically signed document was actually reviewed and not just signed off. There may be no notes or tick marks and the reviewer may not show any evidence of review on the electronic document. The auditor will struggle with proving the thorough review. There needs to be electronic notes to prevent any questions that may arise. The problem with this approach is many professionals know their reports well and scan them for key figures, and may not make any notations. 71 Without the proper workflow and evidence of review controls put in place, using only digital documents will become a struggling area for internal and external auditors.

71 Sue VanSickle
Continued Training

Auditors will need to continue to gain a greater understanding of the systems and technology that will be used by companies in the near future. There is an increasing knowledge base that is forming, and this will allow for new specialties to emerge within the profession. Auditors need to be aware of how the data is pulled from the data warehouse and how the technology interacts with the data.

The external audit practices are also adapting to the increased changes of technology. Blockchain is relatively new, and auditors are starting to get their hands wet with the technology. The current hype in the accounting profession is the use of machine learning and artificial intelligence, but blockchain is starting to follow. New technological advancements will continue to strengthen the ties between information technology departments and auditors. The need for auditors will not be disappearing any time soon, but their focus may be shifting in the next ten to fifteen years. Information technology will still be responsible for developing and testing new software, whether within a company or within an accounting firm. Auditors will need to adapt and learn the basis of the software and how the software operates. This does not mean auditors need to learn the code of the software. However, they need to be able to identify abnormalities that may be occurring within the software, so having an understanding of the programs on at least a basic level is essential to the job activities.

The Big Four Accounting Firms have dedicated departments to research and development of new and emerging technologies. PwC’s Emerging Technology Lab explores technologies that may have a positive impact on the industry. Their team creates

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72 Senior Auditor at Big Four Accounting Firm
prototypes for the ideas generated to understand the feasibility and benefits should the technology be integrated into business practices. KPMG has a similar department which “focuses on the use of innovative tools in its business activities and the development of [a] digital economy.” As with all new business ventures, profitability is considered while exploring new ideas to implement. If no market exists and/or a product does not provide any value-added activities for businesses, the product may not continue in development since businesses may not see the value in the product.

Education for accounting professionals is a never-ending process. The industry is constantly changing and adapting to the current business environment. In order for the accounting profession to remain experts in the public eye, accounting professions need to quickly adapt to both small and drastic changes, not only in the accounting industry, but also in the industry in which their auditing and consulting work is performed. To ensure continual knowledge development, most accounting firms mandate training for their staff. During an interview with A Big Four Accounting Firm, it was mentioned they provide a week of training at least once a year, and additional training if there is a large industry change. This training, although may seem as a burden to staff, covers two purposes. The first purpose is to provide hands-on training with experts who provide updates in their field and firm procedures. It provides an opportunity to ensure the organization is operating synonymously. The other purpose is to provide the necessary Continuing Education Credits (CPEs) to continue practicing with an active CPA license. According

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73 PricewaterhouseCoopers, *PwC’s Emerging Technology Lab* (PwC)
74 KPMG, *Emerging Technologies* (KPMG).
75 Senior Auditor at Big Four Accounting Firm
76 Senior Auditor at Big Four Accounting Firm
to the AICPA, every three years CPAs are required to enroll and complete 120 hours of continuing education courses related to their accounting field, of which 4 hours must be in ethics training. 77 The staff trainings cover a majority of the CPE credit requirements.

Currently accounting firms are leading the development of blockchain, as well as other large multi-national technology companies. Within the consulting practice of firms, business partners are suggesting ways to integrate blockchain into their client’s systems and business practices. The accounting industry is seeking ways to add value to business partners. Non-value added activities need to be discontinued or merged with automated processes that will allow for more time that accountants can spend on adding value to the business and to analysis.

A senior auditor at a Big Four Accounting Firm stated the firm has been performing research and testing potential solutions to blockchain technology. The goal is to bring their auditors to an intermediate level of understanding of the technology. Training and brainstorming sessions are beginning to be rolled out, but before the firms can begin to heavily pursue the technology, companies need to see the value in the technology and want to adopt it. 78 If the need is not current available, the firms need to begin persuading companies to adopt the technology, and this is an essential part of the continuously developing client relationship.

77 AICPA, AICPA Membership CPE Requirements (AICPA).
78 Senior Auditor at Big Four Accounting Firm
Future Accountants

Technology usage is increasing within the accounting profession, and thus having an information systems background is a benefit to accounting students. Since accounting and auditing is taking advantage of new software and technology, having a solid education on technological systems and large databases will help begin their development and see the requirements of the professional skills auditors require. The accountant does not need to be an expert in information systems and their development. This will still fall on the information systems teams, but developing a framework early in their careers will allow students to grow exponentially.

Current students should become familiar with trends and new technologies occurring in the industry, just as current accounting professionals do. This will jump start their education and familiarity with many topics that will be covered during training sessions at the firms and companies of employment. It will also make themselves more marketable to accounting firms since it shows initiative in learning beyond what is taught in the classroom. Accounting students will most likely still be introduced to the accounting profession through an audit or tax route, but there will be technologies introduced throughout internships and future jobs.

Rapid technological changes force university programs to adapt their course offerings in order to continue to prepare students for their future professions. The accounting industry is an industry that will never disappear. Accounting is the language of business, and without it, business as it exists today would be non-existent. This is one of the many reasons students seeking a degree choose accounting. The future success of
accountants begins at university. Northern Illinois University is preparing their students to succeed in the future through their diverse course offerings.

The accountancy department at Northern Illinois University strives to stay ahead of changing technology in the accounting profession. To aid in this task, the department has formed the Accountancy Advisory Executive Council, which consists of 36 accounting professionals ranging from partners to managers from a wide variety of accounting firms and industry members. One of the purposes of this advisory council is to review the current accounting curriculum and suggest modifications based on what the industry is looking for in recent graduates. The 36 individuals educate the accounting faculty on new and upcoming trends in the accounting professions.

In addition to the advisory council, some department professors attend regularly scheduled accounting firm trainings. During these trainings, they have the opportunity to sit in on the firm's trainings for their employees. This provides faculty with a first-hand experience as to what the firms are training and expecting of their employees. These trainings are focused on the firm's staff. Firms also host educator events where faculty members can be with firm employees and can discuss changes in the industry. Faculty members also attend several academic conferences.

Feedback from the advisory council and from students returning from internships suggested that students receive better education in excel since their excel skills were lacking. As a result, the department implemented the excel certification exams into the cost accounting course and data analytics course, both are required courses for the program. It is a part of those courses, but it is not necessarily integrated. Students still

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79 Northern Illinois University Accountancy. *Accountancy Executive Advisory Council (AEAC).*

80 Rebecca Shortridge. (18 April 2018). Personal Interview.
need to learn it on their own, but the hope is that students will continuously be given projects using those excel skills, but currently it is up to the professor to integrate this into their class. This same method has been implemented with other software packages such as ACL and Tableau. The department suggests consistency of software requirements, and they are working on standardizing this. 81

One issue the department is currently mitigating is the use of large data sets. Using technology, such as ACL and Tableau, is not useful unless large amounts of data can be imported. There is progress being made in this area, and is currently much better than in previous years. Accounting firms see the issue for educators and they are taking their own data, scrubbing it, and allowing educators to use it and they are providing real-world cases. 82 There are also publicly available data sets that are being used, such as the city of Chicago.

The accountancy department may be seeking additional ways to integrate information systems into their course curriculum. Recently, a data analytics track was developed in the Master’s of Accounting Science program. As technology becomes more prominent, the department may work towards more joint information systems and accounting programs. This joint venture may introduce database systems, such as SAP, into the accounting program. Currently, the operations management and information systems department provides SAS and SAP training that allows students to test and obtain a certification in these software. With the recent introduction to two new accountancy faculty members, both with PhDs in information systems in addition to their

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81 Rebecca Shortridge
82 Rebecca Shortridge
master’s in accountancy, may be able to bring new course ideas to the department based on their research studies surrounding artificial intelligence and machine learning. \(^{83}\)

Northern Illinois University’s operation’s management and information systems degree programs are also continuously looking for ways to implement new technologies into their courses to ensure students begin developing systems knowledge prior to entering the workforce. In order to aid in this course development, the department has a board, similar to the accountancy board, that meets with the entire faculty once per semester to discuss what business professionals are looking for in students. This meeting allows for the department to gain an understanding of what to incorporate into their courses. The faculty members attend both professional and academic workshops to gain an understanding of the trends in the technology field. Since Northern Illinois University is AASCB accredited, select faculty members have the opportunity to attend workshops put on by AASCB. \(^{84}\)

The Operations management and information system has access to numerous databases through the SAP University Alliance. This program allows the department to use SAP software and the associated databases. \(^{85}\) Through the alliance program, students are gaining access to SAP Leonardo, the system that has the capability of integrating blockchain technology.

There is currently one faculty member that has a lecture on blockchain technology in his course. \(^{86}\) This will be a disruptive change and the department is investigating ways

\(^{83}\) Rebecca Shortridge  
\(^{84}\) Operations Management and Information Systems Professor at Northern Illinois University. (2018, April 18). Personal Interview.  
\(^{85}\) Operations Management and Information Systems Professor at Northern Illinois University  
\(^{86}\) Operations Management and Information Systems Professor at Northern Illinois University
of integrating this into their courses the best way, along with integrating concepts surrounding the internet of things. The curriculum is adapting to the recent technology changes.

Operations management and information systems believes that data analytics and having database knowledge is helpful for auditors. There is beginning to be a small overlap between accounting and information systems. Operations management and information systems launched a new minor in 2016 that is of interest to accountants. The business analytics minor had 35 students participating during the first year, and the number has grown to 123 students. Not all students are from the operations management and information systems degree programs. About half are coming from the accounting, finance, and even computer science programs. 87 Students are seeing the increased marketability and specialization they may be able to provide seeking this new and exciting minor.

According to the Association of Chartered Certified Accountants, “the professional accountant of the future will need forward-looking outlook and skills and abilities that are well rounded, resilient and adaptable to changes in the business environment.” 88 With fast changing industries, students today may be learning items that will become obsolete in the next 10 years. Although the topic may be obsolete, the same underlying principles will be present. The sooner accountants begin to educate themselves with the potential industry changes, the better off they will be when the change occurs. It will allow them to be one step ahead of their peers, and be able to apply their knowledge quickly.

87 Operations Management and Information Systems Professor at Northern Illinois University.
88 ACCA 6
Conclusion

Companies are constantly adapting their practices to stay ahead of the rapidly changing business environment. With the onset of new technologies, it is imperative these adoptions occur rather rapidly to continue to participate in commerce. Blockchain is a revolutionary technology that may be engulfing industries in the next five years. Since almost all business functions have an impact on financials or operating statements, the accounting and auditing profession will be adapting to this new technology. Accounting firms need to continue to be proactive with emerging technologies to help prepare industries in technology adoptions. Blockchain has the potential to impact several industries, and without there being any global standards on the usage, companies are able to develop the technology to fit their business needs and this may set the standards in future years. The premise of blockchain is having independent third party validators, so governmental regulation may hinder innovation. Commerce is changing, and the introduction of blockchain technology will connect the world in ways never imagined.
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