# THE EFFECTS OF BIG DATA AND BLOCKCHAIN ON THE AUDIT PROFESSION

by

Tereesha Marquette Patterson

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Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Business Administration

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Liberty University, School of Business

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**Abstract**

This qualitative study purposed to gain a greater understanding of the technological systems effecting the audit industry. The central focus was to gain an in-depth understanding of the effects of big data and blockchain technology on the audit industry. Interviews were carried out with selected participants working for Certified Public Accounting (CPA) firms. From the interviews, eleven CPAs provided the data to form the discovered themes. The information gathered in the interviews contributed to the body of knowledge concerning big data and blockchain technology as recognized by practicing CPAs. Four themes were identified which aligned with the participants feedback concerning big data and blockchain effects on the audit. The themes discovered were: the need for additional training to fully prepare for the technological spectrums, a need for software developments beyond the traditional excel applications, having an on-going correspondence with information (IT) technology personnel, and an acknowledgment of the limited practical application of blockchain on the audit. This study shall assist auditors and other stakeholders interested in preparing to work with clients that have big data and/or blockchain technology embedded in their systems.

*Keywords:* big data, blockchain, audit, technology

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**Approvals**

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| Edward M. Moore, Ph.D., Director of Doctoral Programs | Date |

## Dedication

I dedicate this doctoral dissertation to my husband, Isaiah Lamar, who sparked the initial interest in this journey and was a constant encouragement throughout the entire process. I love you “Honey.”

**Acknowledgments**

First and foremost, I want to give honor to God, my Lord and Savior Jesus Christ. The Spirit of the Lord was with me and was my present help. To my family and friends that prayed, cheered me on, listened, and spoke words of kindness during this journey, thank you all. Finally, I would like to thank my dissertation committee chair, Dr. Christopher Demaline, and committee member, Dr. Darlene Casstevens.

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## Section 1: Foundation of the Study

External auditors are agents working within the auditing profession to honor and protect public interest by providing a level of certainty for stakeholders. The stakeholders (i.e., stockbrokers, creditors, investors, employers, and society) rely on the audit report or opinion concerning the organization's financial statements and internal controls (Rodgers et al., 2019). The goal and relationship of the external auditor has not changed (Rodgers et al., 2019). However, many researchers believe, the audit profession is embarking upon a new industrial revolution forged by technology (Brazina & Ugras, 2018; Drew, 2019; Smith & Castonguay, 2020; Veerankutty et al., 2018). According to Tysiac and Drew (2018), developments in emerging technology like big data and blockchain provide benefits beyond a firms traditional and legacy systems and because of this the audit process will change.

Research suggests prioritization to adaptation of big data and blockchain starting with strategizing and road mapping which technology an organization seeks to understand (Drew, 2019). Auditors will need to be well-informed about the technology their clients use and be knowledgeable of the internal controls needed to prevent material misstatements in this realm (Brazina & Ugras, 2018). Audit standards and procedures will need to change. Big data uses large amounts of structured and unstructured data, so it is important for audit companies to understand the need for nontraditional software and new database systems to audit this sampling (Dagiliene & Kloviene, 2019). Blockchain technology offers a system of truth and governance in one controlled structure; notably, a shared ledger providing permanent reliable records of information that is not manipulated. It is considered so reliable that any changes that do occur are simultaneously updated from original entry (Rooney et al., 2017). The blockchain process will also require auditors to adapt to new systems. There will be a need to access information on new

technological formats that effect the auditor's role. In addition, their work may be marginalized because of the use of real-time information as well as the reliance on continuous audits (Rooney et al., 2017).

Efforts to study and understand the novel area of big data and blockchain is suggested (Dagliene & Kloviene, 2019; Tysiac & Drew, 2018). The audit profession is behind in understanding technological innovation emergence and audit practitioners as well as regulatory authorities are in need for a more proactive approach to addressing the factors (Farcane & Deliu, 2020). It is essential for auditing firms to understand the value of big data and blockchain and how to incorporate the needs of clients and society. Auditing professionals will be impacted by technological processes that are considered "disruptive" when posed with the transformative effects of a triple-entry accounting system from the traditional double-entry accounting system (Alarcon & Ng, 2018, p. 28). Other issues are blockchain's adaption into a vast array of industries so quickly that regulators lack auditing standards and there are also risks due to a lack significant controls to remedy program errors or system breaches (Alarcon & Ng, 2018). Younis (2020) discussed the fast speed of changes that big data technology forges and highlights unanswered questions this technology creates. Concerning big data, Younis (2020) asserted a need for the future accountant to be prepared with new skill sets, regulators to set standards of conduct for the profession, and users to prepare for the need for more data storage. It is understood that training is also needed, yet, more answers are needed to understand how to train and educate future audit professionals. The tools and approach to big data audit work is not fully understood and the value it brings to audit quality and efficiency is incomplete (Joshi & Marthandan, 2018). This research study examines the nuances, practical experiences, and

suggestions participant CPAs and their firms highlighted concerning big data and blockchain effects on the audit.

**Background of the Problem**

Independent auditors from an accounting perspective execute audits to protect potential internal and external users from conflicts of interest (DeZoort et al., 2018). Independent auditors are on the frontline of promoting governance, fraud risk management, and preventing fraudulent activity. The auditor's role is one of investigation and protection on the behalf of external users from unrepresented financial claims that could be made by an organization. The audit role has become increasingly important because of notable past corruption occurring in organizations like Enron, Tyco, and WorldCom. These corrupt practices went undetected for years due to lack of enforced policy and audit integrity (DeZoort et al., 2018). External auditors are responsible for an independent as well as unbiased assessment of the corporations' reporting (Salehi et al., 2018). Harjoto (2017) emphasized that organizations are continuing to be more susceptible to fraud which creates a continual need for the functions of an auditor. Drogalas et al. (2017) suggested audit training as an imperative to the detection of misconduct and violations that may potentially occur. Indeed, a well-trained auditor correlates to a more effective audit.

As the problem of fraud continues to grow, auditors are a part of the solution. In many ways they play a role in mitigating these risks while also being positioned to handle the creation of newly innovated advances like blockchain and big data (Dezoort et al., 2018). These innovations introduce new impediments on the audit process (Smith & Castonguay, 2020). According to Alles and Gray (2016), these innovations redefine the role of auditors creating a need for firms to better prepare for its future use. The audit of the future will move towards an application of less sampling techniques, a deeper push towards non-financial data than financial

data, heavier use of unstructured data from outside the organization, and a myriad of technical capabilities outside the traditional comfort zone of the audit profession (Alles & Gray, 2016). Certified public accounting (CPA) firms are investing resources to understand and incorporate these innovations into their practices for future audits. The inclusion of big data requires the use of new technology to analyze large sets of data when accessing an industries information which can be costly.

These innovations are also stated to disrupt and transform the audit profession in many ways such as creating a technological revolution due to the use of more automation like automatic confirmations and less reliance on traditional audit services like sample-based auditing (Richins et al., 2017). The use of blockchain by organizations has created the need for less investigation of errors, more real time availability of information, and the move towards more continuous audits which creates obsolescence in auditor's roles as suggested by (Schmitz & Leoni, 2019). Audits will become less labor intensive as information becomes instantaneously available leading to less manually created documents (i.e., journal entries, spreadsheet files, and paper documents) that were traditionally needed (Schmitz & Leoni, 2019). This technological shift changes the auditor's role and functions, requiring new skills to use the blockchain system within audits.

Blockchain is a distributed ledger that was designed using algorithms as a concurrent process to ensure transactions start and finalize correctly (Brender et al., 2019). While these processes create accuracy and less human intervention, many researchers have discussed the complications this has on audit roles and business practices. For example, some organizations are hesitant to adapt to blockchain accounting systems due to the lack of a reasonable need for it or the posed security threats (Kim, 2020). Furthermore, the practicing audit professional's role has

changed. The way they attest due to automation, reductions in sampling, and decreased testing causes many to wonder if auditors will be needed (Oden & Barnes, 2019). There are increased associated issues in having enough data storage and the proper technological tools to access client data as well as understand how to use those tools effectively (Fuller & Markelevich, 2020; Younis, 2020). Reliance on new technology is costly and smaller firms may not adopt as quickly as larger firms due to the financial responsibility needed to incorporate software to handle clients using blockchain in their firms (Moll & Yigitbasioglu, 2019; Vincent et al., 2020). Auditors are more technological information technology (IT) persons working to ensure the blockchain process works which causes many researchers to suggest the need to further understand this responsibility.

Big data presents a new challenge for auditors as well causing implications with client audit relationships. The challenges occur due to the increased remoteness, technological demands incurred, and marginalization of audit functions (Allen, 2015 as cited in Salijeni et al., 2019). Audit firms are faced with the newness of big data while incorporating data analytics on audits, this increases the need for more training, competence, and expertise to serve audit clients. Adapting audits to handle big data requires deciphering, using outside computer programmers, and data structuring. These advances are things firms are not all too sure how to handle in a practical since.

There is a relevance for understanding blockchain and big data to fulfill gaps in the literature (Salijeni et al., 2019). Researchers suggest more studies and empirical evidence which address investigating practitioner's experiences, an understanding of the cost-benefit, the technological acumen, the cognitive skills set needed of auditors, and the unique aspects that will have the biggest impact on audits in practice (Al-Htaybat & Von Alberti-Alhtaybat, 2017;

Schmitz & Leoni, 2019; Sirois et al., 2016). The literature suggests these innovations will change the field of accounting and the way audits will be conducted, but little is known in an informative or practical way. Suggested research includes recommendations to discover ways to prepare auditors, CPA firms, and clients to work together to better prepare for these advances in a practical sense (Salijeni et al., 2019; Schmitz & Leoni, 2019).

**Problem Statement**

The general problem addressed was the failure of auditors in practice to prepare for the implications of big data and blockchain on audits, resulting in limitations when supporting clients. Moll and Yigitbasioglu (2019) stated that auditors need more training due to various technological advances created specifically by blockchain and big data. Big data technology is rapidly affecting the field of accounting specifically audit functions (Salijeni et al., 2019). Blockchain is stated to disrupt the audit profession in such a way that the changes are not fully anticipated (Liu et al., 2019). The new innovations create changes on audit functions, notably new skill sets and business practices to adequately serve clients (Joshi & Marthandan, 2018). This creates a future of changes that employers must adapt to in order to serve audit clients more effectively (Cockcroft & Russell, 2018).

In a recent study, Schmitz and Leoni (2019) found technological changes will directly affect the role and needed skills of accountants and auditors through use of automation, blockchain, and artificial intelligence. As these innovations occur, auditors' specific roles will shift to being more complex, requiring substantive resources, more use of data storage, and the need for auditors to fully understand, operate, and analyze blockchain and associated technologies (Dai & Vasarhelyi, 2017). The specific problem addressed was the failure of auditors in practice within the Illinois, Kentucky, and Indiana tri-state area to prepare for the

implications of big data and blockchain on audits, resulting in limitations when supporting clients.

**Purpose Statement**

The purpose of this qualitative study will contribute to the body of knowledge by examining the implications of big data and blockchain on audits and the limitations when supporting clients. In recent years, there has been increased concern over the effects of big data and blockchain on audit roles due to automation and marginalization. Notably, an empirical study explaining the effects of big data and blockchain on auditor roles, the technological advances, and the future implications to serve clients will be researched (Wu et al., 2019). This phenomenological research explored how auditors prepare for big data and block chain as discovered by participants serving clients within the Illinois-Kentucky-Indiana tri-state area.

**Nature of the Study**

This section addresses the qualitative research method chosen and why it was the best choice for this study. A discussion of multiple methods and designs are provided, including why other designs were not selected. Various perspectives from research methodologist provided the rationale for the selected and eliminated methods and designs.

**Discussion of Method**

The three relevant research methods admissible for research are the qualitative method, the quantitative method, and the mixed method. The type of research method a researcher selects is driven by an alignment with the research questions being investigated (Rutberg & Bouikidis, 2018). It is important to note that the proper selection of the research methods and designs from the start provides the strategies researchers use to collect evidence necessary for testing theories, compiling themes, and aligning the research questions appropriately.

### *Quantitative Method*

Yoshikawa et al. (2008) asserted that quantitative methods analyze the data collected in numeric form. This method could be experimental, using instruments to make comparable experimental measurements in comparison to a control group -from data collected numerically (Westerman, 2006). Evidence can be gathered based on closed-ended questions, predetermined approaches, statistical procedures, and static standards (Creswell, 2014). This method is useful when the development of the hypothesis – the anticipated result, relationship, or expected outcome is central to the study like in a statistically based study (Rutberg & Bouikidis, 2018). The quantitative research method does not best highlight the goal of this study- which is to gain a more phenomenological approach to the research and a less classical concrete numerical experimental analysis of data (Westerman, 2006).

### *Mixed Method*

According to Creswell (2014) mixed method research is the use of both quantitative and qualitative research data in a study. The use of mixed method design for research allows the researcher to combine the numerical/statistical benefits of the quantitative data and the more phenomenological data of the qualitative design to the research (Sandelowski et al., 2012). Combining two methods of research means both quantitative and qualitative methods would bring more value to the study. Mixed method research has a quantitative component involving a hypothesis that is narrowly focused (McKim, 2017). The use of controlled tests, objective instruments, and a rigor requiring (time, funding, and interview space) is what this researcher plans to accomplish more efficiently with data collection from a qualitative study (McKim, 2017). The mixed method research limits the central method for this study due to the quantitative

design's linear attributes, measurements, and use of statistical analysis which does not formulate as well for a phenomenological study based on practical experiences (Stake, 2010).

### *Qualitative Method*

As noted by Stake (2010), a qualitative study relies on the human perception and understanding when generating data to synthesize major themes -including how many qualitative researchers want to improve on how things work. The observations and examinations for the qualitative study and the data collection phase talks with participants in the field (Creswell, 2016). When studying practical experiences, gathering stories of a marginalized group is effectively used in a qualitative study which allows for more open-ended questions (Creswell, 2016). Qualitative research addresses the problem from rich narratives and the design is phenomenological which is ideal for a focus group or small sample size (Rutberg & Bouikidis, 2018). These assertions are in line with the need to enlighten the field of auditing, bringing an understanding of the changes effecting auditor's roles relating to emerging technology. This chosen method allows data collection based on practical experiences and comparisons of auditor's roles across various CPA firms. Moffitt et al. (2018) suggested future research explore the experiences, descriptions, and developments in the field to explain emerging phenomena like the essentials of automation on audits. A qualitative study can provide multiple interpretations and perspectives. The nature of the research questions in this study are interview style and data were gathered in the field from a practical nature. Yli-Huumo et al. (2016) suggested further research studies of discussions on the limitations, identification of the issues, and an understanding of the challenges central to the business environment. The qualitative method and the phenomenological design were used for this studies collection of research.

## Discussion of Design

The goals and characteristics of this qualitative study align specifically with a phenomenological research design. There are a multitude of designs to consider when conducting a qualitative study: narrative, phenomenology, grounded theory, case study, and ethnography.

### *Narrative*

A narrative has literary, singular, and an informal approach to data collection (Creswell & Poth, 2018). This is more biographical and autoethnographic, this alignment captures a nonprofessional side of the story within the research. The participants in this study are professionals working in a formal environment with emerging technology. The study will be a more formal conversation and have less of an informal personal historical background as seen with narrative research. A narrative includes the subjects as characters informally or literally and this is not part of this study (Holley & Colyar, 2009). Keeping with a more business nature and less inner personal experience is why this design was not chosen.

### *Phenomenology*

This present study reflected a qualitative phenomenological method and design. Interviewing individuals, using documents, and observations are essential to the procedures used in a phenomenology. The interviews of a phenomenological research study are considered the dominant method for data collection (Bevan, 2014). In addition, reflexivity is embedded within a phenomenology which allows new knowledge and a new understanding of the phenomenon, which creates discovery, and construction along the study (Enosh & Ben-Ari, 2016.). This added feature of reflexivity is relevant to this study, a discovery of the “what” and “how” type of research questions informs and enhances the purpose of the study. Data collection, management,

and analysis is critical to this study and therefore a method of coding using software to reduce the data into themes will be used (Cypress, 2018). The ability to describe an event holistically from the participants in practice, the informativeness of the study, and the specific research questions style supports this phenomenological study.

Phenomenological analysis of data sensitizes the researcher to the issues, it's a method of discovery, observation, transcription, and explicit meaning noted during the interview process (Hycner, 1985). The story being told is what the researcher must give a keen eye and observance too, looking for clarity, and definitiveness to support points of view and explain the research questions. Meaningfulness, useful feedback, common trends, central themes, and openness to understand are also important features of understanding the phenomenon interview as well (Hycner, 1985). The essence of a phenomenological study describes the lived situation and can include experiences associated with technology (Valentine et al., 2018). According to Bevan (2014), the interview process requires describing a person's experiences in the real sense of how they have experienced it, not from theories, but an interpretive and individualized perspective of the interviewee's own complexities. In general, the essence of a phenomenological study describes the lived situations and can include experiences associated with technology (Valentine et al., 2018).

### *Grounded Theory*

The constructs of grounded theory infer a formalized or prescriptive change, movement, developing process, or social situation (Creswell & Poth, 2018). Grounded theory's fundamental process is not discovered but constructed by the researcher's own experiences and stems away from the purpose of this study (Chun Tie et al., 2019). Suddaby (2006) explained some of the differences between a grounded theory study and a phenomenological study; noting, a grounded

theory study evidentially proposes a focus on defined theoretical statements at end and less of a holistic congruency of lived experiences. The key attributes of a grounded theory's methodology of being not predetermined to start with does not correlate to this study. This study focuses on more of a discovery and illumination of the auditor's experiences in the field.

***Case Study***

The design of a case study is specifically noted to concentrate on an identifiable case, bounded by a system, real life experiences, and central to a problem (Creswell & Poth, 2018). Gerring (2004) described a case study as suitable for studying a single unit with an aim to generalize across a larger set of units and is bounded or limited, which poses an issue for the type of research questions being used in this study. The boundedness of a case study does not fit with this present studies research, neither the method of comparison of a single unit to a larger set of units. A case study is bounded by time and location, and the cases are clearly identifiable from the start. According to Gerring (2004), a case study also should include quantitative as well as qualitative data for a more thorough study - only qualitative data will be collected in this present study.

***Ethnography***

An ethnography design includes an environmental and cultural aspect that resonates more with a narrative or grounded theory study (Morse, 2016). An ethnography's data has strong connections to a person's life surrounded by collecting data about a living situation or environment (Ingold, 2017). While the conditions of a person's lived experience are the focal point, ethnography data are more social, community, and anthropological based (Morse, 2016). The essential nature of the study is to make comparisons about cultural groups, surroundings, the environment, and lifestyles. This anthropological nature of an ethnography does not relate to the

professional business experiences of auditor's in practice whose work is being influenced by emerging technology. Therefore, an ethnography fails to address this study's research questions.

**Summary of the Nature of Study**

In summary, the use of the qualitative method gave support for understanding the effects of emerging technology on auditor's roles – specifically blockchain and big data. This study's data collection was concerned with understanding the various points of views provided by the participants and discovering the impediments and limitations created by big data and blockchain on audits. For instance, blockchain technology is stated to be technologically complex, in a stage of infancy in the research databases, and a phenomenon that needs to be explored empirically is suggested (Wang et al., 2019). Additionally, big data research is also limited in the areas of accounting, audit, and the finance industry. The risks associated with big data are under researched. The accountant's role is subjected to big data in such a way that further explanations and investigations is suggested (Cockcroft & Russell, 2018). This study was exploratory designed to enhance and add to the field of audit practice from the experiences of auditor's working for CPA firms mainly through interviews. Participants working for CPA firms were contacted directly in the local area. A formal request for permission to interview, observations of documents, and gathered feedback to analyze and support the theories was made.

**Research Questions**

The focal research questions for this study were the following:

**RQ1a:** What factors are affecting auditor's roles concerning big data to fully serve clients?

**RQ1b:** How have audit firms addressed the implications of big data on audits to fully prepare to serve clients?

**RQ2a**: What factors are affecting auditor's roles concerning blockchain to fully serve clients?

**RQ2b:** How have audit firms addressed the implications of blockchain on audits to fully serve clients?

## Conceptual Framework

The three theoretical frameworks found in the accounting literature that served as the foundation for this qualitative study were (a) critical theory, (b) role theory, and (c) structuration theory. Critical theory, role theory, and structuration theory are used to further explain the hierarchical roles, authoritative tasks, the historical changes effecting the roles of auditors and the strategies audit firms are using concerning blockchain and big data to serve clients. The flow of the pictorial diagram (see Figure 1) represents the developmental processes necessary to explore the research questions. This study's frameworks posit historical norms, specifics of audit roles, discoveries of the emerging phenomena, and an inclusion of strategic initiatives effecting audits. Critical theory, role theory, and structuration theory are used to explain the points of views.

### *Critical Theory*

Critical theory is often used in research to explain why historical processes have changed and can be used to describe the impact these changes have on society (Tweedie, 2018). For example, the way audits have been conducted historically from start to the finish may have changed due to emerging technology. Society relies on the auditor's report to make informed decisions about an organization, this relates to Tweedie's (2018) notation of accounting as a social practice. Tweedie (2018) also stated that critical theory can be used to describe change processes from a subject's point of view, also highlighting accounting to be a social practice

subjective to various experiences. Critical theory is often used in research to explore technology and individual agency so that the needs and aspirations of individuals are improved (Zheng & Stahl, 2011).

### *Role Theory*

Role theory as a framework defines roles and responsibilities of a position or job. This framework categorizes the everyday activities to include points made on the duties, rights, expectations, norms, and behaviors of unique social group (Ater et al., 2019). The audit is performed by a team of individuals working together on their specific tasks such as sampling or a broaden role such as supervision and review (Lessambo, 2018). Reiche et al. (2017) noted how role theory highlights the variety of functions in a position and includes a connection to the multitude of social structures participants work within. Understanding the interconnection of these roles to complete an audit shall give context to role descriptions, processes, and discussions. Understanding the tasks of audit work supplements the movement into emerging technology and innovative growth processes (Pavlatos & Kostakis, 2018). Moreover, to understand what one does in their everyday work is the beginning of answering what has occurred, what has changed, and who is the direct resource or individual point of contact to promote new initiatives and understanding.

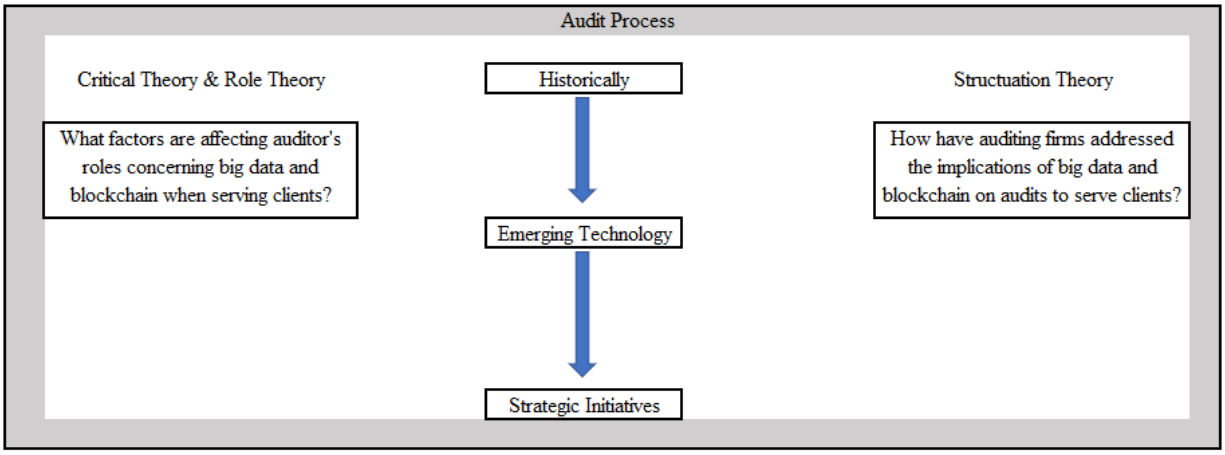
### *Structural Theory*

Fundamentally, structural theory was developed by Giddens (1971) and has been used to analyze the interplay between accounting and strategy within the organization (Englund et al., 2017). Moreover, structural theory sensitizes, and frames accounting research-enhances the theories of organizational strategy and participating agents (Georgios & Lisa, 2018). As auditor's roles change, the factors contributing to this change are associated with the use of emerging

technology. The agents involved are the ones experiencing this phenomenon and the firm's response to this includes the strategic planning initiatives. The diagram below demonstrates the connection of the individual theories to the research questions.

**Figure 1**

*Relationships Between Concepts*




***Discussion of Relationships Between Concepts***

This study sought to expand the research studies concerned with audit processes that are being affected by blockchain and big data in a progressive way: from traditional processes, emergent technical changes, and the strategic initiatives. The audit process has historically changed and is undergoing a new business paradigm (Appelbaum et al., 2017). Agents are well-informed participants in their practice, as such, the auditor has a facilitating role structured by the firms they work within, the regulated audit procedures, and the responsibility to provide the public- at end unbiased information (Coad et al., 2015). Liz (2016) endorsed Giddens structural theory as an appropriate tool for analyzing and understanding human interactions with technology. Auditors are having to adapt their processes as they work with blockchain and big data implications. These processes can be explained and expanded upon to give a better

understanding of the experiences salient to their point of view. Critical theory was used in a previous accounting study to investigate the implications of change an organization experienced adopting a new accounting system (Reis & Lavarda, 2017). In addition, there were not only economic factors to consider but social factors because the organization at hand served the public. Serving the public is reflective to the way auditors working within CPA firms while also serving investors, creditors, and interested parties. Indeed, critical theory combined with structuration aligned the various social reflections describing the process, the emergence, and developments effecting the audit process.

### *Summary of the Conceptual Framework*

In summary, critical theory, role theory, and structural theory provided the theoretical foundation for the study. These theories combined to explain the effects of technological change on the role of audits, the agents involved, the structured institutions they operate within, and social perspectives they support (Modell et al., 2017). Structuration theory is concerned with social processes and events at times and places, the interplay between human actions and social structures. Critical theory can add or explain progression and innovation of accounting from various perspectives, the institutions and the human participants (Merino, 1998). These social structures help to explain why certain practices institutionalized, why certain practices are difficult to change, and what may be needed to allow them to change (Jack, 2017).

## Definition of Terms

*Artificial Intelligence*: Technological systems constructed by people to fulfill and perform special tasks usually done by humans based on knowledge initiated by computer programming (Dignum, 2018; Lu et al., 2018).

*Big data*: Unstructured high volume and varied datasets from sources such as social media, sensors, scientific applications, videos, images, internet texts, weblogs, and documents that require software tools to process, manage, and capture the given data for business decision-making (Luo et al., 2016).

*Bitcoin*: A cryptocurrency built on blockchain technology (Beck, 2018).

*Blockchain*: A peer-to-peer network consisting of a digital ledger of all transactions across a given network of record keeping, which eliminates the need for a centralized authority (Woodside et al., 2017).

*Cryptocurrency*: A digital currency, a medium of exchange like the U.S. dollar but digital and encrypted for control purposes, for monitoring new currency creation, and fund verification (Lansky, 2016).

*External auditor*: A professional who is usually identified as earning a certification as a certified public accountant (CPA), works independently as outside agent of the organization, a principle player that has the responsibility to plan and perform the audit (Ater et al., 2019), obtains reasonable assurance about whether the financial statements are free from material misstatement, expresses an opinion on the company's financial statements and internal controls over financial reporting (Kueppers & Sullivan, 2010).

*Independent audit*: A process that focuses on examining an organizations financial reporting to help promote investor confidence, where the external auditor provides reasonable assurance on the organizations financial reporting- based on management's assertions and that results in an opinion on the company's financial statements and usually an opinion on the company's internal control over financial reporting (Kueppers & Sullivan, 2010).

*Internet of Things (IoT):* A global network of machines and devices interacting with each other, used by a wide range of industries to integrate and connect various business applications for monitoring big data, business analytics, information sharing, and collaboration (Lee & Lee, 2015).

## Assumptions, Limitations, Delimitations

This segment covers the synopsis of the assumptions, limitations, and delimitations associated with this study. These concepts enhance triangulation in the study, allowing for a more robust and distinguished study which sets the scope of research including points from different perspectives, reflections and analyses (Rooshenas et al., 2019). Assumptions, limitations, and delimitations enhances the credibility and the expectations of the study while advancing topical knowledge.

### *Assumptions*

Kornuta and Germaine (2019) pointed out that assumptions are not usually made prior to a qualitative study because that type of study searches for the whole understanding and premade assumptions may distort the findings. However, assumptions are described as an important fact that is presumed to be true but not verifiable (Kornuta & Germaine, 2019). The following assumptions are applicable to this study:

1. The certified public accounting firms in the tristate area of Indiana, Kentucky, and Illinois that will participate in the study were relevant and representative of the geographic region.
2. The participants answered the research questions with a complete and coherent understanding.
3. The participants answered the questions uninhibited, honestly, and openly.

4. The personal beliefs and biases of the researcher was not influencing of the findings.
5. CPA firms vary, so broadening the horizon of firms to cover the tristate area mitigates lack of experiences with emerging technology or access to participants.

Protecting and preserving the trust of the participants and organizations involved in the study is essential to getting honest and open feedback (Turner, 2010). To mitigate the hesitancy to share details or risk exposing private information, it is important to either sign privacy agreements or change names of certain subjects to allow for freedom to share with protection and little disclosure of who the participants were. Building openness and a comfort when asking the research questions requires neutral expressions or reactions from the researcher to questions answered by the participants (Turner, 2010). The researcher is suggested to have a physical and verbal appearance of uninfluential emotions and an interview that is controlled, this aids open and honest feedback from participants. A consideration for remediating bias when interpreting the data may require employing an iterative review process of nonparticipating researchers through a third-party consultant, this assists in quality and effective evaluation of interview transcripts (Creswell, 2014).

The respondents were allowed to answer questions individually and discreetly, not adding the researcher's personal thoughts on any subject, and eliminating any bias's in the research. Preparation for the interview process assists in alleviating any problems in advance, incorporating unambiguous focus and a maximization of the benefit of the research study is necessary (Turner, 2010).

***Limitations***

Limitations are potential weaknesses of the study that is out of the control of the researcher, and place restrictions on the type and extent of data available for the study (Kornuta

& Germaine, 2019). One limitation is the population size and geographical location. This study was sited within the tristate area of Kentucky-Indiana-Illinois. CPA firms in this area are limited in scope and do not represent the entire field of audit or population. The type of participants chosen included a broad array of CPA firms in the area, even though limited in scope, the participants were chosen on the ability to fully describe their experiences being researched (Hycner, 1985). Audits are private and internal information of organizations may have discretion and limits on the shared data. The availability of documents considered private may be a hindrance to articulating and discerning research questions. Essentials of the principles of interview preparation is to explain the purpose of the interview and address terms of confidentiality (Turner, 2010). Informing participants in advance that this study is for academic purposes and to further the field of accounting research hopefully remedies concerns. Noncompete agreements and confidentiality clauses should be agreed upon in advance also. Participant selection is driven by those that are willing to openly and honestly share information and based on criterion sampling in order to obtain qualified candidates (Turner, 2010). Criterion sampling is important when drawing on real-world situations and when criteria is predefined as in this study of the experiences of auditors in CPA firms handling or not handling of big data and blockchain technology (Shavelson et al., 2019). Not every CPA firm has adapted to blockchain and big data or have experiences. Thus, gathering subjects with technical expertise in this area may be minimal. Readers of this research should not formulate the findings of this study beyond the scope of the region and an understanding that the feedback is representative of those involved in the study not the full context of the field of accounting or the audit subset.

### *Delimitations*

Kornuta and Germaine (2019) stated that delimitations form boundaries, narrowing the scope of the research study allowing for manageability and focus. To narrow the scope of this research, the study was limited to the noted geographic target population (Indiana-Kentucky-Illinois) that included CPA firms in the region. While emerging technology is essential to upcoming changes effecting audits, the focus is on big data and blockchain, but the inclusion of other technologies and emerging technological terms may be interchanged to support the study.

## Significance of the Study

This study contributes to the body of literature examining the circumstances blockchain and big data has on audits. These findings further the understanding of the influence these technological innovations have on the role of the auditor. In addition to adding to the theories, a more applied understanding addressing in detail the developments or strategies organizations are implementing to serve clients within this spectrum was be observed.

According to Xu et al. (2019), blockchain studies in the literature is in its infancy; yet, it is stated by various researcher to be a disruptive emerging technology that will affect the social sharing community (i.e., humans, technology, and organizations). Further studies are needed to examine the circumstances that automation, artificial intelligence, and streamlined audit processes pose. Applebaum et al. (2017) supported the notion that the external audit profession lacks empirical research on big data. Applebaum et al. (2017) also asserted that the literature does not cover certain specifics like the needed competencies and the practical processes necessary to provide assurance. This qualitative phenomenological study includes data collected through face-to-face interviews, observations, and supporting documentation provided by

auditors, management, and various participants' (i.e., audit firms, clients, and corporations) experiences.

### *Reduction of Gaps*

This study addressed the gaps in the literature on blockchain and big data through an increased understanding of auditor's experiences. Dagiliene and Kloviene (2019) expressed concern over the limited empirical studies on big data audit processes including an understanding of the reasons why audit firms' value big data. Brender et al. (2019) noted the lack of research on the impact blockchain will have on audits to include the transformation of how audits will be performed, a redefining of audit/control activities, and a paradigm change of the audit profession. Other relevant factors address CPA firms' perceptions concerning the needed strategies to stay competitive. An additional need to probe into the regulators concerns on the upcoming possible adjustments to audit standards. There is a transgression occurring in the field of audit that concerns an interdependence of relationships that span from audit firms, auditor roles, governing bodies, and an epitome by industry concerning big data and blockchain influence on audits (Dagiliene & Kloviene, 2019; Tapscott & Tapscott, 2017). This study sought to address the demands, to investigate the changes blockchain and big data are having on audits. This study offers an exploration of the various points of view in addition to including an analysis of the marginalization of auditor roles.

### *Implications for Biblical Integration*

The three central themes relevant to the theological Christian lens of this study are agency, technological innovation, and strategic planning. Respect for authority, adhering to rules, promoting honesty, and ethical behavior are continuous themes throughout the Bible. Acts 24:16 (AKJV) states, "And herein do I exercise myself, to have always a conscience void of offence

toward God, and toward men." Auditors are considered stewards who influence decision making; agents that stakeholders rely upon to make informed decisions about the financial status of an organization (Rausch, 2011). Auditors also use judgment in their roles; ethically speaking, there is an associated propensity of professional behavior and conscious morality. Everett et al. (2018) examined the religious identities of auditors calling their duties sacred, ethical, and built on faith. From an agency point of view, external auditors operate within their contractual obligations to their clients and are expected to abide by a code of ethics which aid the public to trust their judgments and professional reports. Authority is addressed in Romans 13:1 (AMP) which states, "Let every person be subject to the governing authorities." Everett et al. (2018) suggested auditors are like priests- in a sense, objects of authority, and subject to authority as well. Ethical responsibility towards others is addressed in the Biblical law as noted in Leviticus 19:11 (AMP) "You shall not steal, nor deal deceptively, nor lie to one another." The auditor has a professional responsibility regulated by authority. Morality, honesty, and proper treatment of others is applicable to the texts of the Bible.

Biblical experiences describe points in time where progression, innovation, and technological advances effected the lives of people. In Genesis 1:1-31 (NKJV), God created the world, which was without form. It was a progressive seven-day process to form the earth, separate light from darkness, day from night, and land from water. Another account of what technical advances can do is spread the Gospel and promote the great commission. Mark 16:15 (TLB) states "You are to go into all the world and preach the Good News to everyone, everywhere." Technology is a part of cultural progress, enhancing advancements to meet the needs of society, and increases the ability to connect and share with one another more efficiently across the world.

Historically the accounting field has adapted over time to adjust to economic changes. Auditing as a subset is subject to changes as well (Sanchez-Matamoros et al., 2015). For audit work to be sustainable there must be adaptable process improvements to make audits better at fraud detection and evolving to meet the present conditions of businesses (Chadegani & Mohamed, 2014). Biblically, strategic processes are relative to growth and planning as addressed in Proverbs 15:22 (NLV) which states, "Plans go wrong without talking together, but they will go well when many wise men talk about what to do." This study encourages discussion about what firms are doing to tackle the changes blockchain and big data are impeding on audits. Open dialogue in research and investigation addresses the points of views and processes improvements to implement change.

***Relationship to Field of Study***

One of the greatest leaps in the accounting field being discussed concerns the adaptation of technology; not only as a benefit, but as a new phenomenon that professionals like CPAs are trying to understand (Shaffer et al., 2020). There are a host of concerns that technological advancements will have on the field of accounting such as the effects on tasks, training requirements, accounting regulations, and job elimination/marginalization. Yet, CPAs are suggested to embrace the benefits by developing new skills and finding ways to adapt their roles to meet client's needs (Shaffer et al., 2020). According to Ionescu (2019), internet related technology delivers more accuracy (less human error), efficiency, and the alleviation of certain tasks. Using technology in their roles also heightens opportunities for more service offerings like consulting.

Auditors are accountants and they play a critical role in managing fraud risk. External auditors have a perceived responsibility to detect fraud, and one of the improvements towards

this effort is centered on auditor performance (DeZoort et al., 2018). Technological developments of accounting have evolved the accounting processes, creating new opportunities, and lessening historical tasks. Understanding innovative processes among accounting employees, firm's management, and auditors is crucial for the use of technology-based systems which may be unusual.

### *Summary of the Significance of the Study*

This study contributes to the body of literature on technology-based systems like big data and blockchain that effect auditor roles. The design was for his study to provide auditors, CPA firm's management, and accounting professionals with opportunities to enhance their use of technological innovations like blockchain and big data. An additional expectation is that there will be an increased benefit and relative strategies that better support their organization and clients. With increased pressures for more fraud detection, the use of the internet, and the ever-changing technical tasks of audits, CPA firms can embrace the changes and plan for better alignment within their mission to serve the public.

## A Review of the Professional and Academic Literature

This literature review covers the technological bearings of blockchain and big data that is existent to the field of audit. Most of the research on blockchain and big data was recent and in need of further development as this technology is considered new to the industry and not fully adapted by businesses. Factors pertinent to the literature relating to blockchain and big data were audit and CPA firms need to prepare, be informed, and trained for its use. The players should be open to tapping into the benefits and the opportunities for its use as well as an understanding of the impediments created and the changes to become aware of that will affect traditional audit processes. Innovative technology like blockchain and big data create a new audit and a new

addition to the process and system of governance. The notion of the audit remains in most research to keep the audit quality high and to ensure the external auditor's essential responsibility remains as informed, independent, ethical, and objective.

The organization of the literature review is as follows. First, the methodology of concepts was attained from the literature to frame the study, explaining structuration theory, critical theory, and role theory interrelationship to the study. The next three sections discuss the findings in the literature topically. These sections discuss audit in relation to governance, their role, and the emerging technology - big data and blockchain. The order shall first include the historical fundamentals of audit, second the technological effects of audit, and third how players are strategically planning for the audit of the future.

## Theoretical Frameworks

### *Audit and Structuration Theory*

As a conceptual framework, Giddens theory of structuration gives context to the various actors involved in a social system an interdependence on actors and agents (Schneidewind et al., 2018). The interlinking of human actions, authoritative systems, social structures, and intentions is what integrates the duality of structuration theory (Vanden-Abeele et al., 2018). In this context, there is a source of regulatory power in the field of audit that sets the rules of practice. The acting agent is the auditor who executes on behalf of their clients within a system built on regulations and society's trust.

Fundamentally, structuration theory expounds studies of social groups to include institutions, organizations, and the hierarchy of human interactions (Englund et al., 2017). Indeed, the auditor operates in the real world, often on behalf of the public, encapsulating a social position that hinges on professional practices and interactions with various participants of

diverse statuses internally within the firm and externally with various stakeholders. Expanding beyond the building blocks of Giddens structuration theory's premise of social structure was Englund et al. (2017), the researchers included the cooperative of accounting and strategy. Englund et al. (2017) described Giddens ideas of structuration theory in their study to encourage agents to transform the structures of accounting through their actions (p. 3). The authors advanced structuration theory as a continuum of accounting transformation over time, suggesting its application to the strategic accounting process. Strategy is considered a social process based on something that is done (Englund et al., 2017). Technology is pacing the auditor's role which has created an awareness for new revenue and cost streams for accounting firms.

**Technology and Structuration.** Understanding the changes technology is placing on the role of the auditor is a multifaceted phenomenon. Vanden-Abeele et al. (2018) proposed theories to explain technological structuration as a system that shapes processes and alters routines; emphatically changing the way things are done and restructuring practices. Technology is described as another social structure, based on a logical set of systematic principles. It is relevant use or decision to not use is inherent but also determinable by one's own power. While adjusting to emerging technology like big data and blockchain technological structuration should be a consideration because of the interplay and overlap of power structures (Jack, 2017). The power structures include the regulators, the auditors, the firms, and their relationships with the clients they serve.

**Agency and Structuration**. Jack (2017) pointed out that accounting research involving structuration theory deeply invests in the external and internal viewpoints of the involved agents and their reactions to social structures, with an aim to promote real knowledge, address impeding issues, further change, and new outcomes. Adhikari and Jayasinghe (2017) adapted a

strengthened version of structuration theory called, strong structuration theory, which expands on Giddens theory to include the concepts of collaboration and working through change between agents such as agents-in-focus and agents-in-context. The premise addresses the layers of responsibility or power that the agents-in-focus have compared to the agents-in-context within social positions. Agents-in-focus are the central implementors of change, the chief authority to make a practice happen. The agents-in-context are the professional accountants, administrators, and specific to this study, the auditors. At end, knowing how the two power structures work together in the social realm of accounting systems changes is key.

Adhikari and Jayasinghe (2017) presented a study which focused on the accounting changes occurring in government accounting practices of Nepal. Adhikari and Jayasinghe (2017) examined the implementation deficiencies, how processes may be adopted but not properly implemented, the lack of resources, the information technology issues, and the costs associated with implantation. As auditors work through the emerging technology such as blockchain and big data, they contend with various initiatives (social structures) in their practices while deciphering through layers of power controlled by the regulating authorities, the firm's top management, and the external stakeholders. Bonsón and Bednárová (2019) pointed out that agency theory was noted to give meaning to the existence of blockchain, the idea that there is asymmetry between different agents caused by increased transparency and accountability, which reduces and minimizes agency problems. At end, agents are verifying certain actions that blockchain deems traceable, allowing computational accuracy without human intervention, along with autonomous, and systematically validated transactions.

### *Audit and Critical Theory*

Critical theory is the chosen theoretical framework to address the developmental process from tradition to new developments. It has been designed to assist researchers in understanding the social structures in which subjects are dominated and ways to overcome the influential factors in order to progress (Cordero et al., 2017). Within the realm of pragmatism forwards qualitative research in social science and innovative studies (Timmermans & Blok, 2018). Proponents of critical theory include Visser (2019), who addressed critical theorist John Dewey's pragmatistic view, considering pragmatism as being inspired by Darwin's theory of evolution. The spectrum of critical theory as a social science clarifies the goals, behaviors, and real views of subjects and objects reasoning and affirms a socially applied philosophy (Rehbein, 2018). Influential factors within the ever-changing field of audit share similar views of Visser (2019), noting how managers and firms are urged to broaden interests beyond shareholders to include the interests of employees, clients, and the community at large.

**Technical Innovation and Critical Theory**. Blockchain and big data have an influence on the field of audit that is developmental, progressing, and subjected to human intermediaries as well as nonhuman technological -industrial systems. Understanding these technological emergences and intermediaries within the field of audit draws correlation between crises and reflexivity, a social concept that enlightens a study from a critical theorist philosophy as studied by Cordero et al. (2017). The criterion for exploring a crisis starts with prescribing it from historical traditions to novel innovations, observing it to understand structures, and then resolving its impeding factors. Reflexivity transforms crises by opening responsive thought, comprehensive learning, and interactive social interventions to deal with obstacles as well as complex expectations about lived experiences (Cordero et al., 2017). The critical theory

paradigm attributes to the study of the socio-technical response to structural dynamics which may give insight to the human interventions addressing the traditions and norms of blockchain and big data on audits.

**Technology and Critical Theory**. The threats, efficiency, and effectiveness of technology centralizes a new industrial realm, making institutional growth dependent on a combination of society and corporate development (Cordero et al., 2017). Olohan (2017) discussed hegemony, the social constructs of technology combined with power structures, encouraging adaptation to keep up with the unstoppable momentum technology posits towards improved human conditions. Redshaw (2017) additionally emphasized the hegemony of technology, to include social forces and technical requirements that fall within a system of domination, adding the social layer of the internet. The audit process has changed to offer more real-time audits, information provided by internet sources like social media, and the use of automation which offers less human intervention. Olohan (2017) advocates for increased awareness of how to work with technological advancements, calling for preparedness, and renouncing technological somnambulism. Institutions and participants affected by these changes may need to refocus outcomes, plan strategically, and decide what needs to be done to engage with technological innovation.

**Change and Critical Theory**. Reis and Lavarda (2017) used critical theory when researching the process of change that occurred in the accounting systems of local public organizations within the Brazilian government. The objective of their study contributed to understanding an accounting change occurring that was evolutionary and involving multiple agents that were internal and external, and included the considerations during stages of implementation. Ideally, the progression of change according to Reis and Lavarda (2017), began

with analyzing the historical background and cultural factors. Other inclusive elements of their research which brings context to critical theory studies was the differences in agents' motivational factors and a comparative analysis of what changes have occurred technically. Filling the gaps in the literature includes observing the auditor in practices movement from traditions to other responsibilities and participants needs.

### *Audit and Role Theory*

Role theory symbolizes work positions, also considers other constituents needs, and includes an understanding of the requirements to operate (Reiche et al., 2017). It includes an explanation of the role requirements, characteristics of behaviors, and the task-based activities, the outcomes and expectations. Another important feature is the navigation of other relationships and social and technological dimensions occurring during role performance (Weisner, 2018). The role of the auditor is central to various motivating factors like public interest, client-agency relationships, regulatory systems, and the role of an employee that works in a team environment. Furthering research to include addressing blockchain and big data's inclusiveness will enhance explanations of auditor's roles in practice and further the understanding of their responsibilities to clients and the firms they work for.

**Aspects of the Auditor**. Gissel (2018) stated that failure to perform audit procedures is an issue. Regulators require appropriate audit evidence, and due professional care during an audit as essential attributes. Moreover, professional skepticism is the attitude or mindset of the auditor, a questioning mind that relates to the need for the auditor to make a critical assessment of audit evidence. Mentoring is a common training method for creating a well-trained auditor to operate with professional skepticism in the audit (Gissel, 2018).

In order to obtain audit evidence to base their opinion, auditor's traditionally performed audit procedures as categorized to include in the diagram below (Lessambo, 2018).

**Figure 2**

*Classification of Audit Procedures*


The universal procedures auditors were traditionally performing are changing and moving into a new realm. The new integration of digital technologies like big data and blockchain have complicated the audit functions (Manita et al., 2020). The new auditor will eliminate repetitive tasks. Data were extracted automatically through technical systems. There were shorter and more time saving audits.

## Historical Fundamentals

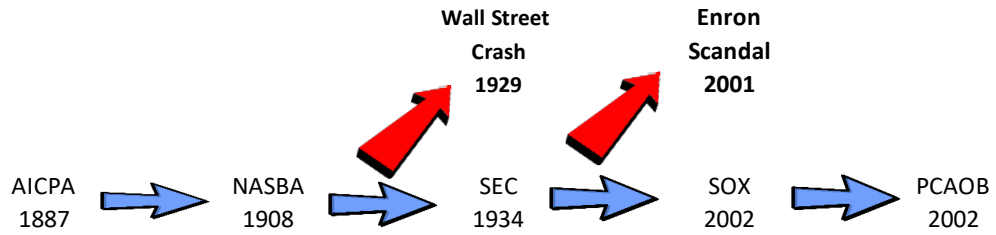
### *Historical Fundamentals of Audit Governance*

Actively monitoring the conduct of accounting professionals includes various regulating authorities that are designed to protect the public and private interests leading to an elimination self-regulation of the accounting field (Jenkins et al., 2018). In turn, five associated entities will be discussed categorized as accounting associations, the effectual rule setters, sanction imposers,

and authoritarians of the accounting profession and its members. As the oldest entity of the group, the American Institute of Certified Public Accountants (AICPA) is the earliest to set platforming trends of enforcement, monitoring, and pronouncedly the latest Sarbanes-Oxley Act (SOX) which started as a result of the effects of the Enron scandal (Jenkins et al., 2018).

**Figure 3**

*Year of Established Governing Authorities and Historical Events*




**American Institute of Certified Public Accountants**. Established in 1887, the American Institute of Certified Public Accountants (AICPA) served the public interest and accounting profession through monitoring, professional membership, and governance of conduct (www.aicpa.org). They are a rule making and standard setting advocate for the audit profession, setting the rules of ethics and technical responsibilities of its members. Guided and written by the AICPA, is the Code of Professional Conduct (CPC) relatable to the profession of accounting members (Jenkins et al., 2018). It is a document of bylaws and principles that CPA societies and state boards of accountancy adapt to (www.aicpa.org).

**National Association of State Boards of Accountancy**. The National Association of state Boards of Accountancy (NASBA) established in 1908 is the forum for the 55 State Boards of Accountancy in the United States (www.naba.org). An objective of NASBA is to monitor trends in technology, implement appropriate technology solutions, and ensure the effective

ongoing use of technology (www.nasba.org/about). Additional regulating responsibilities include licensing CPAs, addressing emerging issues relevant to the accounting profession, and advancing ethical behavior through the NASBA Center for the Public Trust (CPT). A stated overall mission of effectiveness and advancement concerning the common interests of the 55 State Boards of Accountancy (Jenkins et. al, 2018).

**Security Exchange Commission**. Founded in 1934 the securities and exchange commission (SEC) is considered another overseeing or facilitating entity that protects investors, ensuring public companies trading securities are regulated and monitored for public trust (www.sec.gov). The SEC is an agency that enforces federal security laws and voiced concerns over auditor's failure to identify and report material internal control weaknesses (Efond & Lennox, 2017).

**Sarbanes Oxley Act**. The Sarbanes Oxley Act (SOX) establishes and directs the board. This act sets standards for audit and professional practice, compliance, and quality controls for audits of public companies (www.pcaobus.org/standards). The SOX act was passed in the USA in 2002 due to high profile corrupt accounting practices and corporate involvement in irregularities of financial reporting (Fairchild et al., 2019). Governance is a primary role in fraud risk management. SOX was designed to improve organizational audit standards and fraud risk management; to include audits of internal controls, mitigation of fraud risk, and management certification of financial statements (DeZoort & Harrison, 2018). Section 404 of SOX requires an independent audit of internal controls for larger public companies and an opinion by external auditors on the effectiveness of client's internal controls over financial reporting (Efond & Lennox, 2017). The sanctions imposed by SOX controls and disciplined members of the

profession, emphasizing public interest over commercial interest, was a factor in the collapse of Enron (Jenkins et al., 2018).

**Public Company Accounting Oversight Board**. The Public Company Accounting Oversight Board (PCAOB) was created in 2002. It was created by SOX to shape the environment in which accountants operate (www.pcaobus.org). The PCAOB can impose penalties and all US public company audit forms are subject to inspections (Efond & Lennox, 2017). The PCAOB inspections improve the quality of audits using internal controls, prompting auditors to remediate deficiencies (Efond & Lennox, 2017). SOX regulations historically promulgated the foundation of audits as a requirement for public companies, primarily to oversee registration, inspection, standard setting, and enforcement of guidelines.

**Other Key Governing Agents**. There are many governance actors and institutional players positioned to handle issues and prominent factors during an audit. The internal audit staff, external auditor, and audit committee are governance actors (Fairchild et al., 2019). During the downfall of WorldCom, it was noted that a lack of cooperation and liaison caused mismanagement, corporate governance failures, poor internal controls, and accounting irregularities (Fairchild et al., 2019). The board, external auditors, and formal structures have the responsibility for governance of internal controls and risk assessments. The audit committee has the authority to replace and appoint the external auditor and act as intermediary investigator of auditor and management.

### *Historical Fundamentals of the Audit Quality*

Audit is a social process of balancing various relationships including social actors like stakeholders and agents of trust that report on the financial performance of a company (Mahdavi & Daryaei, 2017). Since audits have various objectives, the cognitive ideas and actions of social

actors intersect. There is an interweaving of effects and outcomes one to another. Audit quality is the premise that sets the foundation of the audit processes and is strongly related to the characteristics of those performing the audit (Baah & Fogarty, 2018). Mactavish et al. (2018) explained the specific stages of the audit process to include ethical requirements, planning, evaluation, and reporting. At end, understanding the auditor's tasks assists in transforming the auditing institutional environment.

**Figure 4**

*Connection of Audit Quality to the Audit Process*


**Ethical Requirements**. The tasks associated with ethical requirements include auditor objectivity, ethical judgments, professional skepticism, and the functions of quality control like firm leadership and human resources (Mactavish et al., 2018). Traditionally, accountings global language for communication is the various financial statements being produced, like the balance sheet, profit and loss statements, and statement of cash flows which extend to end users for decision making (Adali & Kizil, 2017). Blay et al. (2019) researched audit quality considering the ethics of social norms, stating that it is enhanced by honesty, moral judgment, as well as auditor independence. These social norms of audit ethics reduce the likelihood of auditor

misreporting and acting on the benefit management rather than investors. The conduct and independence of an auditor improves audit reporting and quality, making the financial reports more creditable (Cuzdriorean, 2018).

**Planning Requirements**. Maksymov et al. (2018) supported the notion that a budget of enough time for essential audit steps is a pertinent indicator of audit quality; adding that, allotted time for parts of the audit is variable to certain procedures. Definitions of audit planning also known as the audit program emerges from AU-C Section 300, Planning an Audit, which highlights an auditor's responsibility to perform an audit efficiently and as an ongoing process (Maksymov et al., 2018). Moreover, the mandates of AU-C Section 300 addresses certain specific planning activities to include the overall audit strategy, the audit plan (nature, timing, and extent of audit procedures), audit supervision, and review (Maksymov et al., 2018). An objective of the audit report is to be timely which is a fundamental component of reporting quality (Habib et al., 2019). Materiality, risk assessment, fraud assessment, and the use of specialists and experts also extend the timing, nature, and extent of audit procedures (Mactavish et al., 2018).

**Evaluation Requirements**. The process of evaluating the audit results include an array of themes, to be discussed is the review process and interactions with clients and the firm (Mactavish et al., 2018). As noted by Ater et al. (2019), the review process is an essential function of a high-quality financial statement audit and is required according to regulating accounting authorities. Audit documentation and audit review are a part of the audit role related to the audit field work. The audit engagement includes partners, managers, and senior personnel all responsible for the evaluation of the audit.

Agency theory's duality is relative to the leadership of clients and the firm, this duality increases the uncertainty of information and conflict between parties (Habib et al., 2019). Knechel et al. (2020) suggested audit quality to be multifaceted, determined by both the characteristics of auditor and client. The conundrum of self-interests within the principle-agent relationship still requires dependence on one another for the best outcome. Depending on the audit staff's training, education, tenure, and authoritative hierarchy at the firm, the functions of the review process are distinct.

**Reporting Requirements**. Financial statements can be complex for outside investors to understand and can be manipulated by management; therefore, the auditor's opinion and commentary on audited financial statements provides information that is valuable and creditable (Elliott et al., 2020). Auditors are tasked with assessing whether an organization will continue in business the following period at minimum into the next fiscal year, positioned to present the going concern opinion (Jemovic et al., 2019). Types of auditor report opinions are unqualified, qualified, disclaimer, and adverse (The Quality, 2020). Audit quality is dependent on new adoptions like Key Audit Matters (KAM) which warrants more disclosures in the audit report; moreover, a revision of the audit report to include key or critical audit matters and a requirement to have engagement partner's signature on the audit report (Abdullatif & Al-Rahahleh, 2020; Li et al., 2019).

### *Historical Fundamentals of Audit Technology*

The digital age has been called the fourth industrial revolution and is rapidly changing the future of accounting and auditing, computers will be interconnected, have analysis ability, and less of a need for human intervention (Kruskopf et al., 2020). The period between a company's yearend and audit report date is called audit report lag (ARL). ARL is time sensitive, the

decisions external stakeholder's make when investing depends on the release date of the audited financial reports (Habib et al., 2019). The SEC adapted new regulations pushing for acceleration of released financial reports for public entities from 90 to 75 days, arguing that information technology and accounting systems used by accounting firms should enable quicker reporting (Habib et al., 2019 ). The use of less human intervention via technology saves time, creates less human manipulation, as well as provides more accuracy when completing an audit. Financial reports are not limited to being read by humans but machines as well (Kruskopf et al., 2020). Yet, there are other factors to consider as traditional technological processes change and places contentions on the field of accounting, audit, and business (Cong et al., 2018).

Corporations like Eastman Kodak, Western Union, IBN, and AT&T are losing hegemony; historically obsolescence to various market share and given over to new innovators like Amazon.com, Google, or Facebook (Cong et al., 2018). In a similar way history could be on the verge of repeating itself as CPA firms must adapt their services to obsolete skills, continuous audits, robotic processes, automation, data interface, big data and blockchain. According to Ater et al. (2019), there is a technological phenomenon occurring that has changed the review process for instance communication occurs more remotely-electronically, thus eliminating the need for face-to-face discussion. Audit feedback also occurs in a variety of ways for example through firm developed technologies, messaging, and email. Feedback is essential to developing and coaching the audit staff as well as critical to firm quality control. Adali and Kizil (2017) noted how a popular audit software like Benford's law-based analysis tool is used to detect fraud, irregularities, identify accounting errors, and has the ability to pinpoint accounts specifically using all the data that are available, not just aggregated data.

**Information Technology**. Information technology is a part of every business in various ways, powered by systems like the Internet of Things, Internet of Systems, and cyber-physical systems (Kruskopf et al., 2020). Umar et al. (2017) stated that information technology plays an important effect toward audit planning, the audit process, audit assessment, and audit documentation. Mustapha and Lai (2017) noted that information technology shortens the time of the audit process and helps auditors get their jobs done more efficiently. Some audits require a firm's computer systems to be audited and evaluated for controls purposes, error free processing, and accurate reporting. Essentially, information system audits are designed to evaluate a firm's computer systems, to assess whether adequate internal controls are in place to ensure efficiency, effectiveness, integrity, and security of the firm's data and information system assets (Kim et al., 2017).

Leaning on agency theory, Kim et al. (2017) found a positive relationship between auditor expertise, audit role clarity, and audit satisfaction; noting, that experienced and competent auditors are determinants of a well-managed, client satisfied, high quality audit. When an auditor is lacking in knowledge of a certain technical system, at times they outsource or utilize an expert, deriving information to make conclusions from their trusted source. Information technology specialist also share in the responsibility of securing a high-quality audit, they are valuable resources to the audit team, adding an expertise or specialization in an area that an auditor may lack (Bauer et al., 2019).

**Robotic Processes**. Robotic process automation (RPA) reduces costs, saves time, and is being effectively introduced into all big four accounting firms, to include these firms working with RPA companies like Uipath and Blue Prism (Kruskopf et al., 2020). Audit evidence according to the PCAOB and AICPA should be "sufficient and appropriate" in essence, it is used

by an auditor to derive conclusions upon which the audit opinion is based (Gross et al., 2020). Robotic process automation (RPA) streamlines audit evidence collection by taking standardized data from different sources, combining data to create one audit work paper. Streamlining making the engagement less labor-intensive, time-consuming, and repetitive testing (Cohen et al., 2019). Information technology systems like RPA are supporting inventory audits, making the process more efficient and less manual; moreover, repetitive tasks such as inventory counts, and asset examinations are benefiting from automated inventory management technology like radio frequency identification (RFID) and bar code scanning (Gross et al., 2020).

**Emerging Technology and Audits**

Information sharing creates an exchange of data between organizations, people, and technology. The variables diversify information, making the financial audit facilitation and reporting more complex. The audit has shifted in complexity to include a technological responsibility as auditors seek to answer the "what" questions of management and customers (Innovations, 2020; Yoon et al., 2018). Big data technology is a smart technology that stores user information by a "cookie" or a small text file which recognizes unique IDs within a computer network (Innovations, 2020). Smart technology also keeps records and histories of "cookies" and search preferences or browsers of websites users visited (Innovations, 2020). At end, blockchain ties records together in blocks and operates in the cloud, allowing information to pass from one person to another validly and more immediately (Kruskopf et al., 2020). Further research is needed to implore the working auditor's use in the field and incorporation of it in present processes.

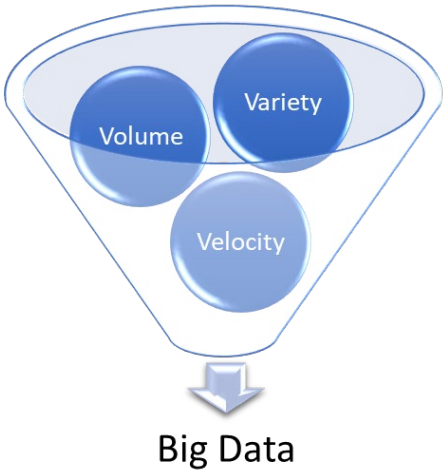
### *Big Data*

Big data technologies shape the auditor's profession and the methods and tools used on audits are more advanced (Rose et al., 2017). Innovations of financial audits include technologies that simplify audit procedures, improve organizational performance, and reduce the level of audit risk (Innovations, 2020). Big four companies are identifying with the idea that the audit has become an IT audit, a continuous audit, or hybrid audit. This means that the IT auditor performs the general IT controls like granting user rights, granting and removing access to users. IT technical skills, training for working in coding, cryptography, and hashing are needed by the auditor in order to understand big data technologies and its translation into the mission of the audit. Audit procedures and tests are evolving, favoring more real time audits or continuous audits which includes current, real, and up to date relevant data (Yoon et al., 2018).

There are three representational elements of Big data: volume, variety, and, velocity (Ahmad, 2019; Green & Green, 2017).

**Figure 5**

*Elements of Big Data*



- Volume: data collection from various sources and storage of massive data, includes collections from social media, Web, mobile platforms, corporate systems.
- Velocity: concerns speed which means faster and shorter processing time.
- Variety: structured data, unstructured data, digital email, video, audio, and financial transactions.

Researchers agree that processes in audits are having to adapt and use vast amounts of data as evidence and analytical tools to explain and organize information (Ahmad, 2019; Barta, 2018). Traditional audits were not focused on real-time measurements as needed today which creates a need for standards regarding audit evidence in the context of Big Data (Appelbaum et al., 2017). One of the issues is with the quality of data, the messiness of data, and the lack of audit trails (Bennett, 2019; Green & Green, 2017). Additionally, more data does not equate to better information but more complications to detecting fraud and deciphering it for assessment purposes (Barta, 2018; Ghasemaghaei & Calic, 2020). Audit standards should be revised to provide more quantitative measure of quality versus quantity in an IT audit (Applebaum et al., 2017). Research is limited and in infancy stages when trying to understand the full effects of the 3V's on audit practice and an exploring of this shall be enhanced by this study.

**Big Data as Audit Evidence**. According to Rose et al. (2017), big data visualization should be introduced at a specific time in the audit to be most effective; at best, as a tool during the auditor's evaluation of evidence and professional judgements. Patterns in big data visualization is not easily recognizable when introduced during the audit before more traditional audit evidence. Big data visualization benefits the audit more when used as audit evidence after traditional methods (Rose et al., 2017). Big four audit firms are using data analytics in audit tests, testing transaction validity, reconciling accounting accounts, and replacing the classical methods

of testing. Larger corporations like LinkedIn, Google, Facebook, and Amazon are working with big data yet many organizations are struggling to understand the big data phenomenon (Del Vecchio et al., 2018; Innovations, 2020; Yoon et al., 2018). The IT of big data cannot substitute the need for human beings, professional judgment, deep thinking and analysis, there will remain a human element and computing progresses by IT experts (Barta, 2018). Even with the use of big data auditors are still responsible for deciphering through invalid data, making predictions, and preparing the audit reports.

Because of the large amounts of unstructured data at varying degrees, traditional querying tools are not enough to process the financial and nonfinancial sources (Choi et al., 2018). The various sources of data are continuous and its effects on audit judgment and decision making is not easily answerable. There is limited evidence on the best practices and several critical issues remain before audit firms can successfully utilize big data in practice. Big data analysis is used in the audit process to identify patterns that are used to plan the audit before another audit evidence is examined.

**Hadoop.** Innovation to the audit profession lies within the ability to verify and work with large amounts of data and communicate with clients from a distance (Yoon et al., 2018). Big data cloud analysis can be performed using software called Hadoop, a set of open source operating utilities for cloud computing that stored distributed data in large quantities processed in parallel (Yoon et al., 2018). Hadoop also allows for a network of multiple computers to be used simultaneously to solve client's problems (SR, 2018). The output of all the data is signified by individual nodes stored in a data warehouse analyzed expeditiously via MapReduce, a program designed for processing vast amounts of nodes, eliminating duplicated information, and keeping

the data uncompromised (Osvaldo et al., 2017). Hadoop's file system provides the auditor with logs like hdfs-audit.log and SecurityAuth-hdfs.audit (Khader et al., 2018).

**3Vs of big data**. The 3Vs of big data are noted by researchers as the essential characteristics that formulate how and what it is (Ghasemaghaei & Calic, 2010; Guha, 2018). Big data volume, velocity, and variety continues to grow due to the internet; improvements are being made via Hadoop and with the use of algorithms to organize and bring meaning from it (Johnson et al., 2017). The context of volume included deeper and detailed information on individual customers, what they do, how they are doing it, where they consume and with whom. Big data variety represents the richness of data, various formats, specific sources, and the range of data that is unstructured or structured (Guha, 2018). It has been noted that 90% of the data are unstructured, which poses the greatest challenge for data variety when analyzing it using traditional statistical methods (Johnson et al., 2017). Big data velocity are aligned with speed, the rate at which firms are processing and analyzing customer data; moreover, transplanting data into knowledge insights and solutions (Hong et al., 2018). Data velocity allows for instantaneous evidence which is continuous and in real time allowing for immediate decision making (Guha, 2018). As stated by Ghasemaghaei and Calic (2020), when firms consider optimizing big data, of the three characteristics, data velocity is considered the greatest at improving firm innovation performance.

Firms are using big data to gain competitive market advantage through sought after new information or get a sense of the market (Johnson et al., 2017). Big data is so vast that standard software like Microsoft Excel cannot manage it for analysis purposes and this is where the impediments to using it begin (Carter & Yeo, 2017). Statistical tools are used to analyze big data, one of the reasons for this is it allows the data to be clustered into managed groups of similarities

or relationships (Guha, 2018). Unstructured data from several sources include text messages, blogs, and social media which provides others personal information and behavioral information online. Unstructured data does not conform to a specific pre-defined data model (Carter & Yeo, 2017). Nastasoiu et al. (2019) noted that unstructured text data has been analyzed using sentiment analysis or computer-assisted content analysis. On the flip side, structured data are complex (e.g., multivariate time series data, data that are collected in regular intervals, functional data, which are data collected by equipment, image data, which is collected by infrared cameras, and other types of unstructured data, such as text and audio data that monitors systems; Hong et al., 2018).

Big data poses a change that is new to business, presently being understood, and still in the developmental stages to fully understand (Carter & Yeo, 2017). Accountants and auditors require more training, a need to differentiate themselves to become competent at handling the techniques and use of big data analytics. Auditors are parts of cross-functional teams, a part of the IT system, working together to make sense of the vast amounts of data. If the data is not made useful, it has limited value to the organization. Software programs such as Hadoop and hardware like Hana support making data management and manipulation possible.

Big data has complimented managerial, financial, and audit practices through increased forms of evidence and supportive information (Marcello et al., 2017; Westland, 2018; Zhai et al., 2018). Within the field of audit big data has helped in fraud detection, providing information on insider trading, and expense reimbursement fraud (Carter & Yeo, 2017). Client data has high volume due to cloud technology capabilities which allow for the integration of client's systems like the Internet of Things and social media (Appelbaum et al., 2017). A common software noted for organizing data for audits is CaseWare (Data, 2017).

### *Blockchain*

Blockchain may open a new category of job tasks called cyber auditing as the potential for cybersecurity, a new socio-technological collaboration between human and machine with sought after agreements of responsibility (Ghazouani et al., 2019; Hayes, 2019). Blockchain was noted to enter the mainstream as of 2017 and is considered a new emergence, disruptive to the accounting profession, and a new landscape- creating questions on its purpose and capabilities (Appelbaum & Smith, 2018). CPA firms will need to begin to adapt and leverage blockchain technology accounting and advisory services, starting with descriptions of what it is, how it works, and the implications for the accounting profession. A new level of technology exists, professionals of accounting or expanding from Microsoft Excel and enterprise resource systems (ERP) platforms to blockchain as a tool.

**Bitcoin and Cryptocurrency**. Satoshi Nakamoto created blockchain, a decentralized ledger, in October 2008 for the facilitation of Bitcoin trading. Because Bitcoin trading had potential risks of being duplicated or environmentally low trust, having an immutable audit trail was needed (Hayes, 2019). Blockchain enabled exchanges of currency called Bitcoin without third party intermediaries like banks, creating real-time verification and communication of information (Smith, 2018). Cryptocurrencies like Bitcoin are traded on public blockchains using a cloud-based storage system. At end, members of a certain “block” and “chain” are granted access with protected security a cryptography, and secured encrypted trails of information, which makes the system fraudulent resistant (Appelbaum & Smith, 2018). The cryptographic hash is unique to each block and chain and builds from the original, a historical trail consisting of hash IDs and time stamps; hence, a virtual connection that forms the blockchain (De Keyser et al.,

2019). The essential positive to this cryptographic system is its propensity to be coded and if the code is broken or altered, the ledger becomes inoperable, detectable, or stagnant.

The cryptographic coding is a mathematical process, managed by and containing a Merkle Root which organizes and completes a uniquely coded hash (Bonson & Bednarova, 2019; Smith, 2018). The Merkle Root forwards the blockchain creating a connection of multiple events and history of exchanges which ensures completion of one blockchain to a new blockchain (Ghazouani et al., 2019). The verifying members of a blockchain is called a node, these are users involved in the transaction's movement from one blockchain to the next blockchain. The nodes verification may include a vast amount which may cause the process to be expensive computationally. This node verification as an approval process is based on the majority, this makes blockchain tamper-proof, as approved block contents cannot be reversed or altered by nodes, and each majority member of a block must provide consensus (Milutinovic, 2018). A blockchain propagates in one chronological direction but can be audited and read nonchronologically. A blockchain may contain a history of cryptocurrency exchange, derivatives market trade, a payment on a loan, a vote or contract.

**Blockchain in Practice**. In the real world of audit practice and accounting, CPA firms that possess blockchain software and their clients as well, may save time, money, and unnecessary validation processes of an audit. Both client and CPA must have blockchain technology software features embedded into their accounting systems. IBM considers blockchain a tool to simplify transactions between companies, facilitate interfirm collaboration, increase trust among partners, and decrease the costs of transacting in industries (Gausdal et al., 2018). The benefits of accounting and auditing include notably: dual party accurately verify and view of transactions, time stamped unaltered numbers, reliability, cutoff, efficiency, and confirmations

(Gausdal et al., 2018). The auditor can perform analytical procedures in real time. When comparing traditional audits to block-chain enabled audits are considered continuous, clients, auditors, and third parties are kept up to date on confirmation transactions like payments, receivables, payables, and inventory which traditionally required hands-on activities like observations, oral interviews, recalculations, walk-throughs, and matching via paper trails.

There are public and private blockchains offered which have created hundreds of options that individuals and businesses may choose from. According to Appelbaum and Smith (2018) the public blockchain supports Bitcoin and the software can be downloaded by anyone that at this site (https://bitcoin.org/en/bitcoin-core/). The permission-less or public blockchain does not have software requirements and uses a proof-of work (PoW) consensus validation (Gausdal et al., 2018). Additionally, the private blockchain is decentralized users, access is restricted, and use requires a solution provider to develop the technical capacities and keys to private passwords.

CPAs are noted to steer towards private blockchains because of the added feature of privacy and utility or the need to be invited access, which limits the exposure of certain information to certain parties. Private blockchains are functional for businesses that desire less time confirming and verifying information (Yang et al., 2020). Common business sectors using blockchain are banking, real estate, constructions, government, mining, insurance, and supply chain (Casino et al., 2019). Using a private blockchain for each client allows sequential processes to be kept up to date, complete real-time verification as accounting entries are finalized in phases, in the double-entry accounting general ledger system and with an extra added triple-entry ledger created by blockchain technology (Gausdal et al., 2018).

Financial and professional institutions are collaborating on the initiatives blockchain bring, this includes Big Four accounting firms (Bonson & Bednarova, 2019). Deloitte who

launched the first blockchain based software platform called Rubix (Karajovic et al., 2019). Deloitte's clients using the Rubix platform allowed clients to automate financial reconciliations, audit processes, and real-time assurance of financial statements. KPMG benefited from blockchain use as well, developing the digital model in collaboration with Microsoft. Ernst & Young is involved in the Libra and EY Ops Chain, a blockchain-based project focused on the creation of distributed ledgers and the digitalization of payments, invoicing, inventory information, inventory pricing, and the integration of digital contracts (Bonson & Bednarova, 2019; Karajovic et al., 2019). Pricewaterhouse Cooper (PWC) created a blockchain platform called De Novo which focuses on the implementation of blockchain into the supply chain. In 2016 the Accounting Blockchain Coalition Conference a consortium to examine blockchain solutions for accounting and auditing was created by the AICP for collaboration between standard setters and regulation (Bonson & Bednarova, 2019; Industry, 2018). For those audit firms and businesses who move towards integration of blockchain, the following benefits and considerations include:

- Reduction of agency costs and information asymmetry
- Increased transparency and auditability
- Increased trust and reliability
- Reduction of costs, human error and fraud
- Improved data quality
- Solution to privacy paradox
- Supply chain transparency (Bonson & Bednrova, 2019).

Blockchain has the potential to organize, people and operations, projects, payments, information, and create smart systems that control system as well as safeguard documentation.

The next step in the digital era and will reshape the way we do business. The internet is a complex global cloud-based network that has changed the way we exchange information; this has led to the development of digitizing and reshaping business processes to include blockchain technology (Khanboubi & Hanoune, 2019).

**Strategic Planning for Future Audits**

Arend et al. (2017) examined the connection of strategic planning as a process vital to the survival and growth of an organization; specifically, during times when technology and market conditions are quickly changing. Further noting that firms can use strategic planning to achieve both high returns on investment and high levels of innovative activity. Moreover, innovative activity was stated to positively affect firm profitability; in relation, blockchain and big data technology innovation is an essential feature of the future CPA firm. One of the features of a high-quality audit is an audit where financial statements are free from misstatements and auditors gave warning signals of organizational distress (Ghebremichael, 2018). There is a positive influence on audits that include a technically competent auditor. Incorporating strategy is a multifaceted and bureaucratic process that is enabled by coordinated efforts, communication, shared knowledge, and various risks of uncertainty that new technological developments entails (Arend et al., 2017; Jacobs et al., 2018; Tighe, 2019).

Auditor technical skills need advancing (Nearly, 2019), noted skills gap in this area include:

- Predictive Analytics
- Artificial Intelligence
- Block Chain
- Machine Learning

- Robotic process automation (Nearly, 2019).

***Planning for Future Governance of Big Data and Blockchain***

A recent press release issued by the AICPA June 2019 addressed the proposed auditing standards need to evolve audit evidence to tackle business using emerging technology like big data analytics and blockchain (https://www.aicpa.org/press/pressreleases/2019/aicpa-proposed-auditing-standard-tackles-evolution-of-audit-evidence-in-todays-business-environment.html). Section AU-C 500, *Audit Evidence*, explains what constitutes audit evidence in an audit of financial statements (www.aicpa.org, 2012). The terms of audit evidence covered include:

- Accounting records
- Appropriateness (of audit evidence)
- Audit evidence
- Management's specialist
- Sufficiency (of audit evidence)

There is a proposed SAS to this standard, a call to action and feedback to address the issues since the existence of AU-C section 500 was originally issued. The noted issues include:

- the use of information as audit evidence when emerging technologies are used by preparers and auditors (e.g., audit data analytics and use of blockchain)
- the application of professional skepticisms
- the expanding sources of information to be used as audit evidence
- broadly, the accuracy, completeness, relevance, and reliability of audit evidence

The future of the audit is expounding to include non-traditional and non-historical evidence as noted, to include the use of automated tools and technologies (Cangemi & Brennan, 2019; Rose et al., 2017).

**Audit Standards.** Researchers are addressing more specific standards in the codification as aligned with big data and blockchain innovation. Enget et al. (2017) examined the role of big data analytics in conjunction with AU 316, Consideration of fraud in a Financial Statement Audit, and its use of big data in journal entry test work. According to the guidance provided in AU 316, material misstatements due to fraud involves manipulation of inappropriate or unauthorized journal entries (http://www.aicpa.org). Journal entry testing is a commonly understood concept in accounting, new audit professionals perform the function of journal entry testing in their first-year engagement, and journal entry testing is a key procedure for examining the risk of material misstatement due to fraud and management override of controls (Enget et al., 2017). Big data will complement the audit of the future as more companies harness its competitive advantages such as cost avoidance, increased profits, clearer thinking, and new product or service development. However, auditors will need to be prepared to deal with the challenges of handling big data which include data consistency, integrity, identification, aggregation, and confidentiality.

There is heighten risk when recognizing revenue, in 2018, the FASB and IASB revamped ASC 605 an industry specific guidance to a broader principles-based approach to revenue recognition standard ASC 606, Revenue from Contracts with Customers (Hepp, 2018; Peterka, 2017).

The current revenue recognition model of the five-step process for determining revenue recognition (Enget et al., 2017):

- Identify the contract with customer
- Identify the performance obligation in the contract
- Determine the transaction price

- Allocate the transaction price to the performance obligations in the contract
- Recognize revenue when the entity satisfies a performance obligation (Enget et al., 2017).

The current structure of substantive audit procedures according to Santay (2019) does not support the use of technology-enabled procedures. Accounting regulators are responsible for implementing processes that shape the future of the accounting profession when adapting to technologies like big data and blockchain (Baker, 2019). More research is needed and is limited on the governance of emerging technology like blockchain and big data according to Daluwathumullagamage and Sims (2020).

***Planning for the Future Role of the Auditor of Big Data and Blockchain***

According to Wittayapoom and Limanonthachai (2017), examination of audit job performance of the tax auditor, audit management strategies significantly impacted audit work performance and positively contributed to competitive advantage. Auditors possessing industry and business knowledge better mitigate risks of audit work and effectively work with audit team members and clients. Audit job performance relates to the quality of audit work and the organizational climate such as time pressure, regulatory standards, professional standards, the audit committee, and client acceptance (Wittayapoom & Limanonthachai, 2017). The ability to manage the climate of the organization and audit management strategies creates a moderating role between client and auditor which was shown to enhance the quality of the audit. The conduct, education, training, and combination of relationships of internal auditors, stakeholders, and all audit firm members on the audit directly and indirectly influence the audit process. Studies on blockchain and big data have implicated that these technologies will be disruptive but

will not eliminate the need for human accountants and auditors (Atwood, 2018; Mahbod, & Hinton, 2019).

**Blockchain Auditor**. The auditor is a watchdog of the public trust, called to be independent, objective, professionally skeptic, and to promote reliability of audited information. The practice of audit is strictly regulated, with professional codes of conduct, and auditing standards as the professional drivers of their roles. Yet, there are suggestions that blockchain may eliminate the need for financial statement audits but also open new opportunities for future auditors (Mahbod & Hinton, 2019). Blockchain is known as a distributed ledger, it is an immutable application, its greatest benefit is centered on reliability, unmodified blocks of information that cannot be deleted and if attempts to tamper with the integrity of a block within a chain, elimination occur (Ferris, 2018). So where does the characteristics of blockchain: real-time, settlement of transactions, distributed ledger, irreversibility, and censorship resistance require of the auditor? According to Mahbod and Hinton (2019), there will still be a need for audit procedures that verify transactions occurring in a blockchain were authorized, legal, without fraud, and not party related. Side agreements could be made outside of the block chain and risks that the information within a blockchain is inaccurate or fraudulent should be considered.

- The functions the auditor of block chain may undertake include:
- Auditor of Smart Contracts and Oracles
- Service Auditor of Consortium Blocks
- Administrative Functions
- Arbitration
- Audit Data Science (Mahbod & Hinton, 2019).

**Other Considerations**. The adaption of blockchain has material consequences on record-keeping techniques, rendering traditional double entry based centralized accounting ledgers obsolete (McNamee, 2019). Moreover, auditors will be forced into understanding the effects of the third ledger, the cryptographically secured transparent encoded blockchain ledger. Another consideration of blockchain is to view it as a foundational technology with the potential to create new foundations for economic and social value (Ferris, 2018). Auditor's and audit firms should be cognitive of its many uses by various organizations. As noted by Ferris (2018), human services use blockchain to improve contracting and procurement. Government blockchains are integrating private or permissioned blockchains but which increases accountability and visibility but does not protect against collusion bribery or fraud, hence garbage can enter the system by unauthorized people (Ferris, 2018). On another note, O'Leary (2017) described the crimes that Bitcoin have created, users are able to hide their identities allowing for laundering and the stealing of illicit funds in the public networks. In a recent white paper, the potential blockchain implications for audit and assurance were the need for CPAs to evolve their skillsets and knowledge, to understand the strengths and weaknesses of the technology, and for CPA firms to envision a future that opens up skills sets and opportunities for blockchain adoption (New White Paper, 2018). Technological advances that include blockchain will require auditors to gain skills on application and interpretation of data as well (Scott, 2019). In addition to that, being strategically aware and having heightened professional ethics remain essential of needed skillsets for the auditor.

**Big Data Auditor.** Big data is a part of the new digitalization technology that is set to frame the future of business decision making causing the auditor with additional insights to answer the needs of the customer (Manita et al., 2020). The impact of digitalization to include

the big data platform complements the audit quality and enhances stakeholder assurance. Audit firms at best must tap into the new opportunities that digitalization introduces. They may seek opportunities to evolve their business models and service offerings to set themselves in a position to stay competitive and stand out amongst other firms. Manita et al. (2020) noted the audit firm's key players, the auditor should also evolve their knowledge of big data through developmental training, understanding analysis tools, and developing IT skills.

The integration of big data into the audit will need competent people that are comfortable with auditing the accounting ledger along with the other technology that supported the transactions. Big data creates a broadening of information that auditors will sample from because of the use of the internet, emails, public social forums, and ease of access to real time information (White et al., 2020). Auditors will be overloaded with information to make judgments and will need the ability to analyze and decipher this information as audit evidence (Ahmed, 2019). The population of big data are enlarged by financial and nonfinancial data which created the need for more storage capacity (Anders, 2017; Joshi & Marthandan, 2018). The auditor's familiarity with structured and unstructured data are also an immediate need of the progressing auditor of the future (Rose et al., 2017).

**Other Considerations.** Gepp et al. (2018) posited that big data techniques have been adapted by some leading firms, but the literature reveals it is underutilized. Auditors are hesitant to use technology lacking full adoption by clients and firms. Yet, the value of big data will strategically put auditors ahead of their clients and other firms if put into practice. Big data in practice was also noted to be not as widespread in audit as in other fields; however, financial fraud modeling is a major genealogy (Gepp et al., 2018). There are many ways auditors could use big data technology, forecasting financial destress with a combination of an auditor's

professional judgment, use in analytical procedures, used to verify information, the detection of fraud, the collection of information from external business relationships, and the analysis of going concern (Boomer, 2018; Gepp et al., 2018; Tang & Karim, 2019).

### *Planning for Future Audit Technology of Big Data and Blockchain*

Big data technology has volume, variety, and velocity, the technology will be designed to make this data less complicated and more useful in an efficient way (Adnan & Akbar, 2019). The audit will include this information for auditors to make judgments, detect fraud, and material misstatements. Everyday operations involving money, assets, and documentation will be conducted via blockchain based distributed ledgers which will include the cryptographic security scheme (Swan, 2017). The auditor will be making assessments and supporting their work papers with information provided by the technologies associated with managing the blockchain technological system. The essential applications of blockchain are presently being tested and applied by large accounting firms such as E&Y, KPMG, Deloite, and Pricewaterhouse Cooper (Stoica et al., 2019). Auditors will be working with technology designed to handle real-time money transfer and payments, property registries, contractual agreements, and identity confirmation. Another main system needed for auditors to understand is cybersecurity technology which is noted to be the biggest driver of blockchain technology adoption (Swan, 2017).

**Big Data Technology Considerations.** Traditional software programs like Microsoft Excel will strain to host and analyze all the information that big data creates. Newer software exists for auditors to familiarize themselves with like analytics visualization software which can take massive amounts of data and make it functional and organized (Pan & Blankley, 2018). There will be increased speed in using these types of software, better filtering, capable

compiling, erroneous record elimination, and streamlined process all compiled into one software program. The list of big data programs noted that auditors should familiarize themselves with include:

- IDEA
- ACL
- SQL
- Microsoft Power BI
- Qlik
- SAS
- Tableau (Enget et al., 2017; Pan & Blankley, 2018; Singh et al., 2021).

The auditing process will use less paper trials and rely on more cloud storage, IT records, and immediate electronically provided information (Salijeni et al., 2019). The IT department will be an important player during the audit and many auditors will specialize as IT auditors (Bradford et al., 2020).

The auditor should also familiarize themselves with the types of data structured and unstructured data which will be extracted and incorporated into the database management systems (Singh et al., 2021). Simply stated, structured data fits squarely into a table or relational database such as an excel spreadsheet, unstructured data which is 80 to 95% percent of the existing data are unstructured data that is not organized by rows and columns (Grossman & Pedahzur, 2020). Software will be needed to extract, make relevant, and organized the information or big data. The information extraction process will make unstructured information more useful and analyzed as unstructured data (e.g., text, images, audio, video, blogs, and websites) comes from multiple formats and diverse sources such as social media, clouds, and

sensors (Adnan & Akbar, 2019). The organization of unstructured data to structured data has additional attributes and classifications to include personal information, quasi-information, and sensitive information which is considered complicated to process using traditional processing systems. As noted, text mining techniques like data mining will also be needed to create information tags that allow for machine understanding and use with subtask information extraction software like Named Entity Recognition (Mehta et al., 2019). Not only will computational power be needed but so will storage capacity as the amount of data are expected to double every 2 years (Grossman & Pedahzur, 2020).

**Blockchain Technology Considerations.** Blockchain is known as a chain of information, also known as digital ledgers that are chronologically linked and replicated on a distributed ledger (McPhee & Ljutic, 2017). Auditors working with organizations that have adopted blockchain may develop audit procedures including its support for audit evidence. The additional tech of a "Changelog" will allow for the audit trail to be traceable and immutable and connected to the database and it is maintained by the client's firm with access limitations for control purposes. The Changelog is what connects the database engine to the application engine of blockchain, this is caused by the change from database engine tier rather than an application tier of how blockchain is deployed (Vincent et al., 2020).

In addition, auditors must be aware of the risks associated with the use of reliance on evidence from blockchain, the balance between technical and regulatory requirements and to have the ability to assist organizations in enhancing the control environment for its use (Liu et al., 2019; McPhee & Ljutic, 2017). Blockchain is a multiple user technology with heavy application to the internet, artificial intelligence, and cloud computing (Liu et al., 2019). Pricewaterhouse Coopers is one of the latest audit firms that supports their clients holding and

transacting cryptocurrency with the Halo tool, a technology designed to provide audit and assurance support for blockchain clients (Pwc, 2019). Halo supports an array of cryptocurrency:

- Bitcoin
- Bitcoin Cash
- Bitcoin Gold
- LiteCoin
- Ethereum
- Tezos
- ERC20-OAX
- LGO tokens (Pwc, 2019).

The peer-to-peer network that blockchain operates within may also provide additional trust between parties which simplifies the audit process timewise and control wise; including, limiting some of the functions the auditor was traditionally poised with (Strawn, 2019). Additionally, CPA firms are leveraging the ability to have continuous audit procedures with blockchain technology which saves time and money. Adapting to the technologies create the opportunity to serve clients that are using the various programs within their organization.

**Summary of the Literature Review**

At end, blockchain and big data are a disruptive technology set to revolutionize business practices allotting for most thematic content to also suggest the need for auditors and firms to be prepared for its novel prominence (Casino et al., 2019; Joshi & Marthandan, 2018). A possible cause for this disruption may be the passivity by auditors to accept the technology into their roles and the lack of preparation and funding of some audit firms other than the big four firms to handle the use of big data and blockchain (Brender et al., 2019; Moll & Yigitbasioglu, 2019).

Another issue is the regulatory authorities that set the pronouncements and standards are still discovering what needs to be addressed and changed to fit the new audit practices (McPhee & Ljutic, 2017). Also, the marginalization of the role of the auditor because of blockchain and big data were also identified in the literature as an issue to contend with (Salijeni et al., 2019). The benefits of blockchain and big data on the audit create a competitive advantage from saving time via automation and the creation of more accuracy due to less human intervention (Xu et al., 2019). The human qualities of the auditor, the abilities that technology lacks will remain even with the use of emerging technology, auditors are posited to reinvent themselves by gaining knowledge and skills as well as looking for new consulting and creative opportunities to meet clients' needs (DeZoort et al., 2018; Kim et al., 2017; Xu et al., 2019).

Blockchain and big data technology have been studied and explored from the angles of Big Four readiness, technological systems needed, auditor skill preparation, and industry use. The majority of the studies have been conducted relatively recently with a call for more empirical studies as related to audit in practice (Alles & Gray, 2016; Appelbaum et al., 2017; Boomer, 2018; Luo et al., 2016; Scott, 2019). The potential effect of blockchain on the audit activities is not fully anticipated. Auditor profiles will change to be more IT oriented, and smaller CPA firms are not as prepared (Brender et al., 2019). The lack of empirical insights exist in the literature on big data nascent developments; yet, prior studies have addressed the developments that big data poses on audit sampling like the 3Vs, and the computer-based analytical tools being used by audit firms such as Data Extraction and Analysis (IDEA) as noted (Salijeni et al., 2019). Social theories platform the individuals' relative standing in a group based on prestige which has been explored in information systems research, especially noting the interconnection and collaboration of functions in an overall process as found in the audit role and

relationships with the firm and their clients (Weisner, 2018). Accounting emerges and changes (Sanchez-Matamoros et al., 2015). Accounting regulations change overtime as well to keep up with the novel requirements effecting businesses, and strategically the audit of the future will be posed with new opportunities to remain competitive ((Englund et al., 2017).

**Transition and Summary of Section 1**

Section 1 comprised the foundation of this qualitative study along with additional subsets. The problem addressed by the study, how auditors perceive and plan for the specialized systems of blockchain and big data, affecting marginalization, training, technology, and serving clients, was fundamental. Furthermore, the justification for electing the qualitative design was examined, the purpose, conceptual framework, as well as the assumptions, limitations, and delimitations relevant to this study. In addition, Section 1 is distinguished by the stated research questions, structured by the supported theories, and adjoins key terms integrated within this study. Finally, Section 1 concludes with a thematic review, focused on salient scholarly and professional literature for understanding the themes in blockchain and big data in the audit environment.

## Section 2: The Project

The purpose of this qualitative phenomenology was to explore a deeper understanding of the effects big data and blockchain technology on auditor's roles. There are challenges and opportunities that blockchain and big data has created on auditors' roles and their ability to serve clients. For example, blockchain is noted to cause disruptions amongst various traditional business processes, requires a new type of database to be understood, and facilitates audit functions autonomously without human intervention (Casino et al., 2019). Blockchain has the potential to create disarray because of the diversity of applications, the lack of its embrace by certain businesses, and the vulnerabilities that a public ledger induces concerning privacy and confidentiality (Casino et al., 2019). Big data will also bring a considerable number of changes to the audit profession. Notably, auditors are enforced to evolve their understanding of the technological integration of big data into the financial audit, the working mechanisms, the algorithms, and the use of new technology like Tableau, Data Analytics, Hadoop, and NoSQL (Innovation, 2020). In addition, big data technology is considered disruptive, audit firms are faced with a future that stems away from traditional sampling methods and includes the non-financial interplay of data on the audit mission. Certain businesses are reliant on their audit firm's ability to audit their systems and provide information to the public about their financials; therefore, exploring what is expected and needed to fulfill client's needs is necessary.

This section begins with a restatement of the purpose statement which describes the intent and focus of the study. It is essential to note that the researcher aims to contribute to the body of knowledge from participants working for audit firms in practice which is lacking in the literature. The role of the researcher will explain the intent in conducting the study, which may include identification and formulization of theories from the feedback of participants. The

procedures for gaining access to participants and measures taken to ensure ethical guardianship will be included. A discussion of the research methods and design justified by the literature will be covered. Additionally, this section will include descriptions of the population and sampling, data collection, data analysis, reliability, and lastly validity.

**Purpose Statement**

The purpose of this qualitative contributes to the body of knowledge, examining the implications of big data and blockchain on audits and the limitations when supporting clients. In recent years, there has been increased concern over the effects of big data and blockchain on audit roles due to automation and marginalization. Notably, an empirical study explaining the effects of big data and blockchain on auditor roles, the technological advances, and the future implications to serve clients will be researched (Wu et al., 2019). This phenomenological research explored how auditors prepare for big data and blockchain, the lived experiences of participants serving clients within the Illinois, Kentucky, and Indiana tri-state area.

**Role of the Researcher**

As the qualitative researcher for this study, this researcher concurs with Stake (2010) that it is foremost personal to me, to be a self-instrument, an observer of actions, a gatherer and interpreter of data objectively. This study is rooted in phenomenological qualitative research, the approach is more of a narrative, exploring the lived experiences of auditors and firms, and using mainly interviews to gather data based on their descriptions (Creswell & Poth, 2018). The qualitative researcher collects the data exclusively, examines the documents, observes the participants behavior, analyzes, and codes the data which came mainly from interviews.

The initial contact with the subjects was made via email, this allowed the researcher to set the stage on building trust, asking for their consent, respecting of their time, and explaining the

purpose as private in nature and for educational purposes. Creswell (2014) highlighted the importance of interviews to be unstructured, the location to be unintimidating, the questions to be open ended, and well documented via audio recordings and note taking. An important point explained to the participants was the ethical responsibility of this research. For example, it is the responsibility of the researcher to secure data, recordings, documents, and journals. The researcher promoted discretion and participant anonymity. Participants and their firms were directly quoted, narrated, and the data did not include the use of their real names.

**Participants**

The participants included certified public accountants, auditors, and the accounting firm's technology staff, from the tri-state area of Kentucky, Illinois, and Indiana. A rich sample involving multiple sources of data from the firm's audit and technology staff's feedback was essential to the study. Documents, technology, and observations created a more multifaceted data source. Various perspectives and resources assist with the creation of themes to include inductive and deductive data analysis (Creswell, 2014). The participants' first point of contact included an in-person request, an email to management, and or a follow up call for confirmation that they would participate.

Sanjari et al. (2014) argued that qualitative study research must set clear protocols concerning anonymity, confidentiality, and informed consent. To minimize the vulnerabilities, those that agreed, were given a formal letter stating the intent of the study. Additional information provided to set the stage was the background information, data collection procedures, risks, benefits, and confidentiality clause. It was important to also inform the participants of the voluntary nature of the study and ethical steps taken to keep information

secure. The data collected from the study was secured in a locked file cabinet which included any writings, documents, electronic files, and audio recordings.

## Research Method and Design

The prominent research methods notable for academics conducting research are qualitative method, quantitative method, and mixed method. The selection of a common research method delineates a "logical plan" by designing the way research will be performed, how data will be collected, and analyzed (Yin, 2016, p. 83). The research questions link the methods, theories, and design of the study which should be set at the beginning stages (Agee, 2009). The research designs associated with qualitative research are case study, ethnography study, phenomenology study, grounded theory study, and content analysis (Williams, 2011). For this study, a qualitative phenomenological design was selected as the applicable method for addressing the research questions and purpose.

### *Discussion of Method*

The qualitative research method highlights real events, the everyday social relationships that explain human actions, and explores the inside stories to bring clarity and meaning to phenomena (Roberts, 2014). Listening and asking good questions is essential to qualitative research, it is an interrogative process that shapes and gives direction to the study. Creswell (2014) discussed the essential nature of qualitative research and its best fit for certain studies. Creswell (2014) emphasized various points such as the focus on a central ideal or phenomenon, reporting from the voice of the participants, and exploring research questions in an open-ended way. The central phenomenon in this research study was to examine big data and blockchain effects on audit firms. Moreover, an exploration of this technological movement from traditional norms to new discoveries within the audit profession, the relatability to business functions, and

the progression being made to serve clients. Understanding processes and social change is an integral part of qualitative studies according to Agee (2009), which addresses the interaction of various participants' points of view on the topic.

This qualitative study was enhanced by data triangulation because of the use of various sources when collecting data. These sources may include different social structures, people with varying roles in audit, documents provided by the participants, or groups significant to the study (Carter et al., 2014). Data triangulation serves a purpose in qualitative research to assist with having a more dynamic and comprehensive study. While there are many types of data triangulation methods, the data source triangulation method resonated with this study because of the use of in-depth interviews in understanding the auditor's experiences. In depth interviewing aided in providing rich information, spontaneity, flexibility, and responsiveness when answering the research questions (Carter et al., 2014).

This study also has a structure of power in participants' relationships, auditors are considered the gatekeepers and external examiners of internal information relied on by the public. The audit firm has various levels of roles from management, information technology specialists, and associates. The use of "elite interviews" is mentioned as a way of handling perspectives from participants of power and privilege (Natow, 2020, p. 160). During the interview process, various teams of management in leadership roles were provided the plans for the study and briefed of the salient points. Personnel selection allowed participant variety and proper respect of management and firm resources. An effort to demonstrate the importance of the study was made. For example, the firm's representatives were given the purpose, background, and documentation on big data and blockchain. An additional goal of this initial contact with firm's representatives stimulates high-level viewpoints and thought in advance (Natow, 2020).

Overall, the use of triangulation, document analysis, and elite interviewing is noted to show that the researcher is prepared, and has some knowledge, an introduction to the participants before the interviews occurs (Natow, 2020).

The quantitative method was not the best plan and procedure for this study for various reasons. For instance, the research questions are closed-ended set from a hypothesis, data are collected on instruments other than observations, and the theories are examined amongst set variables, hence quantitative studies are a more structured study (Creswell, 2014). Qualitative research seeks to understand multiple points of view, quantitative research is theory based deduced via numerical data to test the theory or theories; hence, some questions are answered best with numbers and others with words (Claydon, 2015). Quantitative research may impede the study, not allowing the human condition to be explained due to the way research questions in quantitative research are survey style and the theories are numerically based on dependent or independent variables to explain a factor (Creswell, 2014). There is a nomological, universal law basis of quantitative studies which limits research that seeks explanations beyond statistical results (Smeyers, 2008). When researchers select the worldview to base their study on or the scientific method, it is stated that positivism assumptions according to Creswell (2014) hold more to quantitative research. The social constructivist worldview as aligned with critical theory (Renault, 2020) is the typical approach to qualitative assumptions (Creswell, 2014) and was the goal for this research. At end, having research questions that are broad and general and framed from the participants' experiences is a part of this study.

The mixed method approach combines qualitative and quantitative procedures into one study. Since the quantitative method of the mixed method approach was not used, this technique was not chosen. The mixed method approach is designed to balance and fulfill any data

weaknesses of the qualitative method and quantitative method that doesn't provide enough clarity to the problem being addressed (Creswell, 2014). The research questions in this study are best answered using the qualitative method, the feedback from the firms and auditors' experiences will be gathered from observations and interviews. Adopting the mixed method approach must have a valid and appropriate reason to be used (Gelling, 2014). The quantitative use of certain tools, instruments, and hypothetical experiments will not be needed for this study.

***Discussion of Design***

A qualitative phenomenology study was selected for this research study to examine the effects of big data and blockchain technological implications on audit firms and their ability to serve clients within the Illinois, Kentucky, and Indiana tri-state area. Denny and Weckesser (2019) described qualitative research as furthering understanding of complexities and providing insight of people's experiences. The central phenomenon is the everyday experiences auditors working for CPA firms are facing when performing audits of clients using blockchain or big data and how they are addressing the needs of the profession; whether it be needed training, technology know how, adjustments to traditional audit norms, or the furtherance of strategies to serve clients in the immediate and future. Creswell (2014) called attention to the main features of qualitative research questions, which aligns with the phenomenology plan of this study. The plan was not to seek a specific prediction or objective as with a quantitative study, but the research questions were designed to be broad, exploratory, and emerging.

The research design of this qualitative phenomenological study was chosen to answer the following research questions:

**RQ1:** What factors are affecting auditor's roles concerning big data to fully serve clients?

**RQ2:** How have audit firms addressed the implications of big data on audits to fully prepare to serve clients?

**RQ3**: What factors are affecting auditor's roles concerning blockchain to fully serve clients?

**RQ4:** How have audit firms addressed the implications of blockchain on audits to fully serve clients?

For this study, giving voice to CPA firm's audit staff and personnel serving clients using big data and blockchain technology was addressed. The research questions were designed to address the problem from the point of the participants. Creswell and Poth (2018) described the exploration of the problem with the population in a qualitative study as empowering, a way of gathering deeper thoughts, trends, associations, relationships, and an illumination from the participants' point of view. After the broader research question was explored, the collection of more details specific to the audit firm or the auditor's role as they serve clients using big data or blockchain helped fulfil the complexities and address the implications. In essence, understanding the issues and exploring in detail if there were any factors specific to the firm.

### *Summary of Research Method and Design*

Research method and design is purposeful to the study and sets the stage for tackling the problem and forming the research questions. This study was centered on qualitative phenomenon, this more closely relates to fulfilling the gaps on blockchain and big data research from practicing auditors' points of view and firms working with clients that may have current or future needs. As mentioned by Creswell and Poth (2018), phenomenological research seeks common meaning, the how questions, the what questions, to discern common traits and themes.

Triangulation was used to increase the content, offer various perspectives, and create an uninhabited source of data for this study (Natow, 2020).

**Population and Sampling**

The population was be drawn from accounting firms in the general region of Indiana, Illinois, and Kentucky tri-state. The sample included accounting firms categorized as being Big Four accounting firms: Deloitte, PricewaterhouseCoopers, Ernst & Young, and KPMG (https://big4accountingfirms.org). In addition to the Big Four accounting firms, other smaller but audit and technology heavy servicing firms were included within the same region. The number of participants for the population was selected to give enough saturation to the study. Data saturation is not universal but particular to the type of research design (Fusch & Ness, 2015). The interviews of a qualitative study are stated to be a method of reaching data saturation (Fusch & Ness, 2015; Saunders et al., 2018). Saunders et al. (2018) described data saturation as occurring when a qualitative study reaches a certain level of quality sampling, this is where no new codes are obtained. In essence, data saturation is essential to research quality. The researcher may reach a level of data saturation when themes require no additional probing or interviews. In addition, data saturation occurs when the researcher becomes confident that enough data has been found to address the research questions. To address the research questions in this study, having firms that serviced audit clients that have had experiences with emerging technology such as big data and blockchain is essential. The region was selected to keep the population streamlined, efficient, comparable, and within reach locally.

***Discussion of Population***

The samples in this study were drawn from informative sources that ae relevant to answering the research questions (Van Rijnsoever, 2017). The sources included various samples

of feedback from accounting firms large and small. The reason for the variations in the unit of analysis was to ensure the process was iterative enough to form common themes. The researcher suspected that the Big Four firms' staff and resources may prove beneficial to the study. Big Four firms over smaller firms are known to have more resources, finances, and clients (Karajovic et al., 2019). The sub-population in research is essential to data triangulation, as results are compared within a multitude of participants experiences (Van Rijnsoever, 2017). Indeed, there were a variety of firms in the area that formed the themes. Eleven participants added to the study and provided experiences and interpretation. Stake (2010) described this as interpretive research, giving emphasis to various voices and experiences. In other words, having a saturation of participants enhanced the perceptions and meaning needed to create themes, observations, and assertions.

***Discussion of Sampling***

The sampling technique for this study was purposive, based on informed decisions, including emergent but minimal information to begin with (Van Rijnsoever, 2017). According to Abrams (2010), qualitative sampling is emergent and the researcher exercises judgment on who will provide the best perspective. The literature review provided the theoretical information about big data and blockchain which also assisted with identifying who the participants were. The "snowballing sampling" technique which assumes knowledge about the population will help streamline the themes of the sample (Van Rijnsoever, 2017). There was an active inquiry during the interview process at start, each step provided evidence and allowed for additional discovery. The interviews began broadly, and as new developments and themes were discovered; a code was made. In terms of having enough samples, data saturation was the concept used to get to a point where no new information or themes were observed (Boddy, 2016). Therefore, the

interview process continued until enough information by the participants provided no additional insights or themes.

### *Summary of Population and Sampling*

The target population for this study was accounting firms, Big Four and smaller accounting firms that service audit clients. The main criteria needed, to answer the research questions was inclusiveness of firms having spent time on audits using technology or a strategy towards using technology like big data and blockchain. The participants were contacted initially by email or telephone and respectfully given the initial intent of the study, which is for educational and academic purposes. The researcher used random sampling techniques. The participants in this study consisted of auditors working for certified public accounting firms. The participants had some knowledge of big data and or blockchain involving audit clients. The population and sampling techniques, saturation, and iterative process was intended to provide a thorough and guided study.

## Data Collection

The collection of data for this study included accounting firms in the United States, a variety of accounting firms, located in Kentucky, Illinois, and Indiana. These firms are listed as dominate in the industry (https://big4accountingfirms.org). In addition to the non-Big Four accounting firms, smaller CPA firms in the area included medium to large sized accounting firms having an audit department and or insight on big data and blockchain technology also support this study. The firms were located and searched using the internet, the lane report website, and suggestions of firms in the area from local universities.

The researcher conducted the interviews over zoom and/or face-to-face with the audit team, information technology specialists, and/or managers of the organization over a four-week

period. Each participant was asked to respond to a semi-structured questionnaire so that the researcher gathered a general understanding of the participants' responsibilities, knowledge, skills, and experiences. The researcher then organized the data, transcribed the interviews, and verified the respondent's answers for accuracy. Additional follow up interviews and questions were asked if needed for clarification. In addition, the researcher reviewed relevant documents, viewed technological processes such as system output, minutes of meetings, written procedures, and manuals. Finally, the researcher took notes and annotations about each organization. The researcher created a table of source data and themes relevant to answer and fulfill the research questions. The following sections will include the data collection instruments, data collection techniques, and data organization.

***Instruments***

This researcher was an instrument of the study, the primary collector of data and the lead designer of the study. The data collection and interview strategy phrase referred to as the "researcher-as-instrument" was explained as the researcher's level of involvement as an active participant in the overall research process to include the data collection process and use of instruments (Pezalla et al., 2012). Qualitative research has a recommended conversational space which allows the participants to relax during the interviews and feel safe. The researcher and participants' knowledge collectively navigated and refined the study to make sense of the phenomenon (Barrett, 2007). To guard against researcher bias, reflexivity was used during the interview and data collection process. As noted by Peredaryenko and Krauss (2013), the researchers own predispositions and assumptions were not shared but an appropriate attempt was made to understand the participants' points of view by using semi-structured interview questions. In addition, the participant was made to feel comfortable and confident of privacy by selecting

their choice of interview location in person or over zoom. The researcher used interview questions to address the four primary research questions for an understanding of the effects of big data and blockchain on audits in the Kentucky, Illinois, and Indiana tri-state area. The four research questions are:

- What factors are affecting auditor's roles concerning bug data to fully serve clients?
- How have audit firms addressed the implications of big data on audits to fully prepare to serve clients?
- What factors are affecting auditor's roles concerning blockchain to fully serve clients?
- How have audit firms addressed the implications of blockchain on audits to serve clients?

The semi-structured interview questions used to facilitate understanding of these four research questions are included in Appendix A. The semi-structured interview questions were pre-determined but new questions were also developed to keep the discussion open-ended; in addition to this, the interview questions were designed to increase understanding of personal impressions or experiences. The questions were broad and probing, a method designed for allowing openness in the telling of the participant's story.

***Data Collection Techniques***

Creswell and Poth (2018) described data collection as a series of steps, actions, and conduct when gathering information from participants. At center stage in the process is the importance of ethical considerations, followed by mapping out the proper procedures like gaining access to the sample, selecting a site, recording information, and securely storing data. Peredaryenko and Krauss (2013) explained that the data in the study is determined by the research questions which drives the techniques used to collect the data. Since this qualitative study focuses on the human experience, the tools for data collection were person-to-person

interviews and documents. Field notes were maintained and if permitted, audio-taped interviews. The field notes are non-verbal written descriptions and comments made by the researcher of what was seen. Sutton and Austin (2015) described "field notes" as nonverbal impressions, behaviors, environmental contexts, and cues not captured on the verbal recordings or interview questions (p. 227).

For this study, the researcher sent permission request letters via email to leadership, the decision makers of selected CPA firms requesting participants in the study. CPA firms agreeing to participate in the study signed a statement or letter of permission indicating their approval for participation in the study. The researcher asked for the proper personnel by role and title when contacted for interviews. Upon receipt of the proper channel and way of contacting the appropriate personnel, a letter of intent was emailed stating the purpose of the research, criteria, and expectations. Each participant was also be asked to sign a consent letter. The consent letter clarified the risks, confidentiality, the voluntary nature of the study, the educational purpose of the study, the options to discontinue as a participant, and the benefits to research. Once the participants were populated and consent was given, the researcher contacted the participant to schedule an interview, emailing an official "interview protocol" or guide as described by Creswell and Poth (2018, p. 167). The interview protocol was preliminary to the actual interview and organized the information. It included the time of the interview, date, place, participants' position, and preliminary role and responsibilities of the participant, this provided an overview of whom the researcher was speaking with.

If permitted to record, the researcher used Zoom meetings, WebEx, a digital recording device and or in person interviewing. Transcription of the interview field notes and recordings occurred using Microsoft® Word, this was done verbatim preceding the data analysis process.

Member checking was used to validate the results and check for accuracy (Birt et al., 2016). The respondents were allowed to review the transcription of their interviews and asked to note any discrepancies or clarifications.

***Data Organization Techniques***

The researcher collected data from the interview questions, documentation from the participants, and procedures used during audits of blockchain and big data. Creswell and Poth (2018) suggested data management and organization by digital files and an organized naming system for efficient retrieval. The participants confidentiality was maintained by replacing names with identification number; hence, instead of using the staff's given name or firm's business name. Audio recordings was uploaded from the digital recorder to computer, saved on USB, and organized in the firm's digital folder by date. Zoom meetings was saved on USB drive as well, each meeting will be dated and organized by firm. Documents, interview papers, and recordings on USB file were organized in a locked file cabinet, each participant had an individual file of paper documents and any digital resources. The digital recorder and all USB files were locked in this file cabinet. The file cabinet and all its contents remained in a locked office, with keyed access only by the researcher.

Coding is essential to qualitative analysis and will be done after the text is transcribed from the interviews (Creswell, 2016). The topics, issues, similarities, and differences noted by the participants' narratives were prepped from the validated field notes and interviews into Microsoft® Word. Reading through the data multiple times and reviewing the notes of what people said and did leads up to using the chosen qualitative research software NVivo®12, where the information was uploaded. NVivo®12 makes integration import simple whether using Microsoft® Word or excel and offers many benefits to the qualitative researcher through data

centralization (QSR International, n.d.). This software is also designed to transcribe audio files, assist with data collection, data analysis, and coding. The electronic software coding process was used to take the raw data and categorizes the data into themes (Creswell, 2016).

### *Summary of Data Collection*

The collection of data in a qualitative study has many weaknesses and strengths that the researcher should plan for. Researchers must build trust with the participants while at the same time respecting the power structure of the organization (Creswell & Poth, 2018). The topic may be sensitive in nature for some, discretion may be needed, and privacy may be of concern to the participants as well (Heath et al., 2018). Planning to conduct the interviews and secure the way the participants will be contacted has been explained. Planning to keep files, records, recordings, and artifacts secure has also been discussed. The use of triangulation may increase the confidence in the evidence with member checking and data saturation which could enhance the accuracy of the findings (Stake, 2010). At end, the researcher should prepare to tackle the issues in advance when collecting data for their study.

## Data Analysis

Data analysis of field research is a constant process, time consuming relative to the collection of data, and specific to the type of research (Bailey, 2007). Coding and memoing are two techniques applicable to a qualitative study data and analysis process. Both are designed to assist the qualitative researcher along the data collection, analysis, interpretation, and thematic process. Having a critical data collection process and unbiased judgment of data collection is also helpful for creating thick and rich data that is untainted by personal beliefs or comfort of the researcher (Neusar, 2014).

Birks et al. (2008) stated that memoing enhances the qualitative study; ideally, as the researcher creates records, preserves ideas, and writings of memos, the notion is to have data preservation and establishment. Moreover, another supportive document of written data to reflect upon. Birks et al. (2008) explained the mnemonic meaning of MEMO as mapping research activities, extracting meaning from the data, maintaining momentum and opening communication; hence the mnemonic MEMO. Qualitative researchers may take advantage of these functions of memoing as they progress through data collection, analytical procedures, exploring the phenomenon, examining different ideas, and musing over comments or ideas. Memoing is iterative, provides an in-depth analysis, is used to enhance though, see different perspectives, and a way for the researcher to take another look at that data (Patel et al., 2016).

Interpretation is an activity where the aim is to make sense and meaning of text or written words (Willig & Rogers, 2017). In general, two approaches to interpretation mentioned where the top-down or bottom-up approach. These two approaches to interpretation depend on the aim or goal. For instance, one goal may be to find the true meaning of a text; an alternative may be to dig in deeper and go beyond the surface towards a deeper insight. Interpretations are unique to the researcher making meaning of data which poses risks of its trustworthiness (Willig & Rogers, 2017). The process of evaluating interpretations for integrity and having supportive claims for the theories being made remedies the risks. Another approach that may be helpful for the qualitative researcher engaging in interpretation is the hermeneutic approach (Cho & Trent, 2020). The hermeneutic approach to research focuses on understanding the human perspective from multiple views and leans on presenting rich data and details from the context of the study (Cho & Trent, 2020). Interpretation is a part of most qualitative research requiring the researcher

to use tools like objectivity, transparency, and supportive claims to lessen the risks of unfounded claims.

Bias and overgeneralization can be an issue that qualitative researchers must be prepared to remedy or limit (Neusar, 2014). Retrospective information, information gathered in the past and intuitive judgements such as interpretations and conclusions create bias. Researchers may find the use of qualitative software helpful in remedying bias. In addition, researchers should limit overconfidence in one sided data or what they like or are comfortable with or familiar with. The researcher should have a critical eye, a thick description of experiences, consider the real feedback, and have a questioning approach to weaker claims being made in the study (Neusar, 2014).

Data representation presents the findings in an ethical, organized, condensed, and finalized way (Leavy, 2017). Proper consideration should be given to the justification of research methods, content shared, and procedures employed. The voice and text of the participants is data to this study; therefore, having some visual representation of data synthesized and organized visually enhances interpretation of the feedback (Chandler et al., 2015). Tools used to represent qualitative data visually include using a device called Spectrum, matrices, networks, flowcharts, Venn diagrams metaphorical displays, and decision tree modeling (Chandler et al., 2015). These visual modules create summaries from the theories and data in a thematic way.

Triangulation according to Stake (2010) is an important part of qualitative research data evidence checking, which should include feedback from multiple resources. Member checking is a known technique that qualitative researchers use to assess accuracy of interpretations (Creswell, 2016). The researcher works with the participants and other sources conducting a secondary audit of the data, analysis, interpretations, and conclusions (Creswell & Poth, 2018).

Moreover, this study included member checking, by asking the participant that was interviewed to review what they said and check if the interpretations where accurate (Creswell & Poth, 2018).

Triangulation can be used in both qualitative and quantitative studies giving the study trustworthiness and believability (Noble & Heale, 2019). Qualitative studies may include the use of multiple data sources such as interviews and observations to build coherent justification for themes (Creswell, 2014). In a quantitative study, triangulation may assist in conforming a hypothesis where an alternative set confirms another. Quantitative researchers use inferential statistics to quantify the confidence in a hypothesis, as a way of allowing their instruments to report reliance on their variables or if findings are consistent (Stake, 2010). A mixed study commonly includes triangulation because of the use of multiple sources, the qualitative and quantitative data method is used to support theories (Heale & Forbes, 2013).

***Coding Process***

According to Bailey (2007), researchers interact with their data repeatedly through reading pages of their transcripts and data generated during field work. The coding process is of importance when organizing large amounts of data into smaller segments. Bailey (2007) preferred to call the defined codes formulated by this coding process as taking a pile of collected information from the study and making sense of it thematically. NVivo was the software that this qualitative researcher used to feed in texts, documents, and videos that the researcher has discovered in the study (Silver & Woolf, 2017). The software is designed to use unstructured data to form themes or sentiments which may be represented by common text codes or nodes as well as visual reports like graphs and concept maps (Phillips & Lu, 2018). There were many codes found in the data as noted of qualitative studies generated by the software (Creswell,

2016). A process of aggregating the codes into themes was also a part of streamlining the evidence presented.

### *Summary of Data Analysis*

The collection and analysis of data is a process where the researcher, the participants, and other resources are appropriately collected, organized, and presented. There are many points to data analysis that the researcher should plan for which include studying and interpreting or making sense out of the interviews, documents, and observations (Creswell, 2014). Data analysis in qualitative research is iterative and may require manual written narratives or memos and may include the use of qualitative software like NVivo for additional support and efficiency purposes. Data analysis is an interpretive process as well, engaging the researcher to question and seek more inclusive information if needed, to present a quality and believable study.

## Reliability and Validity

Reliability and validity are both significant steps in the research study used to ensure maximum accuracy and credibility of the findings (Creswell, 2014). There is a subjective nature to qualitative studies, various views from researcher, participants, and reviewers. Therefore, a time for reliability and validity should be taken during the study to remedy bias, increase critical thinking (Stake, 2010), enhance quality of the data, and make the reporting as trustworthy and real as possible.

### *Reliability*

Reliability centers on consistency and cross-checking; furthermore, qualitative studies is a process where researchers check to determine if data like transcripts and codes are reliable, consistent, or stable (Creswell, 2014). In addition, this cross-check or “intercoder agreement” should be done by another person where a reader or researcher should analyze transcript data and

provide a new assessment of codes (Creswell & Poth, 2018). To ensure reliability in this study credibility, transferability, dependability, and confirmability will be discussed.

Credibility and trustworthiness are a perspective of qualitative research. Credibility refers to the truth in data, interpretations, and the researcher's representation of them (Cope, 2014). When qualitative researchers use people as subjects there may be varying perspectives of the phenomenon. Having another individual involved in reviewing notes and mulling over the researcher's thoughts is a way of conducting an external examination, seeking another party's opinion. To remedy bias of interpretations, an audit trail of written notes, thoughts, comments, and documents will be shared and analyzed by another person for differences, accuracy, and confirmation.

Transferability is based on the readers' judgment, also known as transferability judgment, it is where the reader determines if the findings are transferable to their own settings (Korstjens & Moser, 2018). Cope (2014) asserted that transferability in a qualitative study has been met when the reader associates themselves with the findings and finds meaning from the findings. Rich and thick descriptions support reader transferability judgement. Rich and thick descriptions are the details, given context, and the describing of elements in the setting; significantly, providing the meaning and experience to an outsider (Cope, 2014; Creswell, 2014). Transferability is another enhancement to having a quality research study and presenting reliable results that someone not involved in the research can find meaning.

Dependability in a study relates to stages in the research process that if another researcher did the same study, they would concur and simulate the same process (Cope, 2014). Dependability is when the researcher checks for consistency with standards used for their method or research design (Korstjens & Moser, 2018). In a previous study, dependability was

attained through external individuals viewing themes and transcribed material (Cypress, 2017). Maher et al. (2018) confirmed that dependability gives certainty that the descriptions in the audit trail of the study can be duplicated or repeated by a different researcher.

While dependability relates to consistency, confirmability is concerned with the aspect of neutrality and how interpretations should be grounded in the data (Korstjens & Moser, 2018). A checks and balance process help to remedy researcher bias, having someone that did not collect the data check the notes, transcripts, and coding for accuracy may help. Another researcher should have a sense that data and interpretations of the finding are real and aligned to salient research.

### *Validity*

Specifically, qualitative research validity has been deemed a strategic process of the study, the researcher uses validity to check for accurate, authentic, credible, and trustworthy findings (Creswell, 2014). Validity is the intention to measure what was intended to measure where data are rigorous, understandable, and points of views are consistently checked for biases or self-limitations (Pope, 2017). The three strategies discussed for this study were bracketing, triangulation, and saturation.

In a previous qualitative study, bracketing was used to clarify bias (Hall et al., 2016). Bracketing in general addresses the preconceptions whether acknowledged in advance of the study or inherent to the phenomenological nature of a qualitative study (Tufford & Newman, 2012). Bracketing is a multilayered and continuous process throughout the study because preconceptions may arise while gathering data and require monitoring of notions to not negatively affect the research. These notions or anticipations of themes need space require reflective time to limit bias. This researcher self-checked for anticipated themes via theoretical

notes or memos, a free writing describing the researcher's feelings, observations, hunches, and presupposition (Tufford & Newman, 2012). The idea here is to get thoughts and feelings out on paper, which allows more uninhibited interaction with the raw data. The researcher will also employ an external auditor, a person not familiar with the research or study to review transcripts for accuracy, consensus the research questions and data align with the interpretations (Creswell, 2014). Another way to use bracketing to validate findings is to collaborate with the participants in the study by spending quality time in the field, checking codes, and checking themes from the participant's lens (Creswell, 2016).

Triangulation is a cross verification process and should come from multiple data sources and multiple methods (Pope, 2017). Triangulation, according to Carter et al. (2014), checks validity between multiple data sources and spans across four types: method, investigator, theory, and data source. Method triangulation was used in this study which as described included the use of interviews, observations, and field notes. The researcher did not use investigator triangulation because this researcher is the sole practitioner of the study. Theory triangulation was provided by searching the academic literature for synthesis and the provision of the literature review. Data source triangulation may occur with the use of data from varying accounting firms, multiple perspectives, and groups to be included in the study.

Data saturation was used in this study. Data saturation used in qualitative research to gauge a point where no other new data are needed or where additional information has redundancy to previously collected information (Saunders et al., 2018). Observing points in the study where saturation has occurred may occur during the interview stage and a part of the process should be probing and seeking salient data (Weller et al., 2018). The data from the interviews should be examined for repetitive statements and consistencies or assertions that show

agreement with other participants. Data saturation benefits the study because it is where the researcher begins to hear the same information again and again which is another tool for ensuring quality research; moreover, validation consistency.

### *Summary of Reliability and Validity*

Reliability and validity are activities the researcher uses in general to minimize bias in research and promote a real, accurate, and duplicatable study. These processes should be given time and attention, they may also include the researcher being prepared to find and use outside individuals for a fresh look and analysis of transcripts, memos, themes, and codes. At end, a research study should be of quality, trustworthy, consistent, and duplicatable by someone else.

## Transition and Summary of Section 2

The purpose of this qualitative phenomenological study was to add to the understanding of the effects of big data and blockchain on the audit profession, to include the strategies CPA firms are implementing to serve clients. The researcher explored the lived experiences of audit firm employees with blockchain and big data experiences, including information technology specialists of the firm, and influential governing bodies' contributions. Section 2 explains the role of the researcher, participants, research method and design, states the research questions, population and sampling, data collection, data analysis, and reliability and validity of the study.

Section 3 begins with a brief overview of the study. The results of the study are intended to provide audit firms employees, information technology specialist, audit department, and governing bodies' insights to improve experiences handling big data and audit clients. Section 3 describes anticipated themes and perceptions, presentation of the findings, application of professional practice, recommendation for action, recommendation for further study, and reflections. This leads to the final defense.

## Section 3: Application to Professional Practice and Implications for Change

This section finalizes the qualitative research study including the application to professional practice and implications for change. This section will begin with an explanation of the overview of the study, a synopsis of the themes identified from the interviews, and the relatability of these themes to the research questions. The researcher reflects the themes connection to the professional literature, the conceptual framework, and the problem of the study. Section 3 concludes with reflections and the summary of the study.

### Overview of the Study

This qualitative research study was designed with the goal of addressing the complexities and opportunities big data and blockchain technology created for practicing Certified Public Accountants (CPA's) with external audit experience. This study was a phenomenological understanding of the issues, problems, preparedness, and opportunities in the field of audit concerning big data and blockchain.

To address the research questions, the participants in the study had to hold a CPA license or be an IT professional. Audit personnel working directly with a CPA firm with an external audit department were also permitted. Over 500 CPAs or firms were contacted and only eleven agreed to allow for an interview and be a participant. During the interview process 11 CPAs working in the field submitted feedback. The range of audit experience varied from 3 years to 30 years of experience. Most of the participants were at the associate audit level and a few were senior or manager level auditors. For the respect of privacy and auditor concern, none of the participants names were used but an alias or a numbered code was provided, as their responses were quoted for this study.

Due to COVID-19 concerns, the participants were given the option to answer a set of eleven research questions designed to gather information on their experiences in the field concerning big data and blockchain over the phone or by Zoom conferencing. Most of the interviews were conducted over Zoom and lasted no more than 45 minutes using the interview questionnaire as a guide. The participants were interviewed separately, and a follow up call and email confirmed some of the responses in the interview for clarity. The interview questions were designed to gather information relating to the four research questions created by the researcher as noted in Section 2: (a) what factors are affecting auditor's roles concerning big data to fully serve clients, (b) how have audit firms addressed the implications of big data on audits to fully prepare to serve clients, (c) what factors are affecting auditor's roles concerning blockchain to fully serve clients, and (d) how have audit firms addressed the implications of blockchain on audits to fully serve clients.

**Table 1**

*Demographic Survey of Participants Professional Background*

| Participant Code | Job Title | External Audit Experience (yrs.) | Current Firm Big Four or Non-Big Four |
|---|---|---|---|
| Participant 1 | Senior Auditor | 20-25 years | Non-Big Four |
| Participant 2 | Audit Associate | 10-15 years | Non-Big Four |
| Participant 3 | Senior Auditor | 15-20 years | Non-Big Four |
| Participant 4 | Audit Associate | 10-15 years | Non-Big four |
| Participant 5 | Assistant Director of Information Technology Audits | 25-30 years | Non-Big Four |

| | | | |
|---|---|---|---|
| Participant 6 | Audit Associate | 15-20 years | Non-Big Four |
| Participant 7 | Audit Associate | 5-10 years | Non-Big Four |
| Participant 8 | Audit Associate | 5-10 years | Big Four |
| Participant 9 | Audit Associate | 3-5 years | Big Four |
| Participant 10 | Senior Auditor | 5-10 years | Big Four |
| Participant 11 | Audit Associate | 5-10 years | Big Four |

**Presentation of the Findings**

Using a phenomenological qualitative approach of open-ended type interview questions, the researcher transcribed the interviews and coded them using NVivo software. Themes were revealed using the inductive and axial coding process. The themes revealed by the participants during the coding process were identified in the data analysis.

**Theme One**: There is a commitment to training employees to use newly designed audit software and transfer into new methodologies.

**Theme Two**: A need for assistance from IT personnel provides support where CPA's lack technological knowledge.

**Theme Three**: Organizations are designing and using specific software beyond Microsoft Excel.

**Theme Four**: Experience was limited or new to audit and in the infancy stage at their firm.

**Interpretation of the Themes**

The themes were revealed from the participants during the interview process and questions were asked using a survey. The themes noted were identified by multiple participants

for inclusion. The process involved open and axial coding. The literature set the foundation of support and provided an additional validation to the study because of the alignment to the findings.

### *Theme 1: Training*

A common theme was prevalent to nearly all participants which was the need for training. Training that was beyond traditional accounting and audit processes traditionally used. A use of technology specific to big data and blockchain audits was also discovered. The training needs found where required for both big data and blockchain audits, which includes technological or methodological developments. To support the new technology imposed on audits, most firms are developing in-house training programs (Salijeni et al., 2019). Concerning big data, audit training requires understanding how to use: data extraction, data mining, and analysis software. Blockchain software training includes understanding software and new audit methods designed for audits of clients using crypto currencies, continuous audits, and smart contracts (Zhou, 2021). Various steps of the audit process have changed because of the incorporation of big data as audit evidence. These steps include the way audit evidence is collected, analyzed, and reported (Salijeni et al., 2021). Training, as well as new audit processes are listed and supported by the literature. Moreover, training is considered a necessity to the newly imposed big data and blockchain audit initiative.

The participants were asked in the survey to identify the types of considerations organizations are implementing to support big data and blockchain effects on audit. A main theme was the training of personnel to work with software and an establishment of audit procedures that complement the big data and blockchain audit. The reliance on these two technologies posed different needs. Auditing data of blockchain requires less risk and testing

procedures have changed for the better. Big data extraction was not a new development but a transforming process. There is a progression occurring which includes more bits of information and more of a need for data mining.

Participants spoke generally about audit training as an essential need. Many of the participants mentioned some form of training by their organization or professional society. For instance, when educating themselves on the new processes and developments of big data and blockchain on the audit. Most of the training was initiated by their organization to cover the use of their in-house software. Additionally, newly added software designed by programmers outside the organization was also of importance in assisting with the audits of big data and blockchain systems. Courses on big data and blockchain offered by accounting organizations were also suggested as a method of informing and preparing auditors of the upcoming changes. Participant 1 stated the following regarding training: “Both big data and blockchain are included in many audit training sessions I have attended. For example, I attended a CPE event earlier this week and approximately 30 minutes was spent on blockchain and visualization of big data.” Participant 5 stated the following on the importance of training auditors to work with big data: “With the inception big data, there must be extensive training on the data analytics product that is used. Also, the auditor must understand their audit program including data validation.” Participant 7 echoed both participants acknowledgment of training and preparation, stating: “Big data and blockchain has caused my company to hold training, strategy, and planning meetings.” These were some of the findings that coincided with the participant’s acknowledgment of being prepared to audit big data and blockchain underlying protocols.

Participant 8, 10, and 11 described how the audit methods are changing and requiring different shifts in training. Accordingly, there is a shift acknowledged by their organizations

concerning the adaptation towards a technological efficient audit. According to Participant 8 “auditors are doing less work when relying on artificial intelligence, the audit is more digitized, and sampling procedures are changing.” Participant 10 described the need for an understanding of digital assets and more digitized audits noting that “It's all about risk assessment.” Participant 10 further describes how,

> Training on blockchain is a bit more concerning because it ties more closely with substantive testing, and would affect audit risk more directly, since auditors have to evaluate the reliability of the data and the blockchain algorithms introduces something new to the audit.

Participant 11 expands on this thought describing blockchain and big data nuances to the audit methods:

> In my experience, the way that we audit fixed asset acquisitions using blockchain is new. Regarding big data, we haven't changed the way we do analytical procedures (just changed the comparison population), but we have changed the way we set up journal entry testing. Previously, journal entries were selected to test based on haphazard sampling. Now, we include training on the use of visualization software to identify journal entries that stand out or are "red flagged" as being qualitatively and/or quantitatively unique and focus on those for testing purposes. (Participant 11, 2021)

Participant 8 further supports the organization’s importance of training and its effect on audit methods by stating: “The audit methodology is developed nationally, along with the audit tools and it is pushed out to the local engagement teams. Training is held locally and nationally on the audit tools.” An additional supporting comment to the theme on training needs was the statement made by Participant 2 who stated: “The training needs are significant, developed by our learning

and development group and they constantly push out live and virtual trainings to ensure our staff understand appropriate audit policies and procedures to deliver a high-quality audit."

**Summary of Theme 1**

The skills of the auditor can be addressed by constant change and an emergence towards technology permanently changing and redefining their roles (Farcane & Deliu, 2020). Big data analytics will be a proficiency and necessity for auditors to analyze and visualize data to make conclusions (Sastry et al., 2021). There will be a requirement for knowledge and understanding of computer systems, additional training from professional organizations offering CPE courses, and a movement towards adaptation of the technological audit of the future.

***Theme 2: Information Technology (IT) Support***

A second theme discovered during the interview process common to the participants was the added benefit and use of information technology personnel or experts familiar with the technological processes and applications of big data or blockchain technology. It has been suggested that the use of information technology during the audit is growing and provides the auditor a system of support improving quality, efficiency, and effectiveness (Lowe et al., 2018). There was a common range of perspectives concerning the support of IT especially where auditor's lacked skill and abilities.

Most participants interviewed mentioned having a technology department that handles new developments, programming, and technological advances. Some of the firms have specialized teams of technology experts working to create new programs and platforms for the auditors to use and work. These experts and use of programs align with the new initiatives concerning big data and blockchain. Participant 1 stated how their organization has a specific department dedicated to technological advancements: "We have an IT Advisory department that

is utilized during the audit as needed for blockchain and big data support." Participant 3 echoed this sentiment of their firm having a specific team of IT support. Participant 3 stated the following: "There are in-house IT auditing experts who perform certain functions of audits." Participant 12 spoke specifically about the use of IT professionals to handle data analytics during the audit stating: "We have multi-disciplinary teams that include data analytics specialists." Another agreement for the use of experts by firms concerning blockchain was participant 11's statement: "Assurance professionals, software developers, and blockchain experts work together to develop assurance solutions to support this complex and emerging area."

Outsourcing IT support was also mentioned as a way of resolving any immediate needs auditors had while serving clients. Input from IT during an audit is a necessity, systems have an environment of risk and internal control which requires their input. According to a recent article into the literature "auditors should have strong relationships in place with IT and project personnel" (Grocholski, 2017, p. 1). The use of IT professionals is especially useful with the new advances towards technology driven businesses. According to Grocholski (2017), during audit planning, IT audit leaders are involved in the audit committee meetings. Participant 6 emphasized how their organization in certain audits used outside specialists as a way of support during audits by stating: "There are audits that requires more technology training of all auditors and requires the use of technology specialists outside the firm who may hold technology credentials and may not be accountants." Participant 7 affirms this notion stating that: "Audit firms have been hiring IT personnel, and that's been going on even before blockchain. I don't deal with the software requirements because the IT department would take care of that." Participant 8 stated further support echoing the use of outside experts: "To handle this, finding a

specialist or hiring an auditor who has knowledge of big data or blockchain [may be required] for our audit clients."

**Summary of Theme 2**

The emerging theme of having IT support or specialists aid during a technology driven big data or blockchain audit was supported in the literature. The relationships that IT experts and auditors have was strongly tied to a sufficient and supported audit as explained by participants as well. The use of blockchain reduces the transactional work done by auditors for example with smart contracts having immutability, this makes for more of a technology-based audit (Sastry et al., 2021, p. 72). Specifically, "traditional audit evidence will now integrate a new type of supporting evidence from big data" (Sastry et al., 2021, p. 72). For most auditors a shift from traditional skill sets to skills in both the audit and information technology (Sastry et al., 2021). For those firms or auditors who lack an understanding of big data and blockchain, immediate support outsourced or a strategic department of team members may be required.

***Theme 3: Design and Use of Specified Software***

The third theme discovered during the interview process was extracted from the interview questionnaire in which participants were asked to explain any new software developments needed. The majority spoke of using excel and other types of software useful for data extraction, data storage, data mining, analysis, and data visualization. The use of software includes software beyond Excel as stated by Participant 1: "In addition to Excel and PowerBI, we have invested in Dynamic Audit Solution, which is expected to be rolled out later this year or next year." In a similar fashion Participant 2 stated: "We use IDEA a data extraction software and more often and tools within Excel." Participant 3 echoed the sentiments stating: "We use data mining software such as IDEA which is critical to analyzing big data. Incorporating data mining

software into our client's annual audits was the first and largest step. It allowed the firm to understand the capabilities." Participant 6 explained some useful software tools used by their firm for database management stating: "Some potential tools include database management software such as SQL, advanced statistical software such as SAS or SPSS, data visualization software such as Tableau or Power BI, and potentially others."

Most participants' firms invested in similar types of software in the market or had software specifically designed and branded for their firm. The use of software to help perform audits, allows for computerized automation or systems to perform human functions faster, more accurately, and with adaptation to new audit service needs (Al-Aroud, 2020). Participant 1 describes the use of analytics software for data visualization and its purpose in the audit stating: "Now, we use visualization software to identify journal entries that stand out or are 'red flagged' as being qualitatively and/or quantitatively unique and focus on those for testing purposes."

The use of software redefines the audit method, creates a paperless audit, and a focus on risk management and control. The extraction and analysis of data using software programs may use sophisticated algorithms and machine learning to review general ledgers, prepare work-papers, visualize data, and manage unstructured data (Munoko et al., 2020). In response to risk assessment during audit and the use of data analytics, Participant 10 stated: "Our data auditing tools test huge volumes of data, analyzing whole populations to improve risk assessment, analysis and testing. There are tools to meet the unique needs of companies in different industries." Complementary to this notion was Participant 11 who stated: "We use an advanced digital audit technology to make the most of data, pinpoint key audit risk areas, perform smarter audits, and seamless data access."

Blockchain creates continuous audits, uses on time data which is shared between parties, and smart contract application (Lombardi, 2021). The application of blockchain has caused the Big Four firms to invest in resources that provide solutions to real-time audits, the capture of client data from multiple blockchain ledgers, and the monitoring of accounting transactions specifically tax and digital currencies (Bonyuet, 2020). The introduction of blockchain in the audit reduces the auditor judgement role accuracy and verification tasks, a lean towards more risk assessment, data analytic audits, and fraud detection (Bonyuet, 2020). Participant 1 comments on the uniqueness and risk assessment blockchain audits create stating: "In my experience, the way that we audit fixed asset acquisitions using blockchain is new. Blockchain is a bit more concerning because it ties more closely with substantive testing, and would affect audit risk more directly, since auditors have to evaluate the reliability of the data and the blockchain algorithms."

**Summary of Theme 3**

Design and use of software regarding big data and blockchain implications on the audit in practice proved to be a theme of the study and a necessity for the industry. The need for specific software designed to support sampling, risk assessment, fraud, and steps to ensure a quality audit in practice were identified by the literature as well. Sastry et al. (2021) supported the new direction the audit industry was headed concerning big data and blockchain technologically driven audits and the new system requirements. Data analytics combined with new technology creates a new ability for reliable audit evidence, reduce sampling, and a better understanding of the business (Sastry et al., 2021). The gathering of audit evidence is multidimensional and should be gathered from multiple angles (Vincent et al., 2020). Blockchain technology audit processes are being researched from computer science and computer engineering. The new advances

blockchain and big data has created is an improvement to audit quality because of increased data integrity and reliability. The complexities of this introduces a need that has grown, more reliance on software systems and computer science to aid the audit.

### *Theme 4: Limited or Early Stages at Firm*

The fourth theme discovered during the interview process was extracted from the interview questionnaire in which participants were asked to explain the extent of interruption big data and blockchain technology had on their firm's audit process. This question sought to discover in a practical way, the limitations and lack of preparation researchers feel auditors will have because of the new technology. Gauthier and Brender (2021) noted blockchain emergence as disruptive and in the foundational stage. Blockchain is stated to reduce the need for certain confirmations, verifications of amounts, and use more artificial intelligence tool and future preparation is the key to a benefit (Smith, 2018). Participant 4 stated: "We haven't worked with blockchain." Participant 6 supported this stating: "Blockchain has not yet impacted many audits I have performed." Gepp et al. (2018) acclaimed the use of big data techniques in auditing was not quickly adoptable by clients or firms. The future aspects were greater than the immediate adaptation according to some participants. Participant 4 stated: "At this point, Big Data and Blockchain have not been an interruption in the audit process. They are horizon items that could have a future impact." Participant 1 agreed to newness of blockchain on audit at their firm stating: "Blockchain is still relatively new from an audit perspective. Our firm is gradually introducing these areas, while making sure that any procedures used align with audit standards."

### Summary of Theme 4

There is an aspiration and knowledge at some firms to prepare and incorporate the big data and blockchain requirements into audit. However, some participants agreed that firms are

addressing these technologies in their own way and time. The potential impact to the audit profession includes the firm's decisions to implement and invest in advancing technology (McGregor & Carpenter, 2020). Many are in stages of preparation to handle big data or blockchain audits and have had experiences. Arguably there will be a benefit and need to incorporate, prepare, and plan for audits using these technologies, but some firms are in the foundational and preparation phase.

***Representation and Visualization of the Data***

Table 1 provides a visual compass for the recapitulation of the data collected. The data obtained in this section has been characterized within the table and is from the literature and the participants of the study. Table 2 presents a synopsis, comparing the relationship between the research questions of the study, the information collected from the participants, and the current literature regarding big data and blockchain effects on the audit. The representation and visualization of the data table provides a visual support for the relationships between the identified themes and the research questions of the study.

**Table 2**

*Representation and Visualization of the Data*

| Themes | Interview Question Where Theme Emerged | Relationship To Researchers theme from the Literature | Participant Quote Connecting the Research Question |
|---|---|---|---|
| Commitment to Training | 6 | Shaffer et al. (2020) suggested that auditors re-train and develop new technical skills to handle the technical systems introduced to audit/risk management. | RQ1a & RQ2a: "With the inception big data, there must be extensive training on the data analytics product that is used. Also, the auditor must understand their audit program |

| | | | |
|---|---|---|---|
| | | | including data validation." Participant 5 |
| IT Support | 2, 7 | A successful audit engagement includes input from IT and auditors should have a robust relationship in place with IT personnel (Grocholski, 2017). | RQ2a & RQ2b: "There are audits that requires more technology training of all auditors and requires the use of technology specialists outside the firm who may hold technology credentials and may not be accountants." Participant 6 |
| Specified Software | 4, 8, 9 | Salijeni et al. (2021) explained the need for audit firms to adopt analytical tools useful for data mining and data integration and like IDEA and Microsoft Excel. | RQ1a & RQ1b: "We use data mining software such as IDEA which is critical to analyzing big data. Incorporating data mining software into our client's annual audits was the first and largest step. It allowed the firm to understand the capabilities." Participant 3 |
| Early Stages Of Adoption | 2, 3, 11 | Cangemi and Brennan (2019) affirmed that blockchain ledgers are new technologies to the audit and are in the infancy stage of adaption by firms. | RQ2a & RQ2b: "Blockchain is still relatively new from an audit perspective. Our firm is gradually introducing this in particular areas, while making sure that any procedures used align with audit standards." Participant 1 |

### *Relationship of the Findings*

This section connects the participants' responses to the research questions, the conceptual framework, the problem statement, and the academic literature. From the interviews four themes were found. The current literature supported many of the findings the participants had. The relationship to the findings supports the themes found in the interview questions. The study began with a thorough search of the literature which identified impediments to the audit. The topics of discussion were the effects of big data and blockchain technology which drives this study.

### *Relationship to Research Questions*

The study was led by the four research questions. The research questions may be viewed as subsets of one initial question with two parts. The information that converged from the study was employed to address the four research questions of the study. The research questions that guided the study were:

**RQ1a:** What factors are affecting auditor's roles concerning big data to fully serve clients?

**RQ1b**: How have audit firms addressed the implications of big data on audits to fully prepare to serve clients?

**RQ2a**: What factors are affecting auditor's roles concerning blockchain to fully serve clients?

**RQ2b:** How have audit firms addressed the implications of blockchain on audits to fully prepare to serve clients?

The research questions were designed to set the stage and the plan for what the study wanted to answer. The research questions were essential to defining what was happening to the

audit industry because of big data and blockchain new technological advances and implications. The research questions also influenced the questionnaire, which was the instrument used for gathering information from the participants. The questions were open ended which allowed the participant to answer based off their own words (Popping, 2015). The questions were designed to gather information about two technological systems: big data and blockchain. The questions aligned because they identified either blockchain or big data notions. The sub-question and main question were grouped because they were common to the findings. There was an explanation of the factors and how the organization addressed either big data or blockchain. From this information themes were discovered and an alignment with the research questions was formed.

**RQ1a and RQ1b**. The first set of research questions came about because of the big data analytics imposition and suggestion of adaption within the audit field, according to the literature. Big data are enormous amounts of data, varied because of diverse sources, and requires computing power, storage capacity, and effective software to implement (Niebel et al., 2019). Big data innovates the role of the auditor as well as create new implications. According to Tang and Karim (2017), there will be a shift to the audit concerning big data, the auditor will have various forms of accounting information to consider like audio, images, and video. These advances and new volumes of information create a knowledge shift and a skill shift that the auditor must understand.

According to Wadesango et al. (2021), one of the added effects of big data is the use of the information gathered as audit evidence. Audit evidence is used and collected by auditors as part of their audit work. Audit evidence used as supportive information, supports the opinions formed about the financial reporting framework of an organization. Big data is unstructured data. When organized and analyzed it connects patterns of information that may help auditors make

informed decisions and conclusions (Wadesango et al., 2021). According to Werner et al. (2021), manual inspections of data can be time consuming for the auditor. Having training on data mining software is a skill set auditors are suggested to learn because it uses an automated system that can be embedded into an organization's audit of financial statements (Werner et al., 2021). Process mining according to Van der Aalst (2016) is used to extract data from a specific source system, providing information and a graphical representation (Werner et al., 2021). According to Participant 1 the comparison population has increased because of big data analytics effects on the engagement.

**RQ2a and RQ2b**. The second set of research questions came about because of the newness of blockchain and the lack of sufficient information in the literature on how auditors and their firms are addressing or experiencing this technology in the audit. Blockchain will change the audit profession according to researchers and provide many benefits (Dyball & Seethamraju, 2021). There will be new requirements to the audit because inherent risk and control risk, which is stated to amplify during a blockchain audit (Dyball & Seethamraju, 2021). Alternatively, auditing blockchain transactions may be enhanced because of its real-time, up-to-date, immutable, and historical ledgers (Schmitz & Leoni, 2019). As time progresses, more recent studies suggest better benefits and increased understanding of the effects or possibilities.

Blockchain in business practices is a form of digital currency that exists because of a distributed ledger that is said to be encrypted for the purpose of providing trust and immutability because of strict and digitally controlled verification processes (Dunn et al., 2021). Businesses are accepting cryptocurrencies as a form of payment for consumer items, and this is different than using flat currency for purchases. Cryptocurrencies operate on host networks and run

through a system of algorithms which provides the correct proof of its security of transactions within the blockchain (Smith & Kumar, 2018).

Examples of blockchain technology affecting the auditors working roles seemed limited to a few participants. There were not a lot of experiences of its effects on audit clients of the participants interviewed. There was an acknowledgment of the future upcoming nature of cryptocurrency as a digital asset but not a lot of practical examples being addressed by the participants and their firm. According to Farcane and Deliu (2020), regulations are still emerging and the advantages as well as the disadvantages should be monitored by the profession (Stake, 2020).

**Big Data Research Questions 1a & 1b**. The first set of research questions centered on the prospects, experiences, and implications concerning big data on audit. The first emerging theme was the need for training. The factors affecting auditor's roles and being addressed by firms concerning big data effects on audit was training and the use of software beyond Excel. Training is a professional development process, auditors will continue to learn, enhance their skills, and adjust to new initiatives in business (Chiang et al., 2021).

Big data results in large quantities of data from various data sets that must be understood by analysts, auditors, and various users of its information (Jovanovic et al., 2021). Big data is a set of data that the auditor and their firms must learn to work with and figuring out what differences this technology brings to the audit spectrum (Pan & Blankley, 2018). More than half of the participants agreed training was essential to understanding and implementing big data at their firm. The big data technology initiative on audit was encountered during an audit for most participants because of the use of the information during analytics or audit evidence. Having the ability to understand how to extract and use this data was essential to most of the participants

needs. Participant 11 specified that training on big data visualization was essential to seeing patterns in audit client's data and using historical information during audit. Of the participants interviewed, more than half stated their firms set training programs at the organizational level which are a part of the requirements of professional practice. Seven participants mentioned attending a form of professional development organized by their firm or learning about big data from a professional CPE organized by their professional accounting society membership.

Other things affecting auditor's roles mentioned were the use of information technology specialists and having specified software designed to assist in the big data audit. Participant 1 mentioned that big data analysis assisted in identifying irregularities in audit information, so the population was larger. Participant 3 mentioned how big data analysis software was useful when performing analytic testing and journal entry testing because red flags were quickly identified and stood out. Most participants mentioned the use of a common branded software like CaseWare IDEA Data Analysis, Excel, PowerBI, Tableau, or Dynamic Audit Solutions. Participants 9, 10, and 11 mentioned how their organization had custom designed proprietary software their firms used for data extraction and analysis.

**Blockchain Research Question 2a & 2b.** The second set of research questions of the study centered on the factors auditors felt were a part of their audit experiences and firm's movements towards addressing blockchain on audit. The focus was to identify the obstacles and the new processes participants felt were prominent to the audit engagement. A few common themes emerged, such as the minimal practical use of blockchain during the audit, an acknowledgment of its future prospects, and recommendations for the use of outside specialists familiar with this type of technology because of its early stages of entry into the audit process. It has been stated in the literature that blockchain is new to the audit industry (Lombardi et al.,

2021). Blockchain has been called a disruption to the industry because of its potential to render some of the audit functions obsolete (Liu et al., 2019). Distinguished factors causing the obsolescence include: having a less human intervened system, an openness of sharing of the network, irreversibility of transactions, and on-time-continuous allowability to the audited information (Mahbod & Hinton, 2019). Many participants emphasized that blockchain was new to the audit industry. Three participants felt it was so new that in practice they never experienced the working within a blockchain for an audit they were a part of. Participant 1 mentioned how blockchain was a part of their experience effecting the way they audited fixed asset acquisitions. Participant 1 also mentioned that blockchain runs on a new logic- algorithms and is riskier, so the data had to be evaluated for accuracy.

### *Relationship to Conceptual Framework*

The conceptual framework links concepts in a study giving an interpretive approach and relationships to a qualitative study (Jabareen, 2009). This section of the study links the themes identified from the study and the conceptual framework in section one of the study. The study was guided by three theories, critical theory, role theory, and structural theory. The theories guided the researcher in gathering information pertaining to big data and blockchain effects on auditor's roles. Information was gathered from select participants forming a relationship with these theories.

***Critical Theory.*** The role of the auditor in society, the effects of the use of technology, and the migration of historical norms to new phenomena centers on critical theory's philosophical constructs. Tweedie (2018) was a noted researcher of critical theory, describing accounting as a social practice and highlighting how critical theory in a study philosophically explains change subjectively. Zheng and Stahl (2011) explained critical theory as a philosophical

approach used in research concerning technology and individual agency. The relationship to this study concerning this philosophy is that auditors are social subjects whose roles are being changed because of big data and technology. As agents in their field, auditors have a responsibility to the public and to promote audits of quality. At least 80% of the participants generally felt their roles were going to change because of big data and blockchain. More than half of the firms were planning for these changes because of the technological phenomena. Changes mentioned were the way sampling, controls, and risks assessment will assist in fighting fraud. There were new responsibilities many participants felt upcoming. Participant 9 stated that data validity would be required when working a big data audit to ensure accuracy. Transactions involving a blockchain, according to one participant would affect audit risk and create a need to understand the algorithms.

***Role Theory.*** The participant auditors are bounded by characteristics, patterns of behavior, and the expectations of their field. This aligns to the philosophy of role theory (Biddle, 1986). This philosophy was selected in this study because of the identification in the literature of how the auditor's role may change and converge into technology specialists. There is an elevated use and need of technology to handle a quality big data and or blockchain audit. The application of data science changes the way financial statements are audited by providing more automation because computers are replacing what humans used to do (Werner et al., 2021). There is also a fulfillment to include additional software programs and use information technology specialists. Complex audit tasks are being automated and computer assisted tools (CAAT) are popular among the Big Four accounting firms (Werner et al., 2021). Analyzing large samples of data is easier to manage using analytical systems. The audit is described as not quite simple but driven by data and a new third ledger created by the blockchain. The distributed ledger of blockchain is

changing contracts, tracking of supplies, and creating a growth for cryptocurrency (Bennett et al., 2020). The auditor has a role to protect investors and protect public interest by managing the risks blockchain brings into business. The blockchain uses cryptography and algorithms. This digital ledger places a new responsibility on the auditor. The participants of the study had mainly limited experience of working in a blockchain audit. Many participants felt things would change in the future. According to Participant 3 blockchain is a form of transactions to be understood. Participant 2 suggested auditors will need to keep up with the demands and changes of stakeholders.

***Structural Theory.*** The interplay of accounting with the participants and its agents supports Giddens theories on structuration (Coad & Glyptis, 2014). Supporters of this theory in research highlight how accounting and control research is grounded in structuration theory, for example because of the agency and promotion of change (Georgios & Lisa, 2018). The participant auditors work for firms, their roles are governed by accounting standards, and they are external safe guarders or in-betweens for public financial safety. This theory was chosen to highlight the responsibility of the firms and the auditor when adapting to big data and blockchain technology audits. Coad and Glyptis (2014) described a Praxis as a process founded in structural theory that refers to the activities, actions, and practices that create structural change. The use of big data and blockchain in audits creates a condition for change and the agents are the ones responsible for acting. Participant 1 mentioned how there will be an update to SAS122 due to the increases use of blockchain technology and data analytics. Another participant mentioned how the AICPA is set to revise the Audit Evidence Statement on Auditing Standards, making room for new technologies. Many participants highlighted training programs in and outside their organization to keep them abreast of the skills and requirements big data and blockchain will

pose on audit. More than half of the participants describe software programs being added by their firms, some of the programs were newly designed, organizationally created, or adapted from Excel to fit the needs of big data and blockchain audit. Working with their organization's IT personnel was also relevant to the accounting firm's future response as well as the possible need for outsourcing.

***Relationship of the Findings to Anticipated Themes***

The completed interview information revealed the presence of four anticipated themes. The findings were anticipated because of the exhaustive literature review and the support for these findings were revealed during the coding process of the interviews of the participants. This research study is linked to the purpose, framework, problem, and literature review.

***Theme 1***. One of the most recognized themes was the continued need for professional growth by auditors to handle big data and blockchain audit. Some of the ways this training was occurring was through professional organization CPEs and the firm's in-house structures training programs. As the movement towards the extracting and analyzing of data is needed, so will the need for additional understanding of new controls, changes in audit evidence, and the implications on audit risk.

The audit risk model formulates the audit, and it determines the nature timing, controls, design, and effectiveness of the audit (Dohrer, 2019). The findings showed audit risk as the essential to preparing for any changes effected by big data and blockchain technology. The auditor's preparation to audit these technological advances surrounds for preventing fraud tapping into the enhancing aspects of these technologies for an efficient audit.

***Theme 2.*** The second anticipated them correlates with the use of specified software to handle big data and blockchain technological functions. There was a considerable number of

firms prepping for new software, some using common software in the industry and others creating their own in-house brand of software. There was a need for common data extraction software identified in the literature and amongst participants. Other participants highlighted their firm's creation of a software design teams to formulate software programs for data extraction and the creation of blockchain software integration with client's financials. This theme is common to most firms as the audit progresses to handle big data extraction as audit evidence which has vast amounts of volume, variety, and velocity. The new age of cryptocurrency while seemingly new to most participants, was not without recognition as an upcoming change in how this information will be audited and notability of its heavy algorithmic system.

***Theme 3.*** The third anticipated theme was the emphasis of the use of information technology professionals during the engagement. The audit has been elevated to be more technology driven. Auditors are not only accountants but information technology specialist. Initiatives continue to remain and increase the need for information technology specialist. Most participants recognized the need to work with information technology specialist especially in areas they needed technical support to audit or more understanding of the features and effects the technologies had on their engagement. Many identified that, their firm had an IT department and were setting goals to handle the implications of risk and control big data or blockchain may bring.

***Theme 4***. The fourth them to emerge from the study's information was the lack of immediate experience with blockchain or big data. This was more common with blockchain than big data, the lack of experience of its implications in an engagement. The evolution of big data and blockchain led researchers to believe these technologies would affect the role of the auditor and their need to prepare for its use. Some participants acknowledge the upcoming need for their

use, but many lacked practical experience of working a blockchain effected audit. Some participants acclaimed that their firms were preparing for big data implications with new software development in mind. The constructs and nature of blockchain was not heavily discussed as an immediate effect but a future effect and need forthcoming.

***Relationship to Problem***

The problem that was examined in the study was the lack of preparation by CPA firms and auditors pertaining to the use of blockchain and big data on audits to serve customers. An exhaustive research of the current literature revealed common themes as the major challenges CPAs and their firms face when trying to serve audit clients. Moll and Yigitbasioglu (2019) identified the lack of training as an essential problem, to prepare for the blockchain and big data audit, training must be provided. Liu et al. (2019) proclaimed that blockchain will disrupt the audit profession and the needed changes are not fully understood. In addition, new skill sets, and additional business services may be required to serve audit clients of big data and blockchain (Joshi & Marthandan, 2018). The literature supported the common themes of the findings from the participants interviewed and the problem. This section connects the problem being studied and the findings from the participants' interviews.

The set of questions in the interview that identified the obstacles and the preparation auditor's and their firms faced emerged a few common themes. One of the themes was training, most participants were in some form of training or learning of new skills. More than half of the participants mentioned specifically attending continuing education courses by their professional accounting organizations. Another theme was the lack of complete understanding of the full effects blockchain would have on the audit role. More than half of the participants described the lack of practical experience dealing with blockchain within their audit role but did recognize

their firm's acknowledgement of the future implications. Another discovered theme that tied with the problem was the use of technological support personnel, the need for new software programs, and IT support. According to a few participants, firms are hiring computer programmers, purchasing new software programs, and outsourcing IT specialists in preparation of working with big data and blockchain audit clients. Auditors and their firms are making strides to work and prepare for these technological advances to ensure a quality audit.

***Relationship to the Literature***

The current literature regarding big data and blockchain implications on the audit industry were personified by the participants. There were four themes common to the participants that were discovered during the interviews that aligned with the literature. In general, training on software, new skill developments, working with technological personnel, and the limitations of incorporation because of newness into the audit.

Researchers explain the pressures imminent to the audit and a need for the understanding of the threat's technology like big data and blockchain impose (McGregor & Carpenter, 2020). Understanding these threats is considered the first step in implementing and preparing for change. One threat involves monitoring the human element of blockchain, this includes accessibility controls and the input of data, as well as protocols set to secure information. The various risks imposed on the audit of the blockchain client include equipping auditors with knowledge and expertise and the inherent risks associated with its technological use by businesses (White et al., 2020). The risks vary from monitoring, protocols, and technological risks. According to White et al. (2020), interoperability risk is strongly related to blockchain because of the use of various computer systems, software programs, and business processes with

each other that is unrestricted. In addition, the technological capacity should be significant enough to transact with blockchain.

Reshaping their skills and competencies remain an aforementioned response to the perils of big data auditor preparation (Joshi & Marthandan, 2018). The issues vary, the approach to which training to focus on seems to be an issue, security and storage of confidential information pose cyber security risks to be addressed, and a standard for big data analytics theory and application pose conceptual issues (Joshi & Marthandan, 2018). This section of the study shall provide an overview of the similarities and the differences between the data collected and the current literature regarding big data and blockchain implications on the audit industry.

***Theme 1: Relationship to the Literature***

A major similarity between the current literature regarding big data and blockchain audit engagements and the information collected from the participant interviews were the techniques utilized by audit firms and auditor to successfully prepare for a quality audit. The participants were asked questions that were designed to identify how they were planning to engage and work with big data and blockchain within audits to serve clients. As a result, the theme most common to the participants was training and learning about new software and what the new processes would have on the audit environment or model. The themes were like the findings in the literature regarding audit personnel preparation to have a quality big data and blockchain audit.

Theme one identified from the interviews was the importance of a commitment from auditors and their firms to train their audit employees to engage with big data and blockchain technology on audits. The literature regarding this agreed to the participants assertions. Researchers suggest that auditors must commit to understanding the new degree of fraud risk, changes in substantive testing, sampling, real time information, and internal controls that big data

and blockchain pose on the audit to stay in compliance with a quality audit (Dezoort et al., 2018; Oden & Barnes, 2019; Younis, 2020). The findings in the literature were common to the findings in the interviews, a commitment to training and preparing to engage effectively as a professional involved in big data and blockchain audits (Chiang et al., 2021).

***Theme 2: Relationship to the Literature***

The second theme like the literature and data collected from the interviews were the acknowledgement of the need for assistance from computer scientists or information technology specialists, especially when the auditor lacked technological knowledge to perform the audit. The participants were posed with the question of explaining any technological developments or use of additional personnel to perform big data or blockchain audits. This was another anticipated them relevant to the literature and common amongst the participants.

Outsourcing and hiring experts in areas were the auditor or firm lacked expertise was essential to completing a big data or blockchain audit. An advisory department was also set up at various firms to handle information technology and computer science supportive needs. A close relationship was mentioned as a necessity with software experts, was essential, and apart of various stages in the audit, especially the planning stage (Salijeni et al., 2019; Schmitz & Leoni, 2019). According to Grocholski (2017), the audit engagement's success and quality may be dependent on information technology specialists because the audit has entered a more technological driven process.

***Theme 3: Relationship to the Literature***

The third theme identified in the literature and in the questionnaire was the importance of having specific software that supported audits that included blockchain and big data. Essential to the audit is the attesting of financial statements prepared by management for multiple purposes

outside and inside the organization. Big data and blockchain technology have affected audit evidence.

Data extraction software is essential to sorting, analyzing, and using data for sampling and audit evidence (Newman et al., 2021). Blockchain technology is algorithmically based and operates on a decentralized network which creates new toolsets, applications, and platforms to be simplified and managed (Raj et al., 2021). Blockchain technology has also created a third ledger of data and a system of digital assets that may require verification and the understanding of its risks and controls as audit evidence (Dyball & Seethamraju, 2021; Gramoli, 2020). Salijeni et al. (2021) noted similar software tools participants evidenced like IDEA and in-house big data and analytics tools developed by relevant firms. There was a connection to the literature and the interviews concerning having needed software beyond excel and most importantly specifically designed in-house software by firm's technology specialists.

***Theme 4: Relationship to the Literature***

The fourth theme common to participants and identified in the literature as an important factor was the limited practical experiences with blockchain technology. Blockchain was identified as being in early stages of adoption. Participants identified more with big data use and the relatability as evidence within the audit. These themes were relatable to the literature. For instance, there will be some firms that are not as experienced in handling the variables that big data and blockchain pose (Farcane & Deliu, 2020; Kim, 2020; Younis, 2020). According to Austin et al. (2021), a connection with various social groups involved with the dynamics and evolution of data analytics remains complex. The roadblocks include lack of regulation by standard setters, the newness of the phenomena on audit quality, and the potential for

marginalization of the audit role (Austin et al., 2021). These perils remain specifically to be resolved and understood between the social groups.

A few participants mentioned that they had limited experience presently with blockchain within audit; yet, it could have future implications. A few participants mentioned that their firms were preparing to execute new software developments to handle big data extraction. Blockchain and big data will impact the audit profession according to researchers and firms should prioritize their impact (Dagliene & Kloviene, 2019; Drew, 2019). The pace of development for some firms was not as evident and varied.

### *Summary of the Findings*

This qualitative phenomenological study was developed to address the four research questions of the study. This study was accomplished by conducting 11 interviews with auditors working for audit firms. This study revealed four themes relevant to the effects of big data and blockchain on the audit practice.

To meet eligibility requirements, each participant had to have external audit experience and must have been a certified public accountant working for an accounting firm. Participants provided information that helped identify techniques needed for a successful audit engagement, the challenges big data and blockchain posed, the limitations, the up-and-coming prospects, and the immediate response to these emerging technologies. Information identified from the participants formed the themes and from these themes identified, connections were formed. From these interviews four themes emerged, and the four themes were:

**Theme 1**: There is a commitment to training employees to use newly designed audit software and transfer into new methodologies

**Theme 2**: A need for assistance from IT personnel provides support where CPAs lack technological knowledge

**Theme 3**: Organizations are designing and using specific software beyond Microsoft Excel

**Theme 4:** Limited or new to audit and in the infancy stage at their firm

Open and axial coding was used to identify the themes after the interview process. Connections from the participants were associated with the research questions, conceptual framework, problem statement, and the academic literature. The summary of the findings assisted in providing an overview of the themes identified in the study.

The interview questions were developed to align with the research questions. The research questions were subsets of big data and blockchain. Both technologies supported recent research in the literature on the need for preparation of use, benefits, and impediments (Rose et al., 2017; Schmitz & Leoni, 2019). An exhaustive study of the literature revealed that big data and blockchain was positioned to effect audit role in a forthcoming and immediate way (Vincent et al., 2020; Younis, 2020).

The purpose of this study was to add to the literature and explore the effects big data and blockchain posed on the audit. The body of knowledge gained from the literature and the participants supported the purpose of the study. The participants' responses were essential to identifying techniques that practicing Certified Public Accountants (CPAs) were using to remain successful in their field and promote a quality audit. Preparation is key according to the participants to handle technology change. A successful big data or blockchain engagement requires auditors to prepare for new software programs in advance. In addition, the use of an information technology specialists in areas they were lacking experience is also suggested.

Understanding how to incorporate a firm's software program to fit big data and blockchain features was also mentioned. Lastly, the acknowledgment of upcoming changes, discussions, and future plans must be set in place to keep advances in line with a quality audit.

## Application to Professional Practice

The objective of this study was to contribute to the body acknowledge regarding big data and blockchain effects on the audit engagement. Big data and blockchain technology are positioned to change the audit in various ways from historical practice, there was a need for more research in understanding these phenomena in a practical way. The data collected from participants concerning big data and blockchain was used to expound on the current information in the literature. This section of the research study presents an overview of improvements to general business practices, application to professional practice, recommendations, a biblical perspective, and reflections.

### *Improving General Business Practice*

The aim of this study was to find out where improvements could be made to the audit profession in general. The role of the external auditor, CPA was examined in this study concerning new technological innovations such as big data and blockchain. The interviews revealed four common themes amongst the participants. As these themes were revealed and discussed in this study and connections were made, the idea was to understand ways to enhance the audit engagement. This section of the study shall highlight the discussions made in the findings and how they can be used to improve business practices.

The external audit is an effective tool for preventing errors and fraud; therefore, keeping this notion as a common fundamental of how businesses are improved by the audit role is essential (Adali & Kizil, 2017). The professionals that were interviewed in this study were not

unfamiliar with progression and change within their role's created by technology. Most of the CPAs identified with consistent professional development requirements. Most also understood the concurrent need for professional growth, as a requirement for their licenses to remain active. When posed with the question of how big data and blockchain created new responsibilities and how they adapted, the first theme identified by the participants was the ongoing need for training. Training was being addressed by some within their organization and for some through their professional society. The blockchain will add to the audit, streamlining transactions in accounting and creating a real-time audit (Alacorn & Ng, 2018). As far as big data are concerned, the business environment has integrated with the cloud, the Internet of Things, and external data sources to stay competitive (Appelbaum et al., 2017). There is a shift happening in business to use these technological advances purposefully and the audit of today and in the future has been set to change. To address these changes the auditor and their firms are preparing for its use.

The second theme identified by the participants was a constant shift that has been always apart of audit, the relationship with information technology (IT) personnel. Computer scientists and the auditor along with their firms are partnering for a quality audit. The audit of today is more technological and influenced by artificial intelligence. Most firms have an information technology department and many participants mentioned working with IT personnel during their audit. According to Atwood (2018), accountants should learn about the applications of blockchain by interacting with it in business transactions and by finding experts, including nonaccountants with knowledge on how to use it. Many participants agreed that the role of IT professionals is commonplace in their firms and growing. The relationships with IT professionals

and the auditor assist in filling the gaps where knowledge of certain computer programs is not understood by the auditor (Barta, 2018).

The third theme relevant to improving business practices which surfaced from the participants interviews was the use of specified and in-house designed software. The human element of the audit will still be needed; however, business applications and operations are relying on technological software programs and the applications of the internet to make financial and nonfinancial decisions. The audit industry is common to change since the inception of the external audit. Having the audit professional and various personnel equipped and adaptable to these changes leads to an effective, efficient, and quality audit. According to Joshi and Marthandan (2018), big data for instance involves transactions, interactions, and observations of data from the 3Vs (i.e., volume, variety, and velocity). Blockchain interacts with various systems from legacy systems to newly incorporated systems hosting cryptocurrency and real-time processes like smart contracts (White et al., 2020). The literature mentioned the crucial preparation of accounting firm's development of their software programs and use of tailored software programs being offered by industry software designers to address the business needs (Ionescu, 2019; Karajovic et al., 2019; Liu et al., 2019).

The fourth theme related to the application of professional practice was the duty of the auditor to prepare for its future implications. As the auditor embarks on the blockchain and big data technological narrative, limitations were identified in its practical application. The external audit is a process, a system based on factors to remedy risk and create reliance on an organizations financial statement and assertions. The external auditor and their firm will benefit from having an action plan immediately or within the near future to tackle the constructs of big data and blockchain whether they have conformed to its implications or not within their firm.

The idea here is to be prepared because blockchain and big data technology is stated have a significant impact and according to many of the participants, the future implications may be inevitable. The results of this study could assist the practicing external auditor and their firm in tackling the major issues regarding big data and blockchain implications of the audit.

### *Potential Application Strategies*

The application strategy of a business helps the organization use their resources effectively through planning and focusing on process improvements (Phadermrod et al., 2019). Business success is supported by the goals and initiatives set into place by those responsible for implementation. A successful strategy identifies the roadblocks that inhibit current business practices from reaching organizational goals. This section of the study suggests potential application strategies that organizations can use to integrate the results of the study with business practices. Successful application of the results of the study provides businesses with insights on big data and blockchain integration into the audit practice. There are four steps of application strategy suggested for implementation.

A firm's leadership may examine the available resources for training their organizational staff to handle big data and blockchain technological audits. Depending on the audit department's strategy and the sustainability of this business market, preparing to have auditors equipped to serve audit clients starts with defining the acknowledgeable skill sets needed. Gaining knowledge may involve what some participants stated, a connection with the professional societies and attending classes offered by trainers and professional developers. The information gained from training may provide leadership with the sustainable direction their audit staff should be aligned to prepare to audit big data and blockchain.

A second step after the understanding of the training needs of the auditor, would be the examination of audit software to perform audits associated with big data and blockchain technology. The audit technology is a part of what the auditor will work with. Managing big data extraction and blockchain algorithms are noted by audit personnel. Finding the essential technological software needed and platforming it into the firm was mentioned as a potential need by audit personnel. Many auditors mentioned their firm's preparation to integrate new or in-house designed software programs. Having the knowledge of what it takes to host and work with and use this software is essential to incorporating it into the firm.

A third step is the inclusion of information technology professionals into the audit internally by having a department or outsourcing of experts prepared to assist the auditor where needs are concerned. This study discovered the consistent use of information technology experts during the audit. A firm may decide to have a separate department to handle this shift or outsource with experts with knowledge of big data and blockchain key specifics to the audit.

The fourth application to professional practice involves continuous monitoring of the regulatory, financial, and audit market concerning technological needs to serve big data and blockchain clients. A deeper look at what is going to affect their strategic plans is a process of continuous development. Being proactive about upcoming new regulations, rules, or standards that effect big data and blockchain. Taking a financial examination of resources available, the costs, the staff, and the capacity to audit big data and blockchain.

### *Summary of Application to Professional Practice*

When accounting firms execute an application of business functions into their professional practice, having a plan centered on available resources and the unavoidable perils of business is a start. From various external and internal factors, plans are made and initiated. The

resources help to determine where the business is weak or unprepared. An understanding of the training needs in the industry provides the dynamic of skill sets and professional development to be addressed. An awareness and implantation of software requirements, systems, programming, and data platforms required to execute and process the audit. Deciding the best way to include information technology specialists' forthcoming knowledge plans for a sustainable blockchain and big data audit. Continuous acknowledgement of the regulator's responses to rule sets and frameworks that enhance audit quality should be elevated. These are a few of the suggested applications to professional practice found in this research study.

**Recommendations for Further Study**

This study was limited to CPA firms in the jurisdiction of Kentucky, Illinois, and the Indiana tri-state area, it might be useful to duplicate this research in other states. By replicating this study in other states CPA firms, the results could be compared and contrasted firm to firm and state to state. A deeper understanding of big data and blockchain audit engagements across the country or outside of the United States could be obtained, this can help expand the generalizable information of the study's findings.

This study was conducted using qualitative research measures. There are other types of methods like case studies, mixed, or quantitative measures as well. A more in-depth and up to date inquiry on the perceptions of auditors as systems change with time could also be studied. CPA firms audit and technology staff may enlighten the perceptions as new changes occur. Is there new information to be discovered? Are there additional considerations concerning these new technological advances? Has blockchain technology become more relevant than argued and found in this study?

Finally, the researcher recommends that future researchers with an interest in blockchain and big data effects on the audit study the internal controls and authoritative bodies updated pronouncements and standards. It was discovered during this study that the authoritative bodies were in the beginning stages concerning how to regulate the audit processes concerning big data and blockchain. Are there any new updates and pronouncements? Updating this information may enhance the understanding of audit procedures, controls, and regulations. New continuous discoveries and research may add to the field of audit.

**Reflections**

This qualitative study was a combination of stringent processes, using the knowledge of professionals in the field, and additional resources. Initially, the literature was the source of finding the problem or evidential changes effecting big data and blockchain audit processes (Brazina & Ugras, 2018; Drew, 2019; Smith & Castonguay, 2020; Veerankutty et al., 2018). The purpose and goal were to add to the literature concerning the effects of big data and blockchain on the audit industry. The participants had to be Certified Public Accountants (CPAs) or direct associates at an accounting firm having knowledge or experience in the audit industry. The main source of information from this study came from 11 interviews of CPAs with recent audit experience. This researcher gained knowledge and practical feedback from this study. Having a continued research agenda concerning big data and blockchain for future research and writing into the literature is also important to this researcher. Additionally, the biblical and business perspective enhanced this researchers' spiritual values, promoting growth at a secular and spiritual level.

### *Personal and Professional Growth*

As this researcher reflects on this study concerning personal growth, what stands out initially is the relationship this research has with this researcher's common need for change, ownership, creativity, and improvement. Personally, this researcher is the kind of person that is apt to get involved in new and fresh ideas. This researcher is an inquisitive person that has enjoyed understanding the reasons behind new concepts and technological advances. Studying and researching big data and blockchain technology has been an exciting, new, and a fresh theme to the field of accounting. It is important that this study adapts, grows, and enhances the literature. This study has enhanced this researcher's confidence in researching and writing professionally. The overall personal ability to take ownership in a creative product designed individually is rewarding and a confidence builder.

There were various professional developments discovered in this study concerning big data and blockchain effects on the audit. Historically, by experience this researcher has been a professional corporate accountant and most recently within the last few years has embarked on a career in academia. The professional developments found in this study may enhance the audit and business field. This study is relevant to the students of accounting and business. Considering the historical changes and the adaptation into new technological advances are relevant to this researcher's field experience as an accounting professor and credentialed accountant. There is no doubt in this researcher's mind that this study will continue to develop and enhance the field of audit.

Working with professional CPAs, understanding the developments, and sharing this with future colleagues and students of accounting made this experience real and relevant. This researcher has viewed new releases on accounting texts and courses that demand an

incorporation of a technological systems beyond excel, like understanding Tableau. This researcher will continue to add to the academic literature. There are still additional areas concerning big data and blockchain to be discovered and this researcher reflects on this as a professional opportunity.

***Biblical Perspective***

This qualitative research study connects businesses with a biblical perspective in many ways. The accounting and auditing industry are not solely business ideas but have a divine connection as well (Sandelands, 2017). The human existence and divinity of God is where this researcher shall begin to explain the biblical and business connection of this study. Not being singularly goal oriented towards generating profits in business but, having a right heart and spirit in all that is done. The scripture emphasis this by stating, "therefore, whether you eat or drink, or whatever you do, do all to the glory of God" (1 Cor. 10:31, NKJV). Generally speaking, our relationship with God and our reconciliation to Christ is what Sandelands (2017) calls "positive organizational scholarship" (p. 772). God is always with us; there is a goodness to business, and the best human condition elevates above profits. This study was designed to discover a positive outcome in the midst of a changing environment influenced by technology and professional guidance.

From a Christian lens, auditors obey the will of God as essential workers of authoritative figures, not only in a divine way but in the Earth as well, as described in Colossians 3:22. Colossians 3:22 (NKJV) states, "Bondservants, obey in all things your masters according to the flesh, not with eye service, as men-pleasers, but in sincerity of heart, fearing God." This verse relates to what one does or the behavior of a worker when their authoritative figure is watching and/or not watching. The role of the auditor is centered on integrity, stewardship, and honest

feedback. Their opinion on financial and nonfinancial information of an organization is what investors trust and rely upon to make informed decisions. In essence, the nature of the audit and the auditor centers on Christian principles described in various texts throughout the Bible. A notable verse is Proverbs 11:3 (NKJV) which states, “the integrity of the upright will guide them.” Moreover, the desire of our Heavenly Father is for those in right standing to be guided by integrity and the attribute of integrity, honesty.

The subjects of this study provided their real-world experiences in the field of audit, reflecting on risk assessment, audit procedures, and the representation of data with the use of technology. According to Deagon (2021), technology is considered a new type of religion having Christian origins. This idea of connecting Christianity and technology is important to this study. Deagon (2021) explained technology’s premise for change as a “digital salvation” its enhancing nature to make better the human experience (p. 83). Technology should be used for good, a part growth, change, and improvement in society. Our ideas as Christians come from above (James 1:17), our thoughts are inspired by God (1 Cor. 2:16), nothing is impossible to those who believe (Luke 1:37), and with God all things are possible (Matt, 19:26). In essence, technology as an improvement feature, is divine, and allows for goodness and growth. This study was concerned with change, improvement, and growth within the field of audit.

On a final note, this study relates to the biblical principle of how knowledge shall be a part of growth and continuously increased in our lives. Times will change and accomplishing and reaching more people will not be uncommon. Scripture supports the idea of continued wisdom stating in Daniel 12:4 (NKJV) that “knowledge shall increase” in the land. Scripture also emphasizes that perpetual change is constant, just like seasons, there will be constant evolving, and time for aspects in life (Ecclesiastes 3: 1-8). This study has biblical notions, historically, the

field of audit should grow with changing times. The field of audit is a good process, it provides a sense of security to those that rely on the opinion of the auditor report. The field of audit is regulated and rules based, similar to the consideration of obeying the laws of the land as mentioned in Romans 13:1-2.

### *Summary of Reflections*

In summary of the reflections, this doctoral journey was a process that required daily effort, prayer, and personal motivation. The journey was not without the need to consult with professionals but also with this researcher's source of higher power the bible. The Word of God and prayer strengthened this researcher to persevere through the challenges. The interactions with the participants was phenomenal and brought a lot of personal experiences and business knowledge. Having the connection with biblical principles was an added feature that stretched beyond the world view, but a spiritual view that this researcher appreciated. At end, this doctoral journey has enhanced this researcher's spiritual and business perspective and was well worth it.

## Summary of Section 3

This qualitative study aimed to enhance the literature concerning big data and blockchain effects on the audit. The information gathered from the participants in the study provided the practical techniques, actions, and recommendations that interested parties may utilize. Future researchers may continue to grow this body of information in additional studies. Furthering the literature and research in the area of big data and blockchain effects on the audit may be necessary as processes continue to develop. For this researcher, the academic knowledge, professional feedback, and the literature has created an avenue of influence that will allow for continued growth in the field. Reflecting on this study overall enhanced the researcher's spiritual and business acumen.

**Summary and Study Conclusions**

This doctoral journey started with an investigation and discovery of the overall problem in the literature. The purpose of this study was to explore the body of knowledge concerning the audit industry's elements of change concerning big data and blockchain. Investigating the experiences auditors found while working with technical tools, their professional organizations, and their firms' staff provided essential insights to the research questions. The problem to be addressed was for auditors to prepare to work with big data and blockchain technology while effectively working with clients.

This researcher connected with eleven participants that aligned with the parameters of the study; most importantly, being certified public accountants with audit experience. The interviews in this phenomenological qualitative study provided the data for the study. The idea was to gain an understanding of the lived and practical experiences the auditors expressed. The objective was to explore the internal practices, the audit constructs that were historically changing surrounding big data and blockchain technology.

Accordingly, the essential research questions were designed to understand how the auditor's role was affected and how their organizations were addressing the implications. Four themes emerged which were, training needs, assistance from information technology personnel, specific software, and being new or infancy stage at firms. The themes were common amongst the participants. This congruency amongst the participants offered the researcher data saturation. Additionally, in-depth information, which contributed to the current body of knowledge pertaining to big data and blockchain technology's effects on the audit.

The existing literature provided was searched which supported the literature review. The literature aligned with the themes and the feedback extorted by the participants. The results from

the study could provide in-depth information to the current body of knowledge concerning big data and blockchain technology effects on the audit. In conclusion, this research study was designed to enhance the field of audit, give practical in-depth experiences of the audit role, elevate the next developments concerning big data, and blockchain technology effects on the audit.

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## Appendix A: Qualitative Interview Questions

Interview Questions

For an email copy: xxxxxxxxx@liberty.edu

1. In general, how would you define big data and/or blockchain components of an audit client?
2. In general, what extent has big data and/or blockchain interrupted the audit process?
3. What does your firm think is important to consider concerning big data and/or blockchain when it pertains to auditing clients with these types of technological uses at the organization?
4. What procedures have changed since the inception of big data and/or blockchain that have affected the audit?
5. What are audit clients most concerned about or needing when it comes to big data and/or blockchain audit processes?
6. Explain any new training needs since the inception of big data and/or blockchain when completing an audit?
7. Explain any technological departments or use of technological personnel requirements in completing a big data and/or blockchain clients audit?
8. Explain any new software requirements needed since the inception of big data and blockchain on audits?
9. What is the most important response or plan your organization has made to prepare for big data and/or blockchain when it comes to completing a client's audit procedures?
10. Describe any new control procedures, governance, and pronouncements you have had to learn or take note of to audit with big data and/or blockchain clients?

11. Please provide any additional information that you feel is important to clarify any new roles, responsibilities, or procedure needed to complete an audit client using blockchain and/or big data?

## Appendix B: Recruitment Letter

Dear Participant:

As a graduate student in the School of Business at Liberty University, I am conducting research as part of the requirements for my doctoral degree. The purpose of my research is to understand the effects of technology like big data and blockchain on audit roles. I am writing to invite eligible participants to join my study.

Participants should have external audit experience. Participants if willing will be asked to interview in-person or zoom and fill out a survey of questions by email or over the phone. It should take approximately 30 minutes of an interview/ survey fulfillment and another 30 minutes of follow up over the phone, and possibly an additional 30 minutes to clarify statements. Participation will be completely anonymous, and no personal, identifying information will be collected.

To participate please email me or call to complete a brief survey of questions, my email address is xxxxxxx@liberty.edu and my phone number is xxx-xxx-xxxx.

Participants filling out the emailed survey and completing the phone interview will receive $5 gift card or monetary gift.

Sincerely,

Tereesha Patterson MSA CFE

DBA Student

xxx-xxx-xxxx xxxxxx@liberty.edu

## Appendix C: Consent Form

**Title of the Project:** The Effects of Big Data and Blockchain on the Audit Industry

**Principal Investigator:** Tereesha Patterson, MSA CFE

### Invitation to be Part of a Research Study

You are invited to participate in a research study. To participate, you must be an auditor working with or have interest in big data and blockchain client technology effecting audit procedures. Taking part in this research project is voluntary.

Please take time to read this entire form and ask questions before deciding whether to take part in this research. The inclusion criteria is as follows, seeking auditors, staff, managers, and IT personnel working with audit and the audit team.

### What is the study about and why is it being done?

The purpose of the study is to expand the body of knowledge concerning big data and blockchain's effect on auditor roles, procedures, and clients.

### What will happen if you take part in this study?

If you agree to be in this study, I will ask you to do the following things:

1. Email survey (30-45 minutes or conduct by email, in-person or over zoom).
2. Interview over phone or zoom (30-45 minutes).
3. Follow-up call (if needed) 20-30 minutes).

### How could you or others benefit from this study?

Participants should not expect to receive a direct benefit from taking part in this study.

Benefits to society include adding to the body of knowledge for educational and research purposes current trends like blockchain and big data that effect the audit industry.

**What risks might you experience from being in this study?**

The risks involved in this study are minimal, which means they are equal to risks you encounter in everyday life.

Foreseeable risks are minimal but could be categorized as:

- Legal risks, none all participants and client's information are discreet and private and not shared.
- Physical risks, none you will be emailing me or working with me through WEBEX
- Social or economic risks, none all information shared is locked up private and only accessed by me.
- Emotional risks, any emotional or stressful situations will be addressed, and you have the right if needed to stop participating. Strictly voluntary to participate. If any negative emotions, you will need to stop participating and that is strictly your right.

**How will personal information be protected?**

The records of this study will be kept private. Published reports will not include any information that will make it possible to identify a subject. Research records will be stored securely, and only the researcher will have access to the records. Data collected from you may be shared for use in future research studies or with other researchers. If data collected from you is shared, any information that could identify you, if applicable, will be removed before the data are shared.

- Participant responses will be kept confidential using codes. Interviews will be conducted in a location where others will not easily overhear the conversation.
- Data will be stored on a password-locked computer and may be used in future presentations. After three years, all electronic records will be deleted.

- Interviews will be recorded and transcribed. Recordings will be stored on a password locked computer for three years and then erased. Only the researcher will have access to these recordings.
- Confidentiality cannot be guaranteed in focus group settings. While discouraged, other members of the focus group may share what was discussed with persons outside of the group.

**How will you be compensated for being part of the study?**

Participants will be compensated for participating in this study. A five-dollar monetary gift in the form of cash or a gift card will be provided. The gifts will be mailed to the place of business or dropped off physically at a desired location.

**Does the researcher have any conflicts of interest?**

The researcher serves as a student at Liberty University. To limit potential or perceived conflict the researcher will ensure that all data are stripped of identifiers. This disclosure is made so that you can decide if this relationship will affect your willingness to participate in this study. No action will be taken against an individual based on his or her decision to participate or not participate in this study.

**Is study participation voluntary?**

Participation in this study is voluntary. Your decision whether to participate will not affect your current or future relations with Liberty University. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

**What should you do if you decide to withdraw from the study?**

If you choose to withdraw from the study, please contact the researcher at the email address/phone number included in the next paragraph. Should you choose to withdraw, data collected from you will be destroyed immediately and will not be included in this study.

**Whom do you contact if you have questions or concerns about the study?**

The researcher conducting this study is Tereesha Patterson. You may ask any questions you have now. If you have questions later, you are encouraged to contact Tereesha Patterson at xxx-xxx-xxxx or by email at xxxxxxx@liberty.edu. You may also contact the researcher's faculty sponsor, Christopher Demaline, at xxxxxxxx@liberty.edu.

**Whom do you contact if you have questions about your rights as a research participant?**

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA 24515 or email at irb@liberty.edu.

Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted in an ethical manner as defined and required by federal regulations. The topics covered and viewpoints expressed or alluded to by student and faculty researchers are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

**Your Consent**

By signing this document, you are agreeing to be in this study. Make sure you understand what the study is about before you sign. You will be given a copy of this document for your records. The researcher will keep a copy with the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

☐ The researcher has my permission to audio-record/video-record me as part of my participation in this study.

_____

Printed Subject Name

_____

Signature & Date