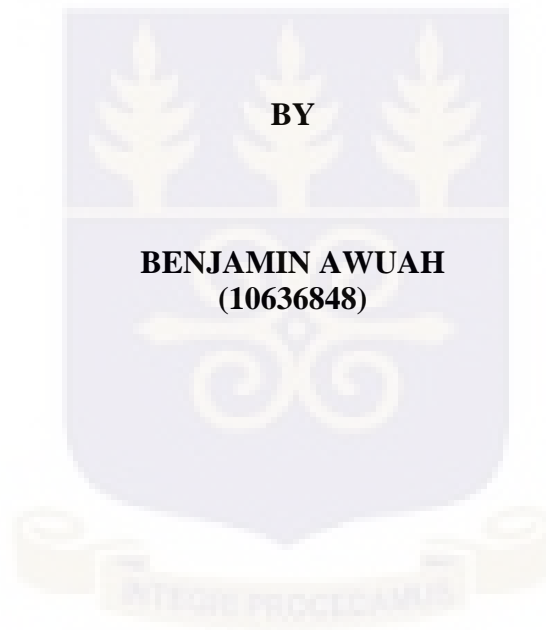


UNIVERSITY OF GHANA

COLLEGE OF HUMANITIES

**ADOPTION OF COMPUTER-ASSISTED AUDIT TOOLS AND TECHNIQUES AMONG
INTERNAL AUDIT UNITS OF GHANAIAIAN FIRMS**



**A THESIS SUBMITTED TO THE DEPARTMENT OF ACCOUNTING, UNIVERSITY
OF GHANA BUSINESS SCHOOL, UNIVERSITY OF GHANA, LEGON, IN PARTIAL
FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF A MASTER OF
PHILOSOPHY DEGREE IN ACCOUNTING**

JUNE, 2019

DECLARATION

I hereby declare that this manuscript represents the result of my own research and has not been submitted either in whole or in part by anyone for an academic award in this or any other university. All references used in the work have been duly acknowledged.

I bear the sole responsibility for any marginal or material shortcomings.

.....

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DATE

CERTIFICATION

I hereby certify that this thesis was conducted and supervised in accordance with procedures laid down by the University.

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DEDICATION

To God Almighty, my wonderful parents, Ivy, Emma, Foster and Devacious.

ACKNOWLEDGEMENT

I thank the Almighty God for seeing me through this two-year journey. Also, my profound gratitude to my supervisors Dr. Joseph Mensah Onumah and Dr. Ibrahim Bedi for their time, effort, assistance and insightful submissions from the start of the work to the successful completion of it. Their valuable contributions to the study have been enormously useful.

Also, my sincere appreciation goes to all the lecturers and staff of the Department of Accounting, University of Ghana Business School for their guidance and constructive criticisms during seminars. I also appreciate the support and motivation from Dr. Albert Ahenkan of the PAHSMD who encouraged me to pursue this programme. I really appreciate my colleagues, Iliyas, Belinda, Comfort, Salomey, Isaac, Esi, Foster, Meek, Ruby, Adwoa and Gabriel. I am highly indebted to you all for the support offered.

To my parents, family and friends, I am much grateful to you all for the love, prayers, support and words of encouragement. I could not have achieved this feat without your support and prayers. I say thank you.

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LIST OF ABBREVIATIONS

ACCOUNTING INFORMATION SYSTEMS	AIS
AMERICAN INSTITUTE OF CERTIFIED PUBLIC ACCOUNTANTS	AICPA
COMPUTER-ASSISTED AUDIT TOOLS AND TECHNIQUES	CAATT
COVARIANCE BASED STRUCTURAL EQUATION MODEL	CB-SEM
DIFFUSION OF INNOVATION	DOI
ENTERPRISE RESOURCE PLANNING	ERP
GHANA INVESTMENT PROMOTION CENTRE	GIPC
GHANA STOCK EXCHANGE	GSE
GENERALIZED AUDIT SOFTWARE	GAS
INFORMATION TECHNOLOGY	IT
INSTITUTE OF INTERNAL AUDITORS	IIA
PARTIAL LEAST SQUARES	PLS
STRUCTURAL EQUATION MODELLING	SEM
STATE ENTERPRISES COMMISSION	SEC
TECHNOLOGY ACCEPTANCE MODEL	TAM
TECHNOLOGY-ORGANISATION-ENVIRONMENT	TOE
THEORY OF PLANNED BEHAVIOR	TPB
UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY	UTAUT

ABSTRACT

The study examines the extent of CAATT adoption and utilization among internal audit units of organisations and the factors that influence the adoption decision. Since the advent of automation and rise of “Big Data” in the corporate world, there have been calls for the auditing profession to automate the audit process in an attempt to conduct effective and reliable audits in big data environments. Despite these calls, extant literature indicate that the adoption and usage of technology-based audit tools has been low, particularly within internal audit units.

Using the TOE framework as a theoretical lens, quantitative data was sought from a survey of internal audit units of 75 private firms and SOEs through self-administered questionnaires while PLS-SEM and descriptive analyses were employed for the purpose of data analyses.

The findings of the study revealed that CAATT adoption rates among organisations in Ghana is fairly high however, the extent of usage low. Risk assessment and fraud detection are areas where CAATT are mostly used within the work of internal audit units. The findings also revealed that CAATT actual adoption and usage in internal audit units are significantly influenced by CAATT behavioural intentions. Moreover, adoption intentions are significantly affected positively by technological readiness (compatibility), organisational readiness (technological competence and management support) and environmental readiness (external pressure and audit standards).

The findings offer valuable insights to management, policy makers and regulators on ways to improve the adoption and use of CAATT particularly within internal audit units. Attention should be given to the training of internal auditors as well as resourcing the unit and revising the standards. CAATT developers and vendors should collaborate with internal audit units to enhance the compatibility of CAATT applications to the work on internal audit.

CHAPTER ONE

INTRODUCTION

1.0 Chapter Overview

In this section, the background to the study followed by a statement of the research problem would be discussed. Based on these foundations, the purpose of the study and research questions are stated. Moreover, this section would outline the significance of the study, as well as the organisation of the rest of the study.

1.1 Background to the Study

Information technology (IT) adoption and application in the corporate environment has seen a significant surge in the last two decades. The automation of business processes has resulted in reductions in operational costs while enhancing efficiency. The InformationWeek magazine, in 2012 reported that “IT investments in the financial services industry of top 500 information systems innovators accounted for 8.7% and 9% of annual revenues in 2011 and 2012 respectively” (InformationWeek, 2012. p. 5). The dynamic and progressive digitization of the business environment due to this development has fundamentally changed the approach and manner of auditing these firms and thus necessitated the need for the audit profession to follow the same by adopting IT in the audit process (Vasarhelyi & Romero, 2014).

Information systems have revolutionized the business environment and currently are fully integrated into various organisations, spanning across all levels and units (Sousa & Oz, 2015). This development has resulted in advancements in the speed of transaction processing, cost savings and reduced inefficiencies caused by human errors. However, IT integration also presents challenges such as data integrity, security and risks. Issa (2013) posits that the adoption of accounting information systems has led to the creation and storing of huge volumes of data, a phenomenon

termed as ‘big data’, completely in electronic format. As Smidt et al. (2018) indicate that “the absence of technology-based audit tools in control environments dominated by big data and large volumes of electronic data will result in auditors’ inability to conduct effective and efficient audits”.

Computer-assisted audit tools and techniques (CAATT) include the “tools and techniques employed by auditors to extract and analyse client’s data of audit significance in a firm’s information systems” (Braun & Davies, 2003. p. 726). CAATT are used by auditors in the performance of specific audit processes that include “browse, analyse, sort, summarize, stratify, sample, apply calculations, convert, and carry out other operations of data extraction and data analytics” (Ahmi & Kent, 2012). CAATT have been argued and touted in literature (Ahmi, Saidin, Abdullah, Ahmad, & Ismail, 2016; Bierstaker, Janvrin, & Lowe, 2014) to offer a range of possibilities to organisations that adopt and utilize them.

Notable benefits include mitigating accounting errors, 100% population testing, fraud detection, increased audit quality, efficiency and effectiveness (Curtis & Payne, 2014; Gonzalez, Sharma, & Galletta, 2012). Higgins and Nandram (2009) also argue that the combination of traditional audit techniques and information technology can improve audits in risk and fraud detection. Information technology forms a fundamental component of the audit process and thus complements the auditor’s judgement in forming an opinion on the evidence gathered. Thus, in an IT-dominated corporate environment, auditors are recommended to employ CAATT with client’s information systems to efficiently and effectively examine the accuracy of the information and provide assurance on effectiveness of the controls (Widuri, O’Connell, & Yapa, 2016).

Internal audit function performs an important role in ensuring prudent financial management and accountability in organisations. The IIA (2016; p. 3) defines this function as “an independent,

objective assurance and consulting activity designed to add value and improve an organisation's operations". It signals the presence of strong corporate governance mechanisms and supports the attainment of organisational goals by "bringing a disciplined approach to risk management, control and governance processes" (Gantz, 2014, p. 45). Internal audit departments identify operational weaknesses, assess the effectiveness of controls, discover anomalies in standards and policies and identify areas to improve operational processes.

As the emergence of big data in the corporate world has resulted in additional challenges in data management and safeguarding, Smidt et al. (2018) suggest that internal audit units have applied alternative approaches in gathering audit evidence and have subsequently adopted technology-based audit tools to improve audit efficiency. Gepp, Linnenluecke, O'Neill, and Smith (2018) also assert that internal auditors can benefit immensely from CAATT by employing financial distress modelling for long term forecasts in assisting management make strategic decisions. Accordingly, Li et al. (2018) argued that the utilisation of CAATT by internal audit functions creates immeasurable opportunities to assess risks and identify operational inefficiencies.

Internal auditors perform much broader tasks as compared to external auditors and therefore should employ CAATT in order to complete audits in an efficient and effective manner. Also, they engage with business accounting data more frequently and thus utilisation of CAATT will help identify anomalies and detect fraud more quickly. Moreover, regulatory requirements for internal auditors are laxer as compared to regulations for external auditors which allow flexibility in exploring several technology-based audit tools Li et al., (2018).

Prior studies (Appelbaum, Kogan, Vasarhelyi, & Yan, 2017; Kim, Kotb, & Eldaly, 2016; Moorthy, Seetharaman, Mohamed, Gopalan, & Lee, 2011) interestingly argue that internal auditors who choose not to adopt CAATT will not only be handicapped in gathering evidence and audit scope

but are of the risk of becoming obsolete in the long run. Thus, the adoption of CAATT is imperative for the 21st century internal audit unit of firms if they are to remain relevant in business environments dominated by big data.

1.2 Statement of the Problem

The adoption of information systems in organisations confronts audit units with a myriad of challenges in processing, storing and assessing the veracity of the data generated (Gepp et al., 2018). Auditors are therefore encouraged to employ technology-based audit tools in carrying out their engagements to match up with the practices of their organisations. The AICPA (2002, p. 17) succinctly asserts that “auditors need to employ computer-assisted audit techniques to gather more extensive evidence about data contained in significant accounts or electronic transaction files”. Moreover, Willborn (1989) asserts that the “quality of audits must be interpreted as a function of compliance to audit standards complemented with the use of technology in the audit engagement and not restricted only to compliance to audit standards”.

Extant literature on accounting information systems (Ahmi & Kent, 2012; Ahmi, Saidin, & Abdullah, 2014; Li et al., 2018; Mahzan & Lymer, 2014b; Vasarhelyi & Romero, 2014) indicate that the utilisation of IT in the auditing profession results in an improvement in performance among adopters. For instance, arguing from the TOE framework, Li et al. (2018) identified that the performance of the unit’s performance is enhanced by application-level usage and feature-level audit analytics usage.

A review of the IT adoption literature suggests that the adoption of technology-based audit tools positively relates to the performance of the adopters by enabling auditors in risk assessment, fraud detection, testing controls and examining the entire population instead of a sample. Thus, auditors, in an attempt to increase efficiency and effectiveness, adopt CAATT in their audit engagements.

Moreover, the IIA recommends that internal auditors employ CAATT in the execution of their responsibilities (IIA, 2016). Also, AICPA (2002), in its standard on the “*Consideration of Fraud in a Financial Statement Audit*” suggests that auditors should employ CAATT, and in the process “gather more extensive evidence about data contained in significant accounts or electronic transaction files and in identifying unusual or unexpected revenue relationships or transactions” (p. 47).

However, with the enormous support and recommendations from the professional bodies and regulators (standard setters) for the adoption and utilisation of CAATT in audit engagements, prior empirical evidence suggests a slow pace in the adoption process particularly among internal auditors and most adopters’ utilisation limited to the basic features (Abou-El-Sood, Kotb, & Allam, 2015; Ahmi & Kent, 2012; Ahmi et al., 2016; Debreceeny, Lee, Neo, Toh, & Lee, 2006; Li et al., 2018). Thus, a significant proportion of internal audit units have not been able to fully integrate CAATT into their audit engagements. Although CAATT utilisation increases efficiency and effectiveness of auditors, adoption is voluntary and thus affects the adoption intentions. However, the literature on technology adoption indicates that “technology cannot improve performance and efficiency” unless it is adopted and utilised in the task for which reason it was developed or procured (Bedard, Jackson, Ettredge, & Johnstone, 2003). While a number of extant literatures has attempted to investigate the benefits of CAATT utilisation, few seem to examine the extent of adoption and utilisation of CAATT within the internal auditing context and factors that contribute to the low acceptance rates.

Moreover, while there exists research examining the determinants for acceptance, studies on the broad institutional and environmental factors influencing adoption within the internal auditing context remain sparse. Few studies conducted within the internal audit settings examined the

factors that influence individual acceptance intentions using individual-level theories rather than factors motivating the internal audit units as an organisation to adopt and utilise a particular technology-based audit tool (Ahmi et al., 2014; Mahzan & Lymer, 2008, 2014). Thus, from the organisational perspective, little has been done to mitigate the paucity of literature examining organisational factors inhibiting or supporting internal audit units to accept and utilise CAATT in the audit tasks such that utilisation is fully integrated within the audit process and not on ad hoc basis. Accordingly, Vasarhelyi et al. (2012) assert that it is imperative to study IT adoption at the organisational level since adoption and implementation decisions are taken and supported by the heads of various units and management as a whole. This has, therefore, necessitated the need to explore the organisational and contextual determinants of CAATT adoption and usage within the internal audit functions of organisations.

Also, contextual gaps have been identified among studies examining this phenomenon. An overwhelmingly body of literature that examined the technology-based audit tools adoption were conducted in advanced economies such as the UK, Australia, Singapore and Malaysia (Ahmi & Kent, 2012; Debreceny et al., 2006; Li et al., 2018; Mahzan & Lymer, 2014a; Smidt et al., 2018). Regardless of the increasing calls to replicate these studies in other geographical contexts particularly within Africa, researchers are yet to respond to these calls. Though few scholars in Africa have tried to ameliorate this dearth of research within the African context particularly in Egypt (Abou-El-Sood et al., 2015; H.-J. Kim et al., 2016), these studies focused on external auditors. Owing to this paucity of literature in the African context, researchers and practitioners often exercise discretion and rely on anecdotal evidence on whether to utilise CAATT within the internal audit profession. Thus, the study seeks to examine the extent of CAATT adoption among

internal audit units and the factors that determine the adoption of CAATT within internal audit units of organisations.

1.3 Research Purpose

From the background and gap identified, the study seeks to examine the extent of CAATT adoption and the technology, organisation and environmental predictors of adoption among internal audit units of firms in Ghana.

1.4 Research Objectives

Specifically, the objectives of the study are;

1. To examine the extent of CAATT adoption among internal units of firms in Ghana.
2. To examine the factors that influence organisations to adopt and use CAATT within the internal audit function.

1.5 Research Hypotheses

The following hypotheses were proposed in order to achieve the research objectives set. A detailed discussion of each hypothesis is presented in chapter two of the study.

H1a: Relative advantage of CAATT will positively influence the technology readiness of the internal audit unit.

H1b: CAATT simplicity will positively contribute to the technological readiness of internal audit to adopt.

H1c: Compatibility will have a positive influence CAATT technological readiness.

H1: Technological readiness of CAATT will have a positive relationship with CAATT adoption intention.

H2a: Technology competence of internal audit units will positively organisational readiness.

H2b: The level of management support will positively contribute to the organisational readiness of internal audit units to adopt CAATT.

H2: The level of organisational readiness of an internal audit unit will positively contribute to CAATT adoption intention.

H3a: External pressures positively influence environmental readiness of internal audit units.

H3: Environmental readiness will positively influence CAATT adoption intention of internal audit units.

H4: The innovativeness of the audit unit head will positively influence the behavioural intention to adopt CAATT within the unit.

H5: Behavioural intention to adopt CAATT will positively influence CAATT actual adoption in internal audit units.

1.6 Significance of the Study

The study aims to contribute to both academic and practice dimensions.

1.6.1 Contributions to Literature

With regards to academic significance, the study seeks to extend the current knowledge on IT usage in the auditing context by investigating the factors that predict internal audit units' adoption of CAATT in their task engagements. Although extant literature has investigated these factors, a greater proportion of these studies focused on the individual antecedents of CAATT adoption and acceptance. Thus, there exists a dearth in literature examining these factors from the organisational perspective. Theoretically, the study would investigate the predictors of CAATT adoption and usage within internal audit units from the tenets of the TOE framework. To the best of our knowledge, few studies have analysed these factors from the organisational perspective and

information adoption theory such as the TOE framework and the individual characteristics of the decision maker within the context of internal auditing.

1.6.2 Contributions to Practice

To practice, the findings of the study are expected to provide guidelines for regulators, professional bodies and managers in improving the internal audit units' effectiveness and efficiency. The study is expected to enlighten managers and heads of internal audit units on the factors that need to be present to ensure the successful CAATT adoption and utilisation in their quest to promote effective and reliable audits.

1.7 Scope of the Study

The study sought to examine the extent of CAATT adoption within internal audit units of organisations and the determinants predicting the adoption and utilization of these technology-based audit tools within the context of internal audit units in organisations. The heads of the audit units play key roles in making adoption decisions and also charged to ensure successful implementation of these tools. The study focuses on state-owned enterprises, firms listed on the Ghana Club 100 and firms listed on the Ghana Stock Exchange. These lists represent firms achieving corporate excellence and also the largest firms in Ghana. Thus, these firms have the financial resources to adopt these innovative audit tools and also ensure the successful implementation and use information technology in their internal operations. Also, the study is limited to the CAATT adoption status of organisations, types of CAATT adopted, the extent of utilisation within the internal audit unit and the factors that influence adoption and usage.

1.8 Organisation of the Study

The study is organised into five main chapters. The foremost chapter entails the introduction which includes the background to the study and the problem statement which clearly establishes the

justification for the study. The purpose, objectives and research questions for the study follow the statement of the problem. The chapter includes the significance, scope and limitations of the study and how the study is organised.

Chapter two reviews literature for the study and discusses important concepts about the study in detail. The review includes both theoretical and empirical review from which a conceptual framework for the study is developed, and the hypotheses for the study will be developed out of the review. Chapter three follows chapter two and discusses in detail the study background, the researcher's philosophy, study approach, research design, population and sampling techniques. The source of data for the study, data collection techniques and methods for data analysis are also be discussed in chapter three.

The penultimate chapter covers data analyses and discussion of the results in line with the literature, the research questions and hypotheses proposed. Lastly, chapter five contains the summary, conclusions and recommendations. Recommendations for understanding the factors that affect CAATT acceptance among internal auditors are provided in this chapter.

CHAPTER TWO

LITERATURE REVIEW

2.0 Chapter Overview

The study aims to investigate the extent of CAATT acceptance within the context of internal auditing and the factors that predict adoption within the internal audit units. In the quest to get answers to this objective, literature is reviewed on internal auditing, CAATT, theoretical review on the TOE framework to develop the hypotheses for the study and lastly on empirical studies on the adoption of CAATT.

2.1 Internal Auditing and Technology

Internal auditing has risen to become a fundamental component of good corporate governance mechanism of contemporary corporate institutions due to the recent global corporate failures such as Enron and WorldCom (Mihret & Grant, 2017; Soh & Bennie, 2014) due to the inability of corporate governance to prevent such failures. Accordingly, Chambers and Odar (2015) asserts that internal auditing must support organisational governance process through evaluation and improvements in the establishment and communication of organisational values and goals, monitoring and accountability. Prior literature suggest that the internal audit has continuously been seen as a component of the firm's risk management function that is responsible in helping firms achieve its corporate goals (de Zwaan et al., 2011; Arena et al., 2010; Spira & Page, 2003). Internal auditing has moved beyond the traditional role of monitoring controls and financial compliance (Alzeban & Gwilliam, 2014), checking the propriety of financial statements (Mihret & Grant, 2017) to a wider organisational consulting function responsible for risk management, fraud detection and provision of assurance about the internal control systems. Particularly within the post 1980 era, internal auditing was transformed and developed to the risk-based approach as a

consequence of the risky and complex business processes and thus it was imperative to focus attention on the provision of assurance on the business processes aimed at ameliorating the risks of the business (Chambers & Odar, 2015; McNamee & Selim, 1998). This line of argument or proposition is in tandem with the IIA definition. The IIA defined internal auditing as “an independent, objective assurance and consulting activity designed to add value and improve an organisation’s operations” (IIA, 2016). As opposed to external auditing which mostly focuses on compliance, internal auditing is greatly influenced by an organisation’s drive to mitigate operational weaknesses, identify anomalies and exceptions from established standards and enhance organisational processes wherever possible.

Extant literature has reported the elements that predict internal audit effectiveness. For instance, Arena and Azzone (2009) studied the effectiveness of internal audit units in Italy observed that, audit team characteristics, organisational ties, audit activities and processes affect the effectiveness of the unit. Mihret and Yismaw (2017) additionally found a positive relationship between internal audit quality and unit’s effectiveness. Additionally, Khlif and Samaha (2016) found that audit committee activities has a significant positive association with internal control quality. The study further found that within the Egyptian setting, Big 4 auditors significantly contribute to the development of internal control quality. These studies therefore, highlight how internal auditing can be enhanced. However, missing from the literature is the adoption of IT in the quest to enhance internal audit effectiveness and efficiency. Dai and Vasarhelyi (2016) observed that audit technology adoption and utilisation has been slow and lagged substantially within the auditing profession. Accordingly, they posit that audit technology utilisation has not been able to court the attention of standard-setters particularly due to emphasis on obsolete practices and measurement methods.

However, corporate organisations have been transformed by the advent of information technology and changes in management needs such that almost all business processes have been automated (Dai & Vasarhelyi, 2016; Smidt et al., 2018). Due to automation, the auditing profession, particularly the internal audit function has transformed in order to continuously exist as a relevant corporate governance element providing consultancy and support services to ensure organisational success. Moreover, Dai and Vasarhelyi (2016) and Kiesow, Zarvic, and Thomas (2014) argue that the advent of AIS such as ERPs and cloud computing by organisations have increasingly made the work on the internal auditor complex due to the huge accounting-relevant data (Big Data) produced.

2.2 Big Data and Auditing

With the competitive advantages associated with huge amounts of data, firms are pressured to increase their investments in data science and analytics in an attempt to exploit the data for these advantages (Provost & Fawcett, 2013). Accordingly, the accounting and auditing disciplines or domains have also had their fair share of this contemporary wave. The concept of big data and its impact on accounting and auditing has been described as complex and multifaceted (Earley, 2015; Gepp et al., 2018; Kiesow et al., 2014). For instance, Provost and Fawcett (2013) argue that the adoption of complex and technology-based analytics tools in big data environments result from the inability of traditional approaches to analysing the volume and variety associated with these data types. In defining big data, Provost and Fawcett (2013, p. 54) assert that “big data refers to large datasets that are too large for traditional data-processing systems and thus require new technologies”. This definition highlight volume or size of the data in storage as a characteristic of big data such that any type of data that is voluminously produced can be termed as big data and thus would require complex data analysis tools.

However, Russom (2011) argued that albeit size is a vital characteristic of big data, there exist other important features. Therefore, according to Russom (2011) and Laney (2001), any data is considered as big data if it is characterized by “the dimensions of volume, velocity and variety” commonly termed the 3 Vs. Volume is a primary characteristic of big data and refers to data that is produced or generated in large formats such that traditional tools are incapable of handling such data. The velocity element refers to the “speed with which such data is generated, the number of times (frequency) data is generated and transmitted such that data is transmitted in real time” (Russom, 2011). Lastly, variety attribute refers to a myriad of sources within which this data can be generated. Event logs, social media and web sources are some of the dominant sources within which big data is generated (Russom, 2011). Accordingly, Gepp et al. (2018, p. 103) defined big data as “any structured or unstructured data sets that are commonly characterised by volume, variety, velocity and veracity”. Their definition introduced another attribute; veracity which refers to the “ability of the quality and relevance of the data to vary dramatically over time” (Gepp et al., 2018, p. 103). Big data can also be defined in the context of the tools and techniques employed to draw inferences and patterns from an array of data sources and types in an attempt to recognise quadratic relationships and cause-effect associations.

Big data has gained prominence in various disciplines including accounting, finance and auditing (Dai & Vasarhelyi, 2016; Earley, 2015; Gepp et al., 2018). Since the focus of this research is how auditing can tap into the big data realm to augment audit effectiveness, the researcher discusses the application of big data procedures in the auditing literature.

Prior literature on big data observed that the application of big data tools in auditing have not evolved as related to other disciplines or domains (Gepp et al., 2018; Kiesow et al., 2014; Vasarhelyi & Romero, 2014). For instance, Gepp et al. (2018, p. 106) observed that big data

research in accounting and finance revolves around three key strands; “financial distress modelling, financial fraud modelling and stock market prediction”. They identified that big data is underutilised particularly within the auditing domain which stems from the inertia to employ tools and techniques that are more advanced and sophisticated than those adopted by their clients. One critical conclusion that can be drawn from prior auditing literature and big data is the focus on external auditors or assurance providers. Internal auditors’ adoption and application of big data techniques have been fairly discussed in the auditing literature and therefore warrants further research. The broader tasks performed by internal audit units, frequent access to business data and lax regulatory requirements should motivate internal audit units to adopt and utilise big data techniques more as compared to external auditors (Li et al., 2018).

Another strand of the knowledge on the big data analytics in the accounting domain centre on the utilization of data mining procedures in identifying and determining financial distress and corporate failures. For instance, Sun and Li (2008) employ data mining procedures to predict the status of 135 listed firms that are financially distressed. Also, Li, Sun and Wu (2010) apply “classification and regression tree techniques” to predict financial distress and corporate failures for a section of listed firms in China. Accordingly, Khandani, Kim and Lo (2010) extended the utilization of big data analytics from corporate entities to involve other corporate stakeholders. The study applies “machine learning techniques” to develop risk models for consumer credit at the individual consumer level through the combination of customer transactions and credit bureau data to significantly enhance the extent of credit card default projections. These studies highlight how big data analytics have been harnessed within the accounting and finance domain which is yielding positive returns. From a review of literature on the utilisation of big data analytics and financial distress modelling, Gepp et al. (2018) concluded that auditors can also explore this new wave to

augment their traditional approaches particularly with internal auditors. They assert that data mining techniques coupled with the auditor's professional judgement can improve going concern evaluations and also avoidance of the error of issuing an "unqualified opinion" on financial statements prior to bankruptcy. With internal auditors, the authors argue that financial distress models could be employed to conduct longer forecast due to their frequent access to the firms' data. These long-term forecasts enable management to implement strategic modifications in an attempt to ameliorate the likelihood of financial distress and corporate failures occurring.

Financial fraud has been a major concern for corporate entities globally and thus institute measures to mitigate its likelihood of occurring. Accordingly, the Association of Certified Fraud Examiners (2016) estimates that fraud in organisations accounts for 5% of revenue losses per year. This has courted the attention of both academics and practitioners to consider how the adoption of technology can mitigate this development. For instance, Thiprungsri and Vasarhelyi (2011) examine the adoption and application of cluster analytics in discrepancy detection in audits. The study focuses on the automation of fraud filtering by applying clustering technology; a big data analytics technique. Also, Chang et al. (2008) in their study on the use of visual analysis of financial wire transactions for fraud detection suggest that this technique is feasible and effective in examining millions of bank wire transactions effectively. Another strand of the literature suggests the use of neural networks and decision trees to examine how best technology can contribute to financial fraud detection. Based on Benford's law, Bhattacharya, Xu and Kumar (2011) developed a genetic algorithm aimed at optimising neural networks. They conclude that this algorithm is promising in fraud detection in financial statements. Ravisankar, Ravi, Rao and Bose (2011) also employed "neural networks and support vector machines" to investigate the firms

engaged fraudulent financial acts and conclude that neural networks performed better than other analogous methods and models.

The above studies highlight how big data analytics and techniques could be used in various situations to detect the occurrence of fraud in organisations. The internal audit profession can harness this data mining technology to improve its risk assessment and fraud detection procedures. Accordingly, Gepp et al. (2018) assert that internal auditors can employ big data financial fraud models and other multivariate techniques in their audit task engagements as these sophisticated techniques present different and better information as compared to the conventional audit approaches and procedures.

2.3 Computer-Assisted Audit Tools and Techniques Adoption

IT has transformed the means and manner in which organisations conduct their affairs (Appelbaum et al., 2017; Vasarhelyi & Romero, 2014). In light of this development, there has been a clarion call on auditors to adopt technology-based audit tools in their engagements with these firms to enhance their effectiveness and efficiency. Prominent among these technology-based audit tools are CAATT. Braun and Davis (2003.p.3) defined CAATT as “any use of technology to assist in the completion of an audit”. They are the systems and techniques used by auditors to “extract data, test data, discover and analyse patterns to identify anomalies for the purpose of planning and performing the audit” (AICPA, 2014).

The literature on technology application in the audit profession has been quite extensive however, little attention has been focused on CAATT adoption factors within the internal auditing context. Prior studies have investigated the behavioural intent to adopt CAATT in audit engagements. For instance, Vasarhelyi and Romero (2014) explored determinants of adoption among external

auditors. The study adopted cross-sectional case studies and posited that, adoption is influenced by manager characteristics, availability of support systems, cost and time to implement the system. Widuri, Sari, Wicaksono, Sun, and Sari (2017) in a study on adoption of CAATT among external auditors concluded that CAATT adoption follows a two-stage approach; first, the need for suitable environmental factors to be present and secondly, the existence of organisational and technology factors.

Technology adoption in the internal auditing context has also received little attention in literature. Few studies on technology adoption by internal auditors have focused on investigating their adoption decisions (Li et al., 2018; Mahzan & Lymer, 2008, 2014b; Gonzalez et al., 2012). Mahzan and Lymer (2014b) explored the predictors for the use of CAATT among internal audit auditors. The study modelled a theoretical framework for successful CAATT adoption through the lens of the (UTAUT) and suggested that performance expectancy, the effect of externalities, facilitating conditions, training availability and compatibility of the software with other departments' systems are the factors influencing internal auditors' intention to adopt CAATT. Gonzalez et al. (2012) also examined the intention of internal auditors to adopt continuous auditing using the UTAUT as the theoretical lens. The results of showed that effort expectancy and social influence are significant factors to positively influence the intention to use continuous auditing. Performance expectancy and facilitating conditions however were not found to be significant to influence internal auditors' intention to adopt continuous auditing. The results however presented inconsistencies in literature with regards to the elements that predict auditor's intention to adopt technology-based audit tools particularly even though both studies employed the same theory. This thus suggests that the internal auditing context is quite different from the mainstream public accounting and assurance arena such that the influencing factors for external auditors may not

apply wholly to the internal auditing domain (Curtis & Payne, 2008; Mahzan & Lymer, 2014b; Omonuk & Oni, 2015).

Furthermore, the extant literature on the adoption and utilisation of CAATT show that the rate of adoption and utilisation has been slow particularly in the internal audit settings albeit with the support of standards and professional bodies (Earley, 2015; Li et al., 2018; Mahzan & Lymer, 2008). Mahzan and Lymer (2008) identified that 60% of the internal auditors surveyed used less than 10% of their billable time on using CAATT. Also, Li et al. (2018) concluded that the extent of audit analytics utilisation by internal auditors was low and usage limited to basic features. Thus, even though firms incur huge amounts to procure these technology-based audit tools, their acceptance among internal auditors is fairly low. The study assessed the acceptance of audit analytics at the organisational level and suggested that it is vital to study the adoption of audit IT at the organisational level because heads of internal audit departments and management initiate and support technology adoption, and implementation within the organisation (Li et al., 2018). Curtis and Payne (2008) intimated that firm resources and characteristics and individual perceptions about the technology may influence the acceptance of CAATT by auditors. Following this review, the study employs an institutional approach to investigate the extent of acceptance of CAATT and factors that affect their acceptance by internal auditors.

It is crucial to state that the determinants of CAATT acceptance have been fairly discussed in the literature particularly within the internal auditing domain and from the perspective of a developing economy. For instance, Abou-El-Sood et al. (2015) found that a greater proportion external auditors surveyed prefer firm-tailored audit software to vendor software such as Audit Command Language (ACL) and Caseware IDEA. Also, utilisation of the audit tools was limited to basic features such as sampling, working papers and ageing analysis (Abou-El-Sood et al., 2015). With

the paucity of studies in the internal auditing domain within the African context, this study, building on previous works using the TOE framework, investigates the extent of CAATT and the predictors for a successful implementation of CAATT by internal audit functions in their quest to augment employing technology within their audit engagements.

2.4 Theoretical Review

CAATT are considered as technological innovation intended to facilitate the audit process and thus adopting a technological innovation theory may be vital for empirical studies on technology adoption and acceptance (Thong, 1999). Rogers (1983.p.4) defined innovation as “an idea, object or practice that is perceived as new to the individual or another unit of adoption”. Thus, innovation is any product or process that equips adopters with novel approaches in solving problems and take advantage of opportunities (Thong, 1999; Vasarhelyi & Romero, 2014). Thong (1999) argues that for organisations with little IT knowledge, initial adoption of an innovation involves a high level of uncertainty and risks as a result of the changes such innovations are likely to cause in the work processes and procedures.

The literature on IT adoption has identified several theories and variables that seek to explain the predictors of IT adoption among organisations and individuals. Notable among these frameworks include the “Technology Acceptance Model (TAM) (Davies, 1989), Theory of Planned Behaviour (TPB) (Ajzen, 1991), Diffusion of Innovation theory (DOI) (Rogers, 1983), Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) and the Technology Organisation Environment (TOE) framework (Tornatzky et al., 1990)”. The TAM, TPB and UTAUT frameworks are employed in studies that examine adoption intentions at the individual levels. The UTAUT has gained prominence in literature due to its relative advantage over the other individual theories in predicting user adoption and acceptance intentions (Venkatesh et al., 2003).

The DOI and TOE models are employed in organisation-level studies and seek to examine the predictors of technology adoption in organisations.

However, Brancheau and Wetherbe (1990, p. 117) argued that “the DOI does not fully explain the innovation adoption and diffusion within organisations”. They argue that the DOI lacked attributes that concentrate or seem to measure the organisational and contextual characteristics that may seem to influence the adoption intentions of organisations. As Zmud (1982) asserts, innovations determinants can be perceived differently as a result of specific organisational and contextual factors. Accordingly, Fichman (1992) contends that the variables of the diffusion of innovation theory are unlikely to be significant determinants of technology adoption and acceptance and thus, suggested the inclusion of new variables either as independent or control variables.

Moreover, Chau and Tam (1997) and Hameed, Counsell and Swift (2012) argue that inconsistencies in results of organisational technology adoption reported in literature could be as a result of the contextual and organisational differences and thus, studies on IT adoption must incorporate organisational and contextual variables tailored to a particular technology. The literature on innovation adoption suggests the existence of many factors that could influence the diffusion of the innovation within an organisational certain. Some determinants may identify with the innovation itself, factors identified with the organisation and other ecological elements. Based on the theories underpinning the work of prior studies, most studies focus on diverse characteristics to influence innovation adoption leading to inconsistent findings. Therefore, a framework for CAATT adoption and acceptance must incorporate higher-level analytical variables that encapsulate the technology features, environmental circumstances and organisational characteristics. Accordingly, Cooper and Zmud (1990) posit that due to the complexity and multidimensionality of IT adoption in organisations, theoretical frameworks must take cognizance

of several factors from various dimensions. Prior literature in an attempt to narrow the debate on models for technology adoption and acceptance process, intended to develop a unified theory to guide future studies on innovation adoption (Venkatesh et al., 2003, Thong, 1999). However, Kimberly and Evanisko (1981) and Fichman and Kemerer (1993) argue that developing “a unifying theory might be inappropriate due to the fundamental differences in the types of innovations” adopted and the contexts within which the adoption occurs.

In this study, the researcher adapts the TOE framework, Yang, Sun, Zhang, and Wang (2015) Tripod model premised on the TOE framework and a vital element from Thong’s (1999) model for innovation adoption in organisations. These models study technology adoption at the organisational context which makes them appropriate for investigating the predictors of CAATT adoption within internal audit departments of organisations.

2.5 Technology Organisation Environment Framework

Tornatzky et al. (1990) developed the TOE framework in response to critiques and lapses found with the DOI model in explaining the predictors of innovation adoption at the organisational level and highlight the relevance of contextual variables in adoption process. The framework argues that technology adoption in organisations is predicted by three interdependent elements: external environment, organisational characteristics and the technology characteristics (Tornatzky et al., 1990). It assumes the relevance of the technology features, organisational characteristics and external environment to the technology adoption and diffusion. The framework extends the elements of Rogers’ (1995) DOI theory by including an additional component, external environment characteristic which presents organisations with both opportunities and challenges for technology adoption (Oliveira & Martins, 2011). However, it is generic in nature such that

researchers are to determine the variables within the confines of technology features, organisational characteristics and external environment affecting adoption and thus hypothesize the relationships.

2.5.1 Technological Context

Tornatzky et al. (1990) defined technological attributes of an innovation to include existing innovation adopted and utilized pertinent to the firm including those available in the marketplace however not in use. As Collins et al. (1998) noted “existing technologies of firms are vital in the adoption process due to their ability to set a broad limit on the scope and pace of technological change that the firm can undertake”. Also, Chau and Tam (1997) assert that the technological context explains available technologies to the firm and how the characteristics of these technologies can affect the adoption and acceptance process. Hage (1980) further classified innovations into three distinct groups: “incremental changes, synthetic changes and discontinuous changes”. Incremental innovations introduce new features, attributes and enhancements to existing technologies.

Synthetic innovations combine existing innovations in an attempt to create new technologies or processes. Discontinuous innovations also termed as “radical innovations” on the other hand involves the development of significant new technologies that depart from the current technologies or processes (Hage 1980; Tushman & Nadler 1986). CAATT can be described as discontinuous innovations as adopters depart from the traditional approaches of obtaining audit evidence. Baker (2012) asserts that firms characterized by discontinuous innovations are obliged to take swift and critical adoption decisions to remain competitive and efficient and effective. Therefore, organisations must consider the impacts of an innovation in an organisation before the adoption takes place. Accordingly, Rogers (1995, p. 27) highlights the existence of various fundamental

attributes of innovations that influence adoption decisions. The study categorized these innate attributes into; “relative advantage, simplicity, compatibility, trialability and observability”. The study provided a conceptual foundation on which empirical research on innovation adoption and diffusion can proceed from.

2.5.2 Organisational Context

The organisational element of the TOE framework explains the characteristics of the organisation that influence adoption decisions. Baker (2012, p. 3) explained this element as the “characteristics and resources of the firm, size, employees, intra-firm communication processes and the amount of slack resources available internally”. This element focuses on the characteristics of the organisation that may promote or constrain the adoption process. Studies have found support for this element as a strong predictor of adoption decisions of organisations. Notable factors within this element that influence adoption include size, management support, IT champion, IT expertise and organisational readiness (Hameed, Counsell, & Swift, 2012b; Li et al., 2018; Pongpatrachai, Cragg, & Fisher, 2014).

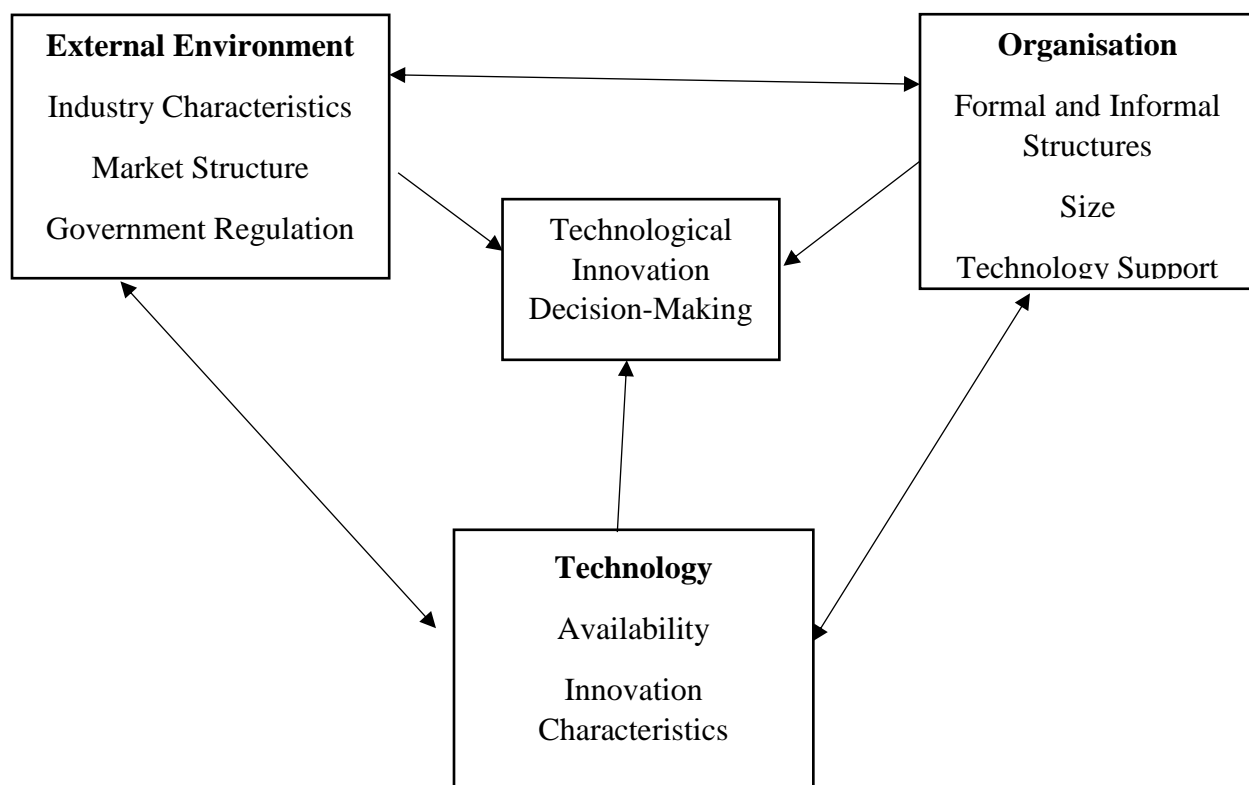
2.5.3 Environmental Element

The environment construct or element describes the external atmosphere within which the organisation conducts its affairs. It relates to the industry, competitors, government, regulatory and professional bodies related to the organisation (Tornatzky et al., 1990). Prior literature (e.g. Mansfield, 1968; Mansfield, 1977) provides empirical support for competition in the external environment to influence the adoption intentions of organisations. The environmental context presents firms with both opportunities and threats for technological adoption as firms are influenced by the conditions within their external environment. Extant literature on technology adoption has found the TOE framework to consistently provide empirical support in several IT

domains, and as a broad theory, it is applicable to all forms of IT adoption within an organisational level.

The theoretical framework from the review of literature on organisational innovation adoption is therefore presented in in Figure 2.1.

Figure 2.1: Technology, Organization, and Environment Framework (Tornatzky & Fleischer, 1990)



2.6 Research Model and Hypotheses Development

In this study, the theoretical framework supporting the hypotheses postulated is TOE framework however, we adapt other elements from Yang et al. (2015) tripod model and Thong (1999) model as crucial factors predicting the adoption of CAATT within the internal audit unit. Chau and Tam

(1997) employed the TOE framework in their work on open systems and modified it such that the adoption of open systems is predicted by three elements; technology attributes, organisational attributes and external environmental features. Using the TOE framework, Li et al. (2018) also developed a conceptual framework to examine the application of audit analytics among internal auditors.

Thong (1999) in determining the antecedents of information systems adoption in small businesses also adopted the TOE framework however, added another element; the CEO characteristics. The study argues that in small businesses, CEO's are the decision makers and thus the qualities of the CEO influence the management approach and technology adoption in the business. The current study also follows this line of argument and would include the individual characteristics of the head of the internal audit unit such that the adoption of CAATT in the internal audit unit would be determined by the characteristics of the technology, organisation, external environment and the head of the unit. Accordingly, Yang et al. (2015) also integrated the elements of technology, organisation and environmental factors to predict SaaS adoption. The study developed a tripod model using formative variables (technological readiness, organisational readiness and environmental readiness) based on the individual constructs associated with each element; technological, organisational and environment.

Based on the framework and prior studies, a conceptual model is developed to predict the factors that influence organisations to adopt and accept CAATT within their internal audit units. The specific constructs examined include technological readiness (relative advantage, simplicity and compatibility), organisational readiness (technological competence and support from top management), environmental readiness (external pressure, standards) and the unit head's innovativeness as predictors of CAATT adoption and utilisation.

2.6.1 Relative Advantage

Relative advantage as defined by Rogers (1995, p. 28) refers to “the degree to which a technological innovation is perceived to provide greater benefits for organisations”. Moore and Benbasat (1991, p. 195) also defined relative advantage as “the degree to which an innovation is perceived to be better than its precursor”. It indicates to the extent to which organisations or individuals perceive technology or a system they intend to adopt or use is better in terms of task performance than the previous approach or tool in use. Firms in making technology adoption decisions would consider the benefits or advantages that would accrue to them before they make any decision. CAATT have been argued in literature to provide auditors with a myriad of benefits thereby increasing performance of the organisation (Braun & Davis, 2003; Appelbaum et al., 2017; Li et al., 2018).

Accordingly, Li et al. (2018) posit that CAATT provides unique advantages to internal auditors which therefore should increase the adoption within the internal audit units. Venkatesh et al. (2003) classified the relative advantage variable as performance expectancy and referred to it as “the degree to which users believe that using a particular system will help them attain gains in their job performance” (p. 24). Extant literature posits that this construct is the most significant factor that influences firms or users to utilise a particular technology-based audit tool (Bierstaker et al., 2014; Curtis & Payne, 2014; Earley, 2015). Building on prior literature, the research expects relative advantage of CAATT to positively influence internal audit units to adopt them. Therefore, we hypothesize that;

H1a: Relative advantage of CAATT will positively influence the technology readiness of the internal audit unit.

2.6.2 Simplicity

Rogers (1995; p. 28) defined simplicity as “the degree to which an innovation is perceived as relatively easy to understand and use”. It alludes to the degree to which users see an innovation or system to be less difficult or complex to adopt and use in their task engagements. Simplicity has been identified in literature (Davies et al., 1989; Moore & Benbasat, 1991) to substantially relate with “perceived ease of use (TAM), effort expectancy (UTAUT) and ease of use (IDT)”. Accordingly, Davis et al. (1989) defined perceived ease of use as “the extent to which an individual perceives an innovation or system effort free”. Venkatesh et al. (2003) and Davies et al. (1989) assert that effort-oriented variables (simplicity, ease of use and effort expectancy) prominent within the “initial phases of learning a novel behaviour when issues concerned with the process represent challenges to overcome and subsequently ameliorated by concerns of instrumentality”.

In a study by Tornatzky and Klein (1982), they concluded that complexity of an innovation positively relates to the rate of adoption, such that the more complex a tool is, the lower the adoption rate. Internal audit units may opt not to adopt CAATT because they appear relatively new to them and their perception about the degree of simplicity will influence their adoption intentions difficult to use. Payne and Curtis (2010) assert that management or head of the audit unit may not only be responsible for adoption decisions, however, they are also in charge of their implementation. Thus, the effort required for the innovation adoption may be more prominent for internal audit units as compared to other professionals and organisations. If internal audit units perceive CAATT simple and easy to understand, the more likely they are to adopt them. Therefore, CAATT simplicity will influence the technological readiness of the internal audit to adopt them. Consistent with prior literature, the researcher proposes that;

H1b: CAATT simplicity will positively contribute to the technological readiness of internal audit to adopt.

2.6.3 Compatibility

Prior literature on technology adoption and acceptance indicate that compatibility of the technology with prior procedures and processes is vital in facilitating the adoption process (Yang et al., 2015). Rogers (1995) defined compatibility as “the degree to which an innovation is perceived to be consistent with the needs of users and potential adopters”. Moore and Benbasat (1991, p. 196) also defined compatibility as “the degree to which users perceive that the innovation to be consistent with their existing values, needs and prior experiences”. High levels of compatibility related to an innovation positively stimulate the adoption process such that users will adopt and accept a particular technology if they regard it to fit well with their existing business processes and values. CAATT enables auditors to perform broader tasks and audit procedures which hitherto would have been difficult to undertake. Continuous auditing which is an element of CAATT enables the automation of the audit process such that real-time reports can be generated and analysis performed on the reports. Therefore, compatibility can be seen as a requirement for the successful implementation of CAATT. If internal audit units’ existing experiences and IS infrastructure are consistent with CAATT, adoption is likely to occur and favourably facilitate the implementation process. In a similar study on technology adoption in firms, Wang et al. (2010) found a positive relationship between compatibility and the adoption of RFID in firms. Also, in a study on cloud computing adoption, Yang et al. (2015) found compatibility to be the significant technology characteristic influencing adoption decisions. Building on these arguments, the researcher hypothesizes that;

H1c: Compatibility will have a positive influence CAATT technological readiness.

In line with the arguments of Yang et al. (2015), we propose a combination of relative advantage, complexity and compatibility to form a higher-level construct; technological readiness. A second-order relationship between the extent of technological readiness and CAATT adoption intention is proposed such that;

H1: Technological readiness of CAATT will have a positive relationship with CAATT adoption intention.

2.6.4 Technological Competence

Technological competence can also be referred to as the technological readiness of an organisation (Li et al., 2018). Technological competence may be classified into two distinct however related categories; technological and human. The technological aspect refers to the extent to which there exist technological infrastructure to support or facilitate the adoption process (Li et al., 2018). Technological infrastructure consists of the available technological resources such as installed network technologies, computers and software packages which serve as the platform for innovation to be built or installed (Low, Chen, & Wu, 2011). The human aspect of technological readiness “refers to the extent to which the organisation possess IT specialists and competent personnel to support the adoption of the innovation” (Li et al., 2018; Low et al., 2011).

Due to the complex nature of CAATT, the technological readiness of the internal audit units is vital for successful adoption and acceptance process and lack of it presents challenges thereof. Extant literature on CAATT adoption (Gonzalez et al., 2012; Li et al., 2018; Vasarhelyi & Romero, 2014) argue that technological competence is a requirement to facilitate successful adoption and acceptance process. CAATT adoption can only improve the performance of internal audit units if there exist the infrastructure and personnel to facilitate the adoption. Therefore, we argue that internal audit units with higher technology readiness (both human and technological) would be

ready to adopt and accept CAATT in their task engagements. Consistent with prior literature, the researcher proposes;

H2a: Technology competence of internal audit units will positively organisational readiness.

2.6.5 Management Support

Prior literature on technology adoption posits that support or commitment from a firm's management is a key predictor in technology acceptance and a critical success factor of technology adoption and acceptance (Rogers, 1995; Thong, 1999; Venkatesh, 2003). It includes the extent to which the top management of firms supports and invests in technology. Barriers to adoption such as complexity and cost can be reduced to facilitate a smooth adoption process through the actions of management by providing resources. Management provides vision and directs the future of an organisation by reinforcing their commitment to a positive environment for technology inclusion in the core activities of the business (Wang et al., 2010).

CAATT adoption would require management to allocate resources to purchase these tools, reengineer the task processes and provide other ancillary services to facilitate implementation. As feature complexity increases, management can provide resources to embark on training programs to equip internal auditors with the requisite skills to increase acceptance. Moreover, investments in technological infrastructure will increase the organisational readiness of the unit to adopt the innovation. Prior empirical literature (Li et al., 2018; Mahzan & Lymer, 2008, 2014) provide support for a positive connection between management support and CAATT adoption. This relationship is also existent in the adoption of open systems in small organisations (Thong, 1999) and RFID adoption in the manufacturing industry. Consequently, the researcher proposes that;

H2b: The level of management support will positively contribute to the organisational readiness of internal audit units to adopt CAATT.

Furthermore, a second-order formative construct (organisational readiness) is proposed as an amalgam of the organisation characteristic; technological competence and management support. Premising our argument of organisational readiness as a strong determinant of innovation adoption in the TOE framework, we hypothesize that;

H₂: The level of organisational readiness of an internal audit unit will positively contribute to CAATT adoption intention.

2.6.6 External Pressure

Prior literature on technology adoption indicates that organisations tend to adopt innovation as a tool or an approach to improve the technical efficiency of adopters (Teo et al., 2003). Determinants of innovation adoption have mostly been argued from the technology diffusion theories ignoring the effect of external pressures. Gibbs and Kraemer (2004) note that organisations may be affected by the external atmosphere in which they exist. Extant literature on innovation adoption suggests that technology decisions are made based on efficiency or legitimacy motives and thus, the institutional theory (Scott & Christensen, 1995) acknowledge the influence of external pressures on firms' decisions. Proponents of the institutional theory assert that organisations tend to become isomorphic as a result of their quest to follow to societal standards and structures in an attempt to achieve legitimacy (Scott & Christensen, 1995; Adhikari & Garseth-Nesbakk, 2016). They argue that decisions about the firm are sometimes not taken purely based on rational motives of efficiency but by concerns for legitimacy (Scott & Christensen, 1995; Gibbs & Kraemer, 2004). Thus, firms tend to operate in a similar manner as a result of the external pressures (isomorphic pressures). These isomorphic pressures exert formal or informal influence on businesses to behave like their competitors.

Prior literature that studied technology adoption and acceptance within the auditing context at the organisational level did not include the institutional effect as a construct to influence adoption decisions (Gonzalez et al., 2012; Li et al., 2018; Mahzan & Lymer, 2014b). However, Mahzan and Lymer (2008) adapted the UTAUT to include the effect of externalities on auditors' intention to adopt CAATT. The study, however, did not find externalities to have an influence on internal auditors' adoption of CAATT. Using the institutional theory as a theoretical lens in investigating factors that influence the adoption of inter-organisational systems, Teo et al. (2003) find that mimetic, coercive and normative pressures were all significant in influencing firms to adopt financial electronic data interchange. These findings suggest that organisations IT adoption decisions are affected by institutional networks within their ecosystem and call for the understanding of the pressures that emanate from such networks.

Adapting the TOE framework by including the effect of external pressures would help provide the model with a better explanatory power in identifying the determinants of CAATT within the context of internal audit. The external pressures exerted by external auditors would influence internal audit units' adoption decisions about CAATT. Consistent with prior information systems literature, we propose that;

H3a: External pressures positively influence environmental readiness of internal audit units.

2.6.7 Auditing Standards

Auditing is a profession that is wholly regulated by standards which stipulate the approaches and strategies to employ in an audit engagement to achieve efficient and reliable audits. The extent of encouragement provided by these standards can affect the degree of adoption and utilization of technology-based tools in the audit process. Albeit auditors are not mandated by the standards to

utilize CAATT, they are recommended so to use (AICPA, 2002). Also, the IIA encourages its members to employ CAATT in the execution of their responsibilities (IIA, 2016).

Thus, professional bodies of which internal auditors are members encourage the utilisation of CAATT in their task engagements to achieve efficiency and effectiveness. Li et al. (2018) assert that organisations appear to face diverse business risks and thus can develop diverse perceptions about the ability of standards to influence the adoption process. Acknowledging this argument, we propose that;

H3b: The level of perceived encouragement from audit standards will positively contribute to the internal audit unit's environmental readiness.

Lastly, the influence of environmental characteristics as a vital predictor of innovation adoption in the TOE framework is assessed by forming a formative construct (environmental readiness) from a combination of external pressure and audit standards. According to Tornatzky et al. (1990), environmental readiness together with technological and organisational readiness drive innovation adoption in organisations. Therefore, we hypothesize that;

H3: Environmental readiness will positively influence CAATT adoption intention of internal audit units.

2.6.8 Internal Audit Units' Head's Innovativeness

Kirton (1976) categorized heads of organisations into two distinct groups; innovators and adaptors. He defined innovators as heads who have a preference for tools that alter the structure in which an issue is approached. Thus, innovator CEO's prefer taking risks in solving problems they are confronted with by employing means that are not tried and tested. Adaptor CEO's are also defined as "leaders who prefer solutions that have already been tried, tested and fully understood to solve a particular problem" (Kirton, 1976). Agarwal and Prasa (1998, p. 206) assert that the individual

innovativeness potentially influences adoption perceptions and thus warrants consideration in IT adoption studies and defined personal innovativeness as “the willingness of an individual to try out any new information technology”. Rogers (1995) conceptualize personal innovativeness by defining it as “the ability of individuals to adopt an innovation at the early stage”. Personal innovativeness has not garnered much attention in technology acceptance literature albeit its relevance in influencing technology utilisation decisions (Flynn & Goldsmith 1993; Agarwal & Prasa, 1998).

Consistent with Agarwal and Prasa's (1998) definition, we argue that the innovativeness of the head of the internal audit unit CAATT adoption decisions. The researcher proposes a direct relationship between the head's innovativeness and CAATT adoption. Rogers (1995) classified innovators as “active information seekers” concerned with novel ideas and are more eager and willing to try with them. Also, he asserts that innovators are risks assuming and thus able to cope with uncertainty thereby developing more positive perceptions or attitudes to use a particular innovation. In line with this argument, we note that CAATT are complex innovations which when not applied and interpreted correctly, may end up providing inaccurate results and only individuals who are risk assuming and able to live with uncertainty will adopt them for their units.

Although prior literature on technology adoption within the auditing domain did not consider personal innovativeness as variable influencing adoption decisions, its relevance can be found in studies in other disciplines. Leonard-Barton and Deschamps (1988) in their study on expert systems acceptance by sales representatives argued that personal innovativeness “moderates the relationship between management support” and acceptance of expert systems. Agarwal and Prasa (1998) concluded that personal innovativeness plays a significant role in predicting the intentions to use a new IT system. Accordingly, Thong (1999) examined the impact of CEO innovativeness

on the adoption of information systems. The study revealed that CEO innovativeness positively influences the likelihood of adopting open systems in small businesses however, CEO innovativeness has a negative insignificant association with the extent of adoption. CAATT adoption decisions within internal audit units are made by the heads of the units and ensure that they are fully implemented. Building on the arguments of prior studies, we propose that the innovativeness of the head of the internal audit unit will influence the units' decision to adopt and use CAATT in their task engagements. In light of this, the researcher hypothesizes that:

H4: The innovativeness of the Head of the internal audit unit will positively influence the behavioural intention to adopt CAATT within the unit.

2.6.9 CAATT Behavioural Intention

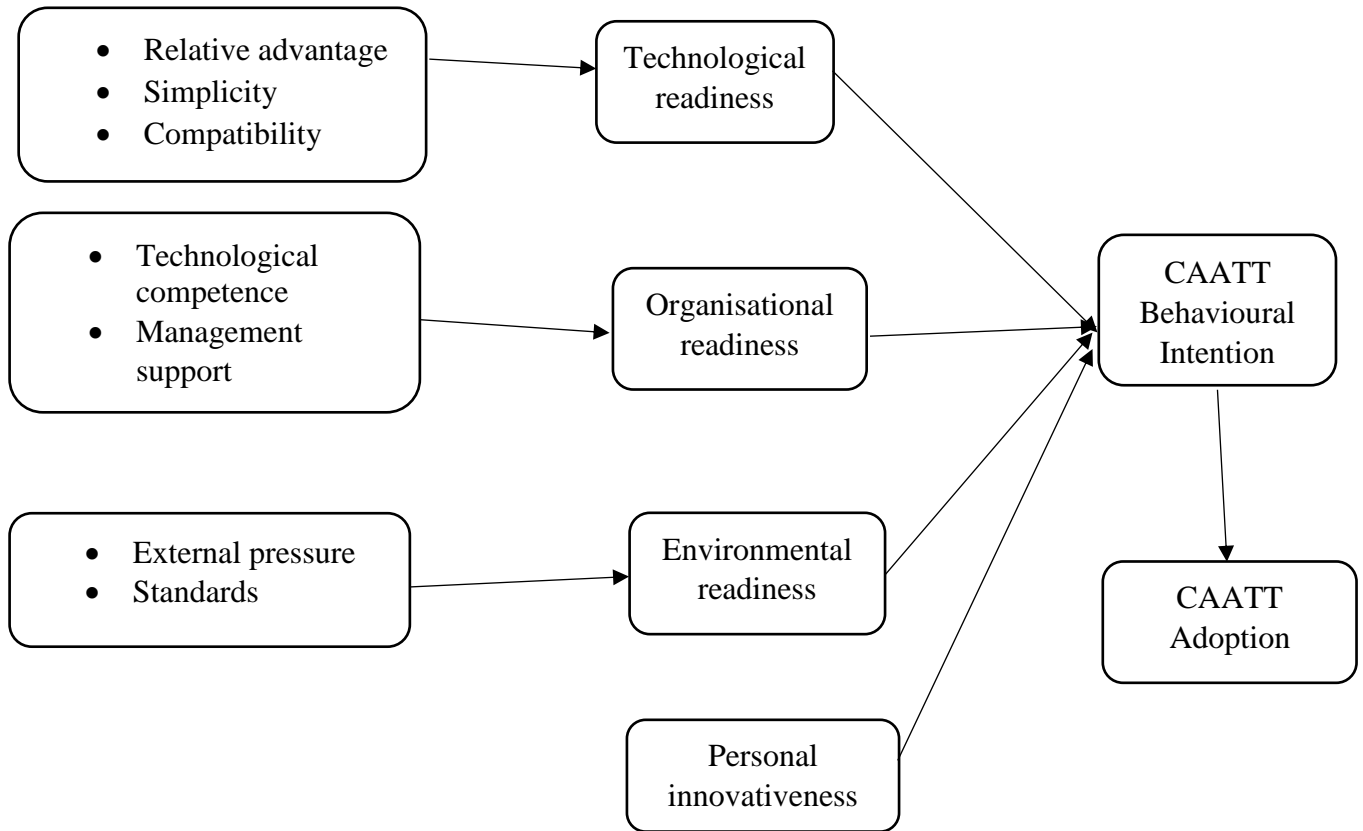
Lastly, the relationship between the adoption intention and actual CAATT adoption is investigated. Prior literature (Fishbein & Ajzen, 1975; Davies et al., 1989; Taylor & Todd, 1995) argue that the formation of positive attitudes or behaviours about an innovation is a strong predictor of actual adoption and use of the innovation. Thompson et al. (1991 p. 126) define behavioural intentions as “what individuals or organisations intend to do”. The study argued that perceptions, beliefs and attitudes influence behavioural intentions which in turn predicts actual behaviour. Consistent with prior theories on innovation adoption, the researcher proposes that:

H5: Behavioural intention to adopt CAATT will positively influence CAATT actual adoption in internal audit units.

Based on the review of literature on IT and CAATT in general, a conceptual framework is developed and depicted in Figure 2.2. The framework assumes that CAATT adoption intentions are driven by technological readiness, organisational readiness and environmental readiness relating to the TOE framework and the personal innovativeness of the decision maker. However, the second-order constructs (technology, organisational and environmental readiness have various

reflective variables mapping on to them). Additionally, the framework assumes that actual CAATT adoption is predicted by the behavioural intention to adopt.

Figure 2.2: Conceptual Framework adapted from Tornatzky et al. (1990) and Yang et al. (2015)



Source; Author's Construct

CHAPTER THREE

METHODOLOGY

3.0 Chapter Overview

This section highlights the methodology that would be adopted and how the study would be carried out. It includes the researcher's paradigm, description of the study approach, study design, population, sampling techniques, sources of data, data collection techniques and procedures for analysing the data.

3.1 Research Paradigm

According to Krauss (2005), a paradigm about the nature of reality is vital in determining the perspective from which research is designed and conducted. The worldview of researchers accounts for the variations in approaches to conducting research. Kuhn (1970) goes further to assert that a “research paradigm is a globally recognized scientific accomplishment that provides model problems and solutions to a community of practitioners”. It is a set of principles and values common among members of a scientific community and directs the types of issues researchers should address and explanations acceptable to them (Wahyuni, 2012).

These definitions, therefore, highlight the relationship between the choice of a paradigm (Creswell, 2013) and the methodology adopted to the study. Thus, the ontology, epistemology, axiology and methodological ideas determine the basis for classification and identification.

Situating this study within Krauss (2005) and Burrell and Morgan's (1979) classification of paradigms, the study would be undertaken within a functionalist/positivist paradigm. The positivist paradigm according to Burrell and Morgan (1979) seeks to explain a phenomenon by identifying patterns and relationships in the social world. Also, Bunniss and Kelly (2010) assert that the positivist paradigm intends to determine reality through “prediction and control characterized by

the scientific method”. Moreover, the positivist paradigm examines causal relationships where manipulation of causes produces a myriad of effects (O’Sullivan & Irby, 2011).

The positivist paradigm believes in a single reality rather than multiple reality (Anti-positivist paradigms), and is therefore deemed appropriate for this study as a result of the purpose of generalizing findings to the population. Moreover, the paradigm is of the belief that “truth and reality are free and independent of the observer” and thus can be scientifically and empirically investigated by way of rational investigation and analysis. Also, the paradigm is deemed fit for this study because of its assumption of rational human actions and beliefs and allows the understanding of a behaviour through hypotheses testing (Aliyu, Bello, Kasim, & Martin, 2014; Burrell & Morgan, 1979). It allows application of quantitative tools and techniques in predicting the relationships among variables and since the researcher seeks to predict the determining factors of CAATT adoption, the positivist paradigm seems appropriate and well fit for this type of research.

3.2 Research Approach

Creswell and Poth (2017) assert that the study approach is affected by the research problem, objectives of the study and worldview assumptions of the researcher. Moreover, Collis and Hussey (2013) assert that research can be classified based on the process it is carried out (quantitative, qualitative and mixed-methods). Malhotra and Birks (2007) assert that quantitative studies seek to measure, determine or predict the extent of the relationship that exists between constructs and a phenomenon. Thus, quantitative studies test hypotheses generated by the researcher to establish relationships among variables and a phenomenon.

The positivist/functionalist paradigm has been touted in literature for its ability to establish relationships among variables and also understand behaviours through the testing of hypotheses (Creswell & Poth, 2017; Burrell & Morgan, 1979). In line with this paradigm, the study would adopt a quantitative approach in investigating the factors that influence internal audit units to utilise CAATT in their task engagements. This approach is chosen as a result of the research objectives and also its appropriateness in helping predict the relationships between the variables in detail. The strengths of the quantitative approach in measuring relationships among variables account for the reasons for choosing to adopt this approach. Moreover, a review of prior knowledge on IT adoption and utilisation within the auditing domain (Gonzalez et al., 2012; Hoffman, Sellers, & Skomra, 2018; Li et al., 2018; Mahzan & Lymer, 2008) indicates an extensive acceptance of quantitative research approaches in data analyses.

3.3 Research Design

Research design specifies how data relating to a given phenomenon should be obtained and analysed. It forms the blueprint for the achievement of the study objectives proposed. Strategies for the collection and analyses of data in empirical studies include surveys, experiments, case studies and archival analysis (Yin, 2003). The study would adopt a survey due to its reliability in the verification of hypotheses proposed to aid generalisation (Saunders, Lewis & Thornhill, 2009). Surveys have been defined by Stangor (2011) as “series of self-reported measures administered either through an interview or a written questionnaire”. Prior literature (Yin, 2003; Saunders, Lewis & Thornhill, 2009) suggest surveys for exploratory and descriptive studies that are concerned with answering questions of what, why, who, how much. Moreover, data obtained from surveys can easily be analysed quantitatively, resulting in summary statistics and other vital information about the sample that can be generalized across a variety of contexts (Saunders et al.,

2009). Moreover, surveys help in obtaining information about the characteristics and opinions of a population. The study would adopt a cross-sectional survey as data would be collected from respondents within a particular period.

3.4 Study Population

A study population refers to a group or scope of possible individuals or measurements of interest. The target population for the study includes internal audit units in both Ghana's private and public sector organisations. The population for the private sector would include firms listed on the Ghana Club 100 (GC 100) organised annually by the Ghana Investment Promotion Centre (GIPC) and firms listed on the Ghana Stock Exchange (GSE). These firms are deemed successful enterprises and achieving corporate excellence. Also, due to the size of these entities and the extent of automation of their business processes, internal audit units in these firms in their quest to conduct reliable and effective audits, are likely to employ technology in their audit tasks. The population for the public sector also consisted of non-subsidised State-Owned Enterprises (SOEs). The entire population for the study was estimated to consist of 160 organisations. However, to achieve the best and accurate information from the organisations, the internal audit units of these institutions formed the respondents for the study.

3.5 Sampling Technique and Size

Creswell and Poth (2017) assert that quantitative studies that are characterised by large and diverse population size need to draw a sample to facilitate a statistical generalisation. Prior literature however observed that, one limitation relating to quantitative studies is the determination of the appropriate sample sizes (Hair et al., 2017; Saunders, et al., 2009). Approaches in determining sample sizes for PLS studies are numerous however, Barclay, Higgins and Thompson (1995) suggest a "10-times rule in determining appropriate sample sizes for PLS analysis". They assert

that “sample sizes should be equal or greater of 10 times the highest number of structural paths directed at a particular construct in the structural model or 10 times the largest number of formative indicators used to measure one construct”. However, Hair et al. (2014) suggested emphasizing on the statistical power of the structural model (Cohen, 1992) rather than the “number of relationships” as posited by Barclay et al. (1995). They argue that PLS-SEM builds on the assumptions of OLS multiple regressions and thus Cohen’s (1992) provide a better justification in sample size determination. This approach takes into consideration the amount of variation in the endogenous construct to be accounted for by the exogenous variables in achieving a particular statistical power. Situating the study within the arguments of this approach, with the eight (8) exogenous constructs, a minimum number of 54 observations is required in other to obtain a statistical power of 80% to be able to account for at least 25% of the variation in our dependent variables at the 5% level of significance. Building on the minimum sample size of the Cohen (1992) statistical power approach, the study used a sample size of 80 respondents for the survey. After determining a representative sample size, a sampling technique needed to be chosen to select the sample from the population. Boateng (2016) and Kotrlik and Higgins (2001) categorise the approaches or techniques of selecting samples into two: probability sampling techniques and non-probability sampling techniques. In probability sampling, samples are chosen randomly and not grounded on the personal decision of the researcher. Creswell and Poth (2017) asserts that in probability sampling, the probability of selecting a particular element can be specified and each element or individual possesses the same opportunity of being chosen. In contrast, with non-probability sampling, samples are chosen based on the personal decision of the researcher (Malhotra & Birks, 2007). Probability sampling techniques are mostly used in quantitative studies where an unbiased sample and true representation of the population is required.

The study employed a systematic probability sampling technique to choose the respondents for the study. This technique was chosen for the study because of its appropriateness for surveys and the ability to offer respondents equal opportunity to be selected (Malhotra & Birks, 2007). In order to use this sampling technique, a sampling frame was generated to select samples appropriately. An updated list of the firms on the GC 100 was obtained from the website of GIPC. A second list comprising the listed firms was also obtained from the website of the Ghana Stock Exchange. Lastly, the list for the non-subvented state firms was also obtained from the State Enterprises Commission (SEC).

3.6 Data Collection Instrument

The primary data collection instrument was questionnaires. Questionnaires are considered the appropriate in addressing the research questions and hypotheses. The questionnaire was adapted and designed from a review of prior literature on the TOE framework and would contain questions on the constructs to be examined. The instrument was structured in three parts and composed as follows: a section that was dedicated to eliciting responses on the demographic profile of the organisations, the extent of CAATT utilisation within the internal audit unit and the factors that influence the adoption of CAATT based on the constructs in the conceptual framework.

3.7 Variable Measurement

The extent of CAATT utilisation within the internal audit unit and stages of audit where they are mostly used was adapted from measures developed and validated by Li et al. (2018). Regarding the extent of utilisation, the degree of which respondents agree to the items was measured on a 7-point Likert scale. The stages of the audit process to be measured include: preliminary analytical procedures, risk assessment, substantive test and fraud detection. Indicator items assessing the stages of the audit were measured using 5-point Likert scale ranging from never to every time. The

technological constructs influencing CAATT adoption and utilisation were adapted from DOI theory (Rogers, 1995) and include relative advantage, complexity and technological competence. The DOI theory is a generic theory for technology adoption (Rogers, 1995) however, the proponents did not empirically test the constructs developed for the theory and thus failed to identify items in measuring the theory (Yang et al., 2015). Due to the close similarities between relative advantage and perceived usefulness, items for measuring this construct were adapted from Moore and Benbasat (1991) and Venkatesh and Davies (2000) in tandem with extant literature on innovation adoption (Yang et al., 2015). Indicator items for simplicity were also adapted from Thompson et al. (1991) and Davis et al. (1989) due to the similarities of this construct and perceived ease of use (Davis et al., 1989). Moreover, the indicator items for compatibility were adapted from Moore and Benbasat (1991) and Grover (1993).

The constructs of the organisational element include management support and technological support. The items for measuring management support and size were adapted from (Li et al., 2018; Wang et al., 2010) relevant measures validated. Similarly, technological competence items were adapted from Iacovou et al. (1995) measures consistent with prior literature (Wang et al., 2010). Moreover, the constructs for environmental element for this study included external pressures and standards. Items for measuring external pressures were adapted from measures used by Mahzan and Lymer (2008). Also, the measures for standards consisted of items adapted from Li et al. (2018). The measures of the innovativeness of the head of the internal audit unit would also be adapted from Agarwal and Prasa (1998) relevant items for measuring personal innovativeness.

The main dependent variables are the behavioural intention and actual CAATT adoption. Measures for behavioural intention to adopt CAATT were adapted from scales developed by Davies et al. (1989) and Taylor and Todd (1995). The actual CAATT adoption decision was measured using

the number of CAATT applications adopted by the internal audit units. The actual CAATT adoption decision was measured using the number of CAATT applications adopted by the internal audit units. This measure is reasonable and consistent with Ghobakhloo, Arias-Aranda, & Benitez-Amado (2011) who studied the adoption of e-commerce in small and medium enterprises

In measuring the degree to which respondents agree or disagree with the questions relating to the factors that influence adoption, a Likert scale ranging from 1 to 7 was adopted; where 1=Strongly Disagree, 2=Disagree, 3=Somewhat Disagree 4=Neither Agree nor Disagree 5=Somewhat Agree 6=Agree 7=Strongly Agree.

Table 3.1: Scale Development Items

Constructs	Number of Items	Source
Relative advantage	6	Moore and Benbasat (1991); Venkatesh and Davies (2000)
Simplicity	6	Thompson et al. (1991); Davis et al. (1989)
Compatibility	5	Iacovou et al. (1995)
Technological competence	3	Wang et al. (2010)
Management support	5	Wang et al. (2010); Li et al. (2018)
External pressure	6	Mahzan and Lymer (2008)
Standards	4	Li et al. (2018)
Personal innovativeness	4	Agarwal and Prasa (1998)
Behavioural Intention	6	Davies et al. (1989); Taylor and Todd (1995)
CAATT Actual Adoption	5	Ahmi and Kent (2012); Mahzan and Lymer (2014)

3.8 Data Analysis

The Statistical Package for Social Sciences (SPSS) version 20.0 and SmartPLS software version 3.0. was employed for the purpose of analysing the data obtained from the respondents. Since a quantitative approach would be adopted, data for the study would also be analysed quantitatively using structural equation modelling (SEM) in SmartPLS and descriptive analysis. A detailed discussion of the data analysis tools and measures follows below.

3.8.1 Structural Equation Modelling (SEM)

The prevalence of SEM in literature has surged over the last two decades and cuts across a range of disciplines in academic research (Hair, Sarstedt, Hopkins & Kuppelwieser, 2014; Gonzalez et al., 2012; H.-J. Kim et al., 2016; H. J. Kim, Mannino, & Nieschwietz, 2009; Li et al., 2018). This domination is as a result of its ability to analyse multiple interrelationships among several constructs and allows greater flexibility to test theories and models empirically (Hair et al., 2014). SEM helps in analysing complex regression models by comparing hypothesized relationships with latent variables and data obtained by the researcher. Thus, albeit multiple regression may still be vital in analysing the relationship among variables, SEM goes an extra mile to help analyse complex regression models and relationships simultaneously on data obtained for the study.

Prominent types of SEM include the CB-SEM and the PLS-SEM. Whiles the CB-SEM is primarily employed in studies that seek to confirm theories, the PLS-SEM on the other hand is primarily used in theory development and also in exploratory studies by predicting the variance in the dependent variables (Hair et al., 2017; Hair et al., 2012). The strengths of the PLS-SEM reside in its ability to work with limited sample sizes and yet attain a high degree of statistical power. Thus, PLS-SEM is recommended in quantitative studies with “small sample sizes and non-normal distributional characteristics” as indicated by Reinartz et al. (2009).

Also, Hair et al. (2017) assert that the PLS-SEM handles complex and numerous structural models and also works easily with both “reflective and formative measurement models”. Edwards and Bagozzi, (2000) assert that an unobserved variable act as a predictor for an indicator behaviour in a reflective model and the manipulation of an unobserved variable causes a change in an indicator behaviour in a reflective model. Accordingly, Chin (1998) asserts that PLS-SEM is the most appropriate in explanatory and predictive studies and also measuring variables that are reflective in nature. Its main objective is to maximise the variance explained and used for predictive purposes. Since the variables that were examined were both reflective and formative in nature, the study adopted the PLS-SEM. Also, PLS-SEM was chosen due to its usefulness in predictive and explanatory studies (Hair et al., 2017, 2017), and as the study seeks to predict the determinants of CAATT adoption, this analyses tool will be of enormous help. Moreover, PLS-SEM was chosen because of its high level of statistical power associated with small sample sizes, and with a population of 130, PLS-SEM is recommended to conduct robust statistical analysis. Besides, the number of constructs that were examined in the study and the hypotheses postulated to be tested necessitated the need to draw from the strengths of the PLS-SEM in analysing complex relationships more easily and simultaneously.

3.8.2 Descriptive Statistics

To understand better the demographic characteristics of the respondents, descriptive statistics would be employed. Descriptive statistics will indicate the means, standard deviation, mean errors and frequencies for the unobserved variables. These statistics provide summarized information about the variables of interest and the respondents of the study.

3.9 Validity and Reliability

Suanders et al. (2009) posit that the validity of an instrument is crucial in ensuring accuracy of the data obtained while reliability ensures that the results collected with the instrument would be

consistent with the results that would be obtained should another researcher use the instrument in a different circumstance.

3.9.1 Validity

The validity of the research instrument examines whether an instrument accurately measures what it purports to measure after considering and eliminating systemic errors as a result of environmental and respondent factors (Stangor, 2011). In measuring the validity of an instrument, Blumberg, Cooper and Schindler (2008) and Hair et al. (2017,2014) assert that two types of validity checks needed to be performed, namely, convergent validity and discriminant validity.

3.9.1.1 Convergent Validity

Convergent validity measures “the extent an indicator item correlates positively with alternative measures of the same variable” (Hair et al. 2017) and ensures that the variables are truly indicative of the items or measures. The authors assert that in evaluating the convergent validity of reflective variables, the average variance extracted (AVE) should be considered. A rule of thumb that has been established in literature is that the “latent variable should explain at least 50% of the indicator’s variance” (Hair et al., 2017; 2014). It measures the amount of variation explained by the indicators in relation to a specific construct. An AVE value of 0.50 or more is deemed as a proof of validity. Thus, an AVE value lesser than 0.50 suggests that a large amount of the variance remains in the error of the items than explained by the construct (Hair et al., 2017).

3.9.1.2 Discriminant Validity

Discriminant validity indicates “the extent to which a construct is truly different from other constructs” (Hair et al., 2017, 2014). It indicates the uniqueness of each item that captures an issue not epitomised by related items in the model. Prior literatures indicate that discriminant validity is assessed using the cross loadings and the Fornell-Lacker criterion (Hair et al., 2017, 2014;

Blumberg, Cooper & Schindler, 2008). For instance, Hair et al. (2017, p. 138) assert that the initial approach to measuring the discriminant validity is to assess the cross-loadings such that “an item’s outer loading on its constructs should be more than any of its cross-loadings or correlation on other constructs”. The Fornell-Larcker criterion also compares the square root of the AVE values with the unobserved variable correlations. Specifically, Hair et al. (2017, p. 139) assert that the “square root of each constructs AVE should exceed its highest correlation with other constructs”.

3.9.2 Reliability

Reliability also measures the extent of consistency in the results produced by the research instrument under different circumstance and conditions (Saunders et al., 2009). A more robust and popular approach to examining the reliability of an instrument is its internal consistency. Internal consistency is measured using the Cronbach’s alpha which “provides an estimate for the reliability based on the intercorrelations of the observed indicator variables” (Hair et al., 2017, p. 136). The Cronbach’s alpha ranges from 0.00 to 1.00 where it is more reliable when the measure is closer to 1.00. Therefore, scholars have agreed that a Cronbach’s alpha of 0.7 or more means that an instrument is internally consistent and thus reliable (Hair et al., 2017,2014).

However, Hair et al. (2017, p. 136) argued that there exist some inherent weaknesses with the Cronbach’s alpha such as its “sensitivity to the number of indicators in the scale and assumption that all indicator items are equally reliable”. Therefore, a more technically appropriate measure of internal consistency “composite reliability” is recommended. The composite reliability also ranges between 0.00 and 1.0 with higher values suggesting higher levels of reliability. Hair et al. (2017) asserts that values within 0.60 and 0.70 are acceptable in studies that are exploratory in nature.

3.10 Ethical Consideration

The concept of adherence to ethics in academic research is paramount in the whole research process. Ethical issues may arise as a result of conflicts of interest between the respondent and the researcher (Malhotra & Birks, 2007) and thus researches must institute measures to mitigate their occurrence. Ethics in research are defined as standards researchers must uphold or adhere to within the process of conducting the study (Swanson & Fisher, 2010). In order to adhere to and comply with these standards and principles, the researcher ensured that requirements in relation to filling the research instrument were made clear and unambiguously written to the respondents. Also, the consent of the respondents was sought by the researcher before administering the questionnaire. Furthermore, the purpose of the study was made clear to the respondents and anonymity and confidentiality guaranteed.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSIONS OF FINDINGS

4.0 Chapter Overview

This chapter of the research presents the results obtained from the analysis of the data collected. An analysis of the responses gathered from the sampled internal audit units of firms under study is also discussed in tandem with the study objectives. The chapter proceeds to present the descriptive statistics of the organisations surveyed, CAATT adoption status, types of CAATT used, the stages of auditing within which CAATT are mostly utilised and the structural analysis of the hypothesized relationships using Smart PLS.

4.1 Data Editing, Coding, Entry and Treatment of Missing Data

Saunders et al. (2009) posit that before a set of data can be used for any meaningful analysis, it is imperative for the researcher to subject such data set to some rigorous processes and procedures such as data editing, coding, screening before final entry as these steps mitigate the errors the data set may contain.

A cross-sectional survey was adopted for the study and therefore obtained data from the respondents through the use of self-administered questionnaires. Data collected was coded and keyed into SPSS version 20.0 while looking out missing data and outliers that could “skew the results” (Coakes & Steed, 2001). Seventy-five questionnaires (75) were obtained from the respondents out of eighty-three (83) distributed for the study yielding a response rate of 90%.

4.2 Demographic Profile of the Organisations

This section sought to describe the demographic characteristics of the organisations used for the purpose of the study according to the industry type, ownership and listing status. *Table 4.1* shows

the frequencies and percentages of the sampled firms used for our study particularly with regards to the industry, ownership and the listing status of these firms.

Table 4.1: Demographic Profile of Firms

Demographic Variable	Frequency	Percent
Industry		
Banking/Finance	23	30.7
Manufacturing	20	26.7
Insurance	8	10.6
Mining/Oil and Gas	7	9.3
Others	13	17.3
Total	75	100
Ownership		
Private	62	82.7
State Owned Enterprises	13	17.3
Listing Status		
Ghana Stock Exchange	23	30.7
Ghana Club 100	39	52.0
State Owned Enterprises	13	17.3
Both GSE and Club 100	14	

Source: Field Work, 2019

From *Table 4.1*, it is evident that out of the 75 firms surveyed in this study, 23 representing 30.7% were from the Banking industry. This was followed closely by the manufacturing industry (20) representing 26.7%. The next largest category to follow was the insurance industry with 8 firms representing 10.6% and manufacturing/Oil and Gas with 7 firms representing 9.3%. The remaining 13 firms representing 17.3% were classified into others as they consist of various individual industries and some not correctly stated.

These results provide an indication that the Ghanaian corporate environment is predominantly dominated by the service firms particularly Banking and Insurance firms and thus the internal audit units of these firms are likely to be challenged with issues of big data that would require the application of technology to enhance their effectiveness. Also, the distribution of the firms

according to the industry type reflects the general profile of industries in Ghana and sectoral contribution to the Ghanaian economy.

With respect to ownership, private ownership represented the majority (82.7%) of the sample, while the representation of public/government enterprises was 17.3% representing 13 firms. It is evident from *Table 4.1* that the majority of the firms sampled (39) representing 52% were listed on the Ghana Club 100 while 23 firms representing 30.7% are listed on the Ghana Stock Exchange. Also, 14 firms were both listed on the Stock Exchange and Ghana Club 100.

4.3 Extent of CAATT Adoption

This section also sought to examine the extent of CAATT adoption according to the adoption status, type of CAATT adopted and the stages within the audit where CAATT's are mostly utilised.

Table 4.2 illustrates the extent of adoption according to adoption status and type of CAATT used.

The results in *Table 4.2* shows that majority of the firms sampled (51) representing 68% have adopted a technology-based audit tool for their internal audit unit while the remaining 24 firms representing 32% are non-adopters. The results provide evidence that the rate of adoption among internal audit units in Ghana is fairly high. This finding is consistent with Mahzan and Lymer's (2008) study on the extent of adoption among internal auditors in the UK. The study found high levels of adoption among internal audit units in the UK, however, the extent of utilisation was fairly low.

Table 4.2: CAATT Adoption Status of Firms

Adoption Status	Frequency	Percentage
Adopter	51	68.0
Non-Adopter	24	32.0
Type of CAATT Used		
Generalized Audit Software	52	49.5
Audit Analytics	28	26.7
Electronic Working Papers	12	11.4
Automated Auditing	10	9.5
Network Security Testing	3	2.9

Source: Field Work, 2019

After the assessment of the rate of CAATT adoption, the respondents were asked to specify the type of CAATT software used within the internal audit unit. Generalized audit software (GAS) was the most cited software used as the results from *Table 4.2* show that 52 respondents representing 49.5% confirmed usage. This result corroborates similar findings in prior studies by Ahmi and Kent (2012), Li et al. (2018), Mahzan and Lymer (2014) and Mustapha and Lai (2017). The use of audit analytics software was found to be the next most adopted audit software (28) representing 26.7% followed by electronic working papers (12) with 11.4% representation. The least adopted tools were continuous auditing (10) and network security testing (3) representing 9.5% and 2.9% respectively. However, it must be noted that the adoption of these range of tools are not mutually exclusive as most internal audit units were found to be using more than one audit software tool.

To assess the extent of utilisation of these tools within the entire audit process, the respondents were asked to indicate the usage frequency on a scale of 1 (never) to 5 (every time). The results of the extent of use are presented in *Table 4.3* with the mean, standard deviation, skewness and kurtosis. It is evident from the results that, the areas of auditing where CAATT are utilised frequently are during risk assessment (mean=3.08) followed by fraud detection (mean=2.89). Also,

the results show that the least used stages are substantive test (mean=2.36) and preliminary analytical procedures (mean=2.02). The results reveal that CAATT utilisation within internal audit units are relatively low as the audit process with the highest mean score was 3.08 indicating that these tools are fairly used. Albeit the results indicate low rates of utilisation, they suggest that internal audit units mostly use the advanced features of these tools since risk assessment and fraud detection would require the application of highly advanced features (data mining, cluster analysis and regression analysis) which results in improvements in audit efficiency, effectiveness and quality (Debreceeny & Gray, 2010; Thiprungsri & Vasarhelyi, 2011). Moreover, the results suggest that the internal auditors do not perceive complexities related to these tools to be a hindrance or a challenge to their utilisation because these advanced features would require internal auditors to possess some technical skills and expertise before they can be used. This suggests that the units have some mechanisms such as training and professional assistance which might be accounting for the continuous use of the advanced features of these technology-based audit tools.

Table 4.3 CAATT Usage in Different Stages of Audit

Stage	Mean	SD	Skewness	Kurtosis
Risk Assessment	3.08	1.115	-0.166	-0.816
Fraud Detection	2.89	1.156	0.298	-0.899
Substantive Test	2.36	1.081	0.537	-0.380
Preliminary Analytical Procedures	2.02	1.008	1.177	1.699

Source: Field Work, 2019

4.4 Descriptive Statistics of the Constructs

This section of the study seeks to describe the mean scores, minimum and maximum values and the standard deviation of the respondents' perception on the technology, organisational, and environmental characteristics as well as personal innovativeness in influencing CAATT adoption decisions. The results of this descriptive analysis of the constructs and items used are presented in

Table 4.4. It is evident from the table that with regards to the features of the technology, relative advantage is the construct with the highest mean of 5.60 and standard deviation of 1.13 indicating a greater propensity to adopt a technology-based audit tool based on its relative importance. Concerning the organisational characteristic to influence adoption intention, the level of management support for the adoption of the tool had the highest mean score of 5.56 and a deviation of 1.22. Given that the study employed a seven-point Likert scale, this result suggests that the perception of respondents on the extent of management support in influencing CAATT adoption intention is fairly high. The characteristic of the organisation that recorded the lowest mean score is the technological competence construct with an overall mean of 2.27 and a standard deviation of 1.05 suggesting that the perception of respondents about this construct influencing adoption decision is low.

From *Table 4.4*, it is evident that regarding the environmental characteristics, the external pressure construct recorded the highest mean of 4.48 and a deviation of 1.68 whiles audit standards had the lowest overall mean 2.44 with a deviation of 1.10. Using a seven-point Likert scale, we can conclude that the perception of respondents on external pressure influencing adoption is fairly high as compared to audit standards. For instance, the indicators “My professional association requires us to use CAATT”, “Our external auditors are willing to provide support for the use of CAATT” and “The external auditors of my organisation use CAATT in their engagement with us” had mean scores of 5.01, 4.72 and 4.48 respectively. Therefore, we can conclude that of the three characteristics (technology, organisation and environment), the results indicate that the firms are more likely to be motivated by the characteristics of the technology; relative advantage, complexity and compatibility in making adoption decisions.

Also, we further analysed the innovativeness of the respondents on a seven-point Likert scale and the results in *Table 4.4* show that the overall mean of personal innovativeness is 4.76 indicating that the respondents sampled in this study are fairly innovative and will appreciate innovative techniques in solving societal or organisational problems. The dependent variables; adoption and performance used in this study have overall means of 4.84 and 5.73 respectively. The results suggest that on a seven-point Likert scale used in this study, the likelihood of respondents adopting CAATT in their internal audit units is fairly high with a mean score of 4.84. The results further suggest that internal audit units that have adopted CAATT software are likely to achieve higher performance within their units as the overall mean for performance is 5.73 with a standard deviation of 0.97.

Table 2.4: Descriptive Statistics of Constructs

Construct/Indicators	Mean	Min	Max	SD
Relative Advantage	5.60			1.13
‘My unit expects CAATT to improve our ability to identify more anomalies	5.61	1	7	1.23
My unit expects CAATT to improve the audit quality of the unit	5.67	2	7	1.08
My unit expects CAATT to improve our audit effectiveness	5.72	2	7	1.01
My unit expects CAATT to improve our productivity	5.47	1	7	1.24
CAATT are likely to make audits easier for the unit	5.26	1	7	1.06
In general, my unit expects CAATT to be of an advantage to our tasks	5.89	1	7	1.19
Simplicity	5.10			1.54
My unit believes CAATT are complex and complicated to use	5.30	1	7	1.62
My unit believes interacting with CAATT will be difficult and not easily understandable	4.89	1	7	1.78
My unit believes that CAATT development will not be easy	5.13	1	7	1.46
My unit believes that CAATT implementation will involve too much time from of our normal duties	5.00	2	7	1.21
My unit believes that learning to use CAATT will take a longer period	4.92	1	7	1.59
It is likely that it will be difficult for my unit to become skilful in CAATT usage’	5.38	1	7	1.57
Compatibility	5.33			1.08
‘The changes introduced by CAATT are likely to be consistent with my firms existing values/beliefs	5.35	1	7	1.13
‘CAATT adoption will be compatible with existing information infrastructure’	5.47	2	7	0.99
‘The changes introduced by CAATT will be consistent with prior practices and procedures’	5.26	2	7	1.08
‘CAATT adoption will be compatible with my firms existing experiences with similar systems or technology’	5.33	1	7	1.05
‘I think that CAATT implementation will fit well with our work style’	5.25	2	7	1.13
Management Support	5.56			1.22
‘My top management is likely to support the financing and maintenance of an audit software	5.86	2	7	1.17
Management requires auditors to attend regular CAATT workshops and training	5.67	2	7	1.11
Management is willing to support the use of CAATT	5.84	3	7	1.15
Management will provide financial support for CAATT training	5.71	3	7	1.04
Management requires the use of CAATT frequently’	4.74	1	7	1.65

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Construct/Indicators	Mean	Min	Max	SD
Technological Competence	2.27			1.05
“The technology infrastructure of my unit is available to support CAATT”	2.24	1	6	1.03
“My company is dedicated to ensuring that employees are familiar with IT related software”	2.26	1	5	1.02
“My unit has a high-level audit technology related knowledge”	2.31	1	7	1.10
External Pressure	4.48			1.68
‘The external auditors of my organisation recommend the use of CAATT	4.29	1	7	1.95
The external auditors of my organisation use CAATT in their engagement with us	4.48	1	7	1.71
“Our external auditors are willing to provide support for the use of CAATT	4.72	1	7	1.62
The use of technology will differentiate my unit from other departments”	4.64	1	7	1.71
“I think my unit experienced competitive pressures to use CAATT”	3.72	1	7	1.70
“My professional association requires us to use CAATT”	5.01	2	7	1.40
Audit Standards	2.44			1.10
“Standards encourage the use of various analytical methods to detect misstatements”	2.74	1	7	1.29
“Standards recommend the use of audit software in the internal audit function”	2.41	1	6	0.99
“Standards recommend the use of advanced analytics to enhance internal audit function reliability”	2.49	1	6	1.03
“If IAG provides guidance on how to use CAATT in audit procedures, I will be willing to use them”	2.10	1	7	1.09
Personal Innovativeness	4.76			1.27
“If I heard about a new information technology, I would look for ways to experiment with it”	5.61	1	7	1.33
“I like to experiment with new information technologies	5.53	1	7	1.19
“Among my peers, I am usually the first to try out new information technologies”	5.58	1	7	1.28
“I think I am more hesitant to try out new information technologies”	2.31	1	7	1.27

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Construct/Indicators	Mean	Min	Max	SD
CAATT Adoption Intention	4.84			1.60
My unit will use CAATT frequently	5.16	1	7	1.49
We will use CAATT as a supplement of the audit function	4.86	1	7	1.64
I think my unit will use CAATT in every task	4.58	1	7	1.65
In general, I think we will employ CAATT as a basis of the audit function	4.77	1	7	1.64

4.5 Measurement Model Assessment

Before testing and analysing the structural relationships that exist between the exogenous variables and the response variable, researchers are required to assess the overall model fitness. According to Hair et al. (2017, p 104), “measurement models measure the relationships between the indicators and the constructs”. In PLS-SEM with reflective measurement models, assessment is carried out by evaluating the reliability, convergent validity and the discriminant validity values (Hair et al., 2014; 2017). The ensuing sections discuss the reliability and validity assessment of the indicators used for the purpose of the study.

4.5.1 Indicator Reliability

To assess or evaluate the reliability of the indicator items measuring the variables, Hair et al. (2014; 2017) and Wong (2013) suggest using the standardized loadings of the items. The outer model indicates the outer loadings that measure the constructs and thus to conclude that the indicator items of a particular construct measures the construct reliably, the loadings must be higher. As a general rule of thumb, prior literatures (Hair et al., 2017; Wong, 2013; Hullard, 1999) suggest an outer loading threshold of 0.70 and above to indicate acceptable indicator reliability. Notwithstanding this reliability threshold, researchers are admonished not to delete items below the threshold however, loadings between 0.40 and 0.70 should only be considered for removal

after considering the effect on the validity and reliability thresholds of the constructs (Wong, 2013). The results of the indicator reliability assessment and composite reliabilities of the constructs are presented in *Table 4.5*.

Table 4.3: Outer Loadings of Indicators and Composite Reliability

Construct	Items	Loadings	CR	AVE
Relative Advantage	RA1	0.767	0.887	0.578
	RA2	0.909		
	RA3	0.860		
	RA4	0.805		
	RA5	0.697		
	RA6	0.419		
Compatibility	CM1	0.748	0.855	0.541
	CM2	0.806		
	CM3	0.705		
	CM4	0.748		
	CM5	0.663		
	CPX1	0.722		
Simplicity	CPX2	0.779	0.909	0.620
	CPX3	0.924		
	CPX4	0.747		
	CPX5	0.708		
	CPX6	0.823		
	MS1	0.866		
Management Support	MS2	0.771	0.920	0.698
	MS3	0.877		
	MS4	0.862		
	MS5	0.795		
	TCP1	0.762		
	TCP2	0.748		
Technological Competence	TCP3	0.761	0.801	0.573
	ST1	0.799		
	ST2	0.917		
Audit Standards	ST3	0.789	0.893	0.678
	ST4	0.781		
	EP1	0.828		
	EP2	0.896		
External Pressure	EP3	0.818	0.892	0.583
	EP4	0.666		
	EP5	0.695		
	EP6	0.644		
	PI1	0.955		
	PI2	0.768		
Innovativeness	PI3	0.841	0.841	0.589
	PI4r	0.387		
	UT1	0.881		
	UT2	0.771		
CAATT Behavioural Intention	UT3	0.782	0.895	0.681
	UT4	0.861		

From *Table 4.5*, it is evident that almost all the loadings of the indicator items of the variables met the 0.70 threshold except RA5 (0.697), RA6 (0.419), CM5 (0.663), EP4 (0.666), EP5 (0.695), EP6 (0.644), PI4r (0.387) and PM1 (0.693). Item RA6 and PI4r were deleted because their loadings were too low however, the remaining indicator items were maintained because their deletion negatively affect the internal consistency measures and the AVE.

4.5.2 Internal Consistency Reliability

The internal consistency reliability of the constructs was assessed using the composite reliability. Prior studies (Ghobakhloo et al., 2011; Kitchell, 2010; Li et al., 2018) have mostly relied on the Cronbach's alpha as a measure for evaluating internal consistency reliability. However, due to the sensitivity of the Cronbach's alpha to the number of indicator items and assumption that all items possess equal outer loadings (Hair et al., 2017), Bagozzi and Yi (1988) and Hair et al. (2017 p. 109) proposed the use of composite reliability as a "measure for internal consistency reliability assessment as it takes into account the different outer loadings of the indicator variables". Hair et al. (2017) proposed a composite reliability score range of 0.60 to 0.90 as acceptable and satisfactory, indicating good degrees of reliability. It is evident from *Table 4.5* that the entire constructs exhibit higher reliability levels as they all have composite reliability scores between 0.60 and 0.90 respectively.

4.5.3 Convergent Validity

In assessing the convergent, the AVE by each construct is used as a common approach of establishing convergent validity. The results presented in *Table 4.5* show that all the constructs used for the purpose of this study exhibit higher convergent validity scores as their AVE scores exceeded the 0.50 threshold.

4.5.4 Discriminant Validity

Discriminant validity measures “the extent to which a construct or variable is truly different from the constructs” (Hair et al., 2017). In establishing the discriminant validity of the constructs used for the purpose of this study, we will report the cross-loadings and the Fornell-Lacker criterion to complement the limitations associated with each of the approaches. We start with the cross-loading criterion which according to Sarstedt et al. (2014) and Hair et al. (2017) suggest that “an indicator’s loading on its associated construct should be higher than its loadings with all the remaining constructs”. The results for the cross loadings are presented in *Table 4.6*. It is evident that the indicator items load more on their respective variables than their cross-loadings on the other variables indicating acceptable discriminant validity.

Table 4.6: Cross Loadings and Discriminant Validity Assessment

	ADP. ^a	SMP. ^b	CMP. ^c	EXP. ^d	INN. ^e	MSP. ^f	REA. ^g	STD. ^h	TCP. ⁱ
AS1	0.322	0.030	0.299	0.312	-0.358	0.536	0.401	0.806	0.481
AS2	0.463	0.149	0.380	0.523	-0.261	0.470	0.234	0.908	0.342
AS3	0.319	0.141	0.357	0.510	-0.205	0.422	0.240	0.816	0.307
AS4	0.342	-0.158	0.492	0.241	-0.218	0.367	0.097	0.757	0.286
CM1	0.494	0.010	0.715	0.409	-0.216	0.569	0.163	0.509	0.551
CM2	0.516	-0.086	0.785	0.251	-0.141	0.510	0.235	0.451	0.415
CM3	0.350	0.062	0.732	0.198	-0.110	0.460	0.202	0.174	0.370
CM4	0.348	-0.111	0.766	0.189	-0.108	0.468	0.148	0.343	0.372
CM5	0.363	-0.092	0.686	0.141	0.006	0.389	0.189	0.178	0.258
CX1	-0.035	0.825	-0.012	0.298	-0.061	0.023	0.181	0.179	-0.069
CX2	0.061	0.725	-0.066	0.413	0.073	0.088	0.096	0.184	-0.074
CX3	0.133	0.750	-0.048	0.185	0.123	-0.127	0.012	-0.037	-0.247
CX4	0.031	0.867	-0.050	0.202	0.056	0.012	0.193	-0.073	-0.068
CX5	0.009	0.864	-0.064	0.203	-0.048	-0.016	0.259	0.047	-0.070
EP1	0.390	0.309	0.229	0.822	-0.021	0.292	0.016	0.399	0.210
EP2	0.574	0.333	0.317	0.880	-0.003	0.370	0.074	0.426	0.270
EP3	0.347	0.210	0.384	0.829	0.026	0.283	-0.056	0.389	0.348
EP4	0.234	0.247	0.014	0.686	-0.105	0.142	0.107	0.211	0.234
EP5	0.369	0.209	0.093	0.679	0.059	0.295	0.056	0.206	0.176
EP6	0.369	0.097	0.359	0.661	-0.156	0.379	0.152	0.572	0.285
MS1	0.553	-0.080	0.677	0.363	-0.175	0.874	0.313	0.502	0.659
MS2	0.462	0.047	0.409	0.300	-0.308	0.768	0.201	0.330	0.523
MS3	0.475	-0.062	0.609	0.235	-0.269	0.889	0.362	0.473	0.650
MS4	0.448	-0.034	0.526	0.276	-0.296	0.878	0.463	0.558	0.667
MS5	0.637	0.130	0.481	0.476	-0.017	0.766	0.331	0.392	0.486
PI1	-0.130	0.027	-0.171	-0.064	0.964	-0.242	-0.403	-0.328	-0.489
PI2	-0.037	0.065	-0.154	-0.033	0.799	-0.199	-0.317	-0.289	-0.360
PI3	-0.051	-0.022	-0.069	0.024	0.847	-0.219	-0.348	-0.170	-0.315
RA1	0.157	0.107	0.300	-0.017	-0.278	0.330	0.839	0.098	0.364
RA2	0.286	0.256	0.224	0.038	-0.353	0.415	0.886	0.277	0.386
RA3	0.308	0.147	0.237	0.203	-0.360	0.357	0.781	0.345	0.336
RA4	0.016	0.214	0.115	0.060	-0.368	0.314	0.874	0.253	0.357
RA5	0.027	0.095	0.158	0.012	-0.386	0.242	0.813	0.269	0.259
TC1	0.214	-0.144	0.306	0.185	-0.418	0.486	0.276	0.239	0.820
TC2	0.342	0.024	0.520	0.329	-0.325	0.764	0.563	0.426	0.803
TC3	0.366	-0.203	0.376	0.235	-0.344	0.310	-0.003	0.282	0.651
UT1	0.882	0.086	0.472	0.483	-0.137	0.621	0.339	0.424	0.439
UT2	0.770	-0.070	0.481	0.363	-0.148	0.500	0.176	0.381	0.401
UT3	0.782	-0.051	0.442	0.347	0.027	0.398	0.014	0.218	0.225
UT4	0.862	0.142	0.480	0.474	-0.055	0.477	0.096	0.403	0.223

- a-ADP: CAATT Adoption Intention
- b-SMP: Simplicity
- c-CMP: Compatibility
- d-EXP: External Pressure
- e-INN: Innovativeness
- f-MSP: Management Support
- g-REA: Relative Advantage
- h-STD: Audit Standards
- i-TCP: Technological Competence

The next measure we employed is the Fornell-Lacker criterion. This approach assesses discriminant validity by “comparing the square root of a construct’s AVE score with its correlation with other constructs” (Fornell & Lacker, 1981). Therefore, to establish discriminant validity, the square root of a constructs AVE should exceed the construct’s correlation with other constructs (Hair et al., 2017). *Table 4.7* presents the results of this approach. The results show that the variables pass the Fornell-Lacker criterion for discriminant validity indicating that discriminant validity has been established.

Table 4.4: Fornell-Lacker Criterion

	ADP.^a	SMP.^b	CMP.^c	EXP.^d	INN.^e	MSP.^f	REA.^g	STD.^h	TCP.ⁱ
ADP.^a	0.825								
SMP.^b	0.041	0.808							
CMP.^c	0.567	-0.058	0.738						
EXP.^d	0.511	0.309	0.326	0.764					
INN.^e	-0.105	0.024	-0.159	-0.042	0.873				
MSP.^f	0.616	-0.004	0.653	0.394	-0.252	0.837			
REA.^g	0.208	0.199	0.255	0.073	-0.413	0.404	0.839		
STD.^h	0.443	0.067	0.457	0.498	-0.313	0.544	0.295	0.823	
TCP.ⁱ	0.402	-0.121	0.538	0.335	-0.469	0.717	0.411	0.426	0.762

- a-ADP: CAATT Adoption Intention
- b-SMP: Simplicity
- c-CMP: Compatibility
- d-EXP: External Pressure
- e-INN: Innovativeness
- f-MSP: Management Support
- g-REA: Relative Advantage
- h-STD: Audit Standards
- i-TCP: Technological Competence

4.6 Assessment of Structural Model

The assessment of the structural model proceeded after the validity and reliability of the constructs and measurement model has been established. The structural model measures the relationships between the independent and dependent constructs. Kline (2015) posits that the structural model measures the statistical tests and hypothesized relationships between the independent and dependent variables. Hair et al. (2017; 2011) posit that the “primary assessment criteria for evaluating structural models in PLS-SEM include the R^2 , significance level of the path coefficients, predictive relevance (Q^2) and the effect size (f^2)”.

4.6.1 Assessment for Multicollinearity

In order to evaluate the explanatory power of the structural model, researchers are required to assess the model for issues about collinearity (Hair et al., 2011). The variance inflation factors (VIF) of the independent variables in structural model are examined to establish whether multicollinearity exists or not. The assessment of the VIF values helps to check and also remove indicators that may bias the path coefficients in the results. As a VIF threshold, Hair et al. (2011) suggest a value of 5 such that any construct that has a VIF score exceeding 5 indicates multicollinearity and must be checked. *Table 4.8* presents the results from the assessment of the VIF scores of the independent constructs used in the model.

Table 4.5: Assessment of Variance Inflation Factor Results

Construct	VIF
Technological Readiness	1.545
Relative Advantage	1.123
Simplicity	1.057
Compatibility	1.079
Organisational Readiness	2.019
Technological Competence	2.142
Management Support	2.522
Environmental Readiness	1.638
Audit Standards	1.329
External Pressure	1.329
Personal Innovativeness	1.182
CAATT Adoption Intention	1.008

Source: Field Work, 2019

From *Table 4.8*, it is clearly indicated that there was no issue of multicollinearity as the VIF values of the constructs are below the threshold score of 5. Therefore, we can conclude that there were no issues of multicollinearity among the constructs in the structural model.

4.6.2 Assessment of the Explanatory Power of the Model (R^2)

The explanatory power of PLS-SEM models is evaluated by the R-square (R^2) value of the dependent variable. The objective of PLS-SEM according to Hair et al. (2011, p.147) is to “explain the endogenous latent variables’ variance” which is the primary objective of the R^2 . The R^2 also referred to as the “coefficient of determination” measures the amount of variation in the response construct that is accounted for by the predictor variables and also assesses the predictive power of the structural model. The value of the R^2 ranges between 0 and 1 such that a higher R^2 value indicates a higher level of predictive power or accuracy. From the analysis of model, the outcome variables; CAATT adoption intention has an R^2 value of 53%. According to Henseler et al. (2009) and Hair et al. (2011; 2017), R^2 values of 0.75, 0.50 and 0.25 can be described as strong, moderate and weak respectively. Therefore, we can conclude that the R^2 value for CAATT adoption is moderate as the exogenous variables account for 53% of the variance in CAATT adoption.

Prior literature (Hair et al., 2011; Henseler et al., 2015) suggest that the use of the coefficient of determination as the only approach in model selection is not appropriate. Therefore, proponents of PLS-SEM recommend conducting additional tests such as assessing effect size and predictive relevance of the structural model. The effect size (f^2) measures the change in the coefficient of determination when a specified independent variable is removed from the model. It measures whether the deleted variable has a substantive effect on the dependent variable (Hair et al., 2017). The f^2 measures the degree or strength of the relationship between the independent constructs and the endogenous construct. In assessing the effect size, Cohen (1988) suggests that f^2 values of 0.02, 0.15 and 0.35 indicate weak, medium and strong effects respectively. The results from the effect size assessment indicate that all the second order independent variables with the exception of technological readiness exhibit weak effect sizes as the f^2 values were between 0.02 and 0.15. For instance, technological readiness has an effect size of 0.159 indicating a moderate effect size. The results show that the constructs possess moderate effect sizes in influencing CAATT adoption. Therefore, we can conclude that the independent variables used in the study possess acceptable levels of effect sizes.

The final step in the structural model assessment conducted is the evaluation of the predictive relevance of the endogenous variables. We employed the Stone-Gaiser's Q^2 criterion (Geisser, 1974; Stone, 1974) which measures the "predictive power of the model" to evaluate the degree of the R^2 values. Hair et al. (2017) posit that reflective dependent variables with Q^2 values higher than zero (0) indicate an acceptable predictive power and exhibit predictive relevance. *Table 4.9* presents the results of the predictive power assessment using blindfolding in PLS-SEM. The results establish that the first and second-order endogenous variables exhibit acceptable predictive powers as their Q^2 are greater than zero.

Table 4.6: Predictive Power Assessment (Q²)

Dependent Constructs	Q²
Technological Readiness	0.215
Organisational Readiness	0.463
Environmental Readiness	0.433
CAATT Adoption Intention	0.326
CAATT Actual Usage	0.071

Source: Field Work, 2019

4.7 Common Method Bias Assessment

Siemsen et al. (2010, p. 457) defined common method bias as “the degree to which parameter estimates asymptotically converge to values different from their true population value as a result of the presence of common method variance”. Gonzalez et al. (2012) posit that common method bias may occur when the independent and dependent variable share a common method such as a respondent providing the items for both variables. Prior literature suggests that the presence of common method variance can inflate or deflate the regression path coefficients as well as construct validity and reliability thereby resulting in Type I and II errors (MacKenzie & Podsakoff, 2012; Podsakoff et al., 2012). It was therefore imperative to evaluate whether our study suffers from common method bias. Two fundamental approaches; statistical control and procedural control have been espoused by prior researchers (Bagozzi, 1984; Williams et al., 2010; Podsakoff et al., 2012) as ways to control for common method bias. In this study we tried to conduct a statistical test to control for this limitation using Harman’s one factor test (Harman, 1976) which has been found to be the most predominant statistical approach in controlling for common method bias. In this approach, all the constructs in the study are analysed using the unrotated factor analysis technique. The single factor analysis assumes that if a significant amount of common method variance exists in the data, either one “general factor should explain more than 50% of the covariance in the independent and the dependent constructs or a single factor will emerge”

(Harman, 1976; Podsakoff & Organ, 1986). The results after controlling for common method bias using the single factor approach are presented in *Table 4.10*.

Table 4.7: Factor Analysis for Common Method Bias Assessment

Component	Total	% of Variance	Cumulative %
1	12.960	28.174	28.174
2	5.263	11.441	39.615
3	4.706	10.230	49.845
4	2.631	5.721	55.565
5	2.350	5.109	60.674
6	2.177	4.734	65.408
7	1.660	3.609	69.017
8	1.410	3.064	72.082
9	1.068	2.321	74.403

Source: Field Work, 2019

From the results of the factor analysis showed in *Table 4.10*, it is evident that none of the factors extracted explains more than 50% of the covariance between the independent and the dependent variables. For instance, component 1 which had the highest percentage of variance explained extracted 28.174 percent of the variance in the criterion variable which is below the 50 percent threshold suggested by Harman (1976). On this basis, the researcher concludes that the study does not suffer from common method bias.

4.8 Path Analysis Assessment

After assessing the structural model, the path analysis of the hypothesized relationships was conducted to generate T-statistics to test the significance of these relationships. In this study twelve (12) hypothesized relationships were postulated in the first model for predicting the determinants of CAATT adoption intention within the internal audit unit. *Table 4.11* and *Figure 4.1* presents the statistical and graphical results of the relationships after the assessment of the path analysis of the model. The estimates of the path model are discussed below.

Table 4.8: Assessment of Path Coefficients

Path	Expected Sign	β	p-values	Decision
Relative_Advantage->Technology Readiness	+	0.107	0.491	Not Supported
Simplicity->Technology Readiness	-	0.153	0.337	Not Supported
Compatibility -> Technology Readiness	+	0.936	0.000***	Supported
Technology readiness-> Adoption intention	+	0.373	0.003***	Supported
Technological_Cmpetence -> Organisational readiness	+	0.249	0.001***	Supported
Management Support -> Organisational Readiness	+	0.779	0.000***	Supported
Organisational Readiness -> Adoption intention	+	0.230	0.043**	Supported
Audit Standards -> Environmental Readiness	+	0.439	0.004***	Supported
Ext Pressure -> Environmental Readiness	+	0.690	0.000***	Supported
Environmental Readiness -> Adoption intention	+	0.294	0.001***	Supported
Innovativeness -> Adoption intention	+	0.091	0.236	Not supported
Adoption Intention -> CAATT Usage	+	0.415	0.000***	Supported

***p<0.01; **p<0.05

4.9 Robustness Checks

Cooke (1998, p.209) assert that “...no single procedure is the best however multiple approaches are helpful to ensure the results are robust across methods”. In order to ensure the robustness of the results, a series of additional analyses were conducted on the data (Latan, 2018; Svesson et al., 2018). These series of analyses focused on addressing issues of unobserved heterogeneity and potential nonlinearity of the effects.

In line with the procedure and guidelines suggested by Sarstedt et al. (2019;2017) and Matthews et al. (2016) on the analysis and treatment of unobserved heterogeneity in PLS path models, we initiated the FIMIX-PLS procedure on the data. Considering the minimum sample size requirements to reliably estimate the model (Svesson et al., 2018; Hair et al., 2017), the analysis employed a two-and three-segment approach. The results of the analysis are presented in *Table*

4.12. From the results in *Table 4.12*, it is evident that the two best-performing criteria (Matthews et al., 2016; Sarstedt et al., 2011), Bayesian information criterion (BIC) and the modified Akaike information criterion with factor 4 (AIC₄) both indicate two segments, therefore establishing support for the solution. Also, the two-segment solution exhibits a corresponding normed entropy value above 0.50 (EN= 0.699) indicating that the two segments are clearly separated and distinct. Further analysis was conducted by considering the segment sizes in order to ensure valid group-specific results (Hair et al., 2016). The results suggest that selecting segments greater than two will produce unreasonable and inappropriate as segment three appear “too small” for a valid analysis. Therefore, the results indicate that no significant amount of unobserved heterogeneity exists in the data.

Table 4.9: Robustness Checks: Unobserved Heterogeneity

Criteria	No of Segments		
	1	2	3
LnL	-145.025	-104.074	-76.609
AIC	324.05	278.147	259.218
AIC ₃	341.05	313.147	312.218
AIC ₄	358.05	348.147	365.218
BIC	365.971	364.454	389.911
CAIC	382.971	399.454	442.911
MDL ₅	669.652	989.681	1336.684
EN	n/a	0.699	0.77

Relative Segment Sizes			
No. of Segments	Segment 1	Segment 2	Segment 3
1	1.00		
2	0.667	0.330	
3	0.420	0.322	0.257

“Note: AIC: Akaike’s information criterion; AIC₃: modified AIC with factor 3; AIC₄: modified AIC with factor 4; BIC: Bayesian information criteria; CAIC: consistent AIC; HQ: Hannan Quinn criterion; MDL₅: minimum description length with factor 5; LnL: Log Likelihood; EN: entropy statistic; n/a: not available; numbers in bold indicate the best outcome per segment retention criterion”.

Lastly, an analysis for possible non-linearities in the path model was assessed following the procedure outlined by Svesson et al. (2018), Latan et al., (2018) and Pierce and Auguinis (2013). The structural model was modified by including interaction variables which represent the quadratic effects and nonlinearity in the technology, organisation and environmental characteristics and personal innovativeness influencing adoption behaviour. The bootstrapped results are presented in *Table 4.13*. It is evident from the results in *Table 4.13* that none of the nonlinear effects (quadratic terms) is significant. In line with the arguments of Svesson et al. (2018), the researcher concludes that there exists no evidence of nonlinearity and thus the linear effect model is significant and robust.

Table 4.10: Robustness Checks for Nonlinear Effects

Path	β	p-values
Technology readiness->Adoption Intention	0.040	0.625
Organisation readiness->Adoption Intention	-0.083	0.388
Environmental readiness->Adoption	0.017	0.798
Innovativeness->Adoption Intention	0.096	0.272

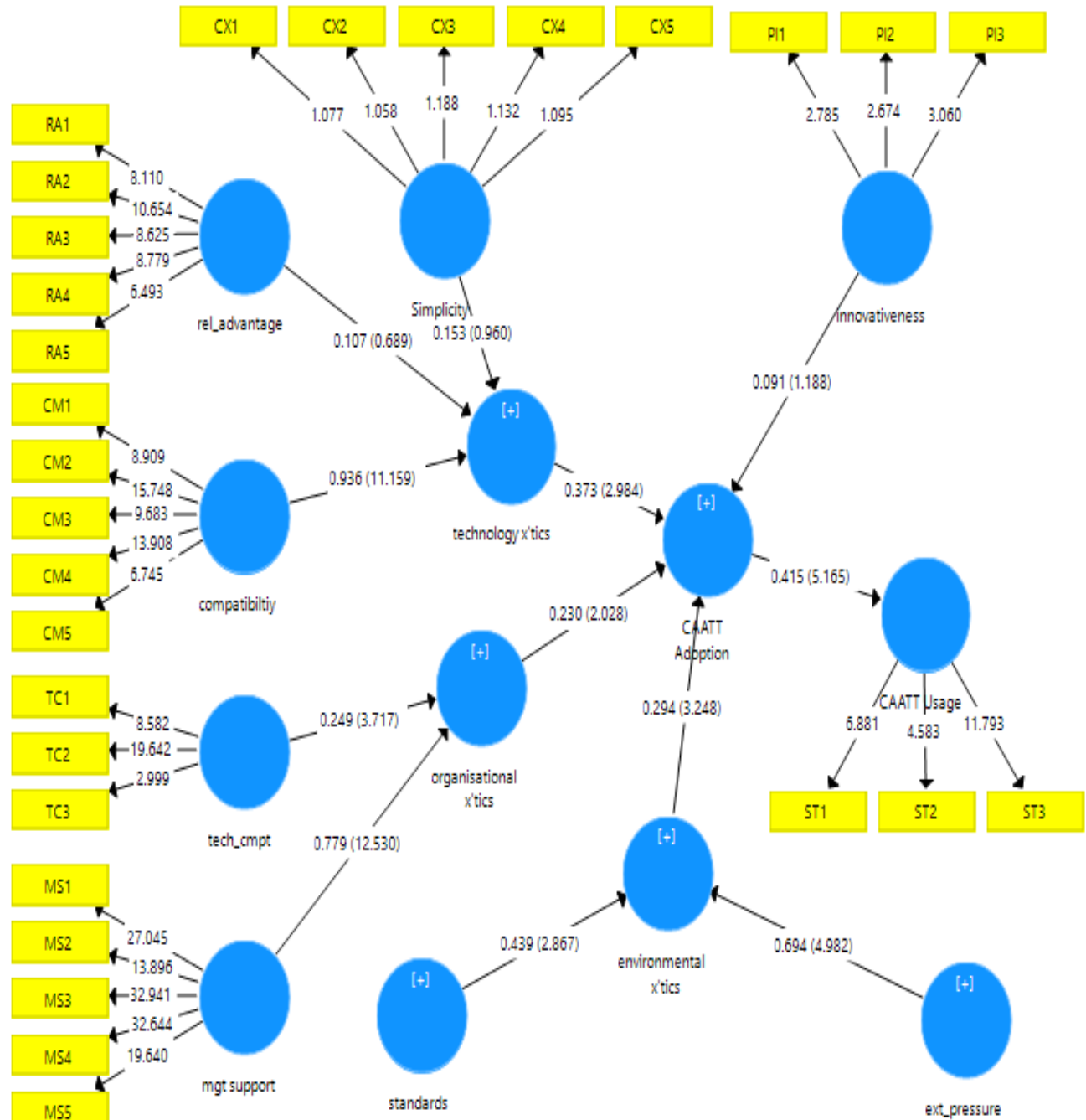


Figure 4.1: A structural model of the technology, organisation and environmental characteristics influencing CAATT adoption.

H1: There is a significant relationship between technology characteristics and technology readiness to adopt CAATT

The technology characteristics employed in this study include the relative advantage, simplicity and compatibility of the technology-based audit software adapted from Rogers' (1965) diffusion of innovation theory for the purpose of this study. From the analysis of the path models in *Table 4.11*, it is evident that all of the technology characteristics employed in this study related positively to technological readiness in line with the hypothesized paths. However, only compatibility ($\beta=0.936$, $p\text{-value}=0.000$) was found to have a significant relationship with technological readiness providing support for hypothesis 1c. The influence of relative advantage and simplicity on technological readiness was found to be positive with beta coefficients of 0.107 and 0.153 and p-values of 0.491 and 0.337 respectively. These results do not provide support for hypotheses 1a and 1b. For instance, we hypothesized that relative advantage and CAATT simplicity will positively contribute to technological readiness. The results suggest evidence of these relationships however, the results show that these factors are not significant in contributing to the formation of technological readiness to adopt and use CAATT.

After testing the existence and strength of these relationships, the formative construct; technological readiness was also tested to establish its influence on CAATT adoption. From the results in *Table 4.11*, it can be observed that technological readiness of CAATT positively influences CAATT adoption decision with a beta coefficient of 0.373 and a p-value of 0.003. Therefore, in tandem with the hypothesized path, the results suggest the existence of a positive and significant relationship between technological readiness of CAATT and adoption intention providing support for H1. This indicates that the characteristics of the innovation itself is a strong

determinant in influencing internal audit units to adopt and use CAATT. Therefore, the results provide support for H1c and H1; however, no support was found for H1a and H1b.

H2: There is a significant relationship between organisational characteristics and organisational readiness to adopt CAATT

With regards to the organisational characteristics, technological competence of the internal audit unit and the perceived level of management support are the constructs that were adapted for the study. The results from the path assessment in *Table 4.11* indicate that all these constructs are significant and positively contribute to organisational readiness to adopt CAATT providing support for H2a, H2b. For instance, technological competence and management support were found to have beta coefficients of 0.249 (p-value=0.000), 0.779 (p-value=0.000) respectively. In line with the hypotheses postulated, all these organisational characteristics exhibit significant positive relationships with organisational readiness to adopt CAATT at the 1% level of significance. The researcher, therefore, continued to test the relationship between the second order construct (organisational readiness) and CAATT adoption intention. The path results from *Table 4.11* indicate that there exists a significant relationship between organisational readiness and CAATT adoption intention within the internal auditing domain with beta coefficient and p-value of 0.230 and 0.043 respectively providing support for hypothesis 2. The results suggest that the characteristics of the organisation are also significant contributors to the decision to adopt and use CAATT within the internal audit department.

H3: There is a significant relationship between environmental characteristics and Environmental readiness to adopt CAATT

Also, for the purpose of this study, the constructs relating to external environment adapted are external pressure and audit standards. We hypothesized that these two constructs will positively

influence the environmental readiness to adopt CAATT. The bootstrapped results in *Table 4.11* clearly suggest that both external pressure and audit standards positively influence CAATT adoption with beta estimates of 0.694 and 0.439 respectively consistent with our hypotheses postulated. Moreover, the external pressure and audit standards constructs were found to have a significant relationship with environmental readiness at the 1% level of significance with p-values of 0.000 and 0.004 respectively.

The researcher proceeded to test the relationship between the formative construct (environmental readiness) and CAATT adoption intention. The bootstrapped results establish that there exists a significant positive influence of environmental readiness on CAATT adoption intention ($\beta = 0.294$, p-value=0.001). The results suggest that level of perceived environmental support has a strong influence on the adoption of technology within the internal audit settings. The bootstrapped results provide support for hypotheses 3a, 3b and 3.

H4: There is a positive relationship between the personal innovativeness of the unit head and CAATT adoption

Following the arguments of Thong (1999) we hypothesized that the innovativeness of the adoption decision maker (internal audit unit head) positively contributes to the adoption of CAATT within the internal audit unit. Consistent with the hypothesized relationship, the results suggest the existence of a positive relationship between the personal innovativeness of the unit head and the decision to adopt and use CAATT within the unit with a beta coefficient of 0.091. However, even though the results were consistent with the hypothesized relationship, this construct was found not to be significant in influencing adoption with a p-value of 0.236. The results suggest that although an innovative head will prefer to adopt and use technology within the unit, their influence on the

adoption decision is however not significant. Thus, the results do not provide support for hypothesis 4.

H5: The behavioural intention to adopt CAATT will positively influence actual CAATT usage

The researcher proceeded to test the relationship between CAATT adoption intention and actual CAATT usage within the internal audit unit by proposing a positive relationship between these two constructs. From the bootstrapped results in *Table 4.11*, it is evident that a significant positive relationship exists between adoption intentions and actual CAATT usage ($\beta=0.415$, $p\text{-value}=0.000$) providing support for hypothesis 5. The results clearly suggest that internal audit units with higher adoption intentions are more likely to adopt and use CAATTs.

4.10 Discussion of Results

4.10.1 Structural Model

Before proceeding to discuss the results of the study, the predictive ability and explanatory capability of the model must be discussed. We evaluated the model quality with the coefficient of determination (R^2), predictive relevance (Q^2) and the effect size of the exogenous constructs. The endogenous variable used is CAATT adoption intention. The results establish that with regards to CAATT adoption intention, an adjusted R^2 estimate of 0.53 was explained by the exogenous variables. This result indicates that the exogenous variables mutually account for 53% of the variation in the dependent variable (CAATT adoption intention). The results further imply that the independent variables mutually exhibit moderate predictive power (Hair et al., 2017; Rigdon, 2012) in explaining the dependent variable.

However, Hair et al. (2017) posit that model complexity, context and research discipline influences R^2 values, therefore, making it difficult to propose acceptable R^2 values and thus these values

should be explained in context and research discipline specific. Furthermore, Sarstedt et al. (2014) assert that exploratory studies normally possess weak to moderate levels of explanatory power. In technology adoption and acceptance literature, a number of studies mostly report R^2 values between 0.2 and 0.5. For instance, Li et al. (2018) in their study on audit analytics usage among internal auditors reported R^2 values of 20.4%, 24.8% and 41.3% for their three endogenous variables. Similarly, Gonzalez et al. (2012) in their study on the adoption of continuous auditing found their model to explain 44.3% of the variation in the dependent variable. Consistent with the findings of prior studies, the researcher concludes that the model accounts for a greater proportion of variation inherent in the dependent variable.

The predictive ability of the structural model was evaluated by adopting Stone-Gaiser's Q^2 criterion (Geisser, 1974; Stone, 1974). Using the blindfolding techniques, we assessed the cross-validated redundancy (Q^2) values. Under this approach, a model is said to have predictive power if the Q^2 values are greater than zero (Hair et al., 2017). With Q^2 estimates of 0.325, the model is assumed to exhibit a higher predictive relevance.

4.10.2 CAATT Adoption and Use within Internal Auditing

Despite the introduction of technology-based auditing tools and applications some decades ago that have gained the attention of academics and practitioners, extant literature indicate that the acceptance rate is low and to date the ability of technology to revolutionise mainstream auditing still remains a façade (Mahzan & Lymer, 2014; Grant Thornton, 2011; KPMG, 2010). The internal auditing context is also yet to catch up with the application of technology albeit the emergence of “Big data” and the automation of business processes require these functional unit of organisations to adopt and utilize these applications in an attempt to improve audit quality and also complement

the professional judgement of auditors (Coderre, 2015; Lombardi, Bloch, & Vasarhelyi, 2014; Vuchnich, 2008).

Consistent with prior studies (Li et al., 2018; Mahzan & Lymer, 2014) the results establish that the adoption rates of technology-based audit tools among internal audit units in Ghana is relatively high as the results in *Table 4.2* indicate. On the contrary the study findings indicate that albeit most internal audit units have adopted in one way or the other a type of CAATT, the ability of the tool to revolutionise auditing within the unit has not been successful. The utilisation of these software is on ad hoc basis and internal auditors' resort to them as and when they deem their usage necessary. The finding is in line with prior literature (Gonzalez et al., 2012) on the usage of continuous auditing among internal auditors. Interestingly and consistent with the findings of Abou-El-Sood et al. (2015), the study found fraud detection and risk assessment as areas or stages where these tools are deployed mostly. This finding suggests that the ability of internal auditors to be employing these tools in these areas of audit demonstrate that internal audit units do not perceive feature/application complexity to be a challenge in the utilisation of these tools as these areas require certain special skills and knowledge before utilisation can be successful. Furthermore, this finding suggests these internal audit units have instituted measures such as complementing their departments with data and IT experts to ameliorate the challenges these tools come with in other to increase their usage in these complex areas. Also, similar to the findings of extant literature on the application of technology within the auditing profession (Abou-El-Sood et al., 2015; Ahmi & Kent, 2012; Mahzan & Lymer, 2014), the findings indicate that generalized audit software (GAS) was the most prominent CAATT type used by internal audit units.

4.10.3 Technology Readiness Influencing CAATT Adoption Intention

This study investigates the broader predictors of the use of technology-based audit tools particularly among internal audit units. Through the lens of the TOE framework, a four-factor model; technology readiness, organisational readiness, environmental readiness and personal innovativeness of the decision maker was developed to predict the determinants of technology adoption within the internal audit setting. Technology readiness was found to be positively related and a strong determinant of the decision to adopt and use CAATT within the internal audit departments. The results suggest that for CAATT adoption and use within internal audit setting, the units are more concerned about the features of the innovation to support the operations of the unit. This result is consistent with findings from prior literature (Yang et al., 2015) that conclude that technology readiness was the most significant contributor to SaaS adoption within organisations.

Compatibility of CAATT to the work of the internal audit unit plays a significant role in the development of the technological readiness associated with these technology-based audit tools as evidenced in the study. This construct was found to be the most important construct of the three technological characteristics used in the study in forming the technological readiness to adopt CAATT. In line with the arguments of Yang et al. (2015), the findings suggest the uniqueness of CAATT as innovation to be used within the unit. Internal audit units are more concerned about how well these technology-based audit tools relate to existing practices and procedures and best practices of the unit. The findings suggest that if the internal audit unit's prior experiences with information technology are consistent and compatible with CAATT, CAATT changes consistent with firm values and beliefs and CAATT adoption will fit well with the style of work of the unit/department, then a positive mindset or perception on CAATT is likely to occur which

ultimately results in the adoption and use of CAATT with the audit department. Consistent with prior studies (Thong,1999; Brown & Russell, 2007; Wang et al., 2010; Ghobakhloo et al., 2011; Yang et al., 2015), the results establish that perceived compatibility of CAATT play a vital role in firm-level decision making to adopt these tools at the organisational level and subsequent use at the individual level. Moreover, the result provides support for Roger's (1965) innovation diffusion theory within the context of internal auditing.

Contrary to our hypothesis, relative advantage and simplicity were found to be insignificant in the formation of technological readiness of the unit to adopt CAATT. These findings are consistent with a strand of prior literature investigating the adoption of innovation (Thong, 1999; Wang et al., 2010; Yang et al., 2015). The insignificance of the relative advantage variable can be attributed to the relative similarities between compatibility variable as evidenced in prior literature (Thong, 1999; Yang et al., 2015). For instance, in studying the adoption of open systems in small organisations, Thong (1999) found that the indicators measuring relative advantage load very well on compatibility and therefore formed a new construct by combining indicators both compatibility and relative advantage. Albeit these variables are insignificant, it does not suggest internal audit departments perceive CAATT to possess a low level of benefits or complex to use as respondents averagely perceived high levels for the items measuring these variables as evidence in *Table 4.4*. The results in *Table 4.4* further suggest that; internal audit units perceive CAATTs to be beneficial to the work of the internal auditor and perceive them to be not so difficult to use.

Unexpectedly and contrary to our hypotheses, CAATT simplicity was found not to be a significant determinant to the formation of technological readiness for CAATT adoption. The relationship of this construct to innovation adoption has produced inconclusive findings in prior literature. Moreover, the insignificance of the CAATT simplicity construct is not farfetched as some prior

literature investigating the adoption of technology within organisations found also did not find this variable to be a significant determinant (Thong, 1999; Yang et al., 2015). This is not surprising as internal auditing is a completely different setting made up of professionals who already perform a more complex task that will require them to apply complex technology whenever they are to carry out these tasks. For instance, the descriptive analysis in the previous sections indicate that technology-based audit tools are mostly applied in fraud detection and risk assessment stages. These areas of audit require complex analytical skills in order to conduct a thorough audit. Moreover, the results suggest that internal audit units have data scientists within them to help ease the complexities these tools may come with and thus resulting in complexity or simplicity of the tool being an insignificant determinant in contributing to the technological readiness to adopt and use CAATT.

Furthermore, the findings of the study establish that internal audit units in forming a positive technological readiness to adopt CAATT place much emphasis on the perceived compatibility associated with these tools rather than the complexities and perceived benefits related to their usage in making a decision on whether to utilise CAATT within the unit or not. Thus, as long as internal auditors perceive these tools as incompatible to their beliefs, values and work style, they would prefer to keep using their traditional approaches to auditing.

4.10.4 Organisational Readiness and CAATT Adoption Intention

With regards to the organisational characteristics, all the variables used in this study were found to possess a significant influence on the formation of organisational readiness to adopt CAATT within the internal audit domain. In assessing the relationship of the individual organisational characteristics on organisational readiness, the level of management support for technology use was found to be the most important construct to facilitate the formation of organisational readiness.

This finding is similar to findings from prior literature on technology adoption in small cloud computing (Yang et al., 2015), RFID adoption (Leimeister, 2009) and within internal auditing (Li et al., 2018). For instance, in studying the value and usage of audit analytics among internal auditors, Li et al. (2018) found the perceived level of top management support to be a significant contributor to the application of technology within the context of internal auditing. The results imply that the behaviour and attitude of firms' management, particularly regarding the use of technology in general, is vital to the decision to adopt CAATT within the context of internal auditing. Top management support is a crucial factor in the adoption of a new innovation because of the role top management plays in championing the vision and commitment in the creation of a positive atmosphere for innovation diffusion. The relevance of top management support for the adoption of CAATT within the internal audit unit is more crucial because of the resource requirements for acquisition, implementation and training the auditors. For instance, a study by AuditNet (2012) found that cost of the CAATT software coupled with training and maintenance cost are some factors influencing the limited use among auditors. The study found that CaseWare IDEA, a popular CAATT software costs \$1995 a year for a single user. Therefore, the unwillingness of top management to dedicate resources to invest in CAATT adoption, implementation and training internal auditors will negatively contribute to the organisational readiness to adopt and use them. Since CAATT have been identified to more effective and beneficial to the work of the internal audit unit, management can improve the rate of adoption and usage by actively emphasizing the need to use technology and provide financial resources to ameliorate the implementation challenges that come along innovation adoption.

The next most significant organisational characteristic to influence organisational readiness to adopt CAATT within the internal audit unit is technological competence. The technological

competence of the internal audit unit was also found to have a significant positive effect on the organisational readiness to adopt CAATT. This finding is also reasonable with findings of similar studies on innovation adoption (Li et al., 2018; Vaserhelyi et al., 2012; Mahzan & Lymer, 2008). Technological competence of an internal audit department is composed of the IT infrastructure (computers, servers and other peripherals) and information system specialists. CAATT are software applications that will require the existence of a strong IT infrastructure before an adoption can occur. Also, the number of information systems specialists an organisation has influenced its technological competence. These specialists possess some special knowledge and skills on data mining and extraction to carry out the complex features CAATT may come with. The presence of these information systems specialists creates a positive atmosphere within the unit that internal auditors can fall on when they encounter any challenge when using these technology-based audit tools. In contrast, internal audit units with limited technologically experienced staff are likely to develop negative attitudes towards organisational readiness to adopt CAATT or seldom use them when adopted. Our findings support the arguments of Rogers (1995), Lin et al. (2007) and Vaserhelyi et al. (2012) that “technological competence is a prerequisite for the successful adoption of technology innovation”. The researcher, therefore, concludes that internal audit departments with greater technology competence will have higher organisational readiness and are more likely to adopt and use CAATT within the audit process.

Lastly, the influence of the organisational readiness formed from the combination of the two constructs (management support and technology competence) of internal audit departments on the CAATT adoption decision and willingness to use them was examined. The findings support hypothesis 2 as we found a significant positive influence of organisational readiness on CAATT adoption and use within the audit process of internal auditors. The findings suggest that internal

audit units with greater organisation readiness are more willing to adopt and use CAATT more frequently within the audit process. The results also suggest that organisational readiness is the least crucial construct after technological readiness and environmental readiness that internal audit units pay much attention to in making a decision to adopt and use CAATT within unit. This finding supports arguments by prior empirical literature (Li et al., 2018; Yang et al., 2015; Thong, 1999) who also found similar results.

4.10.5 Environmental Readiness and CAATT Adoption Intention

Concerning the environmental characteristics influencing environmental readiness to influence adoption, we employed external pressure from external auditors and professional bodies and support from the auditing standards as constructs forming environmental readiness. The results suggest that external pressure has a significant positive influence on the formation of environmental readiness to adopt CAATT. The results imply that the perceived level of support or pressure from external auditors and professional bodies is critical in the formation of an internal audit unit's environmental readiness to adopt and use CAATT. This finding is similar to the findings of prior innovation adoption literature (Li et al., 2018). For instance, Li et al. (2018) found in their study on audit analytics usage within internal audit units that the level of perceived professional support is critical in influencing the use of audit analytics among internal auditors. Also, Wang et al. (2010) found competitive pressure to be a significant determinant of RFID adoption among firms. Internal auditing is an internal advisory body in organisations that do not really have competitive partners. Notwithstanding this attribute, they tend to mimic the activities of their external auditors because the external auditors do rely to some extent on the work of the internal audit unit and will sometimes make recommendations to management about some inherent weaknesses within the unit. CAATT were initially developed to assist the works of external

auditors however, rapid developments within the corporate environment and the perceived benefits associated with the use of CAATT have made it imperative for them to be also adopted within the internal auditing domain. Therefore, external auditors and professional bodies within the auditing ecosystem are supposed to be part of the advocates for the use of CAATT within internal auditing by recommendations coupled with professional support. Because of the external auditors' reliance on the work of the internal auditors, it is not farfetched to assume that the more internal audit units perceive external pressures to be strong, the more environmentally ready and willing to adopt CAATT in their departments, therefore, providing support for hypothesis 3a.

The influence of audit standards and regulators on the formation of environmental readiness to adopt CAATT within the internal audit unit was examined. The findings suggest the existence of a significant and positive relationship between auditing standards and environmental readiness to adopt CAATT. The results also suggest that the attitude and behaviour of standard setters and regulators are very relevant to the decision on whether to adopt CAATT within the internal auditing context. Currently, the auditing standards and standard-setters do not forbid nor encourage the application of data analytics however, recent advancements and the overwhelming relevance and automation of business processes have drawn the attention of regulators to evaluate the need to consider data analytics in the standards as the silence of regulators may be interpreted as a barrier to adoption (IAASB, 2016). Albeit the standards or standard-setters have not stated explicitly provisions for the use of data analytics within the audit process, some auditors have leaned more towards the usage as they argue that the use of technology improves the ability of the auditor to identify relationships and spot inconsistencies, thereby augmenting the auditor's judgement and scepticism. Notwithstanding this deafening silence in the standards, attempts have been made to inculcate the use of technology in some standards (AICPA, 2002). For instance, the

Statement on Auditing Standards No. 99 (SAS 99) highlights the use of technology in risk assessment and fraud detection and also evaluating information in electronic data files. However, a limitation of this standard in support of the use of technology-based audit tools is the absence of a provision on the application of advanced innovation such as data analytics and more sophisticated technology-based audit tools. This limitation has culminated to most adopters expressing concerns about the ability to fit audit evidence generated from data analytics into the audit evidence model within the current standards (IAASB, 2016). Adoption and use of an innovation for which there exists a limited framework by regulators and standards comes at a risk. The auditing profession (both external and internal) is a highly regulated environment such that auditors are more likely not to adopt practices and procedures not explicitly stated by the regulators or within the standards. This finding of the study is reasonable with the above arguments and also in tandem with prior empirical literature (Li et al. 2018) that the attitude of the regulators or standard-setters is very crucial to the formation of environmental readiness by internal audit units to adopt and use these technology-based audit tools in the audit process. Therefore, it is imperative for the audit regulatory bodies, standards setters and other relevant stakeholders to set the tone and also collaborate in exploring how the technological advancements could augment audit quality.

The influence of the environmental readiness of internal audit units on CAATT adoption was examined. The findings support hypothesis 3 as we found a significant positive influence of environmental readiness on CAATT adoption within the audit process of internal auditors. The findings suggest that external pressure and attitude of regulators, standards and standard-setters provide the platform to adopt CAATT within internal audit units. External pressure from auditors and professional bodies as well as the attitude of regulators and standard-setters are consistently the driving forces behind environmental readiness to adopt CAATT within the context of internal

auditing. This finding is reasonable with arguments of the prior empirical literature (Li et al., 2018; Yang et al., 2015; Wang et al., 2010; Mahzan & Lymer, 2008) who also found similar results. We believe that the findings suggest the existence of institutional effects and pressures (coercive and mimetic) on the firms' adoption decision. Our analysis suggests the role of institutions (regulators, standard-setters, professional bodies and external auditors) in affecting the decision-making process of internal audit units to adopt and use CAATT within their departments. The significance of the environmental readiness construct implies that the lag in the adoption and use of CAATT within the internal audit unit can be explained by the absence of external support or coercive pressures from regulators and standard-setters within the auditing profession for the adoption and use of technology-based audit tools.

4.10.6 Unit Head's Innovativeness and CAATT Adoption Intention

Regarding the influence of the personal innovativeness of the audit unit's head on the adoption, contrary to our hypothesis, the findings from the study suggest that personal innovativeness is not a significant determinant in influencing CAATT adoption and use within the internal audit. This finding is reasonable with that of prior literature. Literature on the influence of personal innovativeness on adoption decisions have produced inconclusive findings. While some studies (Ghobakhloo et al., 2011) find this factor to be a significant predictor in the use of an innovation, other studies (Thong, 1999) find it to be insignificant. The findings imply that internal audit units with innovative heads play a role in the adoption and subsequent use of CAATT within the unit however, their influence does not significantly determine whether adoption will occur or not. The insignificance of the innovativeness construct on adoption can be attributed to the type and size of firms employed in this study. The studies that found this construct to be a significant predictor were limited to small and medium enterprises (SMEs). The CEO's of SMEs act as the final

decision makers of their organisations such that the decisions taken are not subject to a review of any sort. However, with regards to the firms used for the purpose of study, all the firms are large firms with a clearly established span of control and organisational structure such that the decisions of the unit head are subject to the review of the management team and board of directors (Audit committee). Audit automation within the internal audit unit requires huge financial resources for training, hardware, software and other miscellaneous cost that requires management's willingness to provide. An innovative unit head in large organisations can only recommend or suggest CAATT adoption to management however, ultimate adoption decision and provision of resources to augment adoption will be taken by management.

4.10.7 CAATT Adoption Intention and Actual CAATT Usage

Consistent with prior literature (Venkatesh et al., 2003; Davies 1989), the findings suggest a strong positive relationship between behavioural intentions and actual usage. The findings establish that internal audit units that develop positive attitudes and intentions to adopt CAATT are more likely to use them. This finding is reasonable with findings of Gonzalez et al. (2012) who studied the intention to use continuous auditing techniques among internal auditors. Furthermore, the findings suggest that technology readiness, organisational readiness and environmental readiness are strong determinants of CAATT actual usage within the internal audit units through the development of strong behavioural intentions to adopt them.

4.11 Chapter Summary

This chapter presented the analysis of the data obtained, findings and a discussion of the major findings of the study. Descriptive statistics of the firms, types of CAATT adopted and stages within the audit process where CAATT are employed mostly were presented with tables. The chapter also indicates the results of the structural modelling of the hypothesized paths using PLS-SEM. The

analysis suggests that CAATT adoption and actual usage within internal audit units is driven by the technological readiness, organisational readiness and environmental readiness. The analysis also revealed that of all the three components, technological readiness was the most important predictor followed by environmental readiness and lastly, organisational readiness.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Chapter Overview

The study sought to investigate the extent of CAATT adoption and usage and the technology, organisation and environmental factors that influence CAATT adoption among internal audit units of firms in Ghana. This concluding chapter summarizes the main findings of the study, conclusions based on the findings of the study are presented and recommendations are also made to improve CAATT adoption process and utilization within the internal audit units.

5.1 Summary of the Study

In an era of rapid technological advancements, the corporate environment has witnessed a surge in innovation investments in an attempt to fully automate the business processes. The auditing profession has therefore been challenged to also invest in technology to be able to conduct effective and reliable audits in these “Big Data” dominated environments. This has necessitated the advent of CAATT, a technology-based audit tool to assist auditors carry out their functions effectively and efficiently in these technology environments. However, prior empirical literature asserts that albeit these tools enhance the work of the auditor, the adoption rates is very low particularly among internal auditors while there is a paucity of literature studying the adoption from a developing country perspective.

It is against this background and problem that this study seeks to examine the extent of adoption among internal audit units of Ghanaian firms and also investigating the factors influencing adoption from the view of technological characteristics, organisational characteristics and environmental characteristics. Specifically, the two objectives were identified in an attempt to

achieve the research purpose. First, the study sought to examine the extent of CAATT adoption among internal audit units of Ghanaian firms. Secondly, to investigate the factors that influence CAATT adoption among internal audit units in Ghana.

The researcher formulated a conceptual framework based on the TOE framework from the review of extant theoretical and empirical literature as the foundational theory in an attempt to achieve the objectives of the study. Twelve (12) hypotheses were further proposed and empirically tested using data obtained from 75 internal audit units surveyed using self-administered questionnaires. Data obtained was analysed using SPSS and PLS-SEM. The results from the study indicated a fairly high CAATT adoption rates among internal audit units however extent of usage fairly low with fraud detection and risk assessment being the areas where CAATT are mostly utilized within the work of the internal audit unit. The structural analyses from PLS-SEM indicated a positive relationship between technological readiness, organisational readiness and environmental readiness and the behavioural intention to adopt CAATT. Further, the results confirmed a positive relationship between behavioural intention to adopt CAATT and actual CAATT adoption within the internal audit unit.

5.2 Summary of Key Findings of the Study

5.2.1 Extent of CAATT Adoption and Usage within the Internal Audit Unit

The first research objective sought to examine the extent of CAATT adoption among internal audit units within Ghanaian firms particularly their adoption status, types of CAATT adopted and the stages within the audit process where CAATT are mostly employed. The findings from the study indicate that the extent of CAATT adoption within firms in Ghana is fairly high as 68% of the sampled firms have adopted a particular CAATT software. Also, consistent with literature (Mustapha & Lai, 2017; Mahzan & Lymer, 2014; Ahmi & Kent, 2012) the results of the study

indicate that Generalized Audit Software is the major CAATT software adopted and used within these firms. Furthermore, to assess the extent of usage within the entire audit process, the results clearly indicate that these technology-based audit tools are mostly used in areas of risk assessment (mean=3.08) and fraud detection (mean=2.89) with the least used stages being substantive test (mean=2.36) and preliminary analytical procedures (mean=2.02). The results show that albeit the advanced features of CAATT are used, their actual utilization rates are low.

The second research objective sought to examine the broader factors that influence organisations to adopt CAATT within their internal audit units through the lens of the TOE framework.

5.2.2 Technology Readiness and CAATT Adoption Intention

The results of the study revealed that the technological readiness of the internal audit unit is a significant contributor to the formulation of adoption intention to adopt CAATT. This finding is consistent with prior technology adoption literature (Li et al., 2018; Wang et al, 2010; Yang et al., 2015). Interestingly, it was evident from the results that the technology readiness of the internal audit unit is the most crucial predictor of CAATT adoption intentions. The results suggest that for CAATT adoption and use within internal audit setting, internal auditors are more concerned about the features of the innovation (perceived benefits, simplicity and compatibility) to support the operations of the unit.

Technology readiness was operationalized as a higher-order construct using the “repeated indicator approach” (Hair et al., 2017;2014; Becker et al., 2012). The first-order constructs used for the purpose of the study include relative advantage, simplicity and compatibility. As evidenced from the results, CAATT compatibility was the most important and significant construct influencing the formulation of technology readiness to adopt them. This finding is reasonable with arguments of prior literature (Yang et al., 2015; Wang et al., 2010). It is interesting to note that internal audit

units are more concerned about the how well these technology-based audit tools relate to existing practices and procedures and best practices of the of the organisation.

Albeit, relative advantage and CAATT simplicity positively relate to technology readiness, they are not significant. This implies that although organisations take into consideration the relative benefits offered by CAATT their associated related difficulties, they do not contribute significantly to the development of technology readiness to adopt them.

The findings imply that when organisations or the audit unit's prior experiences with information technology are consistent and compatible with CAATT, CAATT changes consistent with firm values and beliefs and CAATT adoption will fit well with the style of work of the unit/department, then a positive mindset or perception on CAATT readiness is likely to occur which ultimately results in the adoption and use of CAATT with the audit department.

5.2.3 Organisational Readiness and CAATT Adoption Intention

Organisational readiness was found to be significant and positively related to CAATT adoption intention. The organisational readiness construct was operationalized with first-order constructs; management support and technological competence as characteristics of the organisation. All the first-order variables were found to possess a strong positive influence on the formation of organisational readiness to adopt CAATT. This suggests that internal audit units in firms with greater levels perceived support from top management, available data scientists or experts and IT infrastructure are more likely to develop positive CAATT adoption intentions. This finding is consistent with arguments of prior literature on technology adoption in cloud computing (Yang et al., 2015), RFID adoption (Leimeister, 2009; Wang et al., 2010) and auditing (Li et al., 2018).

5.2.4 Environmental Readiness and CAATT Adoption Intention

With regards to the environmental characteristics influencing CAATT adoption intention, environmental readiness was modelled as a second-order construct comprising audit standards and external pressure as direct determinants of environmental readiness. Both auditing standards and external pressures from regulators, standard setters and external auditors were found to be significant contributors to the formation of environmental readiness to adopt CAATT. The higher order-construct (environmental readiness) also exhibits a strong positive relationship with the behavioural intention to adopt CAATT. This implies that organisations are more willing develop adoption intentions of a technology-based audit tool when they perceive strong pressures from the standard setters, professional bodies, regulators and the standards guiding the auditing practice. This finding is also in tandem with prior literature on technology adoption (Yang et al., 2015; Wang et al., 2010). The results further suggest the role of institutions (regulators, standard-setters, professional bodies and external auditors) in affecting the decision-making process of internal audit units to adopt and use CAATT in the organisations they operate within.

5.2.5 Personal Innovativeness and CAATT Adoption Intention

The role of the internal audit unit head's innovativeness was examined as a predictor of the behavioural intention to adopt CAATT. The findings indicate that even though there exists a positive relationship between personal innovativeness and adoption intentions, this relationship is not significant. Research on the relationship between personal innovativeness and adoption have produced inconclusive findings (Ghobakhloo et al., 2011; Thong, 1999). The finding implies that unit head's innovativeness is key to the development of the adoption intention; however, its effect is not significant. However, the insignificance of this variable can be attributed to the type and size

of organisations employed in this study as prior works were mostly limited to small and medium enterprises with the CEO making all the major decisions.

5.2.6 CAATT Adoption Intention and Actual Adoption

Lastly, the relationship between CAATT adoption intention and actual adoption was examined. Consistent with prior technology adoption literature (Venkatesh et al., 2003; Davies, 1989), the findings indicate a strong positive influence between behavioural intention to adopt and use CAATT and the actual adoption. This implies that internal audit units in firms that have developed positive attitudes and intentions to adopt and use a technology-based audit tool are more willing to actually adopt and utilize them in their task engagements. With regards to literature on technology adoption within the auditing environment, this finding resonates with the arguments of Gonzalez et al. (2012) who also examined the adoption of continuous auditing among internal auditors. The findings further imply that technology readiness, organisational readiness and environmental readiness are strong predictors of CAATT adoption and usage in organisations through the development of positive behavioural intentions to adopt.

5.3 Conclusion

The automation of the business processes of organisations has resulted in improvements in efficiency and effectiveness while further reducing their cost of operations. However, the auditing environment particularly the internal auditing domain has been overwhelmed with “big data” created as a result of the automation. Thus, the absence of technology in these control environments dominated by “big data” will render the auditors ineffective and inefficient in conducting reliable, comprehensive and quality audits. The analysis of the data obtained coupled with the findings of the study provide the framework for some generalization concerning the

adoption of CAATT among internal audit units within Ghanaian firms and the factors spurring the adoption process.

The first objective of the study was on the extent of CAATT adoption among internal audit units within Ghanaian firms. This was operationalized by examining the adoption status of firms in Ghana, the type of CAATT adopted and the areas in the audit processes or stages where CAATT are mostly employed within the task of the unit. It could be concluded based on the findings that the adoption rates among internal audit units within organisations in Ghana is fairly high however, extent of usage within the audit process is still fairly low. Also, Generalized Audit Software (GAS) was the most popular CAATT type adopted by these organisations albeit some internal audit units employ more than one specific CAATT type. Furthermore, it could be concluded that risk assessment and fraud detection are the areas within the audit process where CAATT are mostly employed within the work of the internal audit unit.

The findings also suggest that CAATT adoption within organisations is influenced by the features of the innovation, firm and the environment in which the firm exists. With regards to the features of CAATT influencing adoption intentions, it could be concluded that CAATT compatibility to the work the internal audit unit is very crucial as compared to the perceived benefits and ease of use associated. Concerning the organisational characteristics, both management support and technological competence are also vital to the formulation of positive adoption intentions. Furthermore, support from the standards on CAATT usage and perceived pressures from regulators, professional bodies and standard setters are some environmental characteristics predicting adoption intentions. It is reasonable to also conclude that the innovativeness of the head of the internal audit unit is not a strong predictor of adoption. Lastly, CAATT adoption and usage

within organisations are influenced by their technological readiness, organisational readiness and environmental readiness through the development of positive behavioural intentions to adopt them.

To conclude, the study sought to examine the extent of CAATT adoption among internal audit units within Ghanaian firms and the factors influencing the adoption. The results give credence to the arguments of the proponents of the TOE framework that the adoption and usage of technology in organisations is driven by the features of the innovation, organisational characteristics and features of the external environment within which the firm exists.

5.4 Recommendations

From the results of the study, it was evident that CAATT usage within organisations is fairly low as compared to the fairly high rate of adoption. The results in from this study should be valuable to practitioners, regulators and management. Since standards and pressures from regulators and professional bodies are found to be strong drivers, it is therefore recommended that standards guiding the auditing profession should be revised to reflect current developments in the Big data dominated corporate environment and how audit evidence obtained from data analytics can fit well within the provisions of the standards. Also, organisations should invest more in the technological competencies of their internal audit departments through training workshops on data analytics and technology-based audit tools, hiring more data scientists and equipping internal audit units with the IT infrastructure to support the frequent use and automation of the internal audit process in order to complement the professional judgement of the internal auditor.

Furthermore, seminars and workshops should be organised for internal audit unit heads by the audit regulators, standard setters and professional bodies on the need to embrace technology and data analytics within the work of the internal audit unit. Regulators and professional bodies can

help develop rules and guidelines to encourage the adoption and use of CAATTs within organisations. Lastly, more effort is needed in ensuring that CAATT are compatible with the work of the internal audit unit to enable the complete automation of the audit process.

5.5 Research Contributions

5.5.1 Contributions to Research

The study examines the extent CAATT adoption among internal audit units within Ghanaian firms and the factors driving the adoption process. The literature on technology adoption within the context of internal auditing has been sparse with much focus on external auditing. Therefore, the study contributes to both theoretical and empirical literature on firms' technology adoption within the internal audit setting with a focus on the broad factors driving adoption within organisations.

Conclusive empirical evidence has been offered which suggests that the adoption of CAATT among internal audit units within organisations is relatively higher, however, the extent of their use or application is low as most internal audit units employ them on ad hoc basis. The findings corroborate arguments of prior literature (Mahzan & Lymer, 2014; Gonzalez et al., 2012; Ahmi & Kent, 2012) that adoption rates among auditors tend to be fairly high, the extent of usage still low. Fraud detection and risks assessments are areas where organisations perceive CAATT were adding value to.

Moreover, the study adds to extant research by examining the factors driving CAATT adoption within organisations through the lens of the TOE framework. The study extends the TOE framework by using the hierarchical modelling technique and formative constructs to predict adoption behaviour and actual adoption and usage. This modelling approach captures the effects of the technology, organisation and environmental variables contributing to CAATT adoption. Moreover, this modelling technique highlights the spirit and theoretical arguments of the

proponents of the TOE framework regarding how indispensable and inter-related these three factors are to the successful adoption of technology within and organisational context. Prior literature that adopted this framework modelled the various factors separately with much emphasis of the technology characteristics as direct determinants or predictors of adoption behaviour which makes it challenging to assess the relative value of each of these aspects to technology adoption. The study further contributes to the limited literature on internal auditing.

5.5.2 Contributions to Practice

To practice, the study provides empirical evidence relating to the crucial factors needed to ensure widespread adoption and use of CAATT within an organisation. CAATT compatibility to the task of the internal audit unit was found to be key in contributing to technological readiness. Therefore, software providers are required to tailor these tools to the specific tasks of the internal audit unit in order to improve adoption and usage since technological readiness is a strong determinant of actual usage. Also, the findings of the study provide guidelines to organisations concerning the effective mechanisms in improving audit quality and CAATT usage by employing competent auditors and data scientists and providing IT infrastructure and financial resources. Since the behaviour of regulators, professional bodies and standard setters towards the use of CAATT is shown to be a strong driver, the study provides vital insights particularly on how standards on CAATT usage are important to promote the successful automation of internal auditing.

5.6 Recommendations for Future Research

Notwithstanding these contributions to literature, there still remain several opportunities which should be addressed in further studies. First, future studies can extend and replicate this study within the context of external auditing particularly the small and medium practising (SMP's) firms through the lens of an organisational level theory. Extant literature on CAATT adoption on

external auditing focuses on the Big 4 audit firms with emphases on individual intentions using individual-level theories. Additionally, it is worthwhile to investigate the influence of internal audit units' analytical work on the workload of external auditors' workload, audit fees and audit quality. Last, a comparative study between internal auditors and external auditors could be conducted to examine the relationship between CAATT features and perceived complexity on adoption and utilisation.

5.7 Limitations of the Study

The researcher acknowledges some limitations this study suffers from and results should be interpreted with a fair idea the various limitations. The first limitation relates to the sample used for the study. Owing to this sample size limitation, it was not possible to conduct “multi-group analysis” to examine the effects of ownership type and industry on the adoption and usage. This test will shrink our sample so low to the level where it will be difficult to generate robust results. Future research can address this limitation by involving more organisations in the sample. Also, due to the small nature of the sample, the researcher employed the PLS-SEM to measure the psychological outcomes instead of the actual adoption decision which is a binary variable. Future research can address this limitation with a larger sample size and employ binary logistic regression to distinguish between adopters and non-adopters. Lastly, the study was conducted within the context of internal auditing within organisations. Thus, the results may only be pertinent to the economic and regulatory context of internal auditing. Notwithstanding these limitations, the research highlights valuable insights into literature on the adoption of CAATT within organisations.

5.8 Chapter Summary

This chapter concludes the study. It provides a summary of the findings of the study, in the light of the objectives this study sought to achieve. Conclusions derived at the end of the study were also presented and some recommendations proposed for managers and future researchers in tandem with the findings made.

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APPENDIX A – RESEARCH INSTRUMENT

DEPARTMENT OF ACCOUNTING

Dear Respondent,

The bearer of this questionnaire is a student of the University of Ghana Business School pursuing **MPhil in Accounting**. He is conducting a survey on “**Adoption of computer-assisted audit tools and techniques among internal auditors in Ghana**”. Please kindly respond to the following questions for the student. Your responses will be duly appreciated and treated with utmost confidentiality.

Please tick [] where appropriate.

Section A: Socio-Demographic Characteristics of the Organisation

1. Organisational Ownership Private Sector [] State-Owned Enterprise []
2. If private, is your organisation listed on the Ghana Stock Exchange? Yes [] No []
3. Is the organisation listed as part of the Ghana Club 100 for 2018? Yes [] No []
4. Please indicate the industry your organisation is primarily engaged in.

5. Has your unit adopted a CAATT software? Yes [] No []
6. If adopted, please indicate the type of CAATT used within the unit. [Multiple responses are allowed] Generalized audit software [] Electronic working papers [] Continuous auditing [] Network security testing [] Audit analytics []
 Other:

Section B: *The following questions seek to ascertain respondent’s perception about the extent Computer-assisted audit tools and techniques are used within the internal audit unit. Answer this section only if your unit has adopted any form of CAATT. If not Adopted, please move to Section C.*

7. Please provide your opinion regarding CAATT utilisation within the unit
 1=Strongly Disagree 2=Disagree 3=Somewhat Disagree 4=Neither Agree nor Disagree 5=Somewhat Agree 6=Agree 7=Strongly Agree

	1	2	3	4	5	6	7
My unit intends to adopt CAATT							
We intend to use CAATT as a supplement of the audit function							
I think we will use CAATT in every task							

In general, I think we will employ CAATT as a basis of the audit function							
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9. Please indicate the extent of CAATT usage in the different stages of audit (Preliminary analytical procedures, risk assessment, substantive test and fraud detection)

	Never	Rarely	Sometimes	Frequently	Every time
Preliminary analytical procedures					
Risk assessment					
Substantive test					
Fraud detection					

Section C: The following questions seek to ascertain respondent's perception on the factors that influenced or will influence the adoption of CAATT within the internal audit unit.

10. Please indicate how you agree or disagree with the following statements

1=Strongly Disagree 2=Disagree 3=Somewhat Disagree 4=Neither Agree nor Disagree
5=Somewhat Agree 6=Agree 7=Strongly Agree

	Relative Advantage	1	2	3	4	5	6	7
RA1	My unit expects CAATT to improve our ability to identify more anomalies							
RA2	My unit expects CAATT to improve the audit quality of the unit							
RA3	My unit expects CAATT to improve our audit effectiveness							
RA4	My unit expects CAATT to improve our productivity							
RA5	CAATT are likely to make audits easier for the unit							
RA6	In general, my unit expects CAATT to be of an advantage to our tasks							
	Complexity	1	2	3	4	5	6	7
CX1	My unit believes CAATT are complex and complicated to use							
CX2	My unit believes interacting with CAATT will be difficult and not easily understandable							
CX3	My unit believes that CAATT development will not be easy							
CX4	My unit believes that CAATT implementation will involve too much time from of our normal duties							

CX5	My unit believes that learning to use CAATT will take a longer period							
CX6	It is likely that it will be difficult for my unit to become skilful in CAATT usage							
	Compatibility	1	2	3	4	5	6	7
CM1	The changes introduced by CAATT are likely to be consistent with my firms existing values/beliefs							
CM2	CAATT adoption will be compatible with existing information infrastructure							
CM3	The changes introduced by CAATT will be consistent with prior practices and procedures							
CM4	CAATT adoption will be compatible with my firms existing experiences with similar systems or technology							
CM5	I think that CAATT implementation will fit well with our work style							
	Technological Competence	1	2	3	4	5	6	7
TC1	The technology infrastructure of my unit is available to support CAATT							
TC2	My company is dedicated to ensuring that employees are familiar with IT related software							
TC3	My unit has a high-level audit technology related knowledge							
	Management Support	1	2	3	4	5	6	7
MS1	My top management is likely to support the financing and maintenance of an audit software							
MS2	Management requires auditors to attend regular CAATT workshops and training							
MS3	Management is willing to support the use of CAATT							
MS4	Management will provide financial support for CAATT training							
MS5	Management requires the use of CAATT frequently							
	Firm Size	1	2	3	4	5	6	7
FS1	The capital of my company is high compared to the industry							
FS2	The revenue of my company is high compared to the industry							
FS3	The number of employees in my company is high compared to the industry							
	Audit Standards	1	2	3	4	5	6	7

AS1	Standards encourage the use of various analytical methods to detect misstatements							
AS2	Standards recommend the use of audit software in the internal audit function							
AS3	Standards recommend the use of advanced analytics to enhance internal audit function reliability							
AS4	If ICAG provides guidance on how to use CAATT in audit procedures, I will be willing to use them							
	External Pressure	1	2	3	4	5	6	7
EP1	The external auditors of my organisation recommend the use of CAATT							
EP2	The external auditors of my organisation use CAATT in their engagement with us							
EP3	Our external auditors are willing to provide support for the use of CAATT							
EP4	The use of technology will differentiate my unit from other departments							
EP5	I think my unit experienced competitive pressures to use CAATT							
EP6	My professional association requires us to use CAATT							
	Personal Innovativeness	1	2	3	4	5	6	7
PI1	If I heard about a new information technology, I would look for ways to experiment with it							
PI2	I like to experiment with new information technologies							
PI3	Among my peers, I am usually the first to try out new information technologies							
PI4	I think I am more hesitant to try out new information technologies							

APPENDIX B – ETHICAL CLEARANCE



UNIVERSITY OF GHANA
ETHICS COMMITTEE FOR THE HUMANITIES (ECH)

P. O. Box LG 74, Legon, Accra, Ghana

My Ref. No.....

28th March, 2019

Mr. Benjamin Awuah
Department of Accounting
University of Ghana
Legon

Dear Mr. Awuah,

**ECH 066/18-19: ADOPTION OF COMPUTER – ASSISTED AUDIT TOOLS AND TECHNIQUES
AMONG INTERNAL AUDITORS.**

This is to advise you that the above reference study has been presented to the Ethics Committee for the Humanities for a full board review and the following actions taken subject to the conditions and explanation provided below:

Expiry Date:	22/03/20
On Agenda for:	Initial submission
Date of Submission:	19/11/18
ECH Action:	Approved
Reporting:	Bi-Annually



Please accept my congratulations.

Yours Sincerely,

Prof. C. Charles Mate-Kole.
ECH Vice Chair

Cc: Dr. Joseph Mensah Onumah, Department of Accounting, UGBS, UG.
Dr. Ibrahim Bedi, Department of Accounting, UGBS, UG.

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