Adoption of Generalised Audit Software (GAS) by External Auditors in the UK

A thesis submitted in partial fulfilment of the requirement for the degree of Doctor of Philosophy

by

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Abbreviations

The following abbreviations are used in this thesis:

AAPA	The Association of Authorised Public Accountants
ACCA	Association of Chartered Certified Accountants
ACL	Audit Command Language
AICPA	American Institute of Certified Public Accountant
APB	Auditing Practices Board
ASB	Auditing Standard Board
CAATs	Computerised Assisted Audit Tools
CAATTs	Computerised Assisted Audit Tools and Techniques
CAI	The Institute of Chartered Accountants in Ireland
CIFPA	The Chartered Institute of Public Finance and Accountancy
EAMs	Embedded Audit Modules
GAS	Generalised Audit Software
GASI	Generalised Audit Software over the Internet
ICAEW	The Institute of Chartered Accountants in England and Wales
ICAS	The Institute of Chartered Accountants of Scotland
ICT	Information and Communication Technologies
IDEA	Interactive Data Extraction and Analysis
IDT	Innovation Diffusion Theory
IFAC	International Federation of Accountants
IIA	The institute of Internal Auditors
IS	Information Systems
ISA	International Standards on Auditing (UK and Ireland)
ISACA	Information Systems Audit Control Association
IT	Information Technology
ITF	Integrated Test Facility
MM	Motivational Model
MPCU	Model of Personal Computer Utilization
PASW	Predictive Analytics Software
PCA	Principles Component Analysis
PCAOB	Public Company Accounting Oversight Board
RSB	Recognised Supervisory Body
SAS	Statement on Auditing Standard
SAS	Statistical Analysis System
SCT	Social Cognitive Theory
SMEs	Small and Medium Sized Enterprises
SPSS	Statistical Package for Social Sciences
TAM	Technology Acceptance Model
TOE	Technology-Organisation-Environment
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
TTF	Task-Technology Fit
UTAUT	Unified Theory of Acceptance and Use of Technology

Abstract

This research is motivated by the interest in understanding the usage of the Generalised Audit Software (GAS) by external auditors within public accounting firms. GAS is a tool used by auditors to automate various audit tasks. It helps auditors to analyse accounting data electronically where it is quite impossible to do so manually. GAS is claimed to be the most influential Computer Assisted Audit Tools and Technique (CAATTs) that can facilitate the audit objective. However, research has found that there is little evidence that auditors have extensively adopted GAS. Even greater benefits have been promoted since the existence of GAS, but auditors do not really seem to be interested in this tool.

Most previous studies have focused on either internal auditors, large accounting firms, other countries or merely adopters of GAS. However, there is little evidence that the study of GAS has been conducted on external auditors, especially in small and medium sized accounting firms in the United Kingdom (UK). This study helps to fill this gap by exploring the use of GAS among them, and covers both adopters and non-adopters of GAS.

Through an online survey using both close and open-ended questions, this issue has been investigated among registered statutory auditors. The primary aim of this study is to explore the current usage of GAS and to understand the factors that influence the use of GAS as well as the perceptions and expectations of using GAS. The views are gathered from both auditors who are already implementing GAS and those who are not using GAS. A framework was developed to identify a range of relevant factors which are important when considering the application of GAS. Responses from 205 statutory auditors across the UK were then mapped against the framework.

Of the 14 variables used to test the factors that influence the use of GAS, only six of them are found to be significant from logistic regression analysis. These are firm size, experience of auditors in computerised auditing, organisational influence, client factor, audit engagement allocation and perceived usefulness. The findings show that the utilisations of GAS is unusually low among audit firms in the UK.

Almost 73% of external auditors make no use of GAS, due to the limited perceived benefit of using GAS for auditing small clients. While some respondents recognised the advantages of GAS, they were put off by what they believed to be high implementation costs; the significant learning curve and adoption process; and lack of ease of use. Some auditors expressed their awareness of GAS, but most of them showed a preference for using traditional auditing methods instead. A few problems have also been identified in causing the limitation of GAS usage. This study contributes to the literature on suggestions to improve the use of GAS that can be used by small and medium sized public accounting firm, which is lacking in existing research related to this group.

In sum, this study has deepened current understanding of the GAS usage among small and medium sized audit firms in the UK, and has provided useful insights for audit professionals, software developers, vendors, standards setters, academicians and researchers. This study has also opened up the possibilities for further study on GAS or related areas either in the UK or other places in the world.

Keywords: Computerised Auditing, Generalised Audit Software, Computerised Assisted Audit Tools and Techniques

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Chapter 1: Introduction

1.1 RESEARCH BACKGROUND

Today's organisations rely heavily on information technology to manage daily transactions and accounting records. Popular accounting software provider, Sage (www.sage.co.uk) reported that they already provided software and services to over 760,000 small and medium-sized businesses in the UK. This shows that all of the accounting data is stored electronically. The goal of an auditor is to provide an opinion to the stakeholders that those accounting records are prepared in a true and fair way. To achieve this goal, they have to validate the accuracy of the financial records and the reliability of the systems that process and store those transactions (Flowerday *et al.*, 2006).

As more of the evidence they use becomes electronic and paperless, auditors must change their audit techniques (Mancuso, 1997). The focus of the audit should shift from manual detection to technology-based prevention (Bierstaker *et al.*, 2001). There are well established tools developed which can assist auditors in achieving audit objectives. For example, Computer Assisted Auditing Tools and Techniques (CAATTs) have been developed to assist auditors in performing audits on computerised accountancy data. Generalized Audit Software (GAS) is one of the

most commonly used types of CAATTs (Singleton, 2006; Wehner and Jessup, 2005; Debreceny *et al.*, 2005; Braun and Davis, 2003; Lovata, 1988). GAS is used by auditors to analyse and audit either live or extracted data from a wide range of applications (Debreceny *et al.* 2005). GAS also includes several tools that enable the extraction of data from a client's system and analysis of that data, statistical analysis and audit expert systems (Debreceny *et al.*, 2005, Hunton, Bryant and Bagranoff, 2004).

However, research has found that the use of GAS is minimal. For instance, Brooks & Lanza (2006) found that auditors are slow to adopt GAS, professional software that has been designed for their needs. So, one of the focuses of this research is on gaining and understanding of what are the factors that influence the auditors to use GAS.

To date, as shown in Appendix I, there are a few papers which try to investigate and understand GAS usage especially from the perspective of the auditors who use the software primarily from the big accounting firms. However, very few seek to understand the phenomenon of low adoption of these tools especially from the perspective of auditors who are not using the software and from the small and medium size practices. While there has been previous research into the adoption of GAS, very little research has focused on its use for external auditing. Existing research focuses either on internal auditing, or on a mixture of internal and external auditing. This study intends to fill the gap in the research literature by evaluating the nature and extent of the utilization of GAS by external auditors.

1.2 RESEARCH GAP AND JUSTIFICATION

Accounting information systems data is continually exposed to many risks and threats. For example, every day, reports can be found in accounting and financial publications about computer related data errors, incorrect financial information, violation of internal controls, thefts, burglaries, fires and sabotage (Abu-Musa, 2007). Auditing is one of the ways to make sure that the data that has been prepared for accounting reports is free from errors and misstatements. By using the appropriate

tools such as GAS or any CAATTs, it is expected to be helpful and will enhance the effectiveness and efficiency of the auditing.

Notwithstanding the great effort employed by the different scholars in studying the use of GAS by auditors, there are some gaps which are needed to be filled. There are five essential points that may be noticed.

Firstly, many researchers have investigated the use of technology by the auditors which is related to audit software or CAATTs. For example, there are 14 papers as shown in Appendix I have been published in understanding the use of GAS by auditors. While most researchers have looked into the adoption of audit software, few papers have discussed its usage by external auditors. The rest have focused more specifically focused on internal auditors, which have different objectives in term of audits. Different types of auditors have different structures and different audit objectives. Hence, the factors that will lead to the usage of GAS will be different. For example, an internal auditor who works within the organisation has direct access to an organisation's information systems, while an external auditor who works outside the organisation has more limited access to client data. Both internal and external auditors also have different audit objectives where internal auditors focus more on operational audit, while external auditors are more focused on statutory annual financial statement auditing.

Secondly, most previous research focuses more on big size accounting firms, which have a lot of resources to use GAS. There is very little study focus on the small and medium size of public accounting firms. The factors that influence the usage of GAS might be different, due to the different sizes of the audit firms. Thus, this study will only focus on smaller and mid-tier audit practices.

Thirdly, there is no research about the adoption of GAS or CAATTs or any audit technology by external auditors that has been conducted in the UK. There are a few studies have been conducted in the USA (Janvrin *et al.*, 2008 & 2009; Curtis & Payne, 2008; Wehner and Jessup, 2005), Singapore (Debreceny *et al.*, 2008), Malaysia (Ismail and Zainol Abidin, 2009) and Germany (Greenstein-Prosh *et al.*, 2008). However, no literature has been found concerning technology adoption by

external auditors in this country. As the UK is a technologically advanced economy and one of the very few countries that have played a significant role in the standardisation of modern audit practices (Omoteso *et al.*, 2008), it seems important to investigate the current usage and practices of GAS. UK, which is one of developed countries, is expected to have high numbers of GAS adoption among external auditors.

Fourthly, apart from the study as listed in the Appendix I, some surveys have been conducted by accounting bodies i.e. The Chartered Institute of Public Finance and Accountancy (CIFPA, 2003); Annual Software Survey from 1995 to 2006 by The Institute of Internal Auditor (IIA) and the IIA Dallas Chapter, 2002. However, these surveys only apply to adopters of GAS. The issues and the problems faced by non-adopters are yet to be discovered. Thus, this study will investigate the explanation of GAS usage for both groups.

Fifthly, previous research has found out that there is no or very little evidence that GAS has been used by external auditors. For example, Janvrin *et al.* (2008) found that there is the lowest use of technology, and Debreceny *et al.* (2005) found that there is no evidence that GAS is used by external auditors. Nonetheless, the reasons for this have yet been raised, while since the day GAS exists, it has been promoted to help the auditor to work effectively and efficiently. Therefore, the problems faced by external auditors need to be exposed. Consequently, further improvement can be made in order for them to utilise the available technology already specifically designed for them.

1.3 RESEARCH AIM, OBJECTIVES AND RESEARCH QUESTIONS

The purpose of this study is to examine the use of GAS by external auditors in the UK. The researcher will try to identify the usage of the GAS among the external auditors, the factors that influence the use of GAS and the problems that they face in using GAS. At the same time, this study seeks to identify the way in which the use of GAS can be improved. To understand this research better, the research aim,

objectives and research questions are posited. These are dealt with in the following subsections.

1.3.1 Aim of this research

The primary aim of this research is to explore the current usage of GAS and to understand the factors that influence the use of GAS, as well as the perceptions and expectations of using GAS among external auditors in the UK. Based on the results of the study, the research model will be developed.

1.3.2 Research Objectives and Research Questions

The research objectives and research questions addressed in this study will deal with current usage, the factors that influence the usage and the problems faced when adopting GAS. In accordance with the research aim, a number of objectives have been identified. These objectives will then lead to the research questions that underlie this study.

Objective 1: To explore the current usage of GAS among external auditors

This first objective is to obtain a general view of the usage of GAS among external auditors in the UK. This includes the current state of adoption of GAS, the type of GAS that has been used, the specific area of audit that GAS has been implemented, the techniques of GAS that has been implemented and the satisfaction of GAS usage.

Based on this objective, the following research questions have been posed:
RQ1: What is the current state of GAS usage among external auditors in the UK?
RQ2: What type of GAS have external auditors used?
RQ3: In which type of audit has GAS been implemented?
RQ4: What are the techniques that have been used in GAS?
RQ5: How satisfied are the auditors with GAS?

Objective 2: To investigate the factors that influence the usage and non-usage of GAS by external auditors

Research has found that the use of GAS is minimal especially by external auditors (Curtis and Payne, 2008). While, Debreceny *et al.* (2005) found that there is no evidence that GAS has been used by external auditors. A few reasons found by them are that the external auditors are more concerned about testing the compliance and effectiveness of internal control rather than substantive testing in using GAS. It is also too risky to allow auditors to extract the entire organisation data themselves. Rather, exception reports are given to maintain data secrecy. Furthermore, it is impossible to test millions of transactions for the big organisation such as banks. Other reasons include further limitation of GAS as discussed in Chapter 2.

This objective centres on the need to find out convincing reasons why most of the public accounting firms are not using GAS while the technologies have offered the potential to help increase the efficiency and improve effectiveness of the audit process. More specifically, the factors that influence the usage or non-usage of GAS will be investigated. Some variables will be identified from the literature, and other variables will be analysed from factor analysis.

The next research questions posed are:
RQ6: What are the factors that influence the use of GAS by external auditors?
RQ7: Do external auditors who are not using GAS intend to utilise GAS?

Objective 3: To identify the problems with GAS

In order to understand the minimum adoption of GAS, a few open-ended questions have been asked from both perspectives of auditors who are using GAS and those who are not using GAS. This will provide the auditors with a level of flexibility to express their perception, as well as gain hands on experience with GAS in terms of the problems and worth of investing in GAS within their firm.

The next research questions posed are:
RQ8: What are the problems of GAS?

RQ9: Does the adoption of GAS give rise to the sufficient value in terms of cost and effort?

Objective 4: To identify how the use of GAS by external auditors can be improved

There are many possible reasons why auditors do or do not use GAS in auditing. GAS is typically technically complicated and is not intuitive for auditors to use. But there are some ways by which the use of GAS can be improved. There are probably some requirements missing to fulfil the auditor's need especially for those who are not 'so called' technology experts as most of the financial auditors come from accounting backgrounds rather than IT backgrounds. There are a few techniques that have been proposed in a few research to improve the use of GAS. For example, Gehrke and Wolf (2010) have proposed Web 2.0-based GAS where the auditors can develop and share audit procedures using a collective intelligence approach through the audit community. Liang *et al.* (2001) and Shaikh (2005), meanwhile, suggested a new electronic audit framework called generalised audit software over the Internet (GASI) that can be designed and deployed from the auditee's EDP systems. From this study, the suggestion and recommendation from auditors will be gathered in order to improve the use of GAS in the future.

The next research question posed is:
RQ10: How GAS can be improved to be used by external auditors?

Objective 5: To develop a GAS adoption model

The fifth objective is to develop a GAS adoption model by external auditors in small and medium sized audit firms in the UK. Identifying the factors that contribute to the usage of GAS by external auditors, the satisfaction of GAS, the worth of GAS to the audit community, the intentions to adopt GAS, the problems of GAS and the recommendations to improved GAS will perhaps provide an understanding of GAS adoption by external auditors in the UK as well as in other countries. This model will be developed based on the findings and result from the above research questions.

1.4 RESEARCH APPROACH AND METHODOLOGY

To achieve the research objectives and to answer the research questions, some specific stages have been set out as follows:

Stage 1: A review of the literature

The first objective of this research is to determine the current state of GAS usage among external auditors in the UK. For this reason, the literature on the CAATTs, GAS, computerised auditing and other related issues will be reviewed and analysed. A literature search will be carried out through a variety of journal articles and books to ensure that all latest and relevant issues are raised and defined.

Stage 2: Collecting data from the survey

In this study, data was collected through an online survey from the registered statutory auditors in the UK. An invitation by email was sent to the statutory auditor from public audit firms. It was necessary to gain the approval of the Brunel University of Ethics Committee for the questionnaire before data collection could commence. Data was collected between February and April 2011.

Stage 3: Data analysis

Once the data was collected analysis was undertaken. In the case of quantitative data, the statistical package adopted was Predictive Analytics Software (PASW) version 18 (previously and currently known as Statistical Package for Social Sciences (SPSS)). Qualitative data derived from the open ended questions was collated according to the similarity of views and discussed, along with the inferences drawn based on the strength and logic of the arguments.

Stage 4: Develop the Research Model

Based on the output of this study, the research model will be developed to give a better understanding of GAS adoptions and practices among external auditors in the UK. This model contributes to both theories and practices, especially in terms of technology acceptance by small and medium sized industries.

1.5 CONTRIBUTION TO EXISTING KNOWLEDGE

This thesis represents a more comprehensive study of the usage of GAS by public accounting firms in the UK than has been previously undertaken. It updates knowledge about the audit technologies used specifically on GAS among small and medium sized audit firms in the UK.

The first part of this thesis deals with the current state of GAS usage among the external auditors for both small and medium practices. An overview of the implementation of GAS, types of GAS usage as well as the areas and techniques used in GAS will be revealed. The second part investigates the factors that influence the use of GAS. In addition, the reasons for the usage of GAS will be examined, as well as the reason why it is not used for a particular auditor or particular audit task, or probably in particular auditor's client. Few studies have been found regarding the little usage of GAS by external auditor, but the reasons behind this are yet to be revealed extensively. Finally, the improvement of GAS will be recommended to enhance its usage among the external auditors.

Although the use of GAS is voluntary, with the advanced of the technology used by most of the businesses, especially their clients, required auditors to be more innovative to take the advantages provided by the technologies. There are variations of GAS available on the shelf, which are specifically designed for auditors and the audit profession. Therefore, an understanding of GAS usage and auditor's knowledge in such technology is important, as it will provide meaningful insights for interested parties. For instance, this study might benefit the academicians in generating future auditors; the auditors in order to improve their auditing skills and as continuous professional education; the standard setters in regulating new guidelines; the software developers to fulfil the auditors' needs and requirement for forthcoming GAS; the clients in such a way that they know there are technology exist to analyse their accounting data; the shareholders in understanding that auditors can provide more quality audits through technology; and the researchers in expanding the research in the future.

1.6 STRUCTURE OF THE THESIS

This thesis consists of seven chapters.

Chapter 1 is an introductory chapter that discusses the background, gap and justification of the study, as well as stating the aims, objectives and research questions. A summary of research approach and methodology will also be presented together with the contribution to the study.

Chapter 2 reviews existing literature on auditing, the use of technology in auditing, CAATTs and GAS.

Chapter 3 discusses the theoretical framework, clarification and development of conceptual approach, conceptual framework and research hypothesis.

In Chapter 4, the methodologies are explained. These include the research strategies, research and questionnaire design, reliability and validity of measurement, rules of ethics and confidentiality, pilot survey, data collection, data analysis procedure and limitation of the methodology.

Chapter 5 presents the main study of data analysis and findings. The chapter begins with the sample profile and the descriptive analysis on the use of GAS by the adopters. Further analysis on data screening, factor analysis and logistic regression is then being conducted. The chapter ends by showing the outcomes of hypotheses testing.

Chapter 6 discusses and reviews the result of all hypotheses testing and the findings discovered. The qualitative feedback from the open-ended questions also will be discussed to support the findings from the quantitative analysis.

Chapter 7 will conclude the thesis with a summary and the contribution of the study. In addition, limitations of the study and recommendations for future research are presented.

To simplify the reading of the thesis, a diagram summarising chapter highlight is presented. The high level flow from research objectives, research gap, research questions to contributions, limitation and future research is included. In preference of clarity the flow is presented in sequential form, not showing the iterative nature of artefact refinement that transpired.

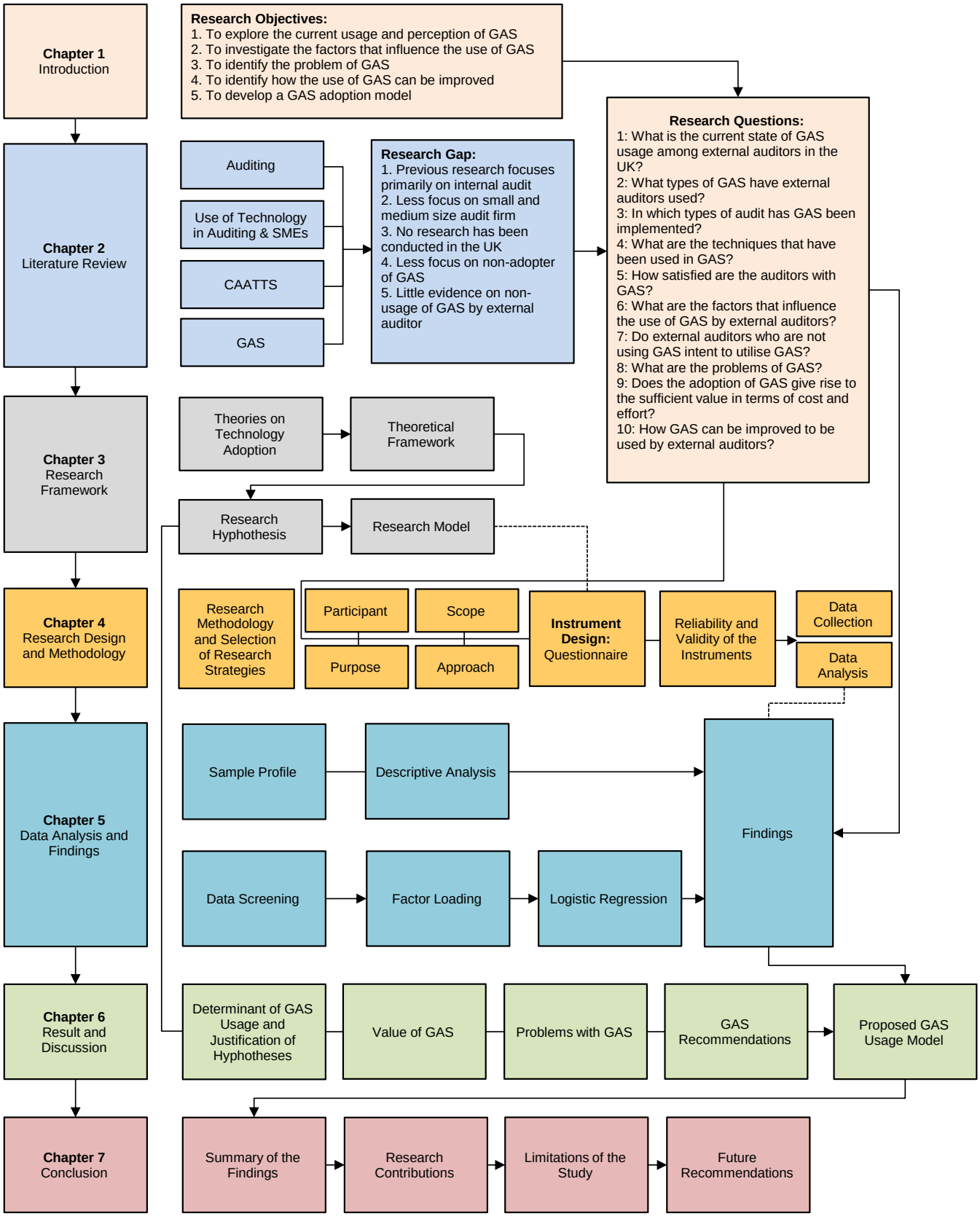


Figure 1-1: Thesis Overview

1.7 CONCLUSION

This chapter has introduced the subject matter of the thesis, the background and scope of the study as well as the research aim, objectives and the research questions. It has also discussed the main contributions of the study in relation to the existing literature in the area of GAS. As adoption of GAS is low among the external auditors in other countries, this study seeks to confirm and explore the current state of its usage among external auditors in the UK. Factors that influence the usage as well as the factors that discourage the auditors for not using GAS need to be investigated. External auditors in small and mid-tier practices are the main focus of enquiry of this study. An overview of this thesis has also been given in order to highlight the main points in each chapter.

Chapter 2: Literature Review

The main purpose of this chapter is to present the literature and background to auditing, related use of technology in auditing and the current usage of GAS. General introduction about auditing will be presented in the first place. Relevant topics such as audit firm category, types of auditor, and types of auditing will be discussed before proceeding with the technology used in auditing. It is important to define the scope which is related to this study before specifically discussing GAS. In the section that follows, GAS and other related technology are explained and current practice about GAS will be exposed.

2.1 AUDITING IN PERSPECTIVE

According to the Auditing Practices Board (APB) (2010), *"an audit involves obtaining evidence about the amounts and disclosures in the financial statements sufficient to give reasonable assurance that the financial statements are free from material misstatement, whether caused by fraud or error. This includes an assessment of: whether the accounting policies are appropriate to the [entity's] circumstances and have been consistently applied and adequately disclosed; the reasonableness of*

significant accounting estimates made by the directors; and the overall presentation of the financial statements."

The requirements for statutory audits are set out by UK Law under the Companies Act 2006. According to the Act, entities with an annual turnover of more than 6.5 million pounds or balance sheet total more than 3.26 million pounds and the average number of employees more than 50 are required to be audited. Any entities also have to be audited if the shareholder requires it or the requirement has been mentioned in the company's article.

Auditors and audit firms in the UK are supervised by bodies known as Recognised Supervisory Bodies (RSBs) to register, monitor and provide investigation and discipline to its members. Below is the list of RSBs in the UK:

- The Association of Authorised Public Accountants (AAPA)
- The Association of Chartered Certified Accountants (ACCA)
- The Institute of Chartered Accountants in England and Wales (ICAEW)
- The Institute of Chartered Accountants in Ireland (CAI)
- The Institute of Chartered Accountants of Scotland (ICAS)

In the UK, audit firms are categorised into three groups, namely Big 4[1], mid-tier firms and smaller firms. The major gap among these groups is in terms of size of the organisations.

2.1.1 Types of Auditors

There are two major types of auditors: internal auditors and an external auditors. The Institute of Internal Auditors (IIA) defines internal audit as *"an independent, objective assurance and consulting activity designed to add value and improve an organisation's operations. It helps an organisation accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes."*

[1] Big 4 audit firms are designated to top largest international firms consist of PricewaterhouseCoopers (PwC), Deloitte Touche Tohmatsu, Ernst & Young and KPMG

Internal auditors are employees of the company and report directly to the audit committee within the organisation. They are generally involved in a wide range of both financial and non-financial audits.

An external auditor is an independent body which resides outside of the organisation. The main responsibility of the external auditor is to perform the annual statutory audit of the company's financial accounts and provide an opinion on whether the accounts represent a true and fair view of the company's financial position. In the UK, the external auditor's function is provided in the Companies Act 1985 (s235 and s237).

It is important to realise the difference between external auditors and internal auditors. Therefore, this study will concentrate only on external auditor which is yet to be covered by many researchers compared to internal auditors in terms of the use of GAS. The general differences between them are shown in Table 2-1.

Table 2-1: Differences between External and Internal Audits

External Audit	Internal Audit
Independent body outside the organisation	Employed by the organisation
Report to shareholders/owners	Report directly to management or audit committee
Objectives of the audit are set by statute	Objectives of audit determined by management
Concerned only on the financial area as its primary mission is to express an opinion on whether the organisation's financial statements represent true and fair view	Concerned with all aspects of financial and operational activities within an organisation.

2.1.2 Classification of Auditing

The nature of auditing differs according to the subject under examination (Moscove *et al.*, 2003). There are various types of audit that can be performed by both internal auditor and external auditor. There are many types of auditing with different names mentioned in different audit books. However, this study tends to elaborate a few types that are commonly used by auditors in the following section.

Financial Statement Audits

This type of audit relates to financial information integrity and reliability. The purpose of a financial audit is to assess the correctness of organisation's financial statements whether it is true and fair view. This audit is typically performed by accounting firms, also known as external auditors. These external auditors provide an independent opinion on the published information given by the organisations.

There is a statutory requirement by which the UK Companies Act 1989 requires that auditors make an annual report to the company members, depending upon the size of the company, on all company accounts. Part 1, Section 9, Sub Section 237 provides as follows:

> *"A company's auditors shall, in preparing their report, carry out such investigations as will enable them to form an opinion as to-*
>
> *(a) whether proper accounting records have been kept by the company and proper returns adequate for their audit have been received from branches not visited by them, and*
>
> *(b) whether the company's individual accounts are in agreement with the accounting records and returns."*

Operational Audit

Operational audit is also known as management performance or value added audits, which is intended to evaluate the organisation's internal control structure for the specific area, department, functional operation or process. This type of audit is usually performed by internal auditors.

Information Systems (IS) Audit

Information Systems Audit Control Association (ISACA) (2009) defines information systems auditing as *"The process which collects and evaluates evidence to determine whether information systems and related resources, adequately safeguards assets, maintain data and system integrity, provide relevant and reliable information, achieve organizational goals effectively, consume resources efficiently and have in effect internal controls that provide reasonable assurance that business, operational and control objectives are met."*

This type of audit is normally performed by Information Systems (IS) auditors who can be from inside or outside of the organisation.

Forensic Audit

Forensic auditing has been defined as auditing that specializes in discovering, disclosing and following up on fraud and crimes. The primary purpose of this is to review the development of evidence by law enforcement and judicial authorities

2.2 THE USE OF TECHNOLOGY IN SMALL AND MEDIUM ENTERPRISES

Before this study moves on to focus on the use of technology within the audit community, it is important to understand the practice and adoption of information technology (IT) within the small and medium sized enterprises (SMEs) in which most of them are the clients for audit firms. IT in the context of this study will cover information system (IS), information and communication technology (ICT), internet and their infrastructure including computer hardware and software, those technologies that processes or transmit information to enhance the effectiveness of individuals and organizations (Ghobakhloo *et al.*, 2011). SMEs are defined as firms with less than 250 number of employees (Companies Act, 2006).

Generally, IT has significantly changed the way in which businesses have been conducted. It not only affects large organisations, but also SMEs. IT has rapidly changing global production, work and business methods and trade and consumption patterns in and between enterprises and consumers (Shah Alam and Mohamad Noor, 2009). Thus, in this modern economic environment, all businesses require IT to operate and all of them realise the importance of IT. The benefits of it are too innumerable to be listed, although there are also some limitations that need to be faced, especially by SMEs.

According to Shah Alam and Mohamad Noor (2009) IT has some effect in terms of intermediate performance measures, such as process efficiency, service quality, cost

savings, organization and process flexibility and customer satisfaction. The use of IT can also enable the SMEs to compete on a global scale, with improved efficiency and closer customer and supplier relationships (Chong, Pervan and Bauer, 2001). IT tools can also significantly help SMEs by supplying the required infrastructure, which is necessary for providing appropriate types of information at the right time (Ghobakhloo *et al.*, 2012). These are among the possible advantages of IT that probably will motivate the SMEs to adopt IT.

In fact, there are many factors that influence the adoption of IT among the SMEs, as found in the previous study. For example, Shah Alam and Mohamad Noor (2009) found that perceived benefits, IT knowledge and government support were significantly important to the adoption of IT. Dyerson, Harindranath and Barnes (2009) in exploring IT adoption and use by SMEs in the UK found that the main reasons for SMEs to implement IT are to increase operational efficiency and to keep up with competitors. However, in more in-depth literature conducted by Ghobakhloo *et al*., (2011), they suggest the influencing factors that influence the use of IT by SMEs may be categorized into two major clusters, these being internal and external factors. These two factors have their subcategories as shown in Table 2-2 below.

Table 2-2: Factors affecting IT adoption in SMEs

Influencing Factors	**Factors**
INTERNAL FACTORS	
Top Management (CEOs)	Perception of and attitude toward IT adoption such as urgency, benefits and costs CEO support and commitment IT knowledge and experiences CEO innovativeness Perceived behavioural control over IT CEOs desire for growth Familiarity with administration
Resources	Financial resource availability Level of IT investment In-house IT experts
End users (Staff)	Users' qualifications (knowledge of IT) Users' training Users' attitudes and opinions toward IT Users' participation and involvement

IT Solution Computer Application	Type and age of implemented IS/Its Quality of software available in market The costs of ITs Perceived impacts and benefits of IS/ITs on the organization Process compatibility IS planning User-friendliness, complexity and popularity Security
Organisational Behaviour and Characteristics	Business growth and expansion SME's strategic context Business size (turnover and number of employees) Type of industry Information intensity Business maturity (high tech and knowledge intensive) Organisational structure Organisational culture Family intervention on management Change (technological change and business expansion) Integration of internal processes
EXTERNAL FACTORS	
Competitive Environments (Competitors)	Business, social, and market pressure to adopt IT Competitiveness of environment (the necessity to stay competitive) Capturing new markets
Government	Legal issues Government policies (aids and supports)
Customers and Suppliers	Customers and supplier pressure for IT adoption (to deliver a higher level of customer service and communicate) Customers demand to adopt IT Larger counterpart demand
External IT Consultant and Vendors	External expertise and services availability and support Consultant effectiveness and competence Strategies of private technology suppliers

Source: Ghobakhloo et al., (2011)

There are also some barriers that can limit the IT implementation within SMEs due to their nature of businesses and the availability of their resources. Parida *et al.* (2010) have identified eight barriers of IT adoption within small firms that probably can prevent SMEs from actively adopting IT. They are the suitability of IT for the type of SMEs, limited IT literacy of owners and employees, lack of standards and IT related application for small firms, the cost of developing and maintaining IT systems, access and interoperability, lack of security and trust, legal uncertainties and IT adoption challenges. These barriers of course can be varied among SMEs depends on their type of businesses, location and size groups.

In spite of barriers which can be considered as challenges that need to be faced by SMEs to adopt IT, the growth of IT usage and implementation by SMEs remains significantly high. Harindranath, Dyeron and Barnes (2008) suggest that most SMEs are in general positively inclined towards adoption and use of ICT. More specifically, Higón (2010) found that 83% of all UK SMEs is used PC applications comprising of word processing, accounting and record keeping software. Dyerson, Harindranath and Barnes (2009) also found that sales recording, order processing and general accounting and finance are three types of IT that are mostly used by SMEs. This evidence shows the relevance for auditors of using IT to keep track of client's accounting transactions.

2.3 THE USE OF TECHNOLOGY IN AUDITING

The advance in IT does not merely affect the SMEs, as has been discussed in the previous section. At the same time, the audit community which is the focus of this study also faces the same reality. From the auditing perspective, the accountant cannot escape from the challenges created by the technology. Bierstaker *et al.* (2001) stated that technology is essential for accountants to understand the client's business processes and contend with the paperless audit environment.

The increasing need for relevant, reliable, and timely information from the user required that IT be widely implemented in every aspect of auditing. At the same time, according to Manson, McCartney and Sherer (2001) IT offers audit firms the opportunity to enhance the quality of their work and to improve the productivity of professional staff.

Furthermore, the legal requirement will give auditors no choice other than to use technology to meet the required demands. For example, the requirement for fraud detection (i.e. SAS No 99) and internal control attestation (Section 404, Sarbanes Oxley Act) has increased the responsibility and workloads for audit teams; thus one approach to meet the need is through the use of audit technologies(Curtis and Payne, 2006). Greenstein *et al.* (2008) also expected that auditors would have higher

knowledge of IT than an average accountant, since they must audit the work of many different clients with diverse information systems.

Since this study only focuses on one type of technology (GAS), it is also important to know of other technologies that can be used in auditing, as well as the purpose of a particular application. Greenstein-Prosch *et al.* (2008) have listed 36 different kinds of technology that can be used in auditing. Table 2-3 below shows the type of technology that can be used in auditing and its definitions as presented by Greenstein-Prosch *et al.* (2008).

Table 2-3: Technology Use in Auditing

Technology	Definition
1. Word Processing	Computer program that facilitates entry and preparation of documents such as letters or reports.
2. Electronic Spreadsheets	Software which allows the auditor to enter either alphanumeric or numeric data and manipulate it either via standard functions or auditor programmed functions
3. E-Mail	Exchange of mail messages via Intranets and/or the Internet.
4. Electronic Working Papers	Software which generates a trial balance, lead schedules, and other schedules useful for the recording of evidence in an audit or assurance engagement
5. Internet Search & Retrieval	Permits user to search text that is in electronic format and retrieve, view, and print desired text.
6. Image Processing	Conversion of paper documents into electronic form through scanning and the subsequent storage and retrieval of the electronic image
7. Electronic Presentations	Software that facilitates the organization and use of text, voice, and/or images to communicate concepts
8. Generalized Audit Software	Computer program which helps the auditor access client computer data files, extract relevant data, and perform some audit function such as addition or comparison.
9. Expert Systems	Computer software that provides relevant information and/or decision models to assist a human in making a decision or accomplishing some task.
10. Embedded Audit Modules	Programmed routines incorporated into an application program which are designed to perform an audit function
11. Real-time Audit Modules	Programmed routines incorporated into an application program which are designed to perform an audit function
12. Database Search & Retrieval	Software that uses relational structures between data files and facilitates varying data retrieval and use.
13. Simulation Software	Abstraction of some aspect of real system via software. Auditor may use model to evaluate the reliability of information from real world sources. This may be thought of as a very high level analytical review of a company's data.
14. Flowcharting/Data Modelling	Software using the source code version of programs to produce flowcharts of program logic
15. Computer Aided Systems Engineering Tools	Integrated package of computer tools that automate important aspects of the software development process to increase software development effectiveness in terms of productivity of systems development and quality of developed systems.

16. Encryption Software	Changing data using some type of encoding/decoding algorithm so that unauthorized persons who can access the encrypted data will not be able to read it or use it.
17. Groupware	Software that permits auditors to categorize, store, and share data among themselves as well as communicate with each other about that data, preferably in a real-time mode.
18. Cooperative Client/Server Environment	Distribution of processing functions between two or more computers as in a local area network. This also includes end-user computing where users on the network also process and store data on their personal computers.
19. Workflow Technology	Software and hardware that facilitates the capture of data in the work place to improve management of the business. For example, using an electronic scanner to record the movement of materials in a warehouse based on the barcodes on the materials.
20. Database Design & Installation	Software that permits the creation and use of relational structures between data files
21. Time Management & Billing Systems	Computer program, which assists in capturing, managing, billing, and reporting time, spent on professional activities.
22. Test Data	A set of transactions processed by the auditor to test the programmed or procedural operations of a computer application
23. Small Business Accounting Software	Accounting software package used to record transactions, maintain general and subsidiary ledgers, and generate financial statements.
24. Digital Communications	Bandwidth – telecommunications devices used to facilitate the rapid and unfettered transfer of data.
25. Tax Return Preparation Software	Software, perhaps incorporating expert knowledge, which assists the accountant/auditor in identifying relevant information, capturing and recording it in a manner that can be filed with tax authorities.
26. Firewall Software/Hardware	Part of "security technology" that enforces an access control policy between two networks.
27. User Authentication Systems	Devices used to verify that a system user is who he/she claims to be.
28. EDI-Traditional	Transfer of data or payments electronically between computers using software that may, or may not, require human intervention to affect the transfer.
29. EDI-Web Based	The extension to XML-based EDI
30. Wireless Communications	The ability to transfer digital data without the use of cables, twisted- pair, or fibre optics.
31. Agent Technologies	Programmed modules that are given certain levels of authority and autonomy to act on behalf of their "supervisor", such as to decide whether to order more inventory and from which supplier
32. Intrusion Detection & Monitoring	Part of "security technology" that identifies unauthorized requests for services
33. Internal Network Configurations	Linkage of individuals and data through hardware and software systems that permit the exchange of various types of data.
34. External Network Configurations	Intranet, extranet, and Internet access devices than enable users physically separated from the server to access it.
35. Enterprise Resource Planning	Business-wide information systems that cross boundaries
36. Application Service Providers	Companies which host (provide hardware, software and connectivity) for specific business applications

Source: Greenstein-Prosch et al. (2008)

All of the above technologies may help auditors perform audits effectively and efficiently. However, a review of the literature indicates that audit professionals have low adoption on the knowledge level of a few audit technologies. For example, a

recent study by Ismail & Zainol Abidin (2009) found that IT knowledge level among auditors in Malaysia is lower than their perception towards the importance of technologies.

Even Greenstein-Prosch *et al.* (2008) found that auditors in Germany and United States (US) lack significant knowledge in terms of three constructs out of the five that were generated from the factor analysis of the above 36 technologies i.e. on e-commerce technologies, networking and data transfer and audit automation technologies. The auditors only have adequate knowledge of general office automation and accounting firm office automation technologies.

2.4 COMPUTERISED ASSISTED AUDIT TOOLS AND TECHNIQUES (CAATTS)

Apart from the technologies discussed in the previous section, the more common technologies that are more practical for auditors are CAATTs. In the past, auditors could choose to audit "around the computer" which involves reconciling the source documents associated with input transactions to the output result while treating the computer process as a "black box" (Braun and Davis, 2003; Doost, 1999). Auditing "through the computer" attempts to verify that the processing controls involved in the accounting information systems (AIS) programs are functioning properly (Moscove, Simkin and Bagranoff, 2003). In addition to this, auditors now use CAATTs to audit "with the computer" to help them to do various audit tasks.

Braun and Davis (2003) define CAATTs as any use of IT in assisting the audit. Specifically, they define it as "tools and techniques employed to audit computer applications and used to extract and analyse data". Rafeq (2004) defines CAATTs as the software tools for auditors to access, analyse and interpret data and to draw an opinion for an audit objective. CAATTs are used as part of audit procedures to process data of audit significance contained in the client's information systems (Singleton, 2006). CAATTs also permit auditors to increase productivity, as well as that of the audit function (Zhao, Yen and Chang, 2004).

Hunton, Bryant and Bagranoff (2004) defined it into two categories. The first category is the software used to increase an auditor's personal productivity and to perform data extraction analysis. This category is represented as tools for the first "T" in CAATTs acronym. The second category is techniques to increase the efficiency and effectiveness of the audit function. This is represented as the second "T" of the acronym.

Based on the IS Auditing Guideline G3 issued by ISACA (2008), there are a few factors to be considered in determining whether to use CAATs which include:

- Computer knowledge, expertise, and experience of the IS auditor
- Availability of suitable CAATTs and IS facilities
- Efficiency and effectiveness of using CAATTs over manual techniques
- Time constraints
- Integrity of the information system and IT environment
- Level of audit risk

2.4.1 Functions of CAATTs

Janvrin, Bierstaker and Lowe (2009) have identified and tested nine different functions or techniques of CAATTs originating from auditing standards issued by the American Institute of Certified Public Accountants (AICPA). In the UK, auditing standards was issued by the Auditing Practices Board (APB). Table 2-4 shows the details of CAATTs that can be implemented using any GAS according to UK and American auditing standards.

Table 2-4: Functions of GAS

Use GAS to:	Auditing Standard	
	SAS*	ISA**
Evaluate fraud risks	AU 316.52	ISA 240.70
Identify journal entries and other adjustments to be tested	AU 316.64	ISA 315.84
Check accuracy of electronic files	AU 308.33	ISA 500.11, ISA 500.36
Re-perform procedures (i.e., aging of accounts receivable, etc.)	AU 308.34	ISA 500.37
Select sample transactions from key electronic files	AU 327.19	ISA 240.70, ISA 330.19
Sort transactions with specific characteristics	AU 327.61	ISA 240.70, ISA 330.19
Test an entire population instead of a sample	AU 327.19, AU 327.27	ISA 240.70, ISA 330.19
Obtain evidence about control effectiveness	AU 316.54	ISA 330.30
Evaluate inventory existence and completeness	AU 314.11	ISA 240 Appendix 2

*Statement of Auditing Standards (US)
**International Standard on Auditing (UK and Ireland)

2.4.2 Traditional Manual Auditing Vs. CAATTs

In terms of traditional manual auditing methods, auditors will build conclusions based on the sample gathered from the accounting documents. The auditors will use the sampling techniques and conduct substantive testing as guided on the specified audit programmes and accepted auditing standard. Without the concern of the numbers of population or transaction for a particular audit period which probably can be reached more than thousands of transactions, only a few number of samples has been tested by the auditor. There is nothing wrong with these procedures, but with the current advance of technology, this practice can be questionable.

With CAATTs, auditors can perform many tests on 100% of the subject being audited. Instead of relying on the sample, any significant irregularities can be detected using certain procedures and tests within CAATTs.

Manual auditing might be convenient for certain types of auditing, especially when it deals with small client with small transaction within audit period. However, it might be irrelevant to extend this to some complicated audit procedure. Chang *et al.* (2008) mentioned that the need for a useful computer auditing system becomes critical

because manual audits cannot immediately recognize significant discrepancies unlike in computers.

2.4.3 Types of CAATTs

CAATTs include many types of tools and techniques. Other than GAS, the examples of CAATTs include utility software, test data, parallel simulation, integrated test facility (ITF) and embedded audit modules. Among these, GAS is one of the most commonly used tools in auditing (Lovata, 1988; Wener and Jessup, 2005; Debreceny *et al.*, 2005; Singleton, 2006) and this will be discussed in details in the next section.

Utility Software

Utility Programs are used by an entity to perform common data processing functions such as sorting, creating and printing files (MIA, 2007). These programs are generally not designed for audit purposes, and therefore may not contain features such as automatic record counts or control totals (MIA, 2007).

Test Data

Test data is one of the methods to test indication of the logic or control problem in the client's system (Braun and Davis, 2003). Auditors will use their own prepared data (with expected output) to be processed by the client's application. The result produced from the client system will then be compared to the expected result to test if there is any discrepancy.

Parallel Simulation

Unlike test data, in the parallel simulation, the auditor will use client's data to be processed in the auditor's application. The results will be compared to enable the auditors to make conclusion about the quality of the process performed by the client's application (Braun and Davis, 2003).

Integrated Test Facility (ITF)

ITF required auditor to be involved in setting up dummy test data or independently calculated data on the application systems. Test data can be placed in the normal

transaction stream, and results can allow the auditor to evaluate application controls during normal operations (Braun and Davis, 2003).

Embedded Audit Modules (EAMs)

EAMs allow the auditor to insert an audit module in the client's application that will identify transactions that meet some pre-determined criteria as they are being processed (Braun and Davis, 2003). In doing so, it can continuously monitor the flow of transactions and identify transactions that match the pre-specified criteria. Once detected, the auditor can be automatically alerted and the transaction data can be copied to a file (Hall, 2000).

2.5 GENERALISED AUDIT SOFTWARE (GAS)

When the abbreviation of GAS has been used, it always refers to the audit software packages that allow for data extraction and analysis. Sometimes, to be aware, when some of the authors refer to CAATTs or CAATs, they actually refer to GAS unless other terms are mentioned. In specific terms, GAS concentrates more on data which is going to be accessed, retrieved and manipulated from the computerised accounting systems.

Wahab (2006) defined, *"GAS is one of the families of the software that is frequently utilized in Computer-Assisted Auditing. It is an off-the-shelf package that can provide a means to gain access to and interrogate data maintained on computer storage media. It is one of the tools IT Auditors utilize to obtain evidence directly on the quality of the records produced and maintained by application systems."*

According to Boritz (2003), GAS is a class of CAATTs that allows auditors to undertake data extraction, querying, manipulating, summarization and analytical tasks. International Federation of Accountants (IFAC) (2003) defines GAS as a computer program which helps the auditor to access client computer data files, extract relevant data, and perform certain audit function such as addition or comparison.

There are a variety of commercial GAS such as Audit Command Language (ACL), Interactive Data Extraction and Analysis (IDEA), TopCAATs, ActiveData for Excel, Panaudit Plus, CA's Easytrieve, Statistical Analysis System (SAS) and Statistical Package for Social Sciences (SPSS). While some big accounting firms have their own proprietary GAS packages for the purposes of auditing their clients, some large organisations also have their in-house development of GAS which is used by their internal auditors for auditing their specific organisation's accounting systems.

Most GAS has the capabilities to read computer data in various types of database and format and perform various types of queries to complete the audit tasks. GAS features include mathematical computations, stratification, statistical analysis, sequence checking, duplicate checking and recomputations (ISACA, 2009).

GAS may be used to gather or assist in gathering evidence in relation to both the effectiveness of operation of a programmed control procedure and the extent of misstatements in account balances and underlying classes of transactions. In other words, this audit software may be used as either a test of control or as a substantive procedure (Gay and Simnett, 2007). Trend analysis and analytical review can also be undertaken, especially in a financial statement audit, to test for the comparison of balance between different accounting periods.

Lanza (n.d.) has listed a core data analysis functions that GAS may offer as shown in Table 2-5.

Table 2-5: Features of GAS

Feature	Description
Aging	Produces aged summaries of data based on established cut-off dates
Append/Merge	Combines two files with identical fields into a single file. An example would be to merge two years worth of accounts payable history into one file.
Calculated Field/ Functions	Creates a calculated field (which can use a Field/ function such as ABS for the absolute value of Functions the field) using data within the file. For example, the net payroll pay to an employee could be recalculated using the gross pay field and deducting any withholding/taxes
Cross Tabulate	Allow you to analyse character fields by setting them in rows and columns. By cross tabulating character fields, you can produce various summaries, explore areas of interest, and accumulate numeric fields.
Digital Analysis/ Benford's Law	Audit technology designed to find abnormal duplications of specific digits, digit combinations, specific numbers, and round numbers in corporate data. Since the objective is to find abnormal duplications,

	auditors need a benchmark that indicates a normal level of duplication. Benford's Law gives auditors the expected frequencies of the digits in tabulated data. The premise is that we would expect authentic and unmanipulated data to exhibit these patterns. If a data set doesn't follow these patterns, this may be a cause for auditor concern and review
Duplicates	Identifies duplicate items within a specified field in a file. For example, this report could be used to identify duplicate billings of invoices within the sales file
Export	Creates a file in another software format (for example, Excel, Word) for testing. An example would be to export customer address information to Word for "Mail Merging" to customer confirmation letters
Extract/Filter	Extracts specified items from one file and copies them to another file, normally using an "if" or "where" statement. Examples include extracting all balances over a predefined limit
Gaps	Identifies gaps within a specified field in a file. For example, identify any gaps in check sequence
Index/Sort	Sorts a file in ascending or descending order. An example would be sorting a file by social security number to see if any blank or "999999999" numbers exist.
Join/Relate	Combines specified fields from two different files into a single file using key fields. This function is used to create relational databases on key fields. It can also be done in an unmatched fashion to identify differences between data files.
Regression	Regression analysis using statistical means to calculate a dependent variable balance (such as net sales) based on various independent variables (for example, product purchases, inventory levels, number of customers, etc.).
Sample	Creates random or monetary unit samples from a specified population
Statistics	Calculates various statistics on a selected numeric field. These may be total positive items, negative items, average balance, etc.
Stratify	Counts the number and dollar value of records of a population falling within specified intervals. Stratifications also provide a useful view into the largest, smallest, and average dollar transactions.
Summarize	Accumulates numerical values based on a specified key field. An example would be summarizing travel and entertainment expense amounts by employee to identify unusually high payment amounts.
Test grouping	These are groups of tests all designed to be run simultaneously on a specific report or area of the accounts, e.g. journals listings, trade receivables, fixed assets, etc.
Highlight differences	Highlights the differences between two different versions of a report
Outlier extraction	Searches for records which lie at the extremes of a population (e.g. all invoices that exceed 3 times the average for that supplier)

Source: Lanza (n.d.)

Based on the above functions, Lanza (n.d.) has made a comparison among five most popular audit softwares: ACL, ActiveData for Excel, Excel, IDEA and TopCAATs. He found that all the products have similar tools and features. However Excel has limited abilities when it comes to more complex or specific data analysis as such program is an incredibly powerful tool and commonly used for data analysis.

2.5.1 Benefits of GAS

There are many benefits and advantages of GAS as promoted by many authors in their paper to motivate most of the auditors out there to use it in their day-to-day works. It is claimed that GAS is easy to use and user-friendly (Sayana, 2003; Wahab, 2006). For example, in ACL, Singleton (2006) mentioned that ACL commands are compatible with the average IT auditor's understanding, experience, training and education. Indeed, this probably applies to those who are familiar with the computer technology and software.

One of the great advantages of GAS is it can examine 100 percent of the data and transactions (Singleton, 2006; Sayana, 2003). The potential of fraud to be detected using this GAS is probably higher, as the auditor can apply various types of tools to analyse all of the data. With the growth of the volume of the transactions in many businesses, it will be impossible to analyse those transactions using the manual methods. The data in GAS usually display as read-only, and there is no possibility for the auditor to unintentionally change it (Singleton, 2006). This is to make sure that the integrity of data is always there during the analysis.

Singleton (2006) added that there are possibilities that auditors have a better sense of direction in their audit procedures, along with their analysis. For example, if the auditors find any irregularities, they can directly focus on that data or transaction for further testing.

The audit software also maintains logs of tests done for review by peers and seniors (Sayana, 2003). Advanced features allow the programming of certain macros and routines that can further enhance audit speeds and efficiency (Sayana, 2003).

However, these benefits seem to be appreciated only by those who have been called “IT Auditor” rather than other types of auditor, especially those who are not familiar with IT. At most, the IT auditor will need training and encouragement to "think outside the box" with these commands (Singleton, 2006).

2.5.2 Problems and Limitations of GAS

As well as the benefits and advantages that have been discussed in the previous section, there are a few drawbacks that limit its usage.

Not all GAS packages are applicable to the auditor's clients, especially those with complicated accounting application. GAS packages also have their own problems and limitations and may not provide the specific tasks required for auditing. Furthermore, some of the GAS need to be associated with another application to complete the cycle of the audit process. This is why some organisations develop their own software to fulfil their specific requirement of the audit and their accounting application. However, development is quite costly and require technical expertise.

The use of GAS typically requires some computer skills. Auditors need to know at least the basic knowledge about databases and data management. Statistical knowledge also has to be strong, as it involves thorough analytical data analysis. Normally, the auditors have some extent of difficulty in preparing the data for first use (Braun and Davis, 2006). The auditors have to sit for an extensive training and encouragement to think analytically (Singleton, 2006) with most of the instructions provided in the software.

Excel is believed to be one of the "must" tools that auditors should be competent in, as the latest IIA survey result shown almost 100% of internal auditor use it for data analysis. However, there are some limitations to Excel, such as its integrity, the limitation of the data that can be handled and the restricted power it has (Singleton, 2006).

Table 2-6 lists the general limitations and disadvantages of GAS as described by different authors.

Table 2-6: Limitation and Disadvantages of GAS

Type of Limitation/Disadvantages of GAS	Source(s)
1. GAS is too technical and complex for non-IT auditors even if training is provided	Coderre (1996)
2. Difficult to prepare the client's data for the first use and required IT specialist to access it	Braun and Davis (2003); Singleton (2006)
3. The cost of acquiring GAS software, licensing and maintenance are expensive	Coderre (1996); Davies (2000); Shaikh (2005); Singleton (2006)
4. Required extensive training to use the software	Singleton (2006)
5. Only operates when large volume of data is going to be analysed	Davies (2000)
6. Some GAS are not applicable to the auditor's client	Hollander, Denna and Cherrinton (2000)
7. Lack of common interface with IT systems, such as file formats, operating systems and application program	Shaikh (2005)
8. Lack of understanding of GAS usage by auditors and clients	Lovata (1988)
9. Auditors may feel that they must conduct reviews manually, physically touching files and reports	Debreceny *et al.* (2005)
10. Clients are worried that their systems and data might be compromised with the use of GAS	Debreceny *et al.* (2005)

2.6 CURRENT PERCEPTION ON GAS

There are a few studies that have been conducted in relation to the use of GAS and CAATTs by auditors that will form the basis for this research.

Generally, auditors' perception on the usage of technology is important, even though they seem not to use some of the applications extensively (Janvrin *et al.*, 2008). Wehner and Jessup (2005) mentioned that auditors' acceptance of technology is minimal even though they found that auditors' perceptions are certainly appearing to influence the GAS usage. They also found that auditors who have recently taken college classes or attended continuing education courses pertaining to audit software are more likely to use GAS. Staff and senior level auditors are more likely to use GAS than supervisory or management level auditors. While their results indicate that age does not impact GAS usage, gender plays an important role by influencing the criteria that auditors use in deciding whether or not to use GAS. In addition, it seems that female auditors use GAS more than male auditors.

Braun and Davis (2003) studied auditors' perceptions of GAS based on their experiences. Ninety auditors from various state legislative audit offices participated in

the survey; 89% of the auditors agreed that using GAS improved their audits but most of them did not feel that they themselves or their colleagues were well trained in the use of GAS.

Janvrin, Bierstaker and Lowe (2009) found that Big 4 audit firms are more likely to use computer-related audit procedures compared to smaller audit firms. They also found that such procedures are used when obtaining an understanding of the client systems and business processes, and when testing application and general computer control.

2.7 GAS USAGE IN AUDITING

GAS can be used as substantive testing, compliance testing and trend analysis and analytical review in financial statement auditing (Boczko, 2007). For example, in substantive testing, GAS can be used to test sample transaction files and data to ensure the accuracy and proprietary of accounting transaction. For compliance testing, GAS can be used to test controls or procedures which cannot be observed directly. In trend analysis and analytical review, GAS can be used to test for trends of transaction between different account types.

Debreceny *et al.* (2005) studied the extent and nature of use of GAS by bank internal auditors and their external auditors with large local and international commercial banks in Singapore. Surprisingly, they found that there was no evidence that GAS is used in the daily work of the external auditor, and little evidence for internal auditor.

Various types of GAS used for data analysis tools, ranging from simple spreadsheets to sophisticated specialty products and internally developed technologies by internal auditors was discovered by The Institute of Internal Auditor (IIA) in their Annual Software Survey 2006 (Gray, 2006). The IIA has conducted this survey since 1995 and 2006 was the latest survey reported by the IIA. Findings from the above mentioned surveys show that GAS has been used for data extraction and analysis even before 1998 (Wener and Jessup, 2005). The IIA survey result of the use of audit software for data analysis is summarised in the Table 2-7.

CIPFA also have conducted a survey in 2003 to look at IT audit activity. The participants include over 200 IT and internal audit managers in the public sector, and this shows that 67% reported using GAS in some of their audits (CIPFA, 2003). All the above-mentioned findings seem to apply specifically to the internal auditor, rather than external auditor who has different objectives for the audit.

Table 2-7: IIA Survey Summary 2000-2006

Year	Author (s)	Members Invited	Survey Responses	Product Use Most Frequently for Data Analysis (%)												
				Access	ACL	AS/400 Query	Crystal Report	Excel	IDEA	Monarch	Oracle	People Soft	SAP	SAS	Internally Develop Software	Other
2000	Glover, Prawitt and Romney	2,700	364	13 Includes Oracle, SQL]	36	-	-	23 Includes Lotus 1-2-3]	5	-	-	-	-	1	7	15*
2001	Salierno	2828	594	14 Includes Oracle, SQL]	40	-	-	21 Includes Lotus 1-2-3]	3	2	-	-	-	3	4	13**
2002	Chapman	2706	610	10	24	2	1	43	10	1	-	-	-	-	1	8***
2003	McCollum and Salierno	4709	688	9	36	1	1	42	3	1	-	-	1	1	3	2****
2004	Jackson	4200	400	7	38	2	-	41	3	-	-	-	2	-	1	6*****
2005	Baker	4675	505	6	28	2	2	49	5	-	-	-	2	1	1	4******
2006	Gray	6500	516	32	50	12	18	94	7	6	11	9	14	5	18	21*******

*Includes Focus (3%), Easytrieve Plus Report Writer (2%), Brio (1%), AS/400 Query, BancAudit, Business Objects, Cognos, Hyperion, Monarch, The Number, PeopleSoft, and Sterling MarkView

**Includes Focus (2%), Easytrieve Plus Report Writer (2%), AS/400 Query, BancAudit, Business Objects, Cognos, Crystal Report, Writer, Hyperion, PeopleSoft, SAP and SPSS

***Includes Hyperion, BancAudit, Business Objects, CaseWare, Cognos, DSS Auditron, Easytrieve Plus Report Writer, Focus, Impromptu, IQ Objects, ITI Prime, Lotus 1-2-3, Oracle, SAP, SAS, SQL, TrendStar, and Vislmage

****Includes Easytrieve, Cognos, Impromtu and Oracle

*****Includes Crystal Report, Monarch and SAS

******Includes Business Objects, Cognos and Lotus 1-2-3

*******Includes ActiveData, Brio, Business Objects, Cognos and SPSS

2.8 CONCLUSION

All entities, including companies, limited liability partnerships and charities that meet certain criteria such as being above a certain size or of public interest, are required by law to have their financial statements audited. With the current advancement in IT, most of the company's data and transactions have been kept electronically, either in their accounting application or in the databases that support the organisational information systems. With this advancement, it is believed that external auditors also have to manage these data electronically. For example, by using GAS, all the client's data can be extracted in GAS and analysed in accordance with the audit procedures.

While the above-mentioned literatures provide awareness in the use of audit software or the factors that influence the usage, they however have a few gaps that need to be filled. For example, most of them are more focused on internal auditors, big audit firms and conducted in other countries. There is little evidence that external auditors, especially in small and medium size firms, have used GAS. The usage among external auditors in the UK is also yet to be explored. The problems faced and the reasons why external auditors do not use GAS are still left unanswered. This study also seeks to recommend how the use of GAS can be enhanced in the future.

Chapter 3: Research Framework

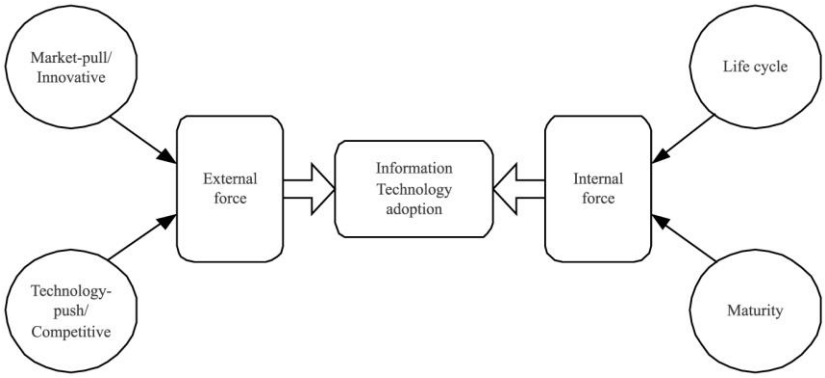
This chapter discusses the theoretical framework, the development of the research model and the hypotheses that need to be tested. It will focus on the specific literature in the related area of GAS and theoretical perspectives on Information System (IS) research. Prior to this, the general IT adoption model within SMEs will be discussed in order to provide a common overview of the IT adoption concept. The frameworks of some previous studies on technology adoption and the items from the frameworks will be reviewed and examined. Moreover, some of the relevant items will be applied, and this will lead to the development of the research model. Finally, the framework of this study will be developed and the hypotheses will be proposed.

3.1 THEORIES ON TECHNOLOGY ADOPTION

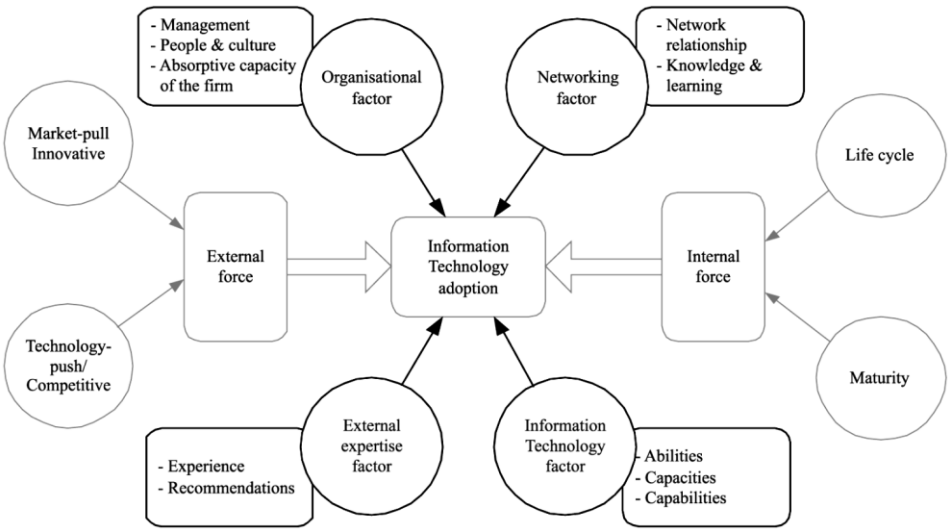
Many studies of technology adoption have been conducted in order to understand how users come to use and accept technology. Many theories and models have been proposed to prove that there are several factors that influence the particular use of technology. The next section will discuss some technology adoption models that have previously has been used in SMEs in general, as well as in specific areas of CAATTs in auditing.

3.1.1 IT Adoption Models in SMEs

In general, there are many models that have been adapted within IT adoption studies in SMEs. For example, Nguyen (2009) has proposed a reconceptualised framework for the IT adoption process (see Figure 3.2) which has been incorporated from the drivers to IT adoption model (see Figure 3.1). The drivers to IT adoption includes the technology-push and market-pull, internal pressure and external pressure, together with competition and innovation. These drivers are then combined with other factors which include organisational factor, networking factor, external expertise factor and IT factor in order to promote a comprehensive IT adoption model within SMEs.

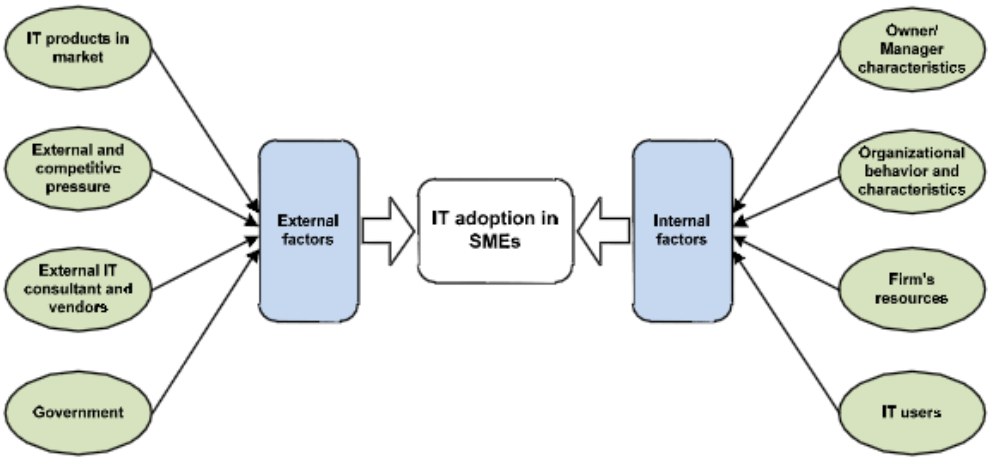


Source: Nguyen (2009)
Figure 3-1: Drivers to IT Adoption Model



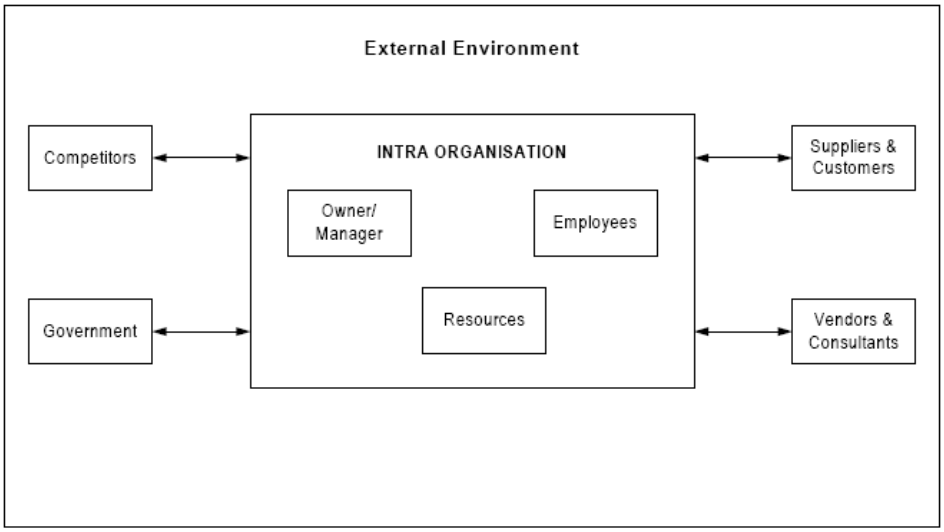
Source: Nguyen (2009)
Figure 3-2: A Reconceptualised Framework for IT Adoption Process

The nearly similar model has also been proposed by Ghobakhloo *et al*. (2012) to classify various issues and factors related to the process of IT adoption within SMEs (see Figure 3-3). This framework merely comprises different aspects of internal and external IT adoption factors, including the drivers, influencing factors and the barriers (Ghobakhloo *et al.*, 2012). This model, however, was slightly different in categorising the internal and external factors, compared to what has been proposed by Nguyen (2009).



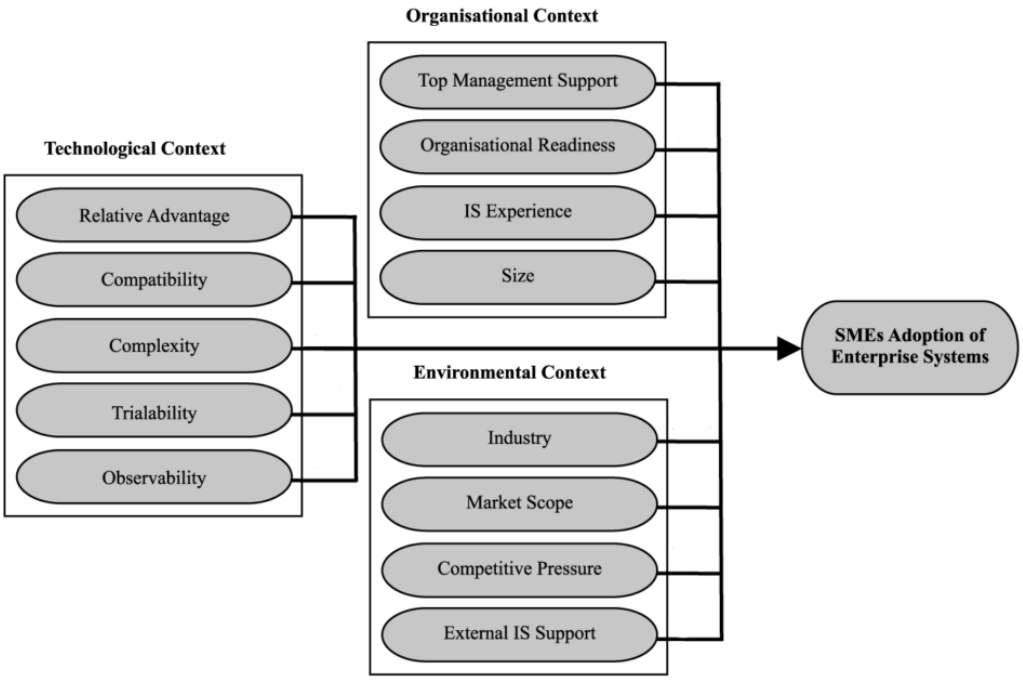
Source: Ghobakhloo et al. (2012)
Figure 3-3: Framework of IT adoption Influencing Factors in SME

In a more general view, Sarosa and Zowghi (2003) suggest that there are a few drivers and barriers of IT adoption within SMEs. According to them, drivers are the positive influences for IT adoption, while barriers are negative influences. Both drivers and barriers may come from two different sources i.e. within the internal SMEs (intra organisation) and from outside SMEs (external environment) (see Figure 3-4).



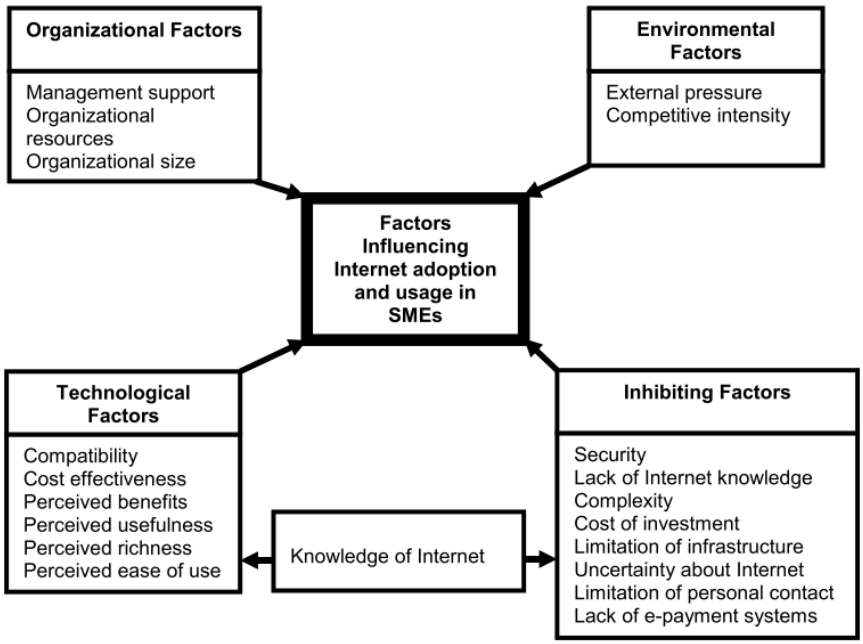
Source: Sarosa and Zowghi (2003)
Figure 3-4: SMEs' IT Adoption Drivers and Barriers

From other perspective, Ramdani, Kawalek and Lorenzo (2009) have used the technology-organisation-environment (TOE) framework developed by Tornatzky and Fleischer (1990) which has been claimed to be a generic theory of IT adoption, to study the SME's adoption of enterprise systems. Their study reveals that SMEs were found to be more influenced by technological and organisational factors than environmental factors.



Source: Ramdani, Kawalek and Lorenzo (2009)
Figure 3-5: Framework of SMEs Adoption of Enterprise Systems

In another study, Lawrence (2010) has proposed a theoretical model which he claims provided a far richer understanding of the factors that influence SMEs decision to adopt and use the Internet in business. He found that the categories of technological, organisational and environmental factors were shown to be relevant in influencing adoption and the use of the Internet, while barriers to Internet adoption hinder the adoption of the Internet.



Source: Lawrence (2010)

Figure 3-6: Motivating and Inhibiting Factors to Internat Adoption and Usage in SMEs

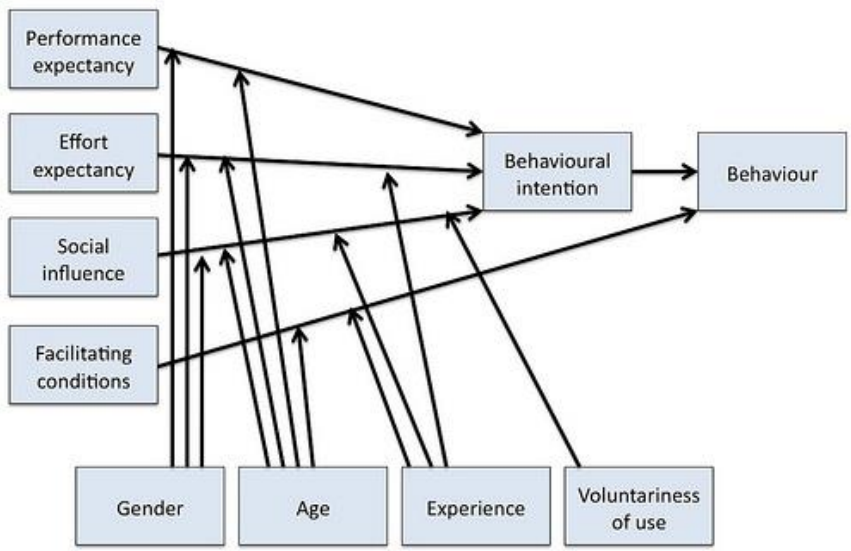
In summary, there are similar pattern of the IT adoption model that has been proposed in the previous studies. The research discussed above indicates that IT adoption may be influenced by both internal and external sources. Within these sources, there are a few factors that have been recognised, such as organisational factors, owner factors, employees factors, resources factors, government factors, competitor factors, vendor factors, environmental factors, product factors, IT factors and networking factors.

Some of these factors will be used in developing a research model, which will be discussed in section 3.2. However, this section will not go into detail regarding every factor that has been proposed. It merely seeks to promote the overview of IT adoption

in general before looking into specific issues on GAS, as will be detailed up in the next section.

3.1.2 IT Adoption Models in Auditing

In order to understand the usage of GAS, and in particular the acceptance of technology within auditing field, there are a few underlying theories that need to be explored. One of the theoretical frameworks that widely used by the latest technology adoption research is a Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al (2003). They developed their own model (see Figure 3-7) after reviewing, comparing and testing eight competing theories which are; the Technology Acceptance Model (TAM), Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), the motivational model (MM), Innovation Diffusion Theory (IDT), Model of Personal Computer Utilization (MPCU), the Social Cognitive Theory (SCT) and a model combining TAM and TPB.



Source: Venkatesh et al. (2003)

Figure 3-7: Unified Theory of Acceptance and Use of Technology (UTAUT)

According to Venkatesh *et al.* (2003), there are four major individual elements that appear to significantly impact the usage of technology. These are Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions. These elements are defined in Table 3-1.

This theory has then been applied and modified by a few studies on the use of technology by auditors. For example, it has been applied by Wehner and Jessup (2005); Mahzan and Lymers (2008); Curtis and Payne (2008) and Janvrin, Lowe and Bierstaker (2009).

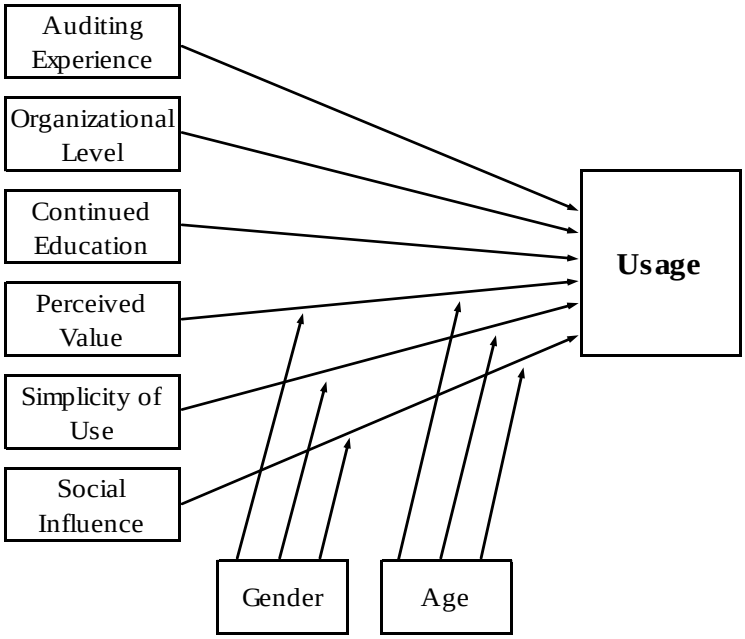
Wehner and Jessup (2005) examine individual factors that influence an auditor's use of GAS. They use the global constructs of perceived value, simplicity of use, and social influence from Venkatesh *et al.* (2003) and added three additional variables; auditing experience, organizational level, and continued education. Gender and age have been used as moderators in their research framework (see Figure 3-8).

Table 3-1: UTAUT Elements

Element	Definition	Constructed From
Performance Expectancy	The degree to which an individual believes that using the system will help him or her to attain gains in job performance.	Perceived Usefulness (Davis 1989; Davis et al, 1989) Extrinsic Motivation (Davis *et al.* 1992) Job-fit (Thompson *et al.* 1991) Relative Advantage (Moore and Benbasat, 1991) Outcome Expectations (Compeau and Higgins 1995b; Compeau *et al.* 1999)
Effort Expectancy	The degree of ease associated with the use of the system.	Perceived Ease of Use (Davis 1989; Davis et al, 1989) Complexity (Thompson *et al.* 1991) Ease of Use (Moore and Benbasat, 1991)
Social Influence	The degree to which an Individual perceives that important others believe he or she should use the new system.	Subjective Norm (Ajzen 1991; Davis *et al.* 1989; Fishbein and Azjen 1975; Mathieson 1991; Taylor and Todd 1995a, 1995b) Social Factors (Thompson *et al.* 1991) Image (Moore and Benbasat 1991)
Facilitating Conditions	The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.	Perceived Behavioral Control (Ajzen 1991; Taylor and Todd 1995a, 1995b) Facilitating Conditions (Thompson etal. 1991) Compatibility (Moore and Benbasat, 1991)

Extracted from Venkatesh *et al.* (2003)

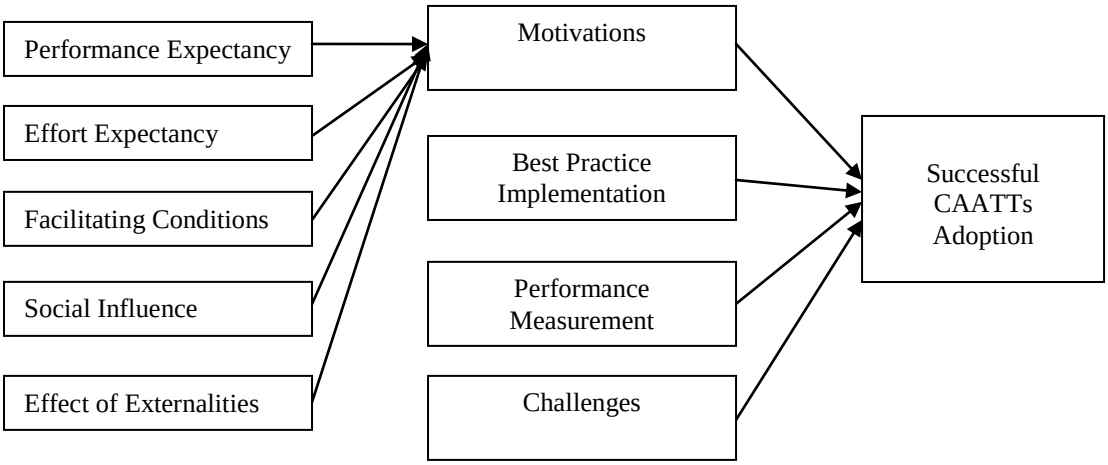
They found that auditors' perceptions appear to influence the usage of GAS. Auditors who have attended courses related to audit software are more likely to use GAS. Staff and senior level auditors are also more likely to use GAS than management level auditors. They also found that age does not impact GAS usage; however, gender plays an important role in influencing the use of GAS. Furthermore, they ascertained that female auditors use GAS more than male auditors.



Source: Wehner and Jessup (2005)

Figure 3-8: Factors Influencing GAS Usage

Mahzan and Lymers (2008) focus on the use of CAATTs by internal auditors. They develop a model of successful CAATTs adoption by internal auditors. Instead of four elements constructed in UTAUT by Venkatest *et al.* (2003), they also add another construct, the effect of externalities (see Figure 3-9). The model comprises four dimensions, covering the issues of factors influencing motivation, best practices of implementation, performance measurement criteria and challenges that can become barriers to successful implementation of CAATTs.



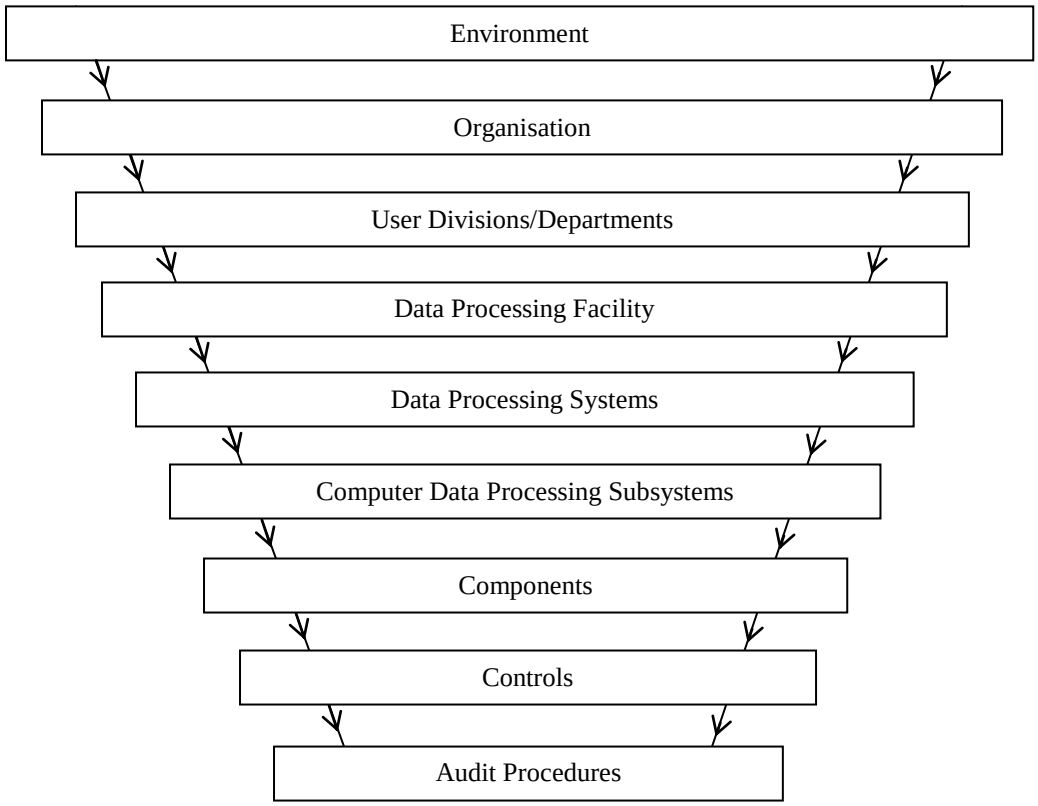
Source: Mahzan and Lymer (2008)

Figure 3-9: Theoretical View of Studying Motivations for Successful CAATTs Adoption

Curtis and Payne (2008) have modified and added a few other factors under UTAUT categories. Under performance expectancy element, they consider the length of the budget and evaluation period to be the factor for the auditor to implement the audit technology. They argue that even audit technology has the potential to improve the efficiency and effectiveness of audit tasks in the long run, however, the budgetary impact of new technology can be substantial in the first period such that 'profits' from the investment will not be seen until future periods. Additionally, based on the model's social influence construct, they consider whether making the attitude of remote superiors (practice office managing partners) known to the auditor will impact their acceptance decision. Finally, in place of the model's typical individual differences (age, gender, etc.), they consider audit experience, risk preference and perceptions of budget pressure because of their potential importance in auditing.

Janvrin, Lowe and Bierstaker (2009) employed an UTAUT model without any additional elements compared to the above studies to identify factors influencing auditor acceptance of CAATTs. They found that performance expectancy and facilitating conditions such as organizational and technical infrastructure support the influence of the likelihood that auditors will use CAATTs. These results suggest that to increase CAAT usage, audit firm management may want to develop training programs to increase the auditors' degree of ease associated with using CAATTs. Furthermore, audit firm management may want to enhance their organizational and computer technical support for CAATTs to encourage their usage.

While the latest research uses UTAUT as the model to identify the factors that influence the use of GAS, Lovata (1988) has applied the model by Davis and Weber (1986) (see Figure 3-10) in relation to the auditor's decision to implement GAS.



Source: Davis and Weber (1986)

Figure 3-10: Model of Stress and the Systems Hierarchy

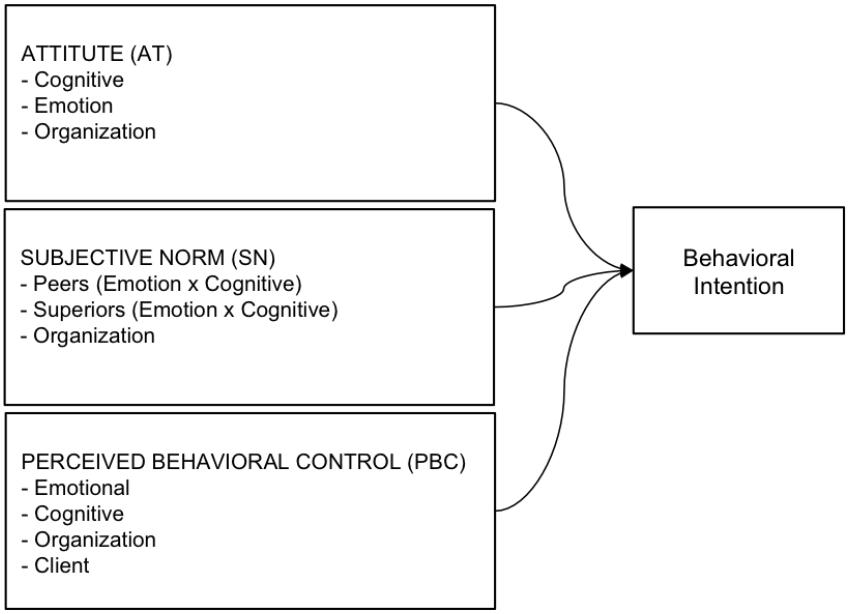
Lovata (1988) utilised this model to identify environmental factors that prompt audit managers to initially consider using GAS. There are three factors that she believes affect the audit procedure used: the sophistication of the computer system, the strength of internal controls and the characteristics of the client's internal audit department. Based on this, 14 situations were developed (see Table 3-2).

Table 3-2: Situations that may influence the auditor's GAS usage decision.

No.	Situation
1.	A new program has been written to handle accounts receivables
2.	The internal control evaluation of accounts receivable this year indicates user controls are much worse than last year
3.	The firm as a whole has been struggling to remain a going concern
4.	There has been a change in upper management
5.	The client has implemented online inputs this year
6.	This year a much larger portion of accounts receivables is more than 90 days overdue
7.	The dollar amount of account receivables has been increasing steadily and now is very large
8.	The internal audit department has been eliminated this year
9.	A new computer system was implemented this year
10.	The IT department had grown substantially this year
11.	The internal control evaluation indicates that general IT controls are much worse than last year
12.	A database system was implemented this year
13.	An internal audit department was added this year
14.	The internal control evaluation indicates that IT software controls are much worse than last year

Source: Lovata (1988)

Schafer and Eining (2005) studied the auditor's adoption of technology from the perspective of TPB. They focus on examining the factors that are important in the decision to adopt new technologies. Unlike the previous literatures that focus on UTAUT, Schafer and Eining (2005) proposed, decomposed TPB also provides significant cognitive and emotional components in the choice of auditors to adopt the technology. Their results suggest that audit firms investing in technology tools should carefully consider the cognitive and emotional components of attitude, subjective norms and perceived behavioural control when investing in technology tools for use in the audit practice. The variables that have been used to determine the behavioural intention to use audit technology is summarised in Figure 3-11 below.



Source: Schafer and Eining (2002)

Figure 3-11: Decomposed Theory of Planned Behaviour

3.2 THEORETICAL FRAMEWORK

In this section, the research model to be adopted in this study is discussed. There are many factors that influence the use of GAS by auditors. For instance, Janvrin, Bierstaker and Lowe (2009) found that performance expectancy and organisational and technical infrastructure support the influence of the likelihood that auditors will use CAATTs. They surveyed 181 different types of auditors representing the Big 4, national, regional and local firms from different regions of the United States to examine the factors that influence individual auditor acceptance of CAATTs.

Wehner and Jessup (2005) as well as Mahzan and Lymer (2008) and Janvrin, Bierstaker and Lowe (2009) focused more on individual factors that influence an auditor's use of GAS which is more on behavioural and IT acceptance research. They are using UTAUT by Venkatesh *et al.* (2003) as a framework for their study.

Mahzan and Lymer (2008) proposed a model of successful CAATTs adoption by internal auditors which are comprised of four dimensions covering the issues of factors influencing motivation, best practices of implementation, performance measurement criteria and challenges that can become barriers to successful

implementation. They found that GAS are widely used by internal auditors in the UK, and the factors that influence the usage of GAS include the ability to train employees on the usage of GAS, compatibility of the software within the department and the ability of software to meet the data manipulation needs.

Janvrin, Lowe and Bierstaker (2009) also suggest that to increase CAATTs usage, audit firm management may want to develop training programmes and enhance their computer technical support to increase the auditor's degree of ease associated with using CAATTs.

There are several theories which have been implemented by information systems researchers to understand technology acceptance and adoption among auditors (Janvrin et al, 2008; Curtis and Payne, 2008). For example, as shown in Appendix I, Wehner and Jessup (2005), Mahzan and Lymer (2008) and Curtis and Payne (2008) used the unified theory of acceptance and use of technology (UTAUT) (Venkatesh *et al.*, 2003); Schafer and Eining (2002) used the decomposed theory of planned behaviour (TPB) (Ajzen, 1991) and technology acceptance model (TAM) (Davis 1989); Banker et al (2002) have applied task-technology fit (TTF) (Goodhue and Thompson 1995); and Lovata (1988) developed her own Audit Adaptation Model based on Davis & Weber (1986), Model of Stress and the Systems Hierarchy.

While looking into the adoption theory that has been used by previous researchers, most of them focused more on behavioural intention as to what has been explained in UTAUT, TPB and TAM rather than to understand the actual use of GAS. The issue here is not just about the intention in the use of technology, but more on understanding the use of technology on the various scopes of audit tasks. Most auditors probably understand the usefulness of GAS, but the use of such technology may not apply to a certain type of audit or may be in the particular audit assignment. The real perspectives from the audit professional point of view are also very limited, especially when it comes from the small and medium size practitioner's point of view. Most previous studies focused on the large firms which have enough resources to implement GAS.

To understand the current usage of GAS and the factors that influence its usage, the model of IT audit quality by Havelka and Merhout (2007) has been modified to fit the objectives of this study. This study chooses this model as a basis for the theoretical model, because all of the factors that have been identified are a set of comprehensive factors considered to be important across the IT audits. Furthermore, most of the variables within the model are pertinent with the audit industry and have its own influence with the subject of this study.

Havelka and Merhout (2007) used nominal group techniques to gather the factors that influence the efficiency, effectiveness and quality of the IT audit process. Five different factors have been identified, namely client, target process or system, IT audit personnel, IT audit organisation and audit process or methodology factors (See Figure 3-12). These factors form the basis of the questionnaire, but are complemented by other factors from previous research that fit with the objective of this study. Some factors that were not previously investigated have also been identified. From the extensive literature review and the feedback from various academics and auditors, factors that are not tailored to the specificity of GAS usage were excluded from the conceptual model.

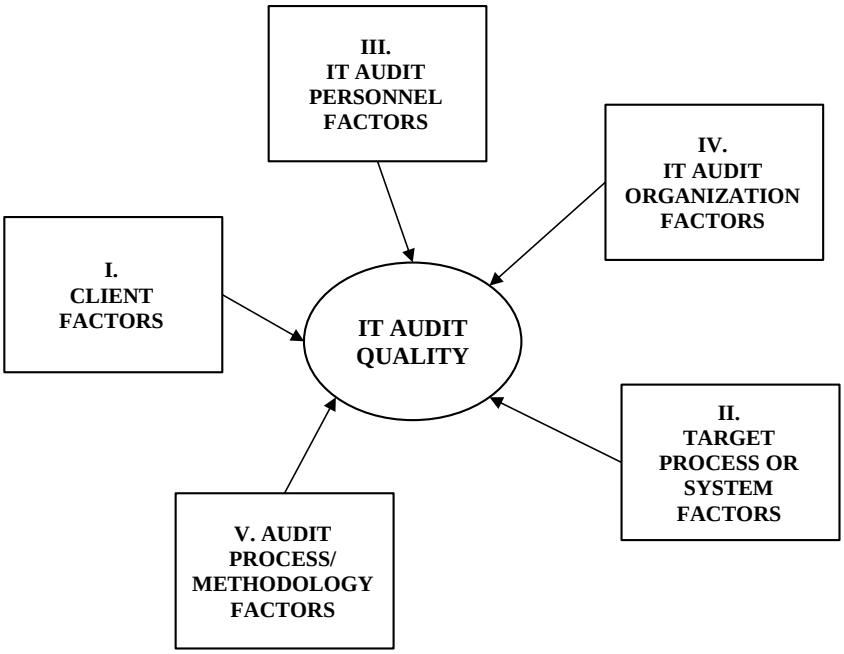


Figure 3-12: A Model of Information Technology Audit Quality by Havelka and Merhout (2007)

Based on the Figure 3-12, the explanation by Havelka and Merhout (2007) as well as in some items of the previous literature, this study has determined six factors that might influence the use of GAS by external auditors in the UK. The shift from the original model to the proposed framework of this study has been detailed in Table 3-3 below.

Table 3-3: The Shift from IT Audit Quality Model to the Proposed Model for the Factors that influence the use of GAS

IT Audit Model by Havelka and Merhout (2007)	Modified Model	
	Factor and Description	**Item**
Target process or system factor: The process or system category included any factors based on the process or system being audited Examples: - the target of the audit, and specific considerations for the specific audit "project" being performed - clearly defined project scope - system complexity and type - amount of manual versus automation in process - the level of documentation for the process or system.	**Technological factors:** The technological category includes all the factors, which are related to the installation and the usage of audit software.	Compatibility of software
		Up-to-date firm's ICT infrastructure
		Ease of use
		Adequate and sufficient documentation to follow
		Easy to modify and upgrade
IT audit organisation factors: The IT audit organization category includes those factors that are characteristics of the IT audit function within the organization. Examples: - the size of the IT audit organization relative to the overall company - the leadership of the IT audit unit - budget and resource availability - the availability and use of technology for testing.	**Organisational factors:** The organisational category includes all the aspects within the audit firms.	Full support from top management
		Strong IT support from IT staff
		Availability of IT audit expertise in the organisation
		Effective and adequate INTERNAL training for staff
		Effective and adequate EXTERNAL training for staff
		Sufficient implementing cost
		Sufficient maintaining cost
		Enough resource to use GAS
		Instructed by the management to use GAS
		Demand in auditor's promotion policies
		Workloads on multiple audit engagement
		Financial budget for audit engagement
		Sufficient time allocated to audit assignment

Audit process or methodology factors: The audit process or methodology category refers to the specific procedures and practices followed by the IT audit team. Examples: - the existence of an audit methodology for the team to follow - coordination between the financial and IT auditors - use of good project management practices - review of field work by a supervisor or senior staffer.	**Audit profession factors:** The professional category includes all the aspects within the audit profession.	Requirements by auditing standards
		Professional audit judgement
		The existence of audit methodology to follow
		Level of audit risk
		The usefulness of the application for auditing
Client factors: The client category included any factors that were characteristics of or dependent on the client. Examples: - expectations of the client - client support of the audit - responsiveness of the client.	**Client factors:** The client category includes all the aspects while the auditors auditing the client's account.	Strength of client's internal control systems
		Complexity of client's IT environment
		Complexity of client's business environment
		Client concern about data security
		Client business size
		Supports provided by client's IT personnel
IT audit personnel factors: The IT audit personnel category includes all the factors that are dependent upon the individuals performing the IT audit tasks. Examples: - knowledge of the process being audited - interpersonal skills - technical expertise - experience level.	**Personal factors:** The individual category includes all the factors that are dependent upon the auditor itself.	Experience with computerised auditing
		Experience with larger audit clients
		An attempt to ensure public accountability
		Enough knowledge to use GAS
		Understanding of the application
		Easy to become skilful using GAS
		Prefer to use GAS rather than traditional audit
		IT Knowledge
		Use GAS regularly in audit assignment
	External factors: The external category includes all the other factors that are not included in the above category.	Adequate technical support from vendors
		The similar application has been used by other audit firms

Based on the above table, it is also important to clarify that the items that have been proposed in the specific factor of this study also have been gained and supported from the previous literatures. Most of the factors have been renamed to fit in with the objective of this study and one of the other factors has been added in order to justify the factors that influence the use of GAS by external auditors. Each of the items within the specific factor has also been explained in the following section.

3.2.1 Technological Factor

The technological category includes all the factors, which are related to the installation, maintenance and the usage of audit software. There are five items in this construct. The one is the compatibility of the software with the client data. Mahzan and Lymer (2008) found out that one of the factors that influence internal auditor's decision to use CAATTs is the compatibility of the software with the other departments' system. They also reveal that the biggest barrier to CAATTs implementation is to resolve technical issues such as the preparation of data for interrogation and analysis.

Abd Rahman (2008) found out that compatibility of software within the existing operating systems is one of the concerns within technological factor. The same issue also has been raised by Lovata (1988) regarding the compatibility.

Since GAS may develop in different platforms and use different kinds of technologies and there are varieties of applications used by the client, there might be an issue of compatibility when the auditor wants to use the client data into GAS. Some GAS may already have solved this issue by providing a variety of options to extract client data from different kinds of platforms and various types of data format. However, this study will try to find out if this issue is still relevant in the context of GAS.

The second item is the latest firm's ICT infrastructure. According to Rezaee *et al.* (2002), effective development of a continuous auditing requires an information technology infrastructure for accessing and retrieving data with various file types and record formats from different systems and platforms. This issue also has been raised by Abd Rahman (2008) regarding the up-to-date ICT infrastructure by the firms. He added that in general, the facilities that reside within organisations would affect the decision to deploy new technology.

The third item is the simplicity of the use of GAS. In the previous discussion on the benefits of GAS, Sayana (2003) and Wahab (2006) have mentioned that GAS is easy

to use. However, Debreceny *et al.* (2005) found one of the reasons that lessen the use of GAS is because of its difficulty.

The fourth item is related to the documentation or instructions manual that comes with the audit software. Banker et al (2002b) stated that all tasks would become easier when high-quality system documentations are provided. O'Keefe *et al.* (1994) argue that audit firms seek standardization to enhance audit quality through training and manuals that may impact the voluntariness of adoption.

The fifth item is related to the software modification and upgrade. From time to time, audit and system requirement are probably changing due to many factors especially when it deals with the technological changes. This change might require GAS to be upgraded to cope with the technology. So, there will be no issue of compatibility being raised.

3.2.2 Organisational Factor

The organisational category includes all the aspects within the audit firms. There are 13 items under this factor. The first one is related to the support of the top management. Mahzan and Lymers (2008) found out that one of the CAATTs implementation best practices is support from the management on the overall adoption process.

The second item for this factor is related to the IT support from the IT staff. Cooperation from other department is also one of the factors for successful implementation of CAATTs (Mahzan and Lymer, 2008). Havelka and Merhout (2007) name it as the coordination between finance and IT auditors.

The third item is the availability of IT audit expertise within the organisation. Mahzan and Lymers (2008) also found out that the important factors that can assist successful in CAATTs adoption is the availability of CAATTs champions and expert users in the organisation. In this case, the availability of GAS expert will help in supporting the auditors for successful implementation of GAS. Janvrin, Bierstaker and Lowe (2009)

acknowledge that auditors from some of the smaller firms may not have had access to IT auditors. This study tries to identify if this item is relevant in the context of GAS.

The first three items above are derived from the Venkatesh *et al.* (2003) under facilitation conditions construct, which explain the technological assistance or support available to the user.

The fourth and fifth items relate to the training for GAS usage either there is effective and adequate training provided for staff internally of externally. Abd Rahman (2008) found that the user needs training to use GAS. Mahzan and Lymers (2008) also found out that the training provided on CAATTs usage is the factor for CAATTs implementation best practices. For the purposes of this study, the training is divided into two; (1) internal training, which normally conducted by the expertise within the firm and (2) external training, which conducted by other expertise outside the firm but supported by the firm.

The sixth and seventh items are related to implementing and maintaining the cost of GAS. Mahzan and Lymer (2008) argue that the cost may no longer an issue due to the availability of cheaper versions of GAS. However, this might not be the case for small and medium size of audit firms. Lovata (1998) found one of the major problems with the implementation of CAATs is the initial cost of the programs. Niemi (2004) also found cost to be a chief concern in GAS implementation.

The eighth item concerns the resource to use GAS. Janvrin, Lowe and Bierstaker (2009) found out that auditor acceptance of CAATs may be driven by firm resource issues and resource availability (Havelka and Merhout, 2007). Most of the study i.e. Janvrin, Bierstaker and Lowe (2009) and Bierstaker *et al.* (2001) found that big firms are more likely to have the resources available to implement new technology.

The ninth item is auditor has been instructed by the management to use GAS. Curtis and Payne (2008) recommended that auditors' decision making is influenced by their superiors. The use of GAS will not become voluntarily if it has been pressured by the top management.

The tenth item is the demand in auditor's promotion policies. For example, Curtis and Payne (2008) suggested that the performance pressure influence the auditor in the technology implementation decision within the audit firm.

The last three items in the organisational factors are related to the audit engagement i.e. audit workloads, financial budget and time allocated.

3.2.3 Audit Profession Factor

The profession category includes all the aspects within the audit profession. There are five items within this factor. The first is the requirement by auditing standards. For example, ISA 500 suggests that auditors may use CAATs to perform additional procedures in evaluating the accuracy and completeness of audit evidence. Another example in Janvrin, Bierstaker and Lowe (2009), in the USA, AICPA (2008) also required auditors to consider using the computer related audit procedure when they obtain an understanding of client internal control.

The second item is related to the professional audit judgement. According to Kelechi (2007) usually, the auditors make a professional judgement regarding the sample size and the extent of test which normally depends on the level of assurance the auditor wishes to obtain. Meanwhile, according to Janvrin *et al.* (2008), decision tools like GAS may impact audit judgement. However, in this case, the auditor may use audit judgement to decide whether they want to use GAS or not.

The third item refers to the existence of audit methodology to follow. According to Havelka and Merhout (2007) audit methodology referring to the specific procedures and practices followed by the audit team.

The fourth is the level of audit risk. According to ISACA (2009) one of the deciding factors for using CAATs is the level of audit risk.

The last item within this factor is the usefulness of the application in auditing. According to Greenstein-Prosch (2008) in order to increase adoption, the usefulness and efficiency of the system need to be made clear to increase their adoption.

3.2.4 Client Factor

The client category includes all aspects, while the auditors auditing the client's account. There are six items under client factor. The first one is the strength of client's internal control systems. ISA 300 required the auditor to consider the client's internal controls when setting the direction of the audit. For example, when a client's internal controls are found to be effective, auditors may use their judgment to proceed with the audit. In this case, the effectiveness of internal control factor will lead the auditor on whether to use GAS or not. Debreceny *et al.* (2005) found that external auditors have limited usage of GAS because the effectiveness of internal controls of their clients is really high.

The second item is the complexity of the client's IT environment. Janvrin *et al.* (2008) examine on the use of IT specialist on the client's IT complexity and suggesting that the frequency of IT specialist use is lower when auditors from the Big 4 firms examine clients with low IT complexity. Another study about IT complexity (or IS complexity) is done by Banker *et al.* (2002b) on audit cost. Mahzan and Lymer (2008) refer it as technical complexity which is one of the challenges for the auditor to use CAATTs. This study, however, will seek to identify whether GAS will be used or not based on the client's IT complexity.

The third item is the complexity of the client's business environment. Instead of looking for the complexity of IT, the complexity of client's business also has been selected as one of the items under client factor. Flowerday (2005) propose that modern-day business complexity and technology are attributes of firms that required auditors to develop new methodologies and process for auditing. He suggests continuous auditing may be one of the processes developed to respond to the business complexity attributes.

The fourth item involves the client's concern about data security. Debreceny *et al.* (2005) found that one of the limitations in the use of GAS is the clients are worried that their systems and data might be compromised by the use of GAS. While according to Temesgen (2005), many auditors have been prevented from using audit software because of client concerns over the security of confidential or sensitive data.

The fifth item concerns client business size. Instead of the individual level or the mandate at the firm level, client business size also plays an important role in deciding to use computer-aided audit techniques as suggested by Curtis and Payne (2008).

The sixth item is the support provided by the client's IT personnel. Havelka and Merhout (2007) give an example of client support of the audit in the client factor. This idea is expanding in this study, as an auditor might require their client to provide the proper format of the data as well as their help and supports before continuing to use GAS.

3.2.5 Personal Factor

The individual category includes all the factors that are dependent upon the auditor itself. There are nine items within this factor. The first two items in this category concern the auditor's experience. It is logical that an experienced auditor will be more likely to adopt new technology that is useful in their work (Wehner and Jessup, 2005). According to Schafer and Eining (2002) experience may impact the acceptance of technology in several ways i.e. in task-specific knowledge, a potential dilution effect and auditor learning and task complexity. This study, however, will examine the experience of the auditor in two elements which are (1) the experience with computerised auditing and (2) the experience of auditor with larger audit clients.

The third item concerns the auditors attempt to ensure public accountability. Abd Rahman (2008) found that this factor seems to be the most influenced in the decision to adopt data mining technology. Public accountability is related to the auditor's responsibility, especially to the client's shareholders in order to make sure the client's accounting records are presented in true and fair view.

The fourth item involves the knowledge of auditor to use GAS. This item also has been suggested by Havelka and Merhout (2007) regarding the knowledge of the process being audited. Further explanation by Mahzan and Lymer (2008) is the auditors are professionals who work within a specialised knowledge domain and have high levels of professional qualifications, while according to Sayana (2003), auditors need to have good knowledge of the business and the application plus the audit skill of determining what to be verified and tested using the audit software.

The fifth item concerns the understanding of the application. Lovata (1998) found that one of the major problems with CAATs is a lack of understanding by auditors.

The sixth item is associated with the belief by the auditors that they are easy to become skilful using GAS. This is one of the UTAUT elements under effort expectancy used by Payne and Curtis (2008) and Janvrin, Lowe and Bierstaker (2009).

The seventh item is about the auditors preference to use GAS rather than traditional audit. Auditors are slow in adopting the technology. It is not because they are not willing to change, but Mahzan and Lymer (2008) found that they are complacent with the manual auditing techniques and not willing to explore CAATTs. This is also supported by Abd Rahman (2008) who believed that accountants are happy with the current system, which may make them less willing to change.

The eighth item concerns the IT Knowledge of auditors. Good IT knowledge will help the auditors to enhance the usage of GAS. For instance, Mahzan and Lymer, (2005) mentioned that it requires technical IT skills, knowledge and experience to get client data from the host system and this cannot be done by the typical auditor with an accountancy background. Janvrin, Bierstaker and Lowe (2009) suggest to investigate whether the use of CAATs is related to the IT knowledge of the individual auditor even though Ismail and Zainol Abidin (2009) found that IT knowledge level among the auditors is lower than their perception towards the importance of the technologies.

The last item is about the regularity usage of GAS in audit assignment. Mahzan and Lymer (2008) found out that one of the factors that influence auditor's decision to use CAATTs is the regularity of its usage.

3.2.6 External Factor

The external category includes all the other factors not mentioned above. There are two items in this factor. The first item is about the technical support from vendors. According to Mahzan and Lymers (2008) one of the facilitating conditions that can impact auditors on their motivation to adopt CAATTs is support from vendors or software providers.

The second item concerns the usage of similar application in other audit firms. According to Wehner and Jessup (2005) it seems logical that the auditor would be more likely to adopt new technology if it is being used by others in the auditing profession.

3.3 PROPOSED MODEL AND RESEARCH HYPOTHESES

In this section, the model of the GAS usage by external auditor is discussed. Six main issues identified as factors that influence the use of GAS by external auditors (technological, organisational, audit profession, client, personal, and external factors) were developed as a combination of factors that influence the use of GAS or other audit technology. At the same time, the auditor's and audit firm's demographic variables may also become important in understanding the GAS usage among the auditors. For example, the audit firm size are used as a firm's demographic information while the auditor's age, gender, experience in auditing, experience in computerised auditing and IT skill are used as auditor's demographic information to determine whether it might have the relationship with the GAS usage.

Figure 3-13 depicts a research model for the GAS usage by external auditors. There are three groups of factors on the left side to be the main reasons identified from the

previous research to play a role in the usage of GAS. There are one factor under audit firm's demographic information, five factors under auditor's demographic information and six items for GAS factors. All of these items will be hypothesised and discussed in the next section.

The final aspect of the model addresses the worth of GAS, GAS satisfactions from the perspective of auditors who use GAS and an intention to adopt GAS from the perspective from those who are not using GAS. However, these issues will not be hypothesised and only be discussed descriptively and qualitatively from the open-ended questions.

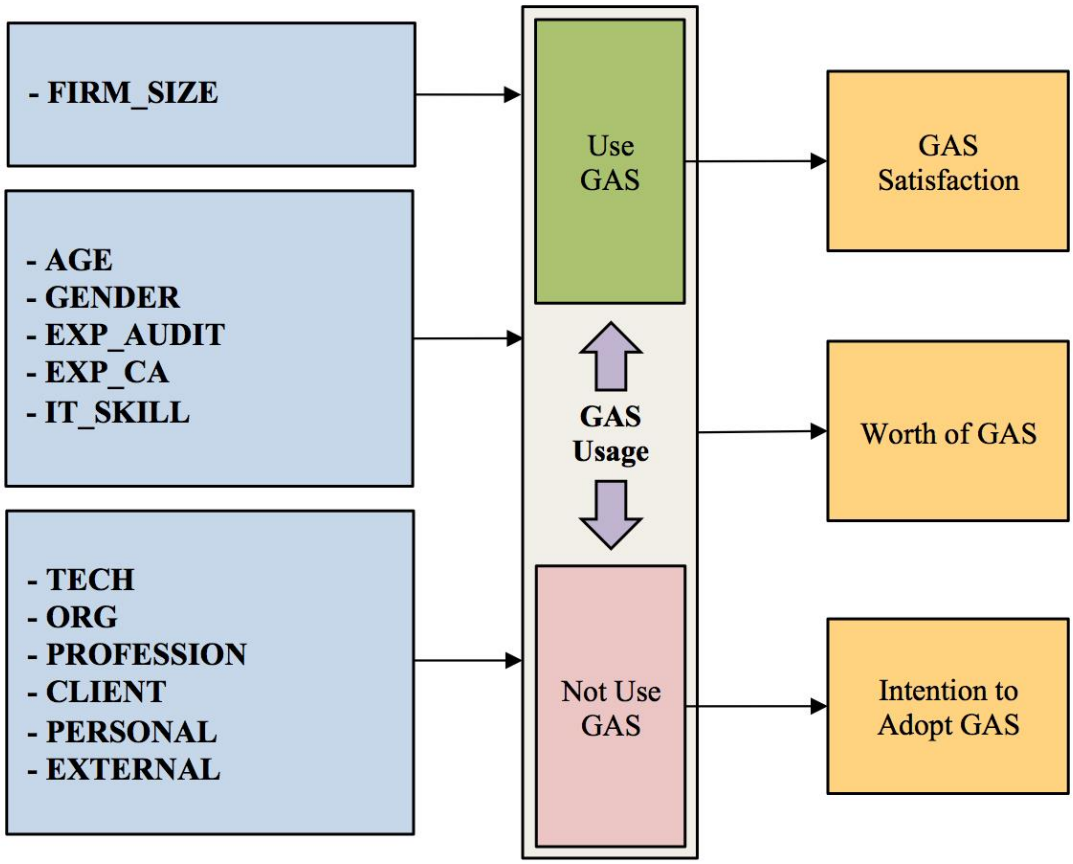


Figure 3-13: Proposed Model for the Use of GAS by External Auditor

3.3.1 Firm's Demographic

In the firm's demographic information, only the audit firm size will be used to test the relationship with the GAS usage. There are few studies that were conducted within external audit entities have used this variable to test its significance. For example, Janvrin, Bierstaker and Lowe (2008) suggest that IT use and perceived importance vary by firm size. They found that Big 4 firms are more likely to use audit applications than non-Big 4. Janvrin, Bierstaker and Lowe (2009) in another paper also suggested that auditors employed by Big 4 firms are more likely to use computer-related audit procedures than those working for smaller firms as larger firms are more likely to have the resources available for training and support (Janvrin, Bierstaker and Lowe, 2009). Unlike the previous study that have a focus on Big 4 audit firms, this study will make the comparison between smaller practices and medium practices on the GAS usage. Therefore, the following hypothesis is proposed:

H_1: *Audit firm size would have significant differences on the use GAS.*

3.3.2 Auditor's Demographic

According to Abd Rahman (2008) individual difference affects beliefs, which in turn affect attitudes, intentions and information system utilisation. Auditor's demographic information, such as auditor's age, gender, experience in auditing, experience in computerised auditing and the level of IT skill are used to determine whether it might have the relationship with the GAS usage.

Auditor's Gender

Wehner and Jessup (2005) suggest that gender plays an important role in deciding whether or not to use GAS. They found that female auditors use GAS more than male auditors. Venkatesh *et al.* (2003) also found that gender moderated the influence on behavioural intention on the use of technology. However, Payne and Curtis (2008) found that gender was not significantly related to the adoption of audit technology decisions. Given the impact of this variable, this study proposed:

H_2: *Auditor's gender would have a positive relationship with the use of GAS.*

Auditor's Age

Previous studies in other fields have found that a respondent's age affects the consequence of usage in technology. For example, Morris and Venkatesh (2000) found that younger workers are more likely to be influenced by attitudes toward the use of technology. However, Wehner and Jessup (2005) found that age does not impact GAS usage. Payne and Curtis (2008) also found that age was not significantly related to adoption of audit technology decisions. To confirm the relationship between age and GAS usage, it is important to test this variable.

H_3: *Auditor's age would have significant differences on the use of GAS.*

Auditor's Experience in Auditing and Computerised Auditing

Past experience may have a positive or negative impact on attitude towards technology and will influence an individual's belief about the future use of information technology (Abd Rahman, 2008). Wehner and Jessup (2005) also suggested that auditing experience would significantly affect behavioural intention to use GAS.

Generally, an experienced auditor would be more likely to adopt new technology that is useful in their work, if it is easy to use, or is being used by others in the auditing profession (Wehner and Jessup, 2005). However, Payne and Curtis (2008) found that a wide range of experience indicators such as experience in the firm, position, fraud, large-client, small-client, and electronic tools were not significantly related to adoption of audit technology decisions. Thus, the different results by previous researcher permits further investigation with the following hypotheses are proposed:

H_4: *Auditor's experience in auditing would have a positive relationship with the use of GAS.*

H_5: *Auditor's experience in computerised auditing would have a positive relationship with the use of GAS*

Auditor's IT Skills

Examining auditor's perceptions of their IT skill levels should provide some insights into which technologies may be more likely to be viewed as useful and easy to use (Greenstein-Prosh *et al.*, 2008). Therefore, the following hypothesis is developed.

> H_6: *Auditor's IT skills would have a positive relationship with the use of GAS*

3.3.3 GAS Factor

Researchers have suggested that various factors affect the relationship between the global constructs of various IT acceptance models and intention to use technology (Wehner and Jessup, 2005). Similarly in this case, the factors that might influence the use of GAS among external auditors have multi dimensions which only can be predicted after a factor analysis test has been conducted. Since the factors that have been suggested at this stage have yet to be confirmed the following general hypothesis is suggested:

> H_n: *X would have a positive relationship with the use of GAS*

The above hypotheses will rely on the findings from the factor analysis that will be conducted in the data analysis chapter in which the "n" number of hyphotheses will be generated and the "X" factors will be defined.

3.4 CONCLUSION

This chapter has provided a detailed investigation of the factors that influence the use of GAS. A review of the earlier studies which is relevant to GAS, auditing and other related technologies has been conducted and a brief description of the studies, the theory has been adopted, while its results for selected studies have been discussed.

Based on the findings and after considering the theories and frameworks from the existing literature, the research model has been proposed. This model will form the basis for the investigation of the use of GAS by external auditors in the UK. The items within particular constructs has been identified and the interrelated relationships with the GAS usage were articulated. This chapter also highlights the hypotheses which demonstrated the relationship between the factors in the framework.

Chapter 4: Research Design and Methodology

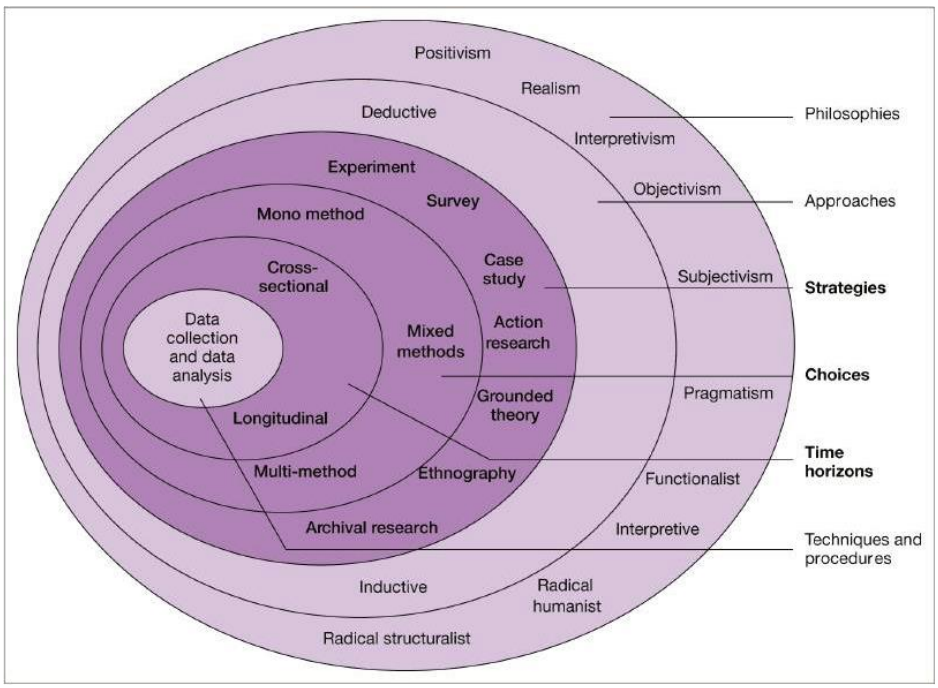
This chapter discusses the methodologies available for further research and which of these are most applicable for this study. In broad terms, this chapter focuses on the methods for achieving the objectives outlined in Chapter 1. It will explain the methods and procedures involved in collecting and analysing useful data necessary to make the contributions of this study. However, before proceeding with the chosen methods, it is worthwhile explaining the fundamental of research terms within the research method and research methodology such as research philosophies, research approaches, research strategy, research choices, time horizons as well as the techniques and procedures for data collection and analysis.

This chapter will also explain the selection of research strategies that have been followed and justification of choosing those strategies. In the section that follows, the process of designing the questionnaire as well as its structure will be explained. The pilot test survey also has been justified in order to ensure the validity and the reliability of the questionnaire. Lastly, the details about data collection and data analysis will be presented in this chapter.

4.1 RESEARCH METHODOLOGY

According to Saunders *et al.*, (2007) the term research methodology refers to the theory of how research should be conducted including the assumptions related to the theoretical and philosophical feature which study is based and the implications of these for the methods adopted, whereas they defined research method as the techniques and procedures used to obtain and analyse research data. In other words, research methods explain how research questions will be answered using available tools and techniques to gather and compile the empirical evidence.

Before proceeding with the selection of the research design and strategies, this study seeks to highlight the alternatives of the research methods available to achieve the objectives of this research. The research 'Onion' as shown in Figure 4-1 by Saunders *et al.* (2007) is the best overview in explaining the fundamental of research terms such as research philosophies, research approaches, research strategies, research choices, time horizons and research techniques and procedures.



Source: Saunders et al. (2007)

Figure 4-1: The Research Onion

The other terms which underlying within the above concept will also basically explained in the following sections.

4.1.1 Research Philosophies

There are 10 different types of philosophical concepts, as shown in Figure 4-1. The first six concepts are the subsets of three main branches of research philosophy: epistemology, ontology and axiology while the last four are the concepts within research paradigms. However, this study will only discuss the first three aspects that come under research epistemology due to its relevance in the context of this study.

According to Myers (1997), all research is based on some underlying assumptions about what constitutes 'valid' research and which research methods are appropriate. Thus, in conducting a research, it is important to know the underlying assumptions before proceeding with the next research approach. These assumptions relate to the underlying epistemology which will guide the research.

Positivism

Saunders *et al.* (2007) define positivism as the epistemological position that advocates working with an observable social reality. Myers (1997) describes positivists are those who generally assume that reality is objectively given and can be described by measurable properties that are independent of the researcher and their instruments. Research can be classified as positivist if there is evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from the sample to a stated population (Orlikowski and Baroudi, 1991). Positivist methods usually incorporate the assumption that there are true answers, and the role of the researcher is to start with the hypothesis about the nature of the world and then seek the data to either confirm or disconfirm it, or the researcher poses several hypotheses and seeks data that will allow selection of the correct one (Easterby-Smith *et al.*, 2008).

Realism

According to Saunders *et al.* (2007), realism is a branch of epistemology which is similar to positivism in that it assumes a scientific approach to the development of knowledge. There are two types of realism. The first type is direct realism, which says that what you see is what you get. In contrast to direct realism, the second type of realism, critical realism argues that what we experience are sensations, in other words, what you see in the real world is not the thing directly. It is the only part of the bigger picture (Saunders, *et al.*, 2007). According to Dobsons (2002), critical realist agrees that our knowledge of reality is a result of social conditioning and, thus, cannot be understood independently of the social factors involved in the knowledge derivation process. Myers (1997) in his article defines this group as critical research, rather than realism or critical realism which focuses on the oppositions, conflicts and contradictions in contemporary society, and seeks to be emancipatory.

Interpretivism

Interpretive studies generally attempt to understand phenomena or everyday social roles through the meanings that people assign to those roles (Myers, 1997; Saunders *et al.*, 2007). According to Myers (1997), interpretive researchers start out with the assumption that access to reality (given or socially constructed) is only through social constructions such as language, consciousness and shared meanings. Interpretive research does not predefine dependent and independent variables, but focuses on the full complexity of human sense making as the situation emerges (Kaplan and Maxwell, 1994). Interpretivism totally contradicts the positivism approach.

4.1.2 Research Approaches

There are numerous research methods (also referred to as "research approaches" or "methodologies") have been used in the IS field. However, one of the most common distinctions is between qualitative and quantitative research methods (Myers, 1997). From the perspective of the research onions as shown in Figure 4-1, qualitative research is inductive and quantitative research is deductive. Deductive is more to positivist while inductive is more to interpretivist.

Quantitative Research

According to Myers (1997) quantitative research methods were originally developed in the natural sciences to study natural phenomena. Straub *et al.* (2004) defined quantitative (positivist) research, as a technique that allow IS researchers to answer research questions about the interaction of humans and computers. Quantitative studies focus on testing hypotheses and generalising the findings to a broader population (Saunders *et al.*, 2007). Examples of quantitative methods include surveys, laboratory experiments, formal methods (e.g. econometric) and numerical methods such as mathematical modelling.

Qualitative Research

Myers (1997) also indicates that qualitative research methods were developed in the social sciences to enable researchers to study social and cultural phenomena. Examples of qualitative methods are action research, case study research, ethnography and grounded theory. Qualitative data sources include observation and participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impressions and reactions.

4.1.3 Research Strategies

There are a few research strategies that can be used in order to achieve the research objectives and answering the research questions. For example, researchers can use experiments, surveys, case studies, action research, ethnography and grounded theory. However, the most dominant approaches that have been used in the previous information systems studies are surveys, experiments and case studies (Mingers, 2001). Table 4-1 summarises the key features, the strengths and the weaknesses of those research strategies which are adapted from Galliers (1992). The following section will briefly discuss about all the similarities and other research strategies.

Table 4-1: A Summary of the Key Features, Strength and Weakness of Research Strategies
(Adapted from Galliers, 1992)

Approach and Key Feature	Strength	Weakness
Laboratory Experiments Identification of precise relationships between chosen variables via a designed laboratory situation, using quantitative analytical techniques, with a view to making generalisable statements applicable to real life situations	The solution and control of a small number or variables, which may then be studied intensively	The limited extent to which identified relationships exist in the real world due to over implication of the experimental situation and the isolation of such situations from most of the variables that are found in the real world
Surveys Obtaining snap shots of practices, situations or views at a particular point in time (via questionnaires or interviews) from which interferences are made (using quantitative analytical techniques) regarding the relationships that exist in the past, present and future.	Greater number of variables may be studied than in the case of experimental approaches. Description of real world situations. More easy/appropriate generalisations.	Likely that little insight obtained. Possible bias in respondents (cf. self-selecting nature of questionnaire respondents); the researcher and the moment in the time, which the research is undertaken.
Case Studies An attempt at describing the relationship which exist in the reality, usually within a single organisation or organisation grouping	Capturing 'reality' in greater detail and analysing more variables than is possible using experiments and surveys.	Restriction to a single event/organisation. Difficulty in generalising, given problems of acquiring similar data from a statistically meaningful number of cases. Lack of control of variables. Different interpretation of events by individual researchers/stakeholders.
Action Research Applied research where there is an attempt to obtain results of practical value to groups with whom the researcher is allied, while at the same time adding theoretical knowledge.	Practical as well as theoretical outcomes most often aimed at emancipatory outcomes. Biases of researcher made known.	Similar to case study research, but additionally places a considerable responsibility on the researcher when objectives are at odds with other groupings. The ethics of the particular research are the key issue.

Laboratory Experiments

Experiment is the classical form of research that owes much of the natural sciences (Saunders *et al.*, 2007). The main purpose of the experiment is to study causal links: whether a change in one independent variable produces a change in another independent variable (Hakim, 2000). Using this approach, the researcher is able to isolate and control a small number of variables which may then be investigated intensively.

The main advantages of experimental research design are that they encourage clarity about what to be investigated and should eliminate many alternative explanations because the random assignment ensures that the experimental and control group are identical in all respects, except for the focal variable (Easterby-Smith *et al.*, 2008).

Surveys

The survey is one of the most popular methods used in previous technology adoption research. It is also a common technique in business and management research, and most frequently used to answer who, what, where, how much and how many questions (Saunders *et al.*, 2007). It involves collecting a large amount of data from a sizable population in an economical way (Saunders *et al.*, 2007). In a survey, the researcher seeks verbal or written responses to questions or statements (Straub *et al.*, 2004). Straub *et al.* (2004) added that the surveys could be very effective in gathering data about individual preferences, expectations, past events, and private behaviours.

Easterby-Smith *et al.* (2008) highlighted three different types of survey: factual, inferential and exploratory. Factual research is mostly associated with opinion polls and market research, and involved collecting and collating relatively factual data from different groups of people. Inferential surveys are aimed at establishing relationships between variables and concepts, whether there are prior assumptions and hypotheses regarding the nature of these relationships. Exploratory surveys attempt to develop a universal set of principle against which any culture can be measured – in the hope that this would provide a basis for predicting the behaviour of individuals and organisations in almost any country.

Case Studies

Yin (2002) defines case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. Case study research can be positivist, interpretive, or critical, depending upon the underlying philosophical assumptions of the researcher (Myers, 1997). A case study is useful if the study needs to focus on contemporary events or phenomena in a natural setting.

There are a few methods that can be used in case study such as observation, interview and organisation's source documents and records.

Action Research

Hult and Lennung (1980) in Baskerville (1999) have defined four characteristics of action research:

1. Action research aims at an increased understanding of an immediate social situation, with emphasis on the complex and multivariate nature of this social setting in the IS domain.
2. Action research simultaneously assists in practical problem solving and expands scientific knowledge. This goal extends into two important process characteristics: First, there are highly interpretive assumptions being made about observation; second, the researcher intervenes in the problem setting.
3. Action research is performed collaboratively and enhances the competencies of the respective actors. A process of participatory observation is implied by this goal. Enhanced competencies (an inevitable result of collaboration) are relative to the previous competencies of the researchers and subjects, and the degree to which this is a goal, and its balance between the actors, will depend upon the setting.
4. Action research is primarily applicable to understanding change processes in social systems.

Ethnography

Ethnographic research is one of the most in-depth research methods possible (Myers, 1999). The researcher is at a research site for a long time, and sees what people are doing as well as what they say they are doing – an ethnographer obtains a deep understanding of the people, the organization, and the broader context within which they work. Ethnographic research is thus well suited to providing information systems researchers with rich insights into the human, social and organizational aspects of information systems (Myers, 1999).

Grounded Theory

Grounded theory is a research method that seeks to develop a theory that is grounded in data systematically gathered and analysed (Myers, 1997). According to Goulding (2002), grounded theory strategy is helpful for research to predict and explain behaviour, the emphasis being upon developing and building theory.

4.1.4 Research Choices

There are three types of research choice: mono method, multi-method and mixed method. Mono method uses a single data collection technique and corresponding analysis procedures. Multi-method uses more than one data collection techniques but do not mix either qualitative or quantitative analysis procedure. Mixed method uses both quantitative and qualitative data collection techniques and analysis procedures.

4.1.5 Time Horizons

In research planning, data can be collected as a snapshot which taken at a particular time (cross-sectional) or more like a diary which data will be taken within a certain period of time or events (longitudinal).

Cross-sectional Study

This method often employs the survey strategy (Easterby-Smith *et al.*, 2008). A sample survey is defined as a cross sectional study in which the sample is chosen to represent the target population at an essential particular point in time and the importance here is on developing the summary of statistics (Churchill, 2001). Most academic research, as well as this study, will be cross sectional due to time constraints.

Longitudinal study

Longitudinal study is a form of developmental research strategy, where data is gathered over an extended period of time (Edwards and Talbot, 1996), or where the same questions are asked at two or more points in time (Singleton *et al.*, 1993).

4.1.6 Selection of Research Strategies

The variety of research philosophies pose complex challenges for the selection of the appropriate research strategies. This study however has chosen the positivism approaches. A positivist view was taken from five Likert scale quantitative data questions and from the justification of the respondents in the open-ended questions.

One of the approaches used in this study was to determine the relationship between the identified variables and the use of GAS. Thus, by adopting the positivist view as the guiding principle, the relationship between the variables that were determined earlier could be proved or disapproved via hypothesis testing.

Apart from those views, this study also gained some information about the additional reasons behind the respondent's actions in answering the closed-ended Likert scale questions. For example, the respondents were asked to answer openly for the other factors that influence the usage or non-usage of GAS, the problems of GAS, the worth of GAS that they might think of as well as the recommendations to improve the use of GAS in auditing. Although the information gathered relied on the explanation, perception and behaviour of the respondents, the depth of the analysis for the answer is not yet considered as interpretive. This approach is still considered as positivism, as the results from those sections will be grouped and themed accordingly.

Based on the chosen philosophies above, it seems that this study also used both quantitative (deductive) and qualitative (inductive) approaches. The survey approach is thought to be the most appropriate research strategy since the main objective is to investigate the current usage of GAS from the large number of audit firms in the UK. There are various types of survey that are regularly used for data collection including questionnaires, interviews, observation and content analysis. According to de Vaus (1986), the questionnaire is the most widely used in survey research. Therefore, this study has adopted the questionnaire method to obtain data from a large number of audit firms across the UK. With the advance and large acceptance of the Internet in the UK, web-based survey will be conducted through email invitations to the auditors. Prior to the full data collection, the questionnaire was piloted.

Mixed methods were used for data collection and analysis. Both closed-ended and open-ended questions have been asked in the questionnaire through an online survey and the data was analysed using both quantitative and qualitative analyses. Figure 4-2 shows the highlighted research strategies that have been adopted in this study.

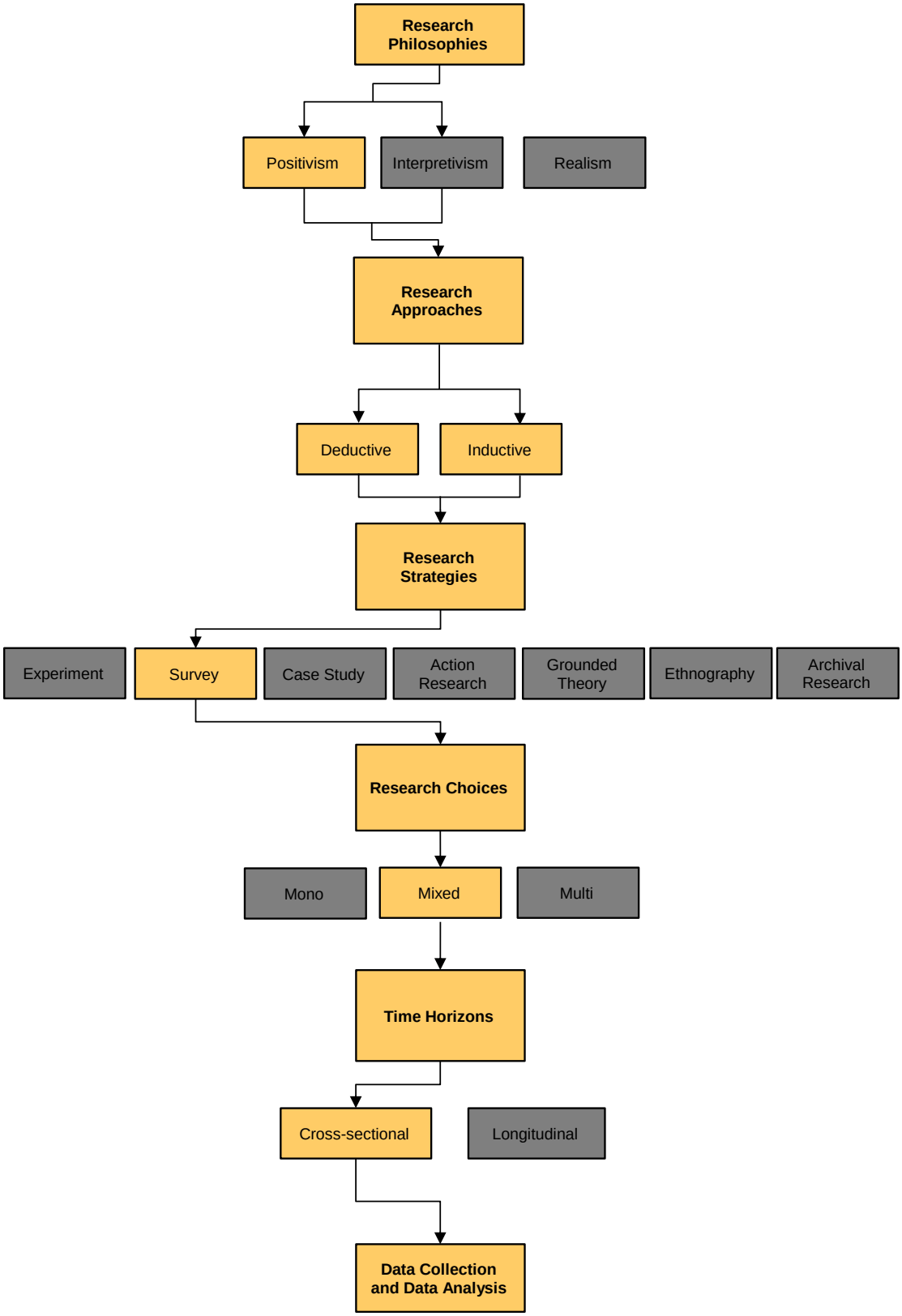


Figure 4-2: Research Strategies Diagram

4.2 QUESTIONNAIRE DESIGN

The overall aim of the research design exercise was to develop a questionnaire that was fit for the purpose of effectively addressing the research objectives, yet as friendly as possible in avoiding imposing too much time upon busy auditors. A number of questions used in the questionnaire were adopted from established research because they have been shown to possess high reliability and validity. Others, however, were developed specifically to meet the needs of this research.

The process of the questionnaire design was initiated from the ten research questions outlined in Chapter 1. Each research question was thus translated into specific relevant questions to provide the necessary data to be evaluated later. The whole of the first section and the last section of the questionnaire focussed on audit firms' and the auditors' details necessary for analysing their profiles. These were five questions altogether in first section asking about audit firms' demographic profile and 11 questions in the last sections asking about individual auditors' demographic profile.

The remaining 32 questions contained in the other six sections were designed to probe into the twelve research questions as shown in the Table 4-2 below:

Table 4-2: The Relevance of the Questions Used in the Questionnaire

Research Questions		Questions' No. in the Questionnaire
RQ1:	What is the current state of GAS usage among external auditors in the UK?	6, 7
RQ2:	What types of GAS external auditors have used?	8
RQ3:	In which types of audit that GAS have been implemented?	9
RQ4:	What are the techniques that have been used in GAS?	11
RQ5:	How satisfied are the auditors with GAS?	19
RQ6:	What are the factors that influence the use of GAS by external auditors?	12, 13, 14, 15, 16, 17, 18, 21, 22, 23, 24, 25, 26, 27
RQ7:	Are external auditors intend to utilise GAS?	28, 29
RQ8:	What are the problems of GAS?	30
RQ9:	Does adoption of GAS give rise to the sufficient value in term of cost and effort?	31
RQ10:	How GAS can be improved to be used by external auditors?	32

In designing the online questionnaire, particular attention was given on the types of questions and the layout of the questionnaire as well as the flow of steps that need to be gone through by the respondents. The questions need to be written in short and simple and care was taken to avoid leading, treating, ambiguous, complex and double-barrelled questions. The validity and the reliability of the survey instrument were also taken into consideration.

The questionnaire had a combination of both close-ended and open-ended questions. The close-ended questions have fixed alternative questions which have a list of possible responses to choose while the open-ended questions were designed to give respondents the opportunity to supply their opinion plainly.

4.2.1 The Structure of the Questionnaire

In sequencing the order of the questionnaire, this study followed the four basic principles of ordering as suggested by Dillman (1978). The four principles were applied on the basis that they would increase the respondents' motivation for, and confidence, in completing the questionnaire. The four principles are:

- Questions are ordered in descending order of importance and usefulness
- Group the questions that are similar in content together, and within areas, by type of question
- Take advantage of the cognitive ties that respondents are likely to make among the groups of questions in deciding the order of the questions involved
- Position the questions that are most likely to be objectionable to respondents after the less objectionable ones

Conforming to Dillman’s four principles, the questionnaire was structured with seven main sections, each encompassing a different theme:

1. Section A of the questionnaire consists of the questions designed to obtain the background information about the audit firm. This group of questions focuses on the year established, location, category, the number of auditors and number of employees.

2. Section B consists of just one question whether the firm uses the GAS or not. If the respondent answer it as Yes, the questionnaire will jump to Section C and if the answer is No, the questionnaire will jump to Section F
3. Section C was designed to investigate the current usage of GAS by the auditors. It consists of the year they implemented GAS, type of GAS used, types of auditing in which GAS has been implemented, and techniques that has been used in GAS.
4. Section D consists of the questions designed to investigate the factors that influence the use of GAS. Each of the items is measured using a five-point Likert scale. There is also one open-ended question asking about the other factors that the respondent thinks might influence their decision in using GAS.
5. Section E consists of the questions to investigate if the auditors were not using GAS for certain case of auditing. The second objective is to determine the level of satisfaction of using GAS.
6. Section F consists of two groups of questions. The first group is designed to investigate the factors for not using GAS in the firm. Each of the items is measured using a five-point Likert scale. There is also one open-ended question asking about the other factors for not using GAS. The second group of questions is asking about the intention to adopt GAS in the future.
7. Finally, Section G focuses on the background of the auditors of the responding audit firm.

Table 4-3: Section of the Questionnaire

Section	Title	Number of Questions		
		Scaled Items	Open Ended Questions	Total
A	Organisation Profile	3	2	5
B	Use of GAS	1	0	1
C	GAS Usage and Implementation	18	2	20
D	Factors that influence the use of GAS	41	1	42
E	Other GAS Usage and Satisfaction	2	2	4
F	Not using GAS	42	1	43
G	Personal Profile	11	8	19
	TOTAL	145	21	166

Table 4-3 above summarises the sections in the questionnaire and the number of close-ended or scaled items and open-ended questions for each section. The full print out version of the questionnaire is available in Appendix III.

4.3 RULES ON ETHICS AND CONFIDENTIALITY

It is a Brunel University requirement that all research involving human participants is subject to ethical scrutiny and approval prior to commencement of the research. Thus, before conducting the survey, the approval of the Ethics Committee of the Brunel University has been obtained. A statement attached to the cover page of the questionnaires was prepared to explain the purpose of the study and the ethical rules. A note of privacy also has been attached in the survey mentioning that the survey is anonymous unless a specific question in the survey has asked for this.

4.4 VALIDITY AND RELIABILITY OF MEASUREMENT

Prior to the actual data-gathering phase, the questionnaire was pre-tested for content validity, and piloted to test the reliability of the instrument.

4.4.1 Pre-Test

The pre-test was run on a few identified auditors and academicians. The pre-test questionnaire included a covering letter addressed to each respondent regarding the main objectives of the study and assuring them of their anonymity and of the confidentiality of the data they would supply in the questionnaire.

To ensure comprehensiveness in the questionnaire, it was pre-tested with 30 participants – 20 lecturers who teach auditing and 10 practicing auditors. The main purpose of the test was to seek clarification regarding the wording of both questionnaire instructions and questions (Oppenheim, 2001). Upon receipt of their comments, the questionnaire was revised and further refined.

Feedback and suggestions from participants were gathered to further improve the contents of the questionnaire. The objective was to make the questions more clearly understood by all respondents and provide meaningful data for the study. In essence, the questions must be in logical order, easy to understand, simple to answer in order to gain the full cooperation from respondents. Appropriate wordings were used to enhance clarity and questions deemed irrelevant were taken out. Based on their feedback, the items were further refined and the revised version of the questionnaire was developed.

4.4.2 Pilot Test

To confirm the reliability and the validity of the questionnaire, a pilot test was conducted. A total of 49 auditors were invited to be involved in the pilot test. A total of 30 questionnaires were returned after a period of one month. To evaluate the reliability of a multi-item measurement scale, the most regularly used and widely accepted method is Cronbach's alpha (Hair *et al.*, 2010).

For the purposes of testing reliability, only items from the factor that influence the use of GAS have been tested. All other items and demographic variables were excluded. Table 4-4 below shows the result of Cronbach's alpha for all the constructs. It indicates that the highest was 0.923 and the lowest was 0.556. According to Hair *et al.* (2010), as a standard measure of reliability, 0.7 should be used as a cut-off point. However, in the initial stages of research, Nunnally (1978) suggests that a coefficient of 0.50 or 0.60 is good enough.

Table 4-4: Pilot Test Result

Construct	Cronbach Alpha	Number of Items
Technological Factor	0.843	5
Organisational Factor	0.902	13
Audit Professional Factors	0.923	5
Client Factor	0.886	6
Personal Factor	0.881	9
External Factor	0.556	2

Further factor analysis was unable to be conducted due to the limited number of respondents. This pilot study disclosed higher internal consistency for all scales. However, there is a need to further confirm these findings using the final main survey questionnaire in the full-scale research.

4.5 DATA COLLECTION

The feedback from the pre-test help the researcher to improve and finalise questionnaire. The questionnaire will be sent out to the external auditors in audit firms in the UK. As audit remains a specialised discipline in the accountancy profession, therefore, this study that is aimed to examine the use of GAS by external auditors cannot be based on a random sampling either across industries or within a particular chosen organisation (Omoteso, 2006).

As the study involved the activities of external auditors in the UK, a list of external auditors who are registered in the Register of Statutory Auditor's website, www.auditregister.org.uk is obtained. As at 1st February 2011, there is a total of 14,500 number of statutory auditors listed and obtained from the website. All of the auditors registered on the website are supervised by five Recognised Supervisory Bodies (RSBs).

The RSBs are:

- The Association of Authorised Public Accountants (AAPA)
- The Association of Chartered Certified Accountants (ACCA)
- The Institute of Chartered Accountants in England and Wales (ICAEW)
- The Institute of Chartered Accountants in Ireland (CAI)
- The Institute of Chartered Accountants of Scotland (ICAS)

The details of the number of statutory auditors listed are breakdown in the Table 4-5 below.

Table 4-5: Statutory Auditor Registered in the Register of Statutory Auditor as at 1st February 2011

RSBs	Number of Statutory Auditors	Percent
AAPA*	0	0.0
ACCA	2,944	20.3
ICAEW	9,226	63.6
CAI	1,694	11.7
ICAS	636	4.4
Total	14,500	100.0

*AAPA has become a subsidiary company of the ACCA in 1996 therefore; all of its members are now grouped under ACCA

** The above number has been configured out after removing the duplicate name due to a few of auditors has been registered more than once for the same firm but place in the different offices

Since CAI is not within the UK territory, it is excluded from this study. There is also a number of 90 statutory auditors, which has been identified located in Ireland, and also excluded from this study. It is also confirmed that there is a total of 1053 auditors who works within Big 4 accounting firms. Hence, the total population for the statutory auditors for small and medium size audit firm registered in the UK is 11,663.

Of 11,663, there are a total of 3,587 email addresses have been randomly selected and identified. Based on the sample size guideline by Krejcie and Morgan (1970), the population size (N) of 11,663 which is within the range of 10000 to 15000, would require a sample size (S) of 373 to 375. This is demonstrated in Table 4-6 below:

Table 4-6: Table for Determining Sample Size from a Given Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note: "N" is population size
"S" is sample size.

Source: Krejcie and Morgan (1970)

Therefore the sample size of 3,587 respondents for the total population of approximately 12,000 is sufficient to accommodate with the sample size requirement.

The first group of emails was sent out on the first week of February 2011. Personalised emails were used to increase the response rate. The email highlighted the importance of the study, as well as the benefits of participating in the survey. The respondents were promised anonymity and confidentiality to encourage response.

Following Dillman's suggestion, two weeks after the first email, a reminder was sent to all respondents. This reminder served as both a thank you for those who have responded and as a friendly and courteous reminder for those who have not. After a further one month, a final reminder was sent to all respondents.

Of the 3,587 questionnaires distributed, 291 emails failed to arrive due to incorrect email addresses, and 177 actively declined to participate in the survey. These 291 and 177 questionnaires however, were excluded from the calculation of the response rate.

Table 4-7: Breakdown of Non-Responses

	Number of Statutory Auditors	Percent
Unsubscribed or Refused to Participate	171	37.01
Email Failed	291	62.99
Total	462	100.0

Finally, a total of 404 responses was recorded after a duration of about three months with two reminders representing 12.95% of responses rate. While the percentage might be considered low and could affect ability to generalize the findings, it is still reasonable for this kind of online survey. It is also worth noting that the sample represented a large proportion of the full UK population of auditors.

Further analysis of the returned questionnaires showed that only 205 were fully completed and usable for further analysis. The rest was either left unfilled or the respondent just filled half part of the questionnaire. Table 4-8 below shows the breakdown of responses. The table indicated that seven of the auditors visit the survey page but not ever fill up the questionnaire. There are about 147 respondents who have filled the questionnaires up to page 2. About 21 respondents filled the questionnaire up to page 3, 3 respondents filled up till page 4, 16 respondents filled up to page 6 and 5 respondents filled it up till page 7.

Table 4-8: Breakdown of Responses

	Number of Questionnaires	Percent
Full Responses [Fill completely until page 8]	205	50.74
Fill up to page 7	5	1.24
Fill up to page 6	16	3.96
Fill up to page 5	0	0.00
Fill up to page 4	3	0.74
Fill up to page 3	21	5.20
Fill up to page 2	147	36.39
Not filling the question at all	7	1.73
Total	404	100.0

4.6 DATA ANALYSIS

Before the data was analysed, it was exported to SPSS and coded accordingly. Three types of data analysis were conducted in this study. The first type involved the descriptive analysis in the form of frequency tables and cross-tabulated based on the issues that will be investigated. For example, the current issue of GAS usage will be presented in the form of frequency and percentage and cross-tabulated between mid-tier practices and smaller size practices. Other issues that will be presented in the same way are the audit firm's profile and auditor's demographic profile. The detailed findings and discussion on descriptive findings are provided in Chapter 5.

The second type of analysis involved the advanced statistical approach. In order to identify factors that influence the use of GAS, factor analysis techniques and logistic regression were used. Factor analysis was run to reduce a large set of variables or scale items down into a smaller and more manageable number of factors (Pallant, 2011). The result of the factor analysis together with the audit firm's and the auditor's demographic variables were then tested in the logistic regression model of the determinant factors of GAS usage. Detailed analysis plan and requirements required prior the factor analysis and logistic regression is also discussed in Chapter 5.

The third type of analysis involved the analysis of qualitative data gathered from the open-ended questions of the survey. The following measures were taken in the process of analysis of this open-ended data. Predetermined themes were set up based on the feedback on the certain issue or question. Each of the themes were then categorised into specific sub themes and quantify manually. The findings were used as part of the supplement of the quantitative results. The characteristics and attitudes of the responses were integrated into the analysis congregate the results of quantitative and qualitative analysis.

4.7 CONCLUSION

This chapter has shed light on the methodological approaches and procedures involved in collecting relevant data that could yield meaningful results and worthy conclusions capable of moving the frontiers of knowledge forward in the area of auditing and the use of GAS. This research adopts positivism and a deductive approach as its aim to prove or disapprove a particular theory via hypothesis testing. Additionally, the findings from the statistical analysis is be supported by the qualitative feedback from the open-ended questionnaires.

The chapter has further shown how the online survey and questionnaire technique could be used to collect useful sets of research data from scattered external auditor across the UK. The next chapter will centre on the analysis of the questionnaire and the results obtainable therefrom.

5

Chapter 5: Data Analysis and Findings

This chapter presents the data analysis for all the responses from the questionnaire. Data analysis has been divided into several parts. The first part is about the sample profile. The profiles of the responding auditors as well as the characteristics of their firms are described. The second part is about the descriptive finding on the GAS usage among the auditors who have already adopted GAS. This part will give an idea about the current state about GAS usage among external auditors in the UK.

The third part presents an advanced analysis on the factors that influence the use of GAS for both auditors who use GAS as well as to those who do not use GAS. This part tries to understand the relationship between a dependent variable (whether auditor use or do not use GAS) and independent variables (a combination of factors that influence the use of GAS and demographic information for the auditor and the audit firm). Based on the dichotomous value of dependent variable, logistic regression will be used to predict the result. Prior to logistic regression, data screening and factor analysis plan have been conducted as part of the data analysis requirement.

5.1 SAMPLE PROFILE

5.1.1 Profile of the Audit Firm

As explained in Chapter Four, a total of 205 completed responses was generated. This section provides background information on the firm that responded to the survey. The characteristics examined include audit firm category, location, size of audit department, size of audit firm and audit firm age.

Category of Audit Firm

Table 5-1 below indicates that auditors from smaller audit firms responded more than their colleagues in mid-tier practices. Gaining the participation from the large audit firms was extremely difficult since most of the auditors from the large audit firms responded that either they were too busy with their profession or their position to participate in any of the survey is limited unless they have gained preliminary permission from the organisation. As a result, the study relied purely on respondents from the mid-tier practices and smaller practices.

Table 5-1: Category of Audit Firm

Category	Frequency	Percent
Mid-Tier Practices	68	33.2
Smaller Practices	137	66.8
Total	205	100.0

Location

Most of the respondents were based in London (25.4%) and South East (20.9%) region. The following Table 5-2 shows that all of the regions in the UK have representative to contribute the feedback for this study.

Table 5-2: Location

Location	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
London	30	14.6	22	10.7	52	25.4
South East	15	7.3	28	13.7	43	21.0
Scotland	6	2.9	15	7.3	21	10.2
South West	3	1.5	12	5.9	15	7.3
West Midlands	4	2.0	11	5.4	15	7.3
North West	1	0.5	14	6.8	15	7.3
East of England	4	2.0	9	4.4	13	6.3
East Midlands	2	1.0	9	4.4	11	5.4
Yorkshire and the Humber	1	0.5	10	4.9	11	5.4
North East	2	1.0	4	2.0	6	2.9
Wales	0	0.0	3	1.5	3	1.5
Total	68	33.2	137	66.8	205	100.0

Size of Audit Department

Table 5-3 below shows the size of the audit department based on the number of auditors within the audit firms. Most of the audit firms have less than 5 auditors representing 27% of the total respondents and 22% of the total respondents have number of auditors between 5 to 9. From the table below, it may also be seen that 20% of the medium audit firms have more than 50 auditors.

Table 5-3: Size of Audit Department

Number of Auditors	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
Less than 5 auditors	2	1.0	53	25.9	55	26.8
5-9 auditors	5	2.4	39	19.0	44	21.5
10-20 auditors	6	2.9	28	13.7	34	16.6
21-50 auditors	14	6.8	16	7.8	30	14.6
Over 50 auditors	41	20.0	1	0.5	42	20.5
Total	68	33.2	137	66.8	205	100.0

Size of Audit Firm

The number of employees has been used in many studies to indicate the size of a firm. Table 5-4 below shows the size of the audit firm based on the number of employees in the firm. Most mid-tier practices have a number of employees between 100-499 that represents 16.6% of the total respondents while most of the smaller practices have the total number of employees between 10-49 that represents 35.1% of the total respondents.

Table 5-4: Number of Employees

Number of Employees	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
Less than 10 employees	0	0.0	26	12.7	26	12.7
10 - 49 employees	3	1.5	72	35.1	75	36.6
50 - 99 employees	7	3.4	24	11.7	31	15.1
100 - 499 employees	34	16.6	15	7.3	49	23.9
500 - 999 employees	4	2.0	0	0.0	4	2.0
Over 1000 employees	20	9.8	0	0.0	20	9.8
Total	68	33.2	137	66.8	205	100.0

The literature suggests that different sizes of audit firms will behave differently, especially in technology adoption. Therefore, it is necessary to investigate whether there are significant differences between mid-tier practices and smaller practices on this study.

Company Age

Table 5-5 below shows the age of the audit firm. It indicates that most of the firms for both mid-tier and smaller practices have operated for more than 40 years which representing almost 60% of the total respondents.

Table 5-5: Company Age

Company Age	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
10 years or less	5	2.4	18	8.8	23	11.2
11 - 20 years	3	1.5	23	11.2	26	12.7
21 - 30 years	5	2.4	19	9.3	24	11.7
31 - 40 years	0	0.0	10	4.9	10	4.9
Above 40 years	55	26.8	67	32.7	122	59.5
Total	68	33.2	137	66.8	205	100.0

5.1.2 Profile of the Respondent

This section will table the result on the profile of respondents.

Respondents' Gender

Table 5-6 shows the breakdown of respondents by gender. Almost 84% of the respondents were male. Only 16% of the respondents were female, which reflects the dominance of male auditors in the UK audit profession.

Table 5-6: Gender of Respondents

Gender	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
Female	7	3.4	25	12.2	32	15.6
Male	61	29.8	112	54.6	173	84.4
Total	68	33.2	137	66.8	205	100.0

Respondents' Age

Table 5-7 below presents the collected responses by age of the respondents. When asked for their age range, about 45% of the total respondents stated that they were in the category of 45-54 years old.

Table 5-7: Respondents' Age

Age	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
18-24 years	0	0.0	1	0.5	1	0.5
25-34 years	7	3.4	14	6.8	21	10.2
35-44 years	18	8.8	40	19.5	58	28.3
45-54 years	34	16.6	59	28.8	93	45.4
55 years & above	9	4.4	23	11.2	32	15.6
Total	68	33.2	137	66.8	205	100.0

When referring to the age of the firm and the age of respondents, it may be seen that most of the respondents are matured auditors that work in established firms.

Respondents' Position

Table 5-8 below shows the breakdown of respondents' position in the sample. The sample selected for this study is gathered from the Register of Statutory Auditors in

the UK. As anticipated, the result in Table 5-8 shows that most of the respondents are partners of the audit firm.

Table 5-8: Respondents' Position

Position	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
Director	2	0.8	4	2.0	6	2.9
Partner	56	22.4	113	55.1	169	82.4
Audit Manager	7	2.8	15	7.3	22	10.7
IT Audit Manager	0	0.0	1	0.5	1	0.5
Senior Auditor	1	0.4	4	2.0	5	2.4
Auditor	1	0.4	0	0.0	1	0.5
Audit Trainee	1	0.4	0	0.0	1	0.5
Total	68	27.2	137	66.8	205	100.0

Respondents' Academic Qualification

The respondents were also asked about their educational levels. Table 5-9 shows the breakdown related to the education level received by the respondents.

Table 5-9: Academic Qualification

Qualification	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
HND/BA/BSc	31	9.6	61	18.8	92	28.4
MA/MSc/MBA	4	1.2	12	3.7	16	4.9
PIIA/MIIA/QiCA	1	0.3	0	0.0	1	0.3
ACA/ACCA/CPFA	65	20.1	121	37.3	186	57.4
Other	7	2.2	22.0	6.8	29	9.0
Total	108	33.3	216	66.7	324	100.0

*Respondent can have more than one academic qualification

Most of the respondents have accounting qualifications, which is part of the requirements to be an auditor. It shows that most of the respondents are sufficiently educated to provide reliable responses.

Respondents' Certification

Instead of academic qualification, the respondents were asked if they had an additional professional qualification. Table 5-10 shows the breakdown related to the respondent's professional qualification.

Table 5-10: Professional Qualification

Qualification	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
Certified Public Accountant (CPA)	2	10.0	3	15.0	5	25.0
Chartered Accountant (CA)	2	10.0	2	10.0	4	20.0
Certified Information Systems Auditor (CISA)	1	5.0	0	0.0	1	5.0
Certified Information Security Manager (CISM)	1	5.0	0	0.0	1	5.0
Chartered Tax Adviser (CTA)	1	5.0	0	0.0	1	5.0
Fellow Chartered Accountant (FCA)	1	5.0	2	10.0	3	15.0
Fellow Chartered Certified Accountant (FCCA)	1	5.0	1	5.0	2	10.0
Responsible Individual (RI)	2	10.0	3	15.0	5	25.0
Total	10	50.0	10	50.0	20	100.0

Number of Years in Position

The respondents were also asked to indicate the audit experience. Results show that 73% of respondents had at least 6 years auditing experience, and 22% of them have a minimum experience of 21 years in the field. The demographic data suggest that the responding auditors are quite experienced in their career, and thus, are able to give meaningful answers to the questions. Table 5-11 below summarises the results.

Table 5-11: Years in Position

Number of Years in Position	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
0-5 years	19	9.3	36	17.6	55	26.8
6-10 years	10	4.9	31	15.1	41	20.0
11-15 years	14	6.8	23	11.2	37	18.0
16-20 years	13	6.3	15	7.3	28	13.7
21 years & above	12	5.9	32	15.6	44	21.5
Total	68	33.2	137	66.8	205	100.0

Number of Years with Firm

The number of years employed reflects the length of time the respondent has been associated with the audit firms, and hence it shows the level of familiarity with the goals and operations of the organisation. Table 5-12 shows the details for respondent length of employment for the sample.

Table 5-12: Years with Firm

Number of Years with Firm	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
0-5 years	10	4.9	23	11.2	33	16.1
6-10 years	12	5.9	29	14.1	41	20.0
11-15 years	9	4.4	27	13.2	36	17.6
16-20 years	8	3.9	15	7.3	23	11.2
21 years & above	29	14.1	43	21.0	72	35.1
Total	68	33.2	137	66.8	205	100.0

From Table 5-12, it appears that 94% of the respondents have been with the firm for more than six years and therefore, they have sufficient knowledge to respond properly.

Number of Years Experience in Auditing

Table 5-13 shows the number of years of experience by auditors in auditing. It shows that more than 62% of auditors have more than 21 years of experience. Thus, the demographic data indicates that the responding auditors are quite experienced in their career.

Table 5-13: Years Experience in Auditing

Years Experience in Auditing	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
0-5 years	4	2.0	1	0.5	5	2.4
6-10 years	2	1.0	11	5.4	13	6.3
11-15 years	8	3.9	22	10.7	30	14.6
16-20 years	8	3.9	23	11.2	31	15.1
21 years & above	46	22.4	80	39.0	126	61.5
Total	68	33.2	137	66.8	205	100.0

Number of Years Experience in Computerised Auditing

Table 5-14 shows the number of years of experience of auditors in computerised auditing. Nearly 40% of the respondents have no experience in computerised accounting. 25% of them have experience less than 5 years.

Table 5-14: Years Experience in Computerised Auditing

Years Experience in Computerised Auditing	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
None	13	6.3	68	33.2	81	39.5
0-5 years	18	8.8	32	15.6	50	24.4
6-10 years	10	4.9	11	5.4	21	10.2
11-15 years	15	7.3	11	5.4	26	12.7
16-20 years	7	3.4	5	2.4	12	5.9
21 years & above	5	2.4	10	4.9	15	7.3
Total	68	33.2	137	66.8	205	100.0

Respondents' IT Skill

Respondents were asked about their general IT skill. Nearly 63% of the respondents indicated that they have at least good IT skill. Table 5-15 shows the frequency and percentage of skills of the respondents in the sample.

Table 5-15: IT Skill

IT Skill	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
Very Good	14	6.8	24	11.7	38	18.5
Good	34	16.6	57	27.8	91	44.4
Adequate	16	7.8	46	22.4	62	30.2
Basic	3	1.5	8	3.9	11	5.4
Very Basic	1	0.5	2	1.0	3	1.5
Total	68	33.2	137	66.8	205	100.0

This result suggests that most of the respondents are capable of using the computers.

5.2 THE USE OF GAS

5.2.1 Use of GAS

Interestingly 73% of respondents indicated their firm did not make use of GAS. Yet some of them were unaware about the existing of GAS. Table 5-16 shows that only 55 respondents out of 205 are using GAS. Similar to the results of previous studies conducted such as Debreceny *et al.* (2005), Greenstein and McKee (2004), Greenstein *et al.* (2005) and Janvrin *et al.* (2008), the results of this study also suggest that GAS usage by external auditors is still minimal. For those who are using GAS, 35 are from mid-tier practices and 20 from smaller practices represent 17% and 10% respectively from the total respondents

Table 5-16: Use of GAS

Use GAS?	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
Yes	35	17.1	20	9.8	55	26.8
No	33	16.1	117	57.1	150	73.2
Total	68	33.2	137	66.8	205	100.0

5.2.2 Number of Years Implementing GAS

The length of time that the audit firms have been using GAS will reflect the factors that influence the respondent for using it. When asked about the number of years implementing GAS, more than 90% of those who use the software stated that they had been using the software for more than 2 years. This result implies that the majority of the auditors who use GAS have relatively sufficient experience in its usage.

The results also show that the new adopters of GAS are very minimal in the recent years. Only two auditors have adopted GAS for less than one year and only two are implementing GAS for the range from one to two years.

Table 5-17: Number of Years Implementing GAS (N=55)

Number of Years	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
Don't know	1	1.8	0	0.0	1	1.8
Less than 1 year	2	3.6	0	0.0	2	3.6
1 to 2 years	0	0.0	2	3.6	2	3.6
More than 2 years	32	58.2	18	32.7	50	90.9
Total	35	63.6	20	36.4	55	100.0

5.2.3 Type of Audit Software Used

IDEA is still the most popular type of software for auditing, representing 43% of the auditors who use GAS. Some of mid-tier firms have developed their own in-house application to cater with computerised auditing but none of smaller practices have their own bespoke GAS. ProAudit, CCH and ACL are also among the softwares that have been chosen by external auditors. Table 5-18 indicates the type of software that has been used for auditing.

Table 5-18: Type of Audit Software Used* (N=55)

Number of Years	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
IDEA	22	33.3	4	6.1	26	39.4
In-House Application	8	12.1	0	0.0	8	12.1
ProAudit	4	6.1	3	4.5	7	10.6
CCH	1	1.5	5	7.6	6	9.1
ACL	3	4.5	0	0.0	3	4.5
IRIS	0	0.0	3	4.5	3	4.5
Mercia	1	1.5	2	3.0	3	4.5
Microsoft Access	2	3.0	0	0.0	2	3.0
Microsoft Excel	0	0.0	2	3.0	2	3.0
Other**	4	6.1	2	3.0	6	9.1
Total	45	68.2	21	31.8	66	100.0

*Participant could use more than one Audit Software
** Other audit software use are include Kestrian, SAPA, Validis Amatino/CreditPal, HAT, TopCAATs

5.2.4 Area of GAS Usage

GAS has also been widely used in financial statement auditing rather than in other types of auditing. Table 5-19 indicates the areas in which GAS has been utilised.

Table 5-19: Area of GAS Usage (N=55)

Type of Task	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	N	Mean	Std. Deviation
Financial Statement Auditing	2	5	8	11	27	53	4.06	1.183
Investigation Auditing	12	6	12	7	5	42	2.69	1.370
Continuous Auditing	16	5	7	6	10	44	2.75	1.616
Control Monitoring	18	7	5	5	7	42	2.43	1.548
Risk Management	18	2	4	9	7	40	2.63	1.644
Ad-Hoc Testing	13	6	11	8	5	43	2.67	1.393
Other	15	0	1[a]	0	1[b]	17	1.35	1.057

[a]For all statutory audits - pension funds, charities, companies, limited liability partnerships
[b]Substantive testing where there is a large population of low value items and/or automated processes

5.2.5 Techniques Used in GAS

This study has also examined the extent to which GAS has been used in auditing. Based on Janvrin, Lowe and Bierstaker (2009) from where they cited from AICPA and from UK auditing standards (ISA 240, ISA 315, ISA 330 and ISA 500) there are nine different CAATs that can be performed using GAS. The mean responses, shown in Table 5-20, suggest that respondents assigned higher ratings to evaluate fraud risk (3.67) and to identify journal entries and other adjustment to be tested (3.49).

Table 5-20: Techniques Used in GAS (N=55)

I used GAS…	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	Mean	Std. Deviation
to evaluate fraud risks	8	8	4	9	26	3.67	1.540
to identify journal entries and other adjustment to be tested	7	7	11	12	18	3.49	1.399
to check accuracy of electronic files	14	7	15	9	10	2.89	1.436
to re-perform procedures (i.e. aging of account receivables, etc.)	14	9	14	10	8	2.80	1.393
to select sample transactions from key electronic files	13	6	13	13	10	3.02	1.434
to sort transactions with specific characteristics	12	6	18	12	7	2.93	1.317
to test entire population instead of sample	13	9	19	7	7	2.75	1.308
to obtain evidence about control effectiveness	13	11	11	8	12	2.91	1.482
to evaluate inventory existence and completeness	15	10	11	9	10	2.80	1.471

n=55

5.3 DATA SCREENING

Before data have been further analysed, a few steps are required to make sure that the data is suitable for further analysis. The first step is data screening. For the purposes of data screening, there are three types of analysis that need to be done. These are response bias, missing data and outliers.

Response Bias

Response bias is run to test if there is any significant difference between the group who immediately responded from the first invitation to the survey (99 responses) and those from the subsequent reminders (106 responses). The first group was labelled as "1" and the second group is labelled as "2". A t-Test was conducted to determine if there was any difference between these groups. From the 18 independent variables tested, only two items were found to have a statistically significant difference ($p<0.05$). There were no major differences for the other 14 items in the earlier responses, compared with the later responses ($p>0.05$). This result indicates that the data for this study is free from response bias, and thus can be used for further analysis.

Missing Data

Missing data often occur when the respondent fails to answer one or more questions in a survey (Hair *et al.*, 2010). In order to prevent the missing data in the online survey, most compulsory questions were marked as required, so the respondents could not skip the question until it had been answered. Sometimes, the length of a questionnaire made the respondent fill half the questionnaire, and leave the rest of the questions unanswered. Depending on the number of the sample required, some incomplete responses may be useful for further analysis, with some remedies applied to the missing value.

For the purposes of this study, only fully completed responses were used for further analysis. Therefore, there is no issue of missing value that need to be treated. Based on data from the online server, there are 130 responses that have been marked as incomplete. In line with the recommendations from Hair *et al.* (2010), these

incomplete responses were removed for further analysis. After removing the missing data, a total of 205 respondents was used to proceed with the analysis.

Outliers

Outliers are observations with a unique combination of characteristics identifiable as distinctly different from other observations (Hair *et al.*, 2010). Hair *et al.*, (2010) classified outliers into four classes: (1) procedural error due to data entry or error in coding; (2) observation that occurs as the result of extraordinary event; (3) extraordinary observation in which cannot be explained by the researcher; and (4) observations that come under the ordinary range of values for each of the variables.

For the purposes of this study, outliers were detected through univariate and multivariate perspective. Univariate outliers were identified from the value of z-scores from the data set of the questionnaire. Coakes and Steed (2003) suggest that if the value of z-score is more than ± 3.0, the data is considered as univariate outliers, and will be eliminated for further analysis.

For the purposes of multivariate analysis, Mahalanobis distances (D^2) test was used across all sets of variables. According to Hair *et al.* (2010), a questionnaire is said to be multivariate outliers if the D^2 or degrees of freedom-df greater than ± 2:58. Data showing an issue of outliers were dropped from the study.

Based on the z-score and Mahalanobis distances test, only one questionnaire was identified as having univariate outliers (z-score > ± 3.0) and no questionnaire was found to have multivariate outliers (D^2 > ± 2:58). This one questionnaire was removed for further analysis.

5.4 FACTOR ANALYSIS

Factor analysis is run to reduce a large set of variables or scale items down into a smaller and more manageable number of factors (Pallant, 2011). The responses to the 40 items were collected to predict the auditors' usage of GAS. This section discusses the results of factor analysis conducted for all items that measured the factors that influence the use of GAS.

5.4.1 Cronbach's Alpha

A reliability test using Cronbach's alpha was conducted to measure the internal consistency of the items in the survey instrument. This test was conducted on all independent and dependent variable. The result of Cronbach's Alpha demonstrates an alpha of 0.909. The result of 0.909 is acceptable within a normal context of statistical test where the general guideline says that alpha value above 0.8 indicates good reliability (Field, 2009).

5.4.2 Kaiser-Meyer-Olkin (KMO) and Bartlett Test of Sphericity

Before proceeding with factor analysis, Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity (BTOS) needed to be measured. The KMO and BTOS measure whether the adequacy of sampling is appropriate to proceed with factor analysis. A small KMO value indicates the factor analysis may not be a good option. Kaiser (1974) quoted in Norusis (1992) suggests that a KMO measure in the 0.90's is considered as 'marvellous', in the 0.80's as 'meritorious', in the 0.70's as 'middling', in the 0.60's as 'mediocre', in the 0.50's as 'miserable', and below 0.50's as 'unacceptable' for sample adequacy for factor analysis purposes.

Following Blaikie (2003), KMO should be at least 0.60 and BTOS was utilised to test for the overall significant correlation among all items ($p < .05$). According to Hair *et al.* (2010), the BTOS is a statistical test for the presence of correlations among the variables. BTOS provides the statistical significance that correlation matrix has

significant correlations among at least some of the variables. The result for the KMO and BTOS are shown in the Table 5-21 below.

Table 5-21: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.880
Bartlett's Test of Sphericity	Approx. Chi-Square	5376.052
	Df	780
	Sig.	.000

From Table 5-21, the KMO measure for the factors that influence the use of GAS showed a value of 0.880. The observed value of the Bartlett test of sphericity was also large (5376.052) and its associated significance level was very low (0.000). Combining the results of KMO measure and Bartlett test of sphericity, the items used to indicate the factors that influence the use of GAS clearly met the conditions for subsequent tests of factor analysis.

5.4.3 Communalities

Models containing multiple constructs are required to have communalities of less than 0.5 (Hair *et al.*, 2010). Communalities can be calculated from factor loading which can be extracted using Principles Component Analysis (PCA). Table 5-22 shows that all variables retained in the factor loading had communality values of above 0.5. The results also confirmed that the high variation ranging from 0.552 to 0.839 indicates high variance among the variables.

Table 5-22: Communalities

	No. Item	Extraction
Compatibility of software	1	0.670
Up-to-date firm's ICT infrastructure	2	0.661
Ease of use	3	0.750
Adequate and sufficient documentation to follow	4	0.703
Easy to modify and upgrade	5	0.721
Full support from top management	6	0.620
Strong IT support from IT staff	7	0.675
Availability of IT audit expertise in organisation	8	0.673
Effective and adequate INTERNAL training for staff	9	0.740
Effective and adequate EXTERNAL training for staff	10	0.642
Sufficient implementing cost	11	0.778
Sufficient maintaining cost	12	0.834
Enough resource to use GAS	13	0.687
Instructed by the management to use GAS	14	0.595
Demand in auditor's promotion policies	15	0.634
Workloads on multiple audit engagement	16	0.699
Financial budget on audit engagement	17	0.725
Sufficient time allocated to audit assignment	18	0.737
Requirement by auditing standards	19	0.721
Professional audit judgement	20	0.795
The existence of audit methodology to follow	21	0.764
Level of audit risk	22	0.809
The usefulness of the application for auditing	23	0.672
Strength of client's internal control systems	24	0.720
Complexity of client's IT environment	25	0.839
Complexity of client's business environment	26	0.794
Client concern about data security	27	0.643
Client business size	28	0.647
Support provided by client's IT personnel	29	0.724
Experience with computerised auditing	30	0.683
Experience with larger audit clients	31	0.660
An attempt to ensure public accountability	32	0.630
Adequate knowledge to use GAS	33	0.785
Understanding of the application	34	0.774
Easy to become skilful using GAS	35	0.741
Prefer to use GAS rather than traditional audit	36	0.700
IT Knowledge	37	0.685
Use GAS regularly in audit assignment	38	0.692
Adequate technical support from vendors	39	0.618
The similar application has been used by other audit firms	40	0.552

Extraction Method: Principal Component Analysis.

5.4.4 Eigenvalues and Variances Percentage

According to Hair *et al.* (2010), during the factor analysis eigenvalue of less than 1 would be rejected and factors with eigenvalue more than 1.0 is considered to be significant and maintained for further analysis. The results of the test revealed that there were nine factors with an eigenvalue exceeding 1.0. As shown in Table 5-23,

the highest eigenvalue is 12.113 explaining 30.28% of the variance. The lowest eigenvalue was 1.012 explaining 2.51% of the variance.

Table 5-23: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.113	30.284	30.284	12.113	30.284	30.284	6.221	15.553	15.553
2	4.560	11.400	41.683	4.560	11.400	41.683	4.386	10.966	26.519
3	3.088	7.719	49.403	3.088	7.719	49.403	3.652	9.129	35.648
4	1.988	4.971	54.373	1.988	4.971	54.373	3.203	8.008	43.655
5	1.758	4.395	58.769	1.758	4.395	58.769	2.625	6.563	50.219
6	1.380	3.449	62.218	1.380	3.449	62.218	2.436	6.090	56.308
7	1.186	2.964	65.183	1.186	2.964	65.183	2.247	5.618	61.926
8	1.104	2.760	67.943	1.104	2.760	67.943	2.182	5.455	67.381
9	1.012	2.529	70.472	1.012	2.529	70.472	1.236	3.091	70.472
10	0.872	2.181	72.653						
11	0.767	1.917	74.570						
12	0.721	1.804	76.373						
13	0.681	1.702	78.075						
14	0.629	1.573	79.648						
15	0.601	1.502	81.150						
16	0.550	1.375	82.525						
17	0.530	1.325	83.851						
18	0.523	1.307	85.157						
19	0.473	1.182	86.339						
20	0.442	1.104	87.443						
21	0.436	1.090	88.533						
22	0.412	1.030	89.564						
23	0.391	0.978	90.542						
24	0.379	0.947	91.489						
25	0.364	0.910	92.399						
26	0.317	0.794	93.193						
27	0.296	0.740	93.933						
28	0.289	0.723	94.656						
29	0.274	0.684	95.341						
30	0.248	0.620	95.960						
31	0.242	0.604	96.564						
32	0.218	0.544	97.109						
33	0.210	0.525	97.634						
34	0.194	0.486	98.120						
35	0.178	0.444	98.564						
36	0.169	0.422	98.986						
37	0.130	0.325	99.311						
38	0.120	0.300	99.610						
39	0.100	0.250	99.860						
40	0.056	0.140	100.000						

Extraction Method: Principal Component Analysis.

5.4.5 Scree Plot

A scree plot is a graph that plots each factor in factor analysis against its associated eigenvalues (Field, 2009). The scree test can be derived by plotting the latent roots against the number of factors in their order of extraction, and to assess the cut-off

point, the shape of the resulting curve is used (Hair *et al.*, 2010). The scree plot in Figure 5-1 shows that the plot slopes steeply downwards from one factor to two factors, and more gently from two factors to three factors, before slowly becoming an approximately horizontal line.

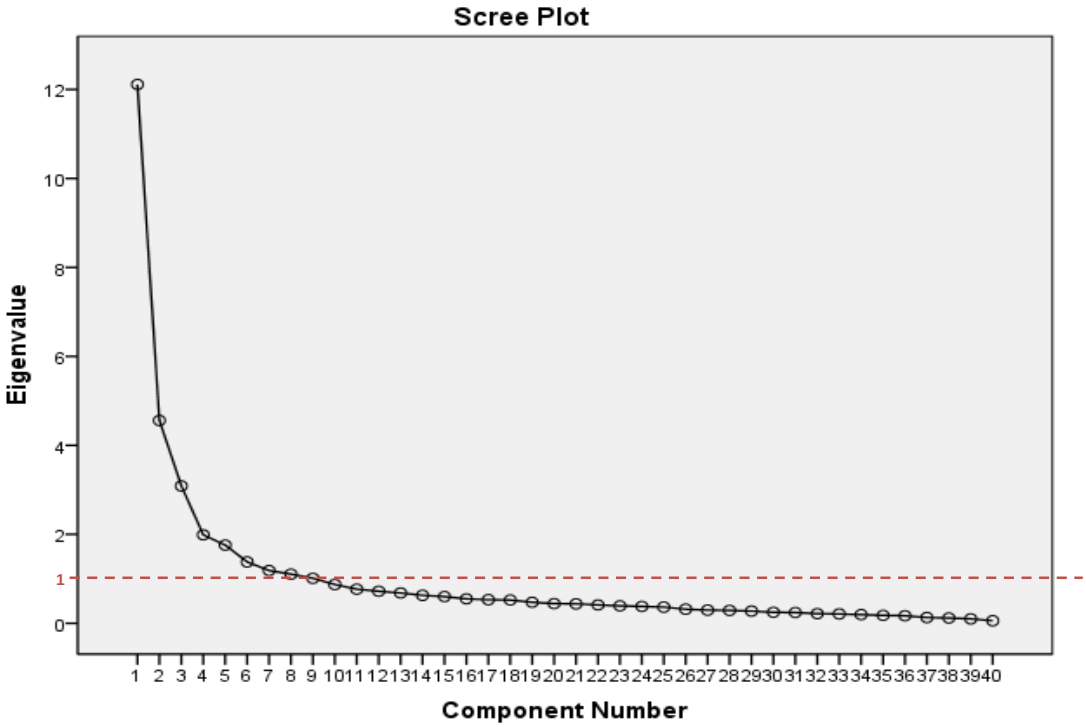


Figure 5-1: Scree Plot

Cattell (1966), in Field (2009), suggested that the cut-off point for selecting factors should be at the inflexion point of the curve. As can be seen in Figure 5-1, the point of inflexion occurs at the fourth data point. According to Field (2009), the factor to the left of the point of inflexion should be retained. However, it was decided that other factor which had an eigenvalue of more than 1.0 i.e. factor 5, 6, 7, 8 and 9 should be retained for further investigation, consistent with the results of the eigenvalue analysis shown in Table 5-23. The above factors were further tested with the principal component analysis (PCA) and Varimax rotation method.

5.4.6 Factor Loading Based on Rotated Component Matrix

Factor analysis in this study was conducted using PCA and rotated using a Varimax method with factor loading more than 0.50. The Varimax method was selected

because it is the most commonly orthogonal approach used, which attempts to minimise the number of variables that have high loadings on each factor (Pallant, 2011). Hair *et al.* (2010) suggest that if the factor loadings are +0.50 or greater, they are considered to be very significant, and can be used for further analysis. After factor analysis was conducted, all 40 items had factor loading of more than 0.50 with nine components having been generated. However, component number nine only had one item. As one item was not strong enough to support the item construct, this factor and the item under this component were dropped from the analysis. Thus, only eight factors were examined for further analysis. The results are shown in Table 5-24.

Based on the items that have been grouped into eight components, each of them were named and labelled as below:

a. Organisational Influence [F1_ORG]
b. Personal Knowledge and Experience [F2_PER]
c. Client Factor [F3_CLI]
d. Perceived Technology [F4_TEC]
e. Audit Requirement [F5_AUD]
f. Work Environment Influence [F6_ENV]
g. Audit Engagement Allocation [F7_ENG]
h. Perceived Usefulness [F8_USE]

The explanation of these factors is discussed in the next section.

Table 5-24: Rotated Component Matrix[a]

	Component							
	F1 ORG	F2 PER	F3 CLI	F4 TEC	F5 AUD	F6 ENV	F7 ENG	F8 USE
Sufficient maintaining cost	0.823							
Sufficient implementing cost	0.808							
Effective and adequate INTERNAL training for staff	0.745							
Strong IT support from IT staff	0.741							
Enough resource to use GAS	0.691							
Availability of IT audit expertise in organisation	0.684							
Effective and adequate EXTERNAL training for staff	0.675							
Full support from top management	0.659							
Adequate knowledge to use GAS		0.792						
Understanding of the application		0.746						
Experience with computerised auditing		0.743						
Easy to become skilful using GAS		0.684						
Experience with larger audit clients		0.624						
IT Knowledge		0.604						
Complexity of client's IT environment			0.881					
Complexity of client's business environment			0.863					
Strength of client's internal control systems			0.760					
Support provided by client's IT personnel			0.705					
Client concern about data security			0.585					
Client business size			0.553					
Compatibility of software				0.695				
Ease of use				0.671				
Adequate and sufficient documentation to follow				0.620				
Easy to modify and upgrade				0.618				
Up-to-date firm's ICT infrastructure				0.560				
Adequate technical support from vendors				0.514				
Level of audit risk					0.864			
Professional audit judgement					0.854			
The existence of audit methodology to follow					0.830			
Demand in auditor's promotion policies						0.675		
An attempt to ensure public accountability						0.571		
Instructed by the management to use GAS						0.568		
The similar application has been used by other audit firms						0.561		
Workloads on multiple audit engagement							0.720	
Sufficient time allocated to audit assignment							0.613	
Financial budget on audit engagement							0.566	
The usefulness of the application for auditing								0.681
Use GAS regularly in audit assignment								0.555
Requirement by auditing standards								0.536

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 14 iterations.

5.4.7 Interpretation of Matric Factor after Rotation

Generally, it is hard to name the components generated from the factor analysis appropriately. After the rotation process, the next step is to label each of the factors based on the general theme that can be established from the items within the component. The result of this factor analysis also will affect the hypothesis that has been suggested in Chapter 3. Each of the factors is discussed below:

Organisational Influence [F1_ORG]

The first factor as displayed in the Table 5-25 shows eight items that have highest factor loading. This factor is named as organisational influence as it relates to the resources and support provided by the firm. All responses show the positive feedback from the auditors with mean for each item is more than 3.0. Each of the items previously was measured in the survey by agreement through a Likert scale represented by 1 to 5, where 1 is strongly disagree and 5 strongly agree. Details of the responses are shown in the Table 5-25 below.

Table 5-25: Descriptive Statistic for Organisational Influence (n=204)

	+/-	Positive Response	%	Mean	Std. Deviation
Sufficient maintaining cost	+	77	37.7	3.31	.957
Sufficient implementing cost	+	78	38.2	3.30	.969
Effective and adequate INTERNAL training for staff	+	109	53.4	3.61	.984
Strong IT support from IT staff	+	99	48.5	3.51	.918
Enough resource to use GAS	+	85	41.7	3.23	1.097
Availability of IT audit expertise in organisation	+	91	44.6	3.23	1.178
Effective and adequate EXTERNAL training for staff	+	88	43.1	3.44	.916
Full support from top management	+	92	45.1	3.46	1.047

Personal Knowledge and Experience [F2_PER]

Second factor generated from the factor analysis consists of six items. This factor has been named as personal knowledge and experience because all of the items that come under this component are related to the knowledge of the auditors as well as their experience in IT and auditing. Table 5-26 below shows all of the items have positive feedback from the respondent except for one item; “Experience with larger audit client”. As most of the respondents come from small and medium sizes of the audit firm, not all of them may have an experience with large client and disagree with the

statement. Therefore, the mean for this item is low, at 2.06, and this shows the negative responses of the auditor.

Table 5-26: Descriptive Statistic for Personal Knowledge and Experience (n=204)

	+/-	Positive Response	%	Mean	Std. Deviation
Adequate knowledge to use GAS	+	71	34.8	3.04	1.087
Understanding of the application	+	77	37.7	3.34	.882
Experience with computerised auditing	+	75	36.8	2.99	1.119
Easy to become skilful using GAS	+	70	34.3	3.24	.891
Experience with larger audit clients	-	79	38.7	2.06	1.113
IT Knowledge	+	83	40.7	3.36	.856

Client Factor [F3_CLI]

A third factor that generated from factor analysis is labelled as client factor. There are six items fall into this component. All of them relate to the auditor's client environment and support. Most respondents answered positively to all items except for one item which the auditor disagreed with; "Client concern about data security" (mean 2.82). Table 5-27 below explains that the highest mean is 3.65 for the item "Client business size".

Table 5-27: Descriptive Statistic for Client Factor (n=204)

	+/-	Positive Response	%	Mean	Std. Deviation
Complexity of client's IT environment	+	75	36.8	3.15	.992
Complexity of client's business environment	+	59	28.9	3.02	.952
Strength of client's internal control systems	+	71	34.8	3.16	.941
Support provided by client's IT personnel	+	57	27.9	3.09	.922
Client concern about data security	-	42	20.6	2.82	.920
Client business size	+	120	58.8	3.65	1.003

Perceived Technology [F4_TEC]

The fourth factor has been named as perceived technology which most of the items are related with the technology i.e. the compatibility of GAS, easy to use, having adequate and sufficient documentation to follow, easy to upgrade, the audit firm's IT infrastructure and support from the vendor. There are six items altogether in this factor. All items have been answered positively by the respondents, with the highest mean of 3.67 for the item "Up-to-date firm's ICT infrastructure". Table 5-28 below explains the result.

Table 5-28: Descriptive Statistic for Perceived Technology (n=204)

	+/-	Positive Response	%	Mean	Std. Deviation
Compatibility of software	+	73	35.8	3.38	.926
Ease of use	+	79	38.7	3.39	.999
Adequate and sufficient documentation to follow	+	69	33.8	3.29	.894
Easy to modify and upgrade	+	63	30.9	3.28	.857
Up-to-date firm's ICT infrastructure	+	108	52.9	3.67	.924
Adequate technical support from vendors	+	56	27.5	3.31	.775

Audit Requirement [F5_PRO]

Audit requirement is labelled as the fifth factor that has been produced from the factor analysis. It relates to the audit requirement which particularly focus on the audit risk, audit judgment and audit methodology. There are 3 items for this factor. All items in this factor were positively responded by the auditor. The highest mean is 3.69 for item "The existence of audit methodology to follow".

Table 5-29: Descriptive Statistic for Audit Requirement (n=204)

	+/-	Positive Response	%	Mean	Std. Deviation
Level of audit risk	+	115	56.4	3.57	.926
Professional audit judgement	+	126	61.8	3.63	.930
The existence of audit methodology to follow	+	123	60.3	3.69	.931

Work Environment Influence [F6_ENV]

The sixth factor is labelled as work environment influence. This factor has been named as such since all of the items that fall into this component reflex the work environment characteristics within the auditor's profession, organisation and other audit firm. There are four items in this factor. Most of the auditors gave low score for most of the items resulting the negative responses with the mean below 3.0. Only one item had a positive response (mean=3.02), which is "The similar application has been used by other audit firm". However, the mean for this item nearly resulted in a neutral (neither agree nor disagree) response. Table 5-30 below explains the result.

Table 5-30: Descriptive Statistic for Work Environment Influence (n=204)

	+/-	Positive Response	%	Mean	Std. Deviation
Demand in auditor's promotion policies	-	27	13.2	2.67	.919
An attempt to ensure public accountability	-	28	13.7	2.78	.850
Instructed by the management to use GAS	-	40	19.6	2.78	1.048
The similar application has been used by other audit firms	+	45	22.1	3.02	.871

Audit Engagement Allocation [F7_AUD]

Audit engagement allocation come under seventh factor resulting from the factor analysis. This factor relates to workloads, time and financial budget on the audit engagement. There are three items in this factor. All factors have been answered positively with items for "Sufficient time allocated to audit assignment" show the highest mean of 3.32. Table 5-31 below explains the result.

Table 5-31: Descriptive Statistic for Audit Engagement Allocation (n=204)

	+/-	Positive Response	%	Mean	Std. Deviation
Workloads on multiple audit engagement	+	60	29.4	3.18	.911
Sufficient time allocated to audit assignment	+	80	39.2	3.32	.954
Financial budget on audit engagement	+	63	30.9	3.05	1.049

Perceived Usefulness [F8_SOF]

Perceived usefulness is the last factor generated from the factor analysis. This factor is named as such because the items listed under this component are related to the value and usefulness of GAS in auditing. There are three items in this factor. Only one item has been responded positively by the respondent; "The usefulness of the application for auditing" (mean=3.25). The other two items have a low score from the respondent resulting low mean. Table 5-32 below summarises the result.

Table 5-32: Descriptive Statistic for Perceived Usefulness (n=204)

	+/-	Positive Response	%	Mean	Std. Deviation
The usefulness of the application for auditing	+	78	38.2	3.25	1.089
Use GAS regularly in audit assignment	-	52	25.5	2.72	1.173
Requirement by auditing standards	-	43	21.1	2.70	1.138

5.4.8 Factors with Cronbach's Alpha, KMO, BTOS, Eigenvalue and Percentage of Variance

After defining the name and label for each of the components from the previous factor analysis, Cronbach's Alpha will be tested for each component for the reliability and validity measurement. Table 5-33 shows the value of Cronbach's Alpha for all factors are greater than .60 (Hair *et al.*, 2010) thus can be used for further analysis. The values of KMO and BTOS also show that it is suitable for factor analysis. Furthermore, the eigenvalue for all factors is more than 1.0, explaining the percentage of variance from 47.21% to 78.82%.

Table 5-33: Factors with Cronbach's Alpha, KMO, BTOS, Eigenvalue and Percentage of Variance Explained

	N	Cronbach's Alpha	KMO	BTOS	Eigenvalue	% of Variance
F1_ORG	8	.915	.853	.000	5.037	62.96
F2_PER	6	.879	.830	.000	3.801	63.36
F3_CLI	6	.846	.796	.000	3.450	57.50
F4_TEC	6	.861	.875	.000	3.580	59.66
F5_AUD	3	.866	.733	.000	2.365	78.82
F6_ENV	4	.604	.673	.000	1.888	47.21
F7_ENG	3	.818	.695	.000	2.204	73.45
F8_USE	3	.782	.701	.000	2.089	69.62

KMO = Kaiser-Meyer-Olkin
BTOS = Barlett test of spherecity ($p < 0.05$).

5.5 LOGISTIC REGRESSION ASSUMPTION

Prior to performing logistic regression analysis, it is important to make sure that the logistic regression model has little or no multicollinearity in which the independent variables should be independent from each other. Multicollinearity occurs when one independent variable is strongly correlated with one or more of the other independent variables ($r > .90$) (Tabachnick & Fidell, 2007). Table 5-34 shows multicollinearity results using Pearson's Correlation. The highest correlation is 0.787 between AGE and EXP_AUDIT while the lowest correlation is 0.002 between F5_AUD and F2_PER. This result shows that there is no serious problem with multicollinearity, consistent with the suggestion by Tabachnick and Fidell (2007).

Table 5-34: Pearson's Correlations (n=204)

		FIRM_SIZE	GENDER	AGE	EXP_AUDIT	EXP_CA	IT_SKILL	F1_ORG	F2_PER	F3_CLI	F4_TEC	F5_AUD	F6_ENV	F7_ENG	F8_USE
FIRM_SIZE	Pearson Correlation	1													
	Sig. (2-tailed)														
GENDER	Pearson Correlation	-.101	1												
	Sig. (2-tailed)	.152													
AGE	Pearson Correlation	-.012	.245**	1											
	Sig. (2-tailed)	.868	.000												
EXP_AUDIT	Pearson Correlation	-.032	.206**	.787**	1										
	Sig. (2-tailed)	.654	.003	.000											
EXP_CA	Pearson Correlation	-.245**	.242**	.216**	.200**	1									
	Sig. (2-tailed)	.000	.000	.002	.004										
IT_SKILL	Pearson Correlation	.092	.038	.354**	.331**	-.133	1								
	Sig. (2-tailed)	.189	.588	.000	.000	.058									
F1_ORG	Pearson Correlation	-.180**	.061	.050	.087	.265**	-.216**	1							
	Sig. (2-tailed)	.010	.386	.478	.215	.000	.002								
F2_PER	Pearson Correlation	-.270**	.151*	-.037	-.002	.389**	-.259**	.570**	1						
	Sig. (2-tailed)	.000	.031	.603	.972	.000	.000	.000							
F3_CLI	Pearson Correlation	-.127	.021	.067	.077	.100	.036	-.170*		1					
	Sig. (2-tailed)	.071	.771	.344	.274	.156	.606	.015	.173						
F4_TEC	Pearson Correlation	-.284**	.073	.008	.041	.280**	-.097	.678**	.590**	-.070	1				
	Sig. (2-tailed)	.000	.300	.914	.558	.000	.167	.000	.000	.318					
F5_AUD	Pearson Correlation	-.155*	.062	.070	.118	.124	.059	-.045	.002	.418**	.039	1			
	Sig. (2-tailed)	.027	.377	.318	.093	.077	.399	.518	.973	.000	.578				
F6_ENV	Pearson Correlation	-.142*	.014	-.017	-.059	.210**	-.088	.305**	.460**	-.029	.496**	-.044	1		
	Sig. (2-tailed)	.042	.843	.804	.400	.003	.209	.000	.000	.679	.000	.535			
F7_ENG	Pearson Correlation	-.146*	.053	.071	.160*	.200**	-.097	.669**	.460**	-.120	.600**	-.003	.326**	1	
	Sig. (2-tailed)	.037	.455	.313	.022	.004	.169	.000	.000	.088	.000	.971	.000		
F8_USE	Pearson Correlation	-.267**	.075	-.062	-.072	.297**	-.069	.391**	.506**	-.067	.530**	.040	.613**	.391**	1
	Sig. (2-tailed)	.000	.288	.381	.309	.000	.329	.000	.000	.339	.000	.568	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

This finding also has been supported by tolerance value and variance inflation factor (VIF) as shown in Table 5-35. According to Hair *et al.* (2010), tolerance value should be above .19 and VIF should be below 5.3. The values in Table 5-35 indicate there is no multicollinearity issue between independent variables.

Table 5-35: Tolerance and VIF

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-1.599	.164		-9.747	.000		
	F1_ORG	.010	.005	.138	1.891	.060	.392	2.551
	F2_PER	-1.883E-5	.006	.000	-.003	.997	.538	1.857
	F3_CLI	.017	.005	.169	3.288	.001	.796	1.256
	F4_TEC	.020	.008	.189	2.592	.010	.394	2.539
	F5_AUD	.023	.009	.128	2.516	.013	.806	1.241
	F6_ENV	.009	.008	.068	1.114	.267	.556	1.798
	F7_ENG	-.028	.011	-.157	-2.446	.015	.507	1.973
	F8_USE	.127	.014	.568	9.008	.000	.527	1.897

5.6 LOGISTIC REGRESSION

Based on the previous factor analysis, eight factors have been determined compared to the six original proposed variables that influence the use of GAS among external auditor in the UK. All of these factors have been named as organizational influence [F1_ORG], personal knowledge and experience [F2_PER], client factor [F3_CLI], perceived technology [F4_TEC], audit requirement [F5_AUD], work environment influence [F6_ENV], audit engagement allocation [F7_ENG] and perceived usefulness [F8_USE] factor. These factors will be combined with the auditor's demographic variables i.e. gender [GENDER], age [AGE], experience in auditing [EXP_AUDIT], experience in computerised auditing [EXP_CA] and IT skills [IT_SKILL] and audit firm's variable, audit firm size [FIRM_SIZE] as independent variables to determine its relationship with one dichotomous variable – USEGAS (whether auditor use or do not use GAS). For the purposes of logistic regression, each of the factors will be analysed separately, and does not relate to the other factor (ceteris paribus).

The binary dependent variables USEGAS will be measured using multivariate logistic regression through the following model:

$$logit\ (P) = \alpha + \beta_1 FIRM\_SIZE + \beta_2 GENDER + \beta_3 AGE + \beta_4 EXP\_AUDIT + \beta_5 EXP\_CA + \beta_6 IT\_SKILL + \beta_7 F1\_ORG + \beta_8 F2\_PER + \beta_9 F3\_CLI + \beta_{10} F4\_TEC + \beta_{11} F5\_AUD + \beta_{12} F6\_ENV + \beta_{13} F7\_ENG + \beta_{14} F8\_USE$$

where:

$$logit\ (p) = \left(\frac{p}{1-p}\right)$$

p	= USEGAS (1 = Use GAS; 0 = Do Not Use GAS)
β_1 - β_{18}	= variables coefficient
FIRM_SIZE	= Audit firm size based on the firm category either small or medium size of audit firm
GENDER	= Gender (1 = Male; 0 = Female)
AGE	= Age of auditor
EXP_AUDIT	= Number of years of experience in auditing
EXP_CA	= Number of years of experience in computerised auditing
IT_SKILL	= Level of IT skills
F1_ORG	= Organisational influence
F2_PER	= Personal knowledge and experience
F3_CLI	= Client factor
F4_TEC	= Perceived Technology
F5_AUD	= Audit requirement
F6_ENV	= Work environment influence
F7_ENG	= Audit engagement allocation
F8_USE	= Perceived usefulness
α	= constant

Since this chapter is interested in understanding the relationship between the dependent variable and all of the independent variables, the direct entry of the independent variables from the above model will be used. There are a few steps that have been identified prior running this logistic regression.

Before proceeding with the logistic regression, the sample size required to run the analysis need to be determined. It is important since the low sample size might not represent the result appropriately. According to Roscoe (1975) as cited in Sekaran (2003), the data set required for each independent variable is from 10-20. The data set

in this study contains 204 cases and 14 independent variables and this represent a ratio of 14:1. This ratio meets the requirement as recommended by Roscoe (1975).

5.6.1 Initial Statistics before Independent Variables are Included

According to Tabanick and Fidell (2007), the log-likelihood is based on summing the probabilities associated with the predicted and actual outcomes. According to them, if independent variables have a relationship to the dependent variable, it will improve the ability to predict the dependent variable accurately, and the log likelihood value will decrease. The initial log likelihood (-2 Log Likelihood or -2LL) value as shown in Table 5-36 is 238.039 on step 0, before any variables have been added to the model.

Table 5-36: Iteration History[a,b,c]

Iteration		-2 Log likelihood	Coefficients Constant
Step 0	1	238.039	-.922
	2	237.810	-.995
	3	237.810	-.997
	4	237.810	-.997

a. Constant is included in the model.
b. Initial -2 Log Likelihood: 237.810
c. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

5.6.2 Significance Test of the Model Log Likelihood

After independent variables are included, the value of -2LL has been reduced to 184.623 (237.810 - 53.187). The reduction of the values shows that the model is better at predicting whether auditors use GAS or not before the independent variables were added. In this study, as shown in Table 5-38, the model Chi-square value of 184.623 is significant at $p < 0.05$. Thus, it may be concluded that there is a significant relationship between the dependent variable and the set of independent variables.

Table 5-37: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	53.187[a]	.595	.865

a. Estimation terminated at iteration number 8 because parameter estimates changed by less than .001.

Table 5-38: Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	184.623	14	.000
	Block	184.623	14	.000
	Model	184.623	14	.000

5.6.3 Measures Analogous to R^2

The R-statistic is the partial correlation between the outcome variable and each of the predictor variables and it can vary between -1 and 1 (Field, 2009). As per Table 5-37, the value of R^2 for Cox and Snell (0.595) and Nagelkerke (0.865) indicates the strength relationship between the dependent variable and the independent variables. The high value of R^2 shows that the variables that have been used in this study contribute the highest amount to the model.

5.6.4 Hosmer and Lemeshow Test

The final measure of model fit is the Hosmer and Lemeshow goodness-of-fit statistic, which can be used to access how well the chosen model fits the data (Field, 2009). If chi-square value is not significant, then the model has adequate fit. However, if the test is significant, the model does not adequately fit the data. In this case, the goodness-of-fit measure has a value of 0.871 which has the desirable outcome of non-significance (p=0.885).

Table 5-39: Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	3.675	8	.885

5.6.5 Classification Table

The classification table indicates how well the model predicts group membership. As shown in Table 5-40, the current model correctly classifies 143 auditors who are not using GAS but misclassifies 6 others (it correctly classifies 96.0% of cases). The model also correctly classifies 48 auditors who are using GAS but misclassifies 7 others (it correctly classifies 87.3% of cases). Overall, the model correctly classifies 93.6% of respondents, and it can be concluded that the accuracy of this model is quite high.

Table 5-40: Classification Table[a]

	Observed		Predicted		
			USEGAS		Percentage Correct
			No	Yes	
Step 1	USEGAS	No	143	6	96.0
		Yes	7	48	87.3
	Overall Percentage				93.6

a. The cut value is .500

5.6.6 Variables in the Equation

Table 5-41 shows that the coefficients and statistics for the variables that have been included in the model. The B value represents the change in the logit of outcomes variable associated with a one-unit change in the predictor variable. B coefficients normally associated with standard errors which can produce very large coefficient if the standard error is large. If a large standard error is found that is over 2.0, there is a possibility of numerical problems in the statistic. Based on the result, standard errors (S.E.) and B coefficient are not excessively large, so there is no evidence of a numeric problem with this analysis.

Table 5-41: Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	FIRM_SIZE	-2.886	.932	9.591	1	.002*	.056
	GENDER	2.475	1.629	2.309	1	.129	11.886
	AGE	-.755	.674	1.256	1	.262	.470
	EXP_AUDIT	.127	.535	.056	1	.813	1.135
	EXP_CA	.885	.331	7.124	1	.008*	2.422
	IT_SKILL	1.309	.737	3.153	1	.076	3.703
	F1_ORG	.214	.103	4.321	1	.038*	1.239
	F2_PER	-.147	.117	1.576	1	.209	.863
	F3_CLI	.334	.124	7.199	1	.007*	1.396
	F4_TEC	.098	.121	.657	1	.418	1.103
	F5_AUD	-.132	.166	.634	1	.426	.876
	F6_ENV	.211	.144	2.130	1	.144	1.235
	F7_ENG	-.608	.227	7.143	1	.008*	.545
	F8_USE	1.983	.507	15.286	1	.000*	7.268
	Constant	-25.249	5.893	18.357	1	.000	.000

a. Variable(s) entered on step 1: FIRM_SIZE, GENDER, AGE, EXP_AUDIT, EXP_CA, IT_SKILL, F1_ORG, F2_PER, F3_CLI, F4_TEC, F5_AUD, F6_ENV, F7_ENG, F8_USE.
* $p<0.05$

Column Wald in Table 5-41 above shows Wald chi-square statistic, which tests the unique contribution of each variable assuming other variables are constant (ceteris paribus). From the column labelled Sig., the variable FIRM_SIZE, EXP_CA, F1_ORG, F3_CLI, F7_ENG and F8_USE have a significant relationship at $p < 0.05$ with the dependent variable.

The sign of the coefficient for the FIRM_SIZE and F7_ENG is negative, indicating an inverse relationship with USEGAS. Whereas there is a direct relationship for the EXP_CA, F1_ORG, F3_CLI and F8_USE with the dependent variable. The interpretation of these variables is that positive values to all questions are associated with the positive (Yes or 1) category of the dependent variable USEGAS.

More crucial to the interpretation of logistic regression is the value of the odds ratio (Exp(B)), which is an indicator of the change in odds resulting from a unit change in the predictor (Field, 2009). For example, it can be said that auditors with a value of EXP_CA are .885 times as likely to have a score of 1 (Yes) on the dependent variable USEGAS. Similarly, auditors whose score are high on the independent variable F8_USE have a 1.983 greater likelihood of using GAS.

5.7 CONCLUSION

This chapter has highlighted the quantitative data analysis and the findings from the survey questionnaire. There are three main parts of this chapter. The first part discussed the profiles of the audit firms and the auditors. The results have been tabled accordingly to give an idea regarding the background of the respondents. The second part showed the descriptive analysis of the current usage of GAS specifically from the respondents who are implementing and using GAS in their current practice as an auditor. The result also will give an overview regarding the implementation of GAS by external auditors in the UK.

The third part focused on the advanced statistical analysis of the 205 fully completed questionnaires particularly focus on the factors that influence the use of GAS among the external auditors in the UK. Dichotomous dependent variable (USEGAS) has been tested to find the relationship between other 14 independent variables. Logistic regression has been used to find the relationship. Prior to logistic regression, data screening and factor analysis have been tested as part of the logistic regression analysis.

The general findings in this study indicate that audit firm size, auditor experience in computerised auditing, organisational influence, client factor, audit engagement allocation and perceived usefulness are the factors that significantly influence the use of GAS. Meanwhile, other independent variables i.e. gender, age, experience in auditing, IT skills, personal knowledge and experience, perceived technological, audit requirement, and work environment influence are found not to significantly influence GAS usage.

Chapter 6: Results and Discussion

This chapter presents a comprehensive discussion of the research findings based on the previous results. As an introduction, the problem statement will be highlighted to show the significance and justification of this study. This chapter will then be organised based on the research objectives and the research questions stated in the earlier chapter. Current state of GAS usage by the external auditors in the UK has been explored. Fourteen hypotheses that posit the relationships between factors that influence the use of GAS have been tested and already confirmed their validity. The relationships and interrelationships between dependent and independent variables have been examined and statistically tested, and their results are explained in detail. Furthermore, the worth of GAS as well as the satisfaction of its usage have been discovered from the perspective of the GAS user and the readiness of implementation of GAS from the non-user. The problem of GAS has also been revealed. Lastly, some suggestions and recommendations to improve the use of GAS in the future have been provided to provide further ideas to interested parties.

6.1 PROBLEM STATEMENT

Technology usage in business seems compulsory in most organisations. This not only makes the business process easier and faster, but there are lots of other advantages that people cannot imagine especially if the particular assignment is done manually. However, audit practices are slow in adopting changes. External auditors still have low acceptance in the use of GAS even the specific application has been designed for them and for their audit work. Although there is nothing wrong with the traditional audit practices, it will still impact the audit efficiency and effectiveness, since most of the business entities, which also happen to be their clients, are now being fully computerised. Some auditing standards also encourage auditors to use CAATTs. Even though this is not compulsory, external auditors, especially those from the small and medium practices, are still reluctant to use it.

6.2 CURRENT STATE OF GAS USAGE

GAS has been available in the market for more than 20 years, and was in use at the time when accounting records were computerised. Among the first studies about GAS were those of Lovata (1988) and Lovata (1990). At that time, she found that only a few external auditors used GAS extensively. Subsequent studies about GAS also found that the use of GAS was very low i.e. by Greenstein and McKee (2004), Greenstein *et al.* (2005), Debreceny *et al.* (2005), Brooks and Lanza (2006) and Janvrin *et al.* (2008). Similarly, this study still found that the external auditors are truly slow in adopting GAS. Only about 27% or the total respondents of 205 of auditors are using GAS while the rest of 73% auditors are still conducting an audit based on the traditional methods of auditing. These findings are quite surprising, as in such a developed country where the acceptance of technology is among the highest in the world, this acceptance is not widespread in the auditing profession in the UK.

It was also found that there have been no new adopters of GAS in the past 2 years. Of 55 respondents who are using GAS, only 4 auditors have implemented GAS for less than 2 years while another 50 auditors already implemented GAS for more than 2

years. This indicated that most of the auditors who have used GAS were experienced in using it.

In terms of the type of GAS used, IDEA is the most popular software that has been used by external auditors and it represents almost 40% of the total number of respondents who use GAS. Although previous researchers mentioned that other popular software is ACL, it seems only three respondents (4.5%) using ACL and its ranking dropped to number five. The second popular software is an in-house application which has been established by totally mid-tier practices. No smaller firms have their own developed software. The result also indicates that ProAudit software and CCH are another popular software which ranks number three and number four respectively among the popular audit software used by external auditors in the UK.

Since most of the external auditors' main task is in financial statement auditing, it seems that GAS has been mostly applied to this particular area. However, some auditors also use GAS in other types of auditing i.e. in investigation auditing, continuous auditing, control monitoring, risk management and ad-hoc testing.

6.3 DETERMINANTS OF GAS USAGE

To identify the determinants of the GAS usage, hypotheses were developed on the basis of relationships between independent and dependent variables. The general findings in this study indicate that audit firm size, auditor experience in computerised auditing, organisational influence, client factor, audit engagement and allocation and perceived usefulness are the factors that significantly influence the use of GAS. Meanwhile, there are no direct relationships for gender, age, experience in auditing, IT skills, personal knowledge and experience, perceived technological, audit requirement and work environment in influencing the GAS usage.

The summary of the research findings of each variable is shown in Table 6-1 below:

Table 6-1: Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	FIRM_SIZE	-2.886	.932	9.591	1	.002*	.056
	GENDER	2.475	1.629	2.309	1	.129	11.886
	AGE	-.755	.674	1.256	1	.262	.470
	EXP_AUDIT	.127	.535	.056	1	.813	1.135
	EXP_CA	.885	.331	7.124	1	.008*	2.422
	IT_SKILL	1.309	.737	3.153	1	.076	3.703
	F1_ORG	.214	.103	4.321	1	.038*	1.239
	F2_PER	-.147	.117	1.576	1	.209	.863
	F3_CLI	.334	.124	7.199	1	.007*	1.396
	F4_TEC	.098	.121	.657	1	.418	1.103
	F5_AUD	-.132	.166	.634	1	.426	.876
	F6_ENV	.211	.144	2.130	1	.144	1.235
	F7_ENG	-.608	.227	7.143	1	.008*	.545
	F8_USE	1.983	.507	15.286	1	.000*	7.268
	Constant	-25.249	5.893	18.357	1	.000	.000

a. Variable(s) entered on step 1: FIRM_SIZE, GENDER, AGE, EXP_AUDIT, EXP_CA, IT_SKILL, F1_ORG, F2_PER, F3_CLI, F4_TEC, F5_PRO, F6_ENV, F7_AUD, F8_SOF.
* $p<0.05$

Based on the above findings, the justification of the hypotheses is explained in the following sections.

6.3.1 Firm's Demographic

H_1: Firm Size and GAS Usage

There are two types of firms under firm size (FIRM_SIZE), namely mid-tier practices and smaller practices. In logistic regression, 0 value is given to mid-tier practices and 1 to the smaller practices. Mid-tier practices is defined as the control group because it has been given the value of 0 in the logistic regression. The coefficient value for FIRM_SIZE as shown in Table 6-1 is -2.886. This indicates that smaller practices (N=137) have less probability than mid-tier practices (N=67) to use GAS.

This result support H_1 at $p < 0.05$ where there are significant differences (Sig = 0.002) between mid-tier practices and smaller practices to adopt GAS in auditing. Thus, null hypothesis for this variable is rejected at $p < 0.05$.

6.3.2 Auditor's Demographic

H_2: Gender and GAS Usage

There are two types of gender: female and male. In logistic regression, 0 value is given to female and 1 to male. The female is defined as the control group because it has been given the value of 0 in the logistic regression. The coefficient value for GENDER as shown in Table 6-1 is 2.475. It indicates that male (N=32) has more probability than female (N=172) to use GAS.

This result does not support H_2 that gender differs significantly in terms of the use of GAS. This is because the probability that the difference between female and male women found no significant (Sig. = 0.129). Therefore, hypothesis null cannot be rejected. These variables cannot be considered to clarify the question of the use of GAS as the evidence obtained is not sufficient.

Although previous research posits gender to have impact on the usage of technology (Venkatesh and Morris, 2000; Wehner and Jessup, 2005), this study finds no direct effects of gender and it did not significantly interact with the usage of GAS by external auditors.

H_3: Age and GAS Usage

Auditor's age (AGE) variable represents coefficient value of B = -0.755 with Exp (B) = 0.470. This result indicates that AGE negatively correlated with the USEGAS. Assuming other variables are constant (ceteris paribus), each additional one unit at AGE scores can be attributed to a reduction of the use of the log likelihood ratio of 0.755 or the reduction of GAS adherence probability of 53% (1 - 0.470).

The direction of the relationship between the two variables above is consistent with expectations of H_3, the negative direction. However, these results indicate the relationship between AGE and USEGAS is not significant (Sig = 0.262). From these results it can thus be concluded that there is no sufficient evidence to assert the existence of such a relationship. Therefore, the null hypothesis could not be rejected.

H_4: Experience in Auditing and GAS Usage

Table 6-1 shows the coefficient B = 0.127 with Exp (B) = 1.135 for auditors experience in auditing (EXP_AUDIT). This coefficient can be interpreted that each unit increase in EXP_AUDIT associated with increased probability ratio log USEGAS 0.127, assuming other variables are constant (ceteris paribus). This means that each increase in EXP_AUDIT variables, associated with an increase of 13.5% (1-1.135) probability of GAS usage. However, the position of this coefficient is not significant (Sig. = 0.813).

These results support H_4 hypothesis in terms of the relationship but this coefficient failed in the significance test. Thus, the study did not obtain sufficient evidence to support H_4. Therefore, the null hypothesis cannot be rejected.

H_5: Experience in Computerised Auditing and GAS Usage

Hypothesis H_5 emphasizes that there is a positive relationship between auditor experience in a computerised audit and the use of GAS. Thus, the coefficient B which represents EXP_CA expected to show positive and significant in this logistic regression analysis.

Table 6-1 shows that coefficient B has a positive figure, which is 0.885 with Exp (B) = 2.422. The increase of one unit associated with the increase in 0.885 EXP_GAS log likelihood ratio usage or increase the probability of use of 142.20% (1-2.422), assuming other variables are constant (ceteris paribus). The table also shows the significant value of EXP_CA lower than 0.05, which is 0.008. Therefore, hypothesis null is rejected.

The argument that states there was a positive relationship between auditor experience in a computerized audit (EXP_CA) with the use of GAS can be accepted. Thus, the higher auditors experience in computerised auditing, the higher the probability for them to use GAS.

H_6: IT Skill and GAS Usage

Hypothesis H_6 also emphasizes that there is a positive relationship between IT skills and the use of GAS. Table 6-1 shows coefficient B has a positive figure, which is 1.309 with Exp (B) = 3.703. It means, the increase of one unit of IT_SKILL associated with the increase in 1.309 log likelihood ratio usage or increase the probability of use of 270.30% (1-3.703), assuming other variables are constant (ceteris paribus).

The argument that states there was a positive relationship between IT_SKILL with the use of GAS can be accepted. However, the significant value of IT_SKILL was higher than 0.05, which is 0.076. Therefore, hypothesis null cannot be rejected as the study did not obtain sufficient evidence to support H_6.

6.3.3 GAS Factor

As discussed in Chapter 3 in section 3.3.3 regarding the research hypotheses, it seems that the result from the factor analysis derived eight different factors. Based on the results, the following hypotheses are proposed:

H_7: *Organisational influence would have a positive relationship with the use of GAS.*

H_8: *Personal knowledge and experience would have a positive relationship with the use of GAS.*

H_9: *Client factor would have a positive relationship with the use of GAS.*

H_{10}: *Perceived technology would have a positive relationship with the use of GAS.*

H_{11}: *Audit requirement would have a positive relationship with the use of GAS.*

H_{12}: Work environment would have a positive relationship with the use of GAS.

H_{13}: Audit engagement allocation would have a positive relationship with the use of GAS.

H_{14}: Perceived usefulness would have a positive relationship with the use of GAS.

H_7: Organisational Influence and GAS Usage

The first dimension in GAS perception is an organisational influence (F1_ORG). It is expected that F1_ORG to have the positive relationship with GAS usage. Table 6-1 shows coefficient B = 0.214 and Exp (B) = 1.239. It means that the increase of one unit of F1_ORG associated with the increase in 0.214 log likelihood ratio usage or increase the probability of use of 23.9% (1-1.239), assuming other variables are constant (ceteris paribus).

With the above results, the hypothesis H_7 is supported and the study has strong evidence to indicate that there is a positive relationship between F1_ORG and the use of GAS. Given the results obtained are significant, the null hypothesis is rejected at the 95% confidence level.

H_8: Personal Knowledge and Experience and GAS Usage

Personal knowledge and experience (F2_PER) is the second factor in GAS perception. This factor is expected to have a positive relationship with the use of GAS. Table 6-1 shows coefficient B = -0.147 and Exp (B) = 0.863. It means that the increase of one unit of F2_PER associated with the decrease of 0.147 log likelihood ratio of usage or decrease the probability of use of 86.3% with p = 0.209.

The negative value of B does not support the hypothesis H_8 in terms of the relationship. Furthermore, the relationship is also not significant because $p > 0.05$. Therefore, the null hypothesis cannot be rejected.

H_9: Client Factor and GAS Usage

The third dimension in GAS perception is client factor (F3_CLI). It is expected that F3_CLI to have the positive relationship with GAS usage. Table 6-1 shows coefficient B = 0.334 and Exp (B) = 1.396. This means that the increase of one unit of F3_CLI associated with the increase in 0.334 log likelihood ratio usage or increase the probability of use of 39.6% (1-1.396), assuming other variables are constant (ceteris paribus).

With the above results, the hypothesis H_9 is supported and the study has strong evidence to indicate that there is a positive relationship between F3_CLI and the use of GAS. Given the results obtained are significant, the null hypothesis is rejected at the 95% confidence level.

H_{10}: Perceived Technology and GAS Usage

The fourth dimension in GAS perception is a perceived technology (F4_TEC). It is expected that F4_TEC to have the positive relationship with GAS usage. Table 6-1 shows the coefficient B = 0.098 with Exp (B) = 1.103. This coefficient can be interpreted as each unit increasing in F4_TEC associated with an increased probability ratio log of USEGAS of 0.098, assuming other variables are constant (ceteris paribus). This means that each increase in F4_TEC, associated with an increase of 10.3% (1-1.103) probability of GAS usage. However, the position of this coefficient is not significant (Sig. = 0.122) at $p < 0.05$.

These results support hypothesis H_{10} in terms of the relationship but this coefficient failed in the significant test. This means that the study did not obtain sufficient evidence to support H_{11}. Therefore, the null hypothesis cannot be rejected.

H_{11}: Audit Requirement and GAS Usage

The fifth dimension in GAS perception is an audit requirement (F5_AUD). It is expected that F5_AUD to have the positive relationship with GAS usage. Table 6-1 shows the coefficient B = -0.132 with Exp (B) = .876. This coefficient can be interpreted that the increase of one unit of F5_AUD associated with the decrease in 0.132 log likelihood ratio usage or decrease the probability of use of 12.4% (1-.876),

assuming other variables are constant (ceteris paribus). However, the position of this coefficient is also not significant (Sig. = 0.426) at $p < 0.05$.

These results do not support the hypothesis H_{11} in terms of the relationship and its coefficient also failed in the significant test. This makes the study did not obtain sufficient evidence to support H_{13}. Therefore, the null hypothesis cannot be rejected.

H_{12}: Work Environment and GAS Usage

The sixth dimension in GAS perception is a work environment (F6_ENV). It is expected that F6_ENV to have the positive relationship with GAS usage. Table 6-1 shows the coefficient B = 0.211 with Exp (B) = 1.235. This coefficient can be interpreted that the increase of one unit of F6_ENV associated with the increase in 0.211 log likelihood ratio usage or increase the probability of use of 23.5% (1-1.235), assuming other variables are constant (ceteris paribus). However, the position of this coefficient is also not significant (Sig. = 0.144) at $p < 0.05$.

These results support the hypothesis H_{12} in terms of the relationship, but this coefficient failed in the significance test. This makes the study did not obtain sufficient evidence to support H_{12}. Therefore, the null hypothesis cannot be rejected.

H_{13}: Audit Engagement Allocation and GAS Usage

The seventh dimension in GAS perception is an audit engagement allocation (F7_ENG). It is expected that F7_ENG to have the negative relationship with GAS usage. Table 6-1 shows coefficient B = -0.608 and Exp (B) = 0.545. It means that the increase of one unit of F7_ENG associated with the decrease in 0.608 log likelihood ratio usage or decrease the probability of use of 54.5%.

The negative coefficient above conflicts with what has been expected earlier in the hypothesis. Thus, the hypothesis H_{13} is not supported due to the negative direction of the relationship between F7_ENG and the use of GAS. However, given the result obtained is significant, the null hypothesis is rejected at the 95% confidence level.

H_{14}: Perceived Usefulness and GAS Usage

The last dimension in GAS perception is perceived usefulness (F8_USE). It is expected that F8_USE to have the positive relationship with GAS usage. Table 6-1 shows coefficient B = 1.983 and Exp (B) = 7.268. It means that the increase of one unit of F8_USE associated with the increase in 1.983 log likelihood ratio usage or increase the probability of use of 626.8% (1-7.268), assuming other variables are constant (ceteris paribus).

With the above results, the hypothesis H_{14} is supported and the study has strong evidence to indicate that there is a positive relationship between F8_USE and the use of GAS. Given the results obtained are significant, the null hypothesis is rejected at the 95% confidence level.

6.3.4 Model of GAS Usage

Based on the previous findings, the proposed model for determinants of GAS usage is shown as per Figure 6-1 below. This demonstrates the interaction between the significant variables that were investigated in this study and GAS usage.

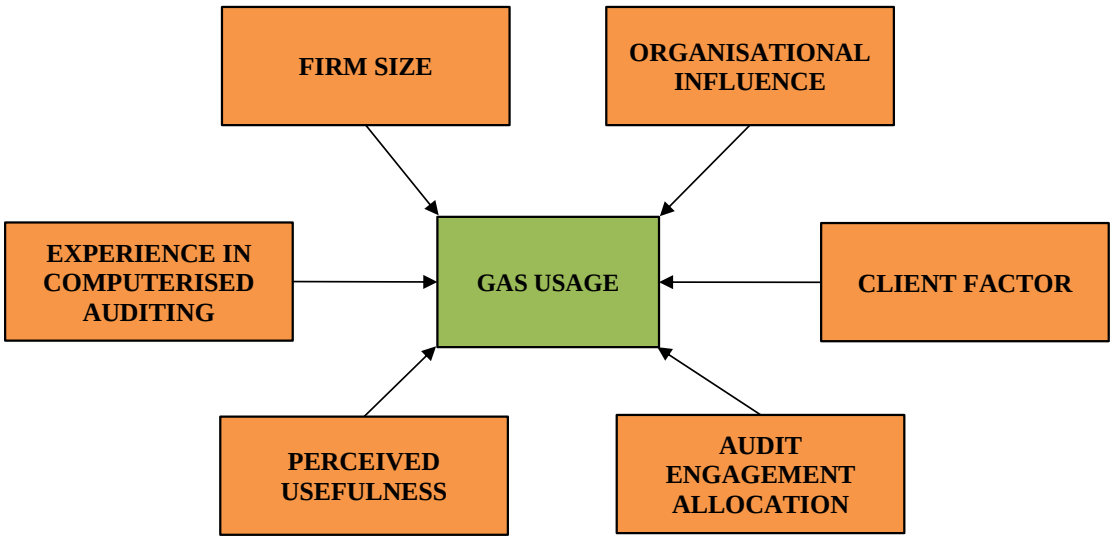


Figure 6-1: Determinants for GAS Usage by External Auditors

The above model offers insights into the perception and adoption of GAS, particularly by external auditors in small and medium sized audit firms in the UK. The model

might draw attention to audit practitioners in order to adopt technology within their firm, or any other researchers who may wish to investigate these variables further.

Audit firm size i.e. mid-tier practices or small practices is the first factor that influences the use of GAS. Big audit firms tend to use GAS more than the smaller audit firm. Auditors who have an experience in computerised auditing also contribute to the determinants of GAS usage. Auditors who have more experience in computerised auditing tend to use GAS rather than those who are lack of experience and IT skills.

The results also suggest that organisational influence plays an important role in allowing the GAS to be used by the auditors. Cost is believed to be the main constraint in GAS adoption. However, with the sufficient maintaining and implementing of costs, as well as the availability of resources, the adoption of GAS will be more than possible. Support elements from the IT staff and the top management will also encourage auditors to use GAS. A further important element in the organisation is the training that can be provided to audit staff. The training can be divided into internal training and external training. Professional training is probably quite expensive, but it is good and important for continuous professional education especially in auditing career.

The fifth significant factor about GAS usage relates to client or auditee. Since the audit heavily involved with the client, especially in order to make sure that the clients' accounts are free from misstatement, their elements also play an important role in the use of GAS decision. Based on the findings, small clients' business sizes, as well as the smaller numbers of client, are among the major reasons for not utilising GAS. It is impractical to invest some amount of money where gains are not justifiable to recover costs.

The complexity of the client's IT and business environments is another element that needs to be considered. More complex the IT and business environments, the probability auditors will use GAS is higher. Client's internal control is also another important element when deciding to use GAS. Stronger internal control systems mean that the reliability of the accounting reports produced by the client is high. The

consequence of this is that probably less substantive test need to be conducted by the auditor. However, the use of GAS will be more helpful to support the evidence that the client's internal control is dependable.

The support provided by the client will be meaningful for auditors to further analysing client's data through GAS. Auditors need the proper format of data with the right timing of transactions to be tested and audit. With the kind help and support of the client, there will be more chances for the auditor to adopt GAS.

Clients' data are always confidential and the breach of the data will impact the client's business and organisation into risk. Giving the data to the auditors in which it can easily be transferred into the current cloud age, will make the client more concern about their data security. Although there is an early agreement about the protection of confidentiality of client's data, this issue is still a concern not to be taken for granted by the client. Furthermore, the clients also are subject to audit requirement in which there is supposed to be no limitation for the auditors in granting an access into client data. Otherwise, this limitation will have an impact on the audit report. However, this element is also among the justification factors for the auditor to implement GAS.

The sixth factor that influences the use of GAS is related to the specific audit engagement allocation. There are three elements within this factor that concern the auditors in terms of implementing GAS, which are related to audit workloads, time allocated and financial budget on the audit engagement. This finding suggests that the more index on the audit engagement; the probability that auditors will use GAS is low.

The seventh factor which has significantly influenced the use of GAS is the perceived usefulness factor which is related to the software itself. The more useful the software is, the higher the intention to use GAS will be. Furthermore, if the use of software is regularly used in audit assignment, GAS will be more likely to be adopted. Last but not least, the requirement to use audit software in auditing standards will also influence auditors to use GAS.

6.3.5 Qualitative Findings

Instead of asking close-ended questions regarding the factors that influence the use of GAS which already being analysed quantitatively, the respondents were also asked about other factors that might influence the usage in the open ended questions. 20 responses were received for this question, in which five responses are from those who are using GAS and another 15 responses are from those who are not using GAS. Only one response was received from a smaller practice (who is using GAS) while the other responses are from mid-tier practices. The word cloud that has been generated using Wordle (www.wordle.net) on the responses on the other factors that influence the use of GAS is shown in Figure 6-2. This shows that the most common factors that influence the usage of GAS are clients and cost.

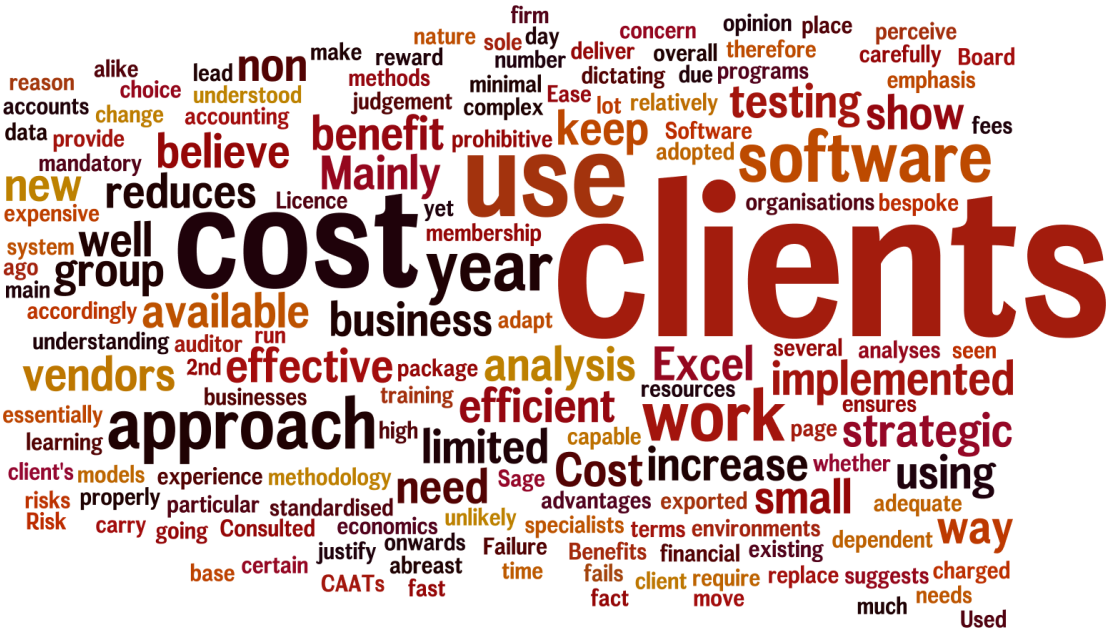


Figure 6-2: Word Cloud on the Responses on the Other Factors that Influences the Use of GAS

Factors that Influence the Use of GAS

Two of the auditors replied that the use of GAS for their firm was mandatory as it formed part of requirement of group membership, while another auditor justified the fact that that he had no choice but to use it because it was his firm's own software.

One of the auditors simply responded that the factor that influenced the use of GAS was ease of storage.

One of the auditors from the smaller practice mentioned that *"We don't use GAS as much as I believe we could, essentially because a lack of understanding at the strategic level, which (a) reduces the budget available for adequate training and (b) fails to provide strategic direction for the effective and efficient use of GAS."* Although this response is not directly answering the question, it is important to note that the implementation of GAS will be unsuccessful if the auditors cannot understand the objectives and use of GAS.

Another auditor replied, *"The need to be seen in the market place, as keep abreast of change, and being able to show that we can adapt and deliver"*. Interestingly, this response is related to the previous one especially, and shows the importance and benefits of GAS to the audit community.

Factors that Influence the Non-Usage of GAS

The main issue that was stressed by the auditors who are not using GAS was that of the clients themselves, as per what has been highlighted in the word cloud in Figure 6-2. A few respondents mentioned that their clients were relatively small and not complex. Thus, they perceive GAS as being unlikely to lead to a more efficient or effective audit. Furthermore, as their clients are quite small, the issue of complexity is justified in terms of non-usage of GAS. For example, one respondent mentioned that, *"Most of them use an accounts package like Sage where we can restore the information onto our computers and manipulate it as we wish."* Another respondent used their own IT specialist to analyse their client's data, replying, "*We have a small number of such clients on which we use our own internal IT specialists with their own techniques."*

Another respondent added: *"Most clients' accounting and financial reporting software allows data to be exported into Excel, and any capable user of Excel can carry out the analyses which used only to be available with CAATs several years ago"*. This feedback indicates that they manage to use computer software (in this case

Excel which is also part of GAS) to analyse non-complex client data although their perception and understanding about GAS is different.

A further respondent used another approach, in which they replied, *"Our database management system together with a blank page approach to planning and executing our audits ensures they are to a high standard and are bespoke to the client's particular circumstances and risks. No two clients are alike and accordingly a standardised approach would be inappropriate."*

Due to the size of the clients, as well as the small amount of fees received, it is also uneconomical for the auditors make use of GAS. The main concern here is about cost. One of the feedbacks noted, *"Initial cost is expensive- cost analysis from another firm that has implemented GAS show a 25% cost increase during the first year, a 15% cost increase during the 2nd year and minimal benefits from year 3 onwards"*.

A few respondents had conducted cost benefit analysis. The following are their feedback:

> *"Cost-benefit and risk-reward tests only work in environments which are totally dependent on IT for business continuance."*
>
> *"Cost benefit analysis suggests that economics isn't going to be a saving despite what vendors say."*
>
> *"Benefits do not outweigh the costs and at the end of the day, we are a business and auditing needs to be performed commercially as well as professionally."*

Another issue related with cost is about the software licensing. One of the respondents mentioned, *"Licence models from vendors seem to work against our organisation structure."* According to Lanza (n.d.), the cost for ACL and IDEA is extremely high, at more than USD2000.00 per licence. This probably justified the reason for not implementing GAS. However, there are alternatives of GAS that can be chosen. TopCAATs has been offered at USD199.00 as an introductory price compared to its standard price at USD399.00. Auditors also can get ActiveData for Excel for just USD249.00 for a single licence.

The other fact which is quite common among the auditors is they are happy with the traditional method of auditing. For example, one of the respondents replied, *"Mainly due to the fact that non-IT testing procedures work perfectly well for most clients therefore investment in GAS for a few situations where applicable is prohibitive in terms of time, learning and cost"*. And another reason is *"There is currently no pressure from the regulators to move this way."* Other auditor answered, *"Our audit methodology does not require its use in most cases so only limited experience of it."*

Another auditor simply mentioned that, *"Software cannot replace auditor judgement, concern over software dictating methods."* Although GAS is computerised, auditor still required to use their professional knowledge to analyse and interpret the findings.

A noteworthy point is that one of the auditors realised the benefits of GAS. However, he failed to convince the top management to implement GAS. He wrote, *"Failure of Board to realise the advantages sole reason for non implementation - now persuaded"*.

A further factor for non-usage of GAS is the limitation of resource available. As one of the respondents explained, *"To be understood carefully, we have to run so fast to keep up with mandatory regulatory changes that we do not have the resources to properly explore whether "a new (in the sense of new to us) way of doing things" would be beneficial to us overall."*

Others prefer to use another approach in auditing, which wrote, "*We believe we audit efficiently using existing programs and emphasis on risk-based audit approach which reduces the need for detailed testing."*

6.4 VALUE OF GAS

The respondents were asked whether the implementation of GAS was or would be worthwhile in terms of cost and effort, and 64% of the respondents did not agree that it is was worthwhile, 36% of them answer yes to the question. Surprisingly, as shown in Table 6-2, 4 out of 55 of those who are using GAS found that the implementation

of GAS was not worthwhile. 22 t of the 150 of respondents who were not using GAS feel that GAS is worth in terms of cost and effort. This shows that the perspectives of GAS from both sides of auditors i.e. those who are using GAS and those who are not using GAS was different. For those who are using GAS, most of them agree that GAS is worth in terms of cost and efforts. While from the perspective from those who are not using GAS, they think oppositely. However, there were some auditors who were not using GAS who thought it could bring benefits to them.

Table 6-2: Is GAS Worth Cost and Effort?

	Using GAS				Not Using GAS				Total	%
	Mid-Tier Practices	Smaller Practices	Total	%	Mid-Tier Practices	Smaller Practices	Total	%		
Yes	32	19	51	24.9	9	13	22	10.7	73	35.6
No	3	1	4	2.0	24	104	128	62.4	132	64.4
Total	35	20	55	26.8	33	117	150	73.2	205	100.0

Appendix III indicates the feedback on open-ended questions in terms of the reason why the auditors think about the worth of GAS. After reviewing all the responses, each item has been categorised according to specific issues and themes for better understanding of the worth of GAS. Figure 6-3 illustrates the perception of auditors on the worth of GAS (whether it is Yes or No) from the perspective of auditors who use GAS and those who are not using GAS.

Use GAS and Answer YES

For those who used GAS and answered yes, 10 of the respondents indicated that GAS is worth because it can improve the audit efficiency and effectiveness. This result is consistent with Lovata (1988), Omoteso (2006), Braun and Davis (2003), Curtis *et al.* (2009), Janvrin, Bierstaker and Lowe (2009) who indicated that GAS or CAATTs can improve audit efficiency and effectiveness. One of the respondents mentioned that if GAS was successfully implemented and embedded in auditing, with the adequate staff training, GAS should improve audit efficiency and effectiveness. A few respondents commented that GAS could provide more powerful output and improved productivity. The word cloud, as shown in Figure 6-3, also shows that the most common words for the feedback are efficient and effective.

However, a few respondents stated that the worth of GAS depended on a few circumstances. For example, some mentioned that it was only practical on larger audits. Some look at GAS as just a tool in a toolbox in which they do not use it in every assignment but there are times and places where it is highly effective and efficient. Often, the practical difficulties of GAS outweigh any potential benefits.

	WORTH OF GAS	
	YES	**NO**
USE GAS	**Improve audit efficiency and effectiveness (10)** **Depends (5)** **Help directional auditing (4)** **Cost effective (3)** **Increase level of audit assurance (3)** **Ease of use (2)** **Reduce time (2)** **Saved space and storage (2)** **Extended test (1)** **GAS is essential (1)** **Improve audit quality (1)** **Flexible (1)**	Implementation problem (1) Prefer to use traditional audit approach (1)
NOT USE GAS	**Depends (11)** **Help directional auditing (2)** **Saved space and storage (1)** **Reduce Risk (1)** **Increase level of audit assurance (1)** **Improve audit effectiveness and efficiency (1)** **Improve allocation of resource (1)** **Flexible (1)** **Cost effective (1)**	Not effective (26) Prefer to use traditional audit approach (5) Depends (4) Don't know (3) Simply replaces other processes (1) Nothing can be done with current standard tools (1) Not flexible (1) Not convinced about GAS (1) Not compatible (1) Not at the moment (1) No requirement for GAS (1) Market incentive of GAS are low (1) Low level of IT used by clients (1) Less use of audit judgement (1) Lees learning curve (1) Ignorance of GAS (1) GAS is not important (1) Client software are far too varied (1) Auditing will be too procedural (1)

Note: Number in the bracket shows the total responses regarding the issue.

Figure 6-3: Worth of GAS

Some of the auditors mentioned that GAS would help directional auditing where it had clearer documentation, brings discipline in conducting an audit and giving

consistency of audit work. There are also a few of them stated that GAS is cost effective for their firm. One of them just spent minimal cost of GAS implementation as he is just using Microsoft Excel to realise GAS in auditing.

A further important benefit that has been raised is that GAS can help to increase the level of audit assurance, as well as audit evidence.

GAS also has been seen as easy to use, as one of the respondents stated that it is better to access compared to paper based auditing and it is less likely to get the loss.

GAS is also worthwhile because it can reduce time especially on sampling transactions and giving additional comfort on key items, journal transactions. Previous literature also stated that GAS or CAATTs could reduce audit hours (Janvrin *et al.*, 2008; Banker *et al.* 2002; AICPA, 2001).

GAS from the perspective of those who are using it also could save them in terms of space for filling as well the storage cost. Banker *et al.* (2002) mentioned that a current trend is to create a paperless office environment that replaces paper documents with electronic documents so that information can be accessed easily and with much less effort. Thus, using GAS can promote paperless audit. Bierstaker *et al.* (2001) predicted that, paperless audits will become commonplace as audit clients increasingly shift to paperless systems and audit software is developed that allows auditors to complete most procedures online.

One of the greatest benefits of GAS is it can run some analysis (as what has been discussed in Chapter 2) which is impossible to be run manually. This benefit is supported by one of the respondents who mentioned that it can perform audit tests that cannot be undertaken when auditing 'round' the computer. With the systems and accounting applications which are widely used by most of the clients, one of the respondents mentioned that GAS was essential because of this.

The last two pieces of feedback from the respondents were that GAS is worthwhile because it is flexible, and can improve audit quality.

Not Use GAS and Answer YES

It is also important to understand and discuss the worth of GAS from the perspective of those who are not using it. Although they are not using GAS, from the feedbacks received, we can understand their perception and understanding of GAS. Most of the auditors who were not using GAS expected that the worth of GAS might benefit them depend on some circumstances. Among the issues at stake are cost, client size, complexity of auditing, the firm's size and whether they know how to use the tool correctly and efficiently.

For example, one of the respondents stated: *"But only at a certain scale automation of systems in the audited entity and firms with a few clients to which this applies have only limited incentives to implement given the intellectual investment required (IT expertise and training for auditors in liaising with IT auditors)".*

From another perspective, *"GAS is likely to be beneficial on large audits where the costs can be recovered within the fee constraints."*

A further respondent concluded: *"It would be worth it for the very small number of firms who have complex audits i.e. big 4 and certain mid-tier firms and for smaller firms with smaller audits with high volumes of transactions e.g. those selling in significant amounts over the Internet."*

Auditors who are not using GAS also agreed that GAS will help directional auditing. They expected GAS to enable better tailoring of tests and so improve focus during the audit. Another mentioned that GAS should supply a more systematic and rigorous approach to audit assignments.

One specified that using GAS will avoid the administrative element of storing and retrieving files. Thus, indirectly, it will save storing space as well as storage costs. A further respondent stated that the cost of software was offset by savings in files, paper and storage.

GAS is also expected to increase the level of audit assurance by using a valid statistical approach. Process driven in GAS also will improve the audit efficiency and

audit effectiveness. One mentioned that GAS also would improve the allocation of resource during the audit process. The ability of GAS, which can handle large volume of data, also expected to make it worth for auditors. One last comment from this group of auditor is the use of GAS can also reduce risk.

Use GAS and Answer No

As shown in Table 6-2, there are four respondents who are using GAS stated that it is not worth for them. One of them faced difficulties in the implementation phase. He stated that, *"There have been more implementation problems than first noted, a lot of frustration and down time amongst staff, and additional IT costs that have had to be incurred."*

Although it was thought to be a problem in the implementation phases, they realised that the rewards of GAS implementation would be gained at least after 12 months of implementation. The same previous respondent added, *"...once the system is up and running properly, and especially after it has been established for 12 - 18 months we are confident that the rewards will start to become more apparent."*

Another respondent merely preferred to use a traditional audit approach and focus on substantive auditing. The other two respondents did not leave any comment on why they think GAS is not worth for them.

Not Use GAS and Answer No

Of the 150 auditors who are not using GAS, 128 of them stated that GAS is not worth for them. Most of their comments mentioned that GAS is not effective for them due to the small audit exercises that have been conducted by them. This includes small firm, small client, limited number of audit clients, non-complex audit, small volume of transactions and unsophisticated proprietary systems. This issue also relates to the second most given answers which particularly address the cost concern.

As one of the auditors mentioned: *"The software is very expensive and I can only see it benefiting the top 10 firms of whom have clients that pay £100,000's for an audit. Private client audits are much more price sensitive and it is difficult to justify the cost of implementation of the software."* Another auditor added, *"My view is exclusively*

from the position of my firm as a small provider of audit services to small companies. I can understand the need for GAS for larger firms who undertake numerous audits on a continual basis. However, their costs would be significantly higher from the companies I deal with and the client would get no benefit from the use of GAS".

According to Mahzan and Lymer (2008) cost considerations may no longer currently represent the same challenges, due to availability of cheaper versions of CAATTs resulting from constant upgrade and refinement by CAATTs providers and also wider trends in technology cost reductions, training costs and improvements in practice of, and understanding of data security. However, as a contradiction to this study, the cost is still the biggest problem for auditors in small and medium firms.

One of the auditors stated: *"For the audits that we conduct, the cost of implementing, maintaining and using would far outweigh the benefits of testing or information gathering."* Another point which is worth to note is related to the increase of audit threshold as what has been commented by respondent, "*Generally with the increase in audit threshold, we are unlikely to have sufficient audits to warrant the cost of the software".*

Subsequent to small audit specifically on the limited numbers of audit, one of the auditors feels that it is not good enough to make the learning curve worthwhile.

The third reason given by the respondent is they prefer to use traditional audit approach instead of GAS. One of them stated that the current paper based system that they use seems to work perfectly fine. This is supported by another auditor who mentioned that *"Not broke so don't mend at present".* Another auditor prefers to use traditional methods because he taught that human input is always required which will result the right audit opinion. His argument is also supported by another auditor who stated that GAS would make less use of audit judgement to specify and identify risks and develops testing. However, it may be argued that even the use of GAS required computer to make it works, audit judgement still important to interpret the result. Another auditor mentioned that he has a predefined audit process and does not require GAS for their audit. Another auditor did not consider that GAS would improve the quality of the work performed from that of using a manual approach. Last two

comments from the respondents which prefer to use traditional approach are just ignorant of GAS and no requirement for it.

Some of the respondents considered that the use of GAS depends on a few circumstances which is similar to the issue that has been discussed in the previous section. As one of the auditors noted, *"Not worth it unless the client is large and sophisticated in terms of its IT systems, in which case use of GAS will help sort and interrogate data. If a client runs its accounts in Excel or Sage, there is little benefit to be gained."*

Three of the respondents mentioned in the comment section that they did not know about GAS as they never seen GAS in operation before. Interestingly, one of the respondents does not even know that GAS exists. He wrote, *"The issue is we don't know the software products available or their cost as despite asking service providers there does not seem to be any software applicable for small firms."*

A discussion is provided below of the responses which uniquely applied to the single feedback of each. First, one of the auditors stated that GAS will simply replace other processes and may well lead to increased work with no additional benefit to the audit opinion.

Secondly, the auditor sees GAS as unimportant, as the audit now can be done perfectly well with standard MS Office tools. A further auditor sees GAS or computerised data extraction and analysis as an unimportant part of the audit. For him, understanding company performance and mitigating audit risk are more important.

Fourthly, one of the respondents mentioned that he was not convinced about GAS. He said, *"We have looked at various suppliers of this technology. No one has convinced us that it is better than combination of traditional files and technology."* This is probably the challenge for the vendor out there to fit the audit needs and its requirement as well as to simplify the audit with this group of auditors.

GAS also has been seen as not flexible. He noted, *"Not enough flexibility at present therefore some processes will still need to be done "outside the system" which would not be efficient."*

One of the respondents stated that their client was not compatible with GAS. He added "We can extract all the data we need from their systems without GAS."

The increase of audit threshold also impacted on GAS, where the auditor sees that the market incentives of GAS become low. One of the respondents pointed out, *"With an increasing number of companies becoming audit exempt as the threshold rises, the incentive in our marketplace to introduce GAS lessens."*

One of the auditors realised that GAS was important, but conceded that they were not ready for it. He stated, *"Not for us at present although we do use IT a lot for various clients during our audit and other support work. Still quite rare for pure audit to apply."*

Another auditor stated that GAS is not worth because of the low level of IT used by clients. He stated, *"With the low level of IT used by our clients there are no likely benefits."* Another added that client software has been far too varied. He mentioned, *"Clients' accounting software, and hence databases, are far too varied for the current techniques to make implementation worth the time and effort."* He estimated that the client accounting systems are reliable enough for not to be investigated further.

Although other respondents mentioned that GAS is worth in helping the directional audit in which can guide them to implement GAS, but one of the auditors sees it as a negative view. He thought it could make the audit too procedural.

6.4.1 GAS Satisfaction

Those who are using GAS were asked whether they were satisfied with the use of GAS. Table 6-3 below summarised their answers.

Table 6-3: GAS Satisfaction

GAS Satisfaction	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
Very satisfied, no improvement required	10	18.2	5	9.1	15	27.3
Reasonably satisfied, although some improvement may be required	18	32.7	8	14.5	26	47.3
Needs improvements, but still usable	7	12.7	7	12.7	14	25.5
Total	35	63.6	20	36.4	55	100.0

Only 27% of the respondents were fully satisfied with GAS, while 47% of them reasonably satisfied, although some improvement may be required. 25% of them stated that GAS might need some improvements.

Only seven items of feedbacks were received related to the above responses. One of the auditors who is reasonably satisfied with GAS stated that, *"Increasing use of macros enabling audit teams to extract data from standard accounting packages without the need to involve IT specialists…"* It is one of the evidences that the use of GAS is easy and do not require technical use of IT.

One of the auditors mentioned that if GAS was more user friendly, then it might be more widely used. The researcher more than agreed with the statement. It may be that the vendors of GAS have some ideas on how making it friendly for external auditors.

GAS also needs to cover more software types. There is flexibility issue that needs to be adjusted to make it work with the client's data. One of the auditors also has faced hardware technical difficulties when working remotely. However, he still felt that GAS was reasonably satisfactory, although some improvement may be required.

There were two comments on those who ticked that GAS needs improvements, but still usable. One mentioned that, *"The product does not link as well as expected to our current accounts package, however this issue is being worked on, and we hope to have a resolve in the imminent future."*

A further one seemed to have a limitation of the budget when considering of GAS usage. He mentioned that GAS works better when tailored, but budgets prevent this from happening on a regular basis.

6.4.2 Intention to Adopt GAS

Respondents who were not implementing GAS were also being asked if they have an intention to adopt GAS in the future. Of the 150 respondents, 68 (45%) of them had no intention at all to adopt GAS and 53 (35%) of the respondents had little attention to adopt GAS. Only 9 (6%) respondents definitely want to adopt GAS. Table 6-4 below indicated the result:

Table 6-4: Intention to Adopt GAS

Intention to Adopt GAS	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
No intent to adopt	9	6.0	59	39.3	68	45.3
Little intent to adopt	12	8.0	41	27.3	53	35.3
Moderate intent to adopt	5	3.3	9	6.0	14	9.3
Definite intend to adopt	2	1.3	7	4.7	9	6.0
Don't know	5	3.3	1	0.7	6	4.0
Total	33	22.0	117	78.0	150	100.0

For those who had the intention to adopt GAS, they have been asked to anticipate when the use of GAS can be implemented. Table 6-5 summarised the result. This shows that only four respondents planned to adopt GAS for less than 12 months period, five of them planned to adopt GAS within 12-18 months, seven of the respondents planned to adopt it within 18 to 24 months and 21 of the respondents planned to adopt Gas for more than 24 months. 90 of the respondents clearly stated that they had no plan at all to adopt GAS.

Table 6-5: How Soon to Adopt GAS

When to Adopt GAS	Mid-Tier Practices		Smaller Practices		Total	
	Frequency	% of Total	Frequency	% of Total	Frequency	% of Total
Less than 12 months	2	1.6	2	1.6	4	3.1
12 to 18 months	2	1.6	3	2.4	5	3.9
18 to 24 months	2	1.6	5	3.9	7	5.5
More than 24 months	5	3.9	16	12.6	21	16.5
No plans to adopt	19	15.0	71	55.9	90	70.9
Total	30	23.6	97	76.4	127	100.0

6.5 PROBLEMS WITH GAS

An open-ended question about the GAS problems was asked in the questionnaire from both who use GAS and those who are not using GAS. Appendix V indicates the feedbacks while Figure 6-4 indicated the summary of the problems of GAS. From the overall perspective, the results indicate that the main problems with GAS are cost, compatibility and its difficulty.

However, in discussing the problems of GAS, it is better to look into different perspectives especially from those who are using GAS to elaborate their experience and those who are not using GAS to understand their perception on GAS. The problems that will be discussed in the following section are not just intended to show the disadvantages and limitations of GAS, but also to highlight the issues especially for the software vendors and developers, as well as to the audit practitioners out there. It is important that any problems be raised, so that some improvement may be implemented in the future.

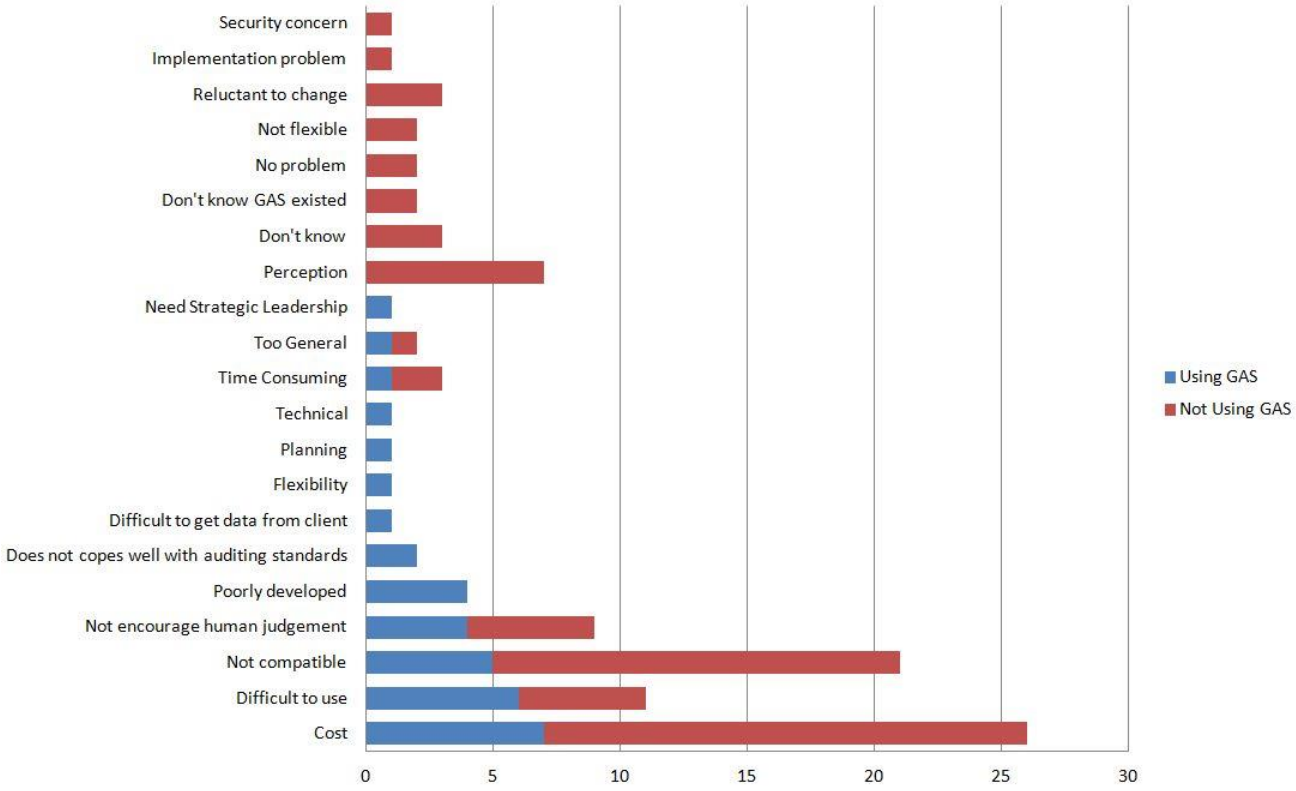


Figure 6-4: Problems with GAS

GAS Problems from the Adopter's Perspective

While GAS has been implemented by a few auditors, they also found some problems with it. The first issue of GAS that mainly has been raised is about the cost especially for the first year of setup. Implementation cost seems quite high and some of the respondents mentioned that they only would get back the return after 3 years of implementation. Furthermore, another issue which is related with cost is about the training of staff to use the systems.

The second issue is about the difficulty to use the systems. As one of the auditors mentioned, *"Accountants now have to be computer experts, learning and understanding complex systems, reading computer language to tag accounts, linking systems etc. In many cases the systems are not designed by those that are actually actively still practising, and so therefore the real life happenings are often overlooked with an idealistic version of how things work."* This statement clearly mentioned that the use of GAS required additional technical computer knowledge by auditors.

A further auditor replied, *"Only specialists can use it and having spent a fair amount of time setting up the tests the results can often be insufficiently precise to place reliance on them."* Meanwhile, another auditor added, *"If not set up well, it can be cumbersome to complete in practice."* The main cause of this problem was what has been mentioned by one of the respondents, *"Lack of understanding and ability to use and cascade knowledge."* Therefore, training is essential to make use of GAS.

In referring to the consequences of the difficulty of the problem, it seems that some of the auditors will either not use it at all, even if the software has been purchased, or just use the basic function of the system. In such a case, the usage of GAS has not been utilised at the maximum level, and its benefits are far from having been gained. As one of the auditors illustrated, *"Still difficult to tailor so that minimum work conducted."*

The compatibility issue is also one of the main focuses that has been raised by the auditors. Some GAS are not able to accommodate with a wide range of software types, and in other cases, it is hard to adapt to the specific types of clients due to the different business settings and software interfaces.

Noteworthy feedback from the respondents also indicates that with the use of GAS, it does not promote the auditors to use their own human judgement as everything have been processed by the computers. Some mentioned that GAS could become too robotic and too formalised. Thus, it does not encourage independent thought and judgment.

The other problem that seems to be faced in practical terms by the auditors who have some experience using GAS is that for them, GAS is poorly developed. The issues regarding this problem include the layout of the software, lack of availability of multiple accesses and reliability of the hardware to use Wi-Fi.

A further problem with GAS is that it does not cope well with auditing standards. One of the auditors pointed out, *"Methodology not always the same as ISAs e.g. emphasis on risk at overall level and account balance level rather than assertion level. Does*

not cope well with auditing IFRS accounts or audits of groups (group audit methodology)"

To make the use of GAS smoothly works, the support for the clients is also important. However, the difficulty to get the data from the client will also raise a problem. One of the respondents stated, *"The main issue is getting the right data from the client in a timely manner."*

Issues such as lack of the flexibility of the software as well as technical problems for GAS also need to be dealt with especially by the software vendors and developers. One of the auditors also concerns about the planning resource into audit as they might have limited resources to perform the audit using GAS.

The last three problems that have been raised by the auditors who have been using GAS are time consuming for accommodating changes in auditing, too general and need strategic leadership to use GAS effectively.

GAS Problems from the Non-Adopter's Perspective

From the perspective of auditors who are not using GAS, cost, compatibility, difficulty and perceptions are the main problems. However, the main cause of these problems is that most of the auditors that give the feedback in this section are from the smaller firms and only have limited or small numbers of clients. High implementation and running costs make it unreasonable for many small audit firms. Meanwhile, costs such as hardware, software licensing, training and time seem not to be economical for them. A few mentioned that they were not cost effective for their size of business. Expensive training cost for audit staff is only applicable to a minority of clients.

Compatibility issues such as its suitability and complexity for their sizes of firms and clients, justify the reason that GAS is not compatible for them. One of the respondents mentioned that, *"Not the most effective way of auditing SME businesses. A manual substantive approach is more effective where total transactions per annual less than £10,000."* For most of the auditors who wrote about the compatibility problems, GAS is only applicable to complex systems, large audit firms and large clients. For

instance, one of them wrote, *"Tailored purely to very large audit assignments and complex systems not suitable for small or medium sized of audits with more straightforward systems."*

GAS also seems quite difficult to use due to the rigid process. Interestingly, from one of the auditor's perspective, electronic files seemed to be harder to be reviewed by more expensive partners and managers.

Since this questionnaire has been asked to the auditors who have not implemented GAS, their perception also seems to be a problem. The uniqueness of this problem is not about GAS, but more on what auditors think about GAS and related technology. For example, one of the auditors stated, *"Mistakes can lead to significant errors of omission e.g. if area marked N/A at start it will be edited out completely. The review process should pick up but needs to be good."* The similar issue also has been raised by other auditors with the statement, *"Danger of a press the button attitude with no thought processes"*. Both perceptions are quite conventional, and probably come from those who are afraid with technology.

A further auditor stated, *"Clients tend to spend time adapting and altering their software products away from the software house base products to aid with their business in a more effective way. This reduces the effectiveness of GAS."* The auditor thinks that client's bespoke systems cannot be audited using GAS while in reality, GAS will be more effective to audit such systems.

Meanwhile, another auditor mentioned, *"Data can already be extracted & sorted from accounts systems as sage using sage reporting and excel therefore GAS is a duplication of existing capability."* Although Excel is part of GAS, the audit techniques that can be applied in them are quite difficult compared to the existing GAS which specifically designed for audit purpose.

The fifth problem about GAS is similar to what has been raised by the auditor who used GAS: Not encourage human judgments. One of the auditors mentioned, *"Although GAS can be useful, it can lead people to stop thinking for themselves and relying on what a computer programme is telling them to do."* Another auditor also

commented, *"Reliance solely on a computer package doing the audit work could mean insufficient thought actually put into audit evidence gathering - garbage in-garbage out?"* Last but not least, another respondent stated, *"Restricts the lack of professional judgement and ability to make decisions taking into account the specific needs of businesses in different sectors."* These perceptions might lead to the wrong understanding about GAS. Simply it is because audit judgement is still required in evaluating the results from GAS.

An additional problem involves GAS flexibility. Some of the respondents mentioned that GAS was not flexible, as they need to scan and rescan if there are some changes in the paperwork.

Interestingly, some auditors did not know that GAS exists. One of them replied, *"I don't know of any other than GAS is not a product I have ever known any audit firm to use or have I ever heard of it being recommended."* It seems that the promotions of GAS has not reached this group of auditors. Although some of them know that GAS exists, most of them just do not know the problems that might emerge from it.

There are also auditors out there who are reluctant to change. They feel that the traditional methods of auditing are more than enough for them to run their businesses. As one mentioned, *"The problem is that no-one seems to have failed an audit inspection for not using GAS".* Another auditor does not believe that using GAS will enhance their firm's audit work. Moreover, another auditor stated, *"We perceive some staff resistance. Also doubt it would lead to any reduction in time or costs"*

There were also a few issues that have been raised by one of the auditors. One of the auditors stated, *"Audit programmes in particular at planning and completion are already rigid in design and structure. The software will continue to enforce. These are the areas of the file generally completed by expensive members of the team, therefore potential for savings is less than vendors believe and experience from other firms is just that. Efficiencies can be gained in staff pulling files together and not getting side tracked by carrying out unnecessary tests in low risk areas. Problem with senior individuals reviewing electronic files - until this personal issue is addressed will always be a problem in our organisation"*

The last two problems that have been stated by the auditors are implementation problems, which it will be hard work to be done especially in the first year of implementation and security concern especially in extracting clients' data in different systems.

Based on the discussion of the findings, as above, it can be concluded that there are three main categories of the problems that have been found in this study. The first category is about implementation problems, the second category is about the GAS usage problems and the third category is about the GAS perception problems. The implementation problems include the software licensing cost, training cost, hardware cost, time and support from management. The usage problems include GAS difficulty, required technical knowledge, compatibility and support from clients. While the perception problems include the perceptions of the respondents who think that they are small firms, having small clients or small numbers of clients, technophobia, GAS does not encourage human judgement, GAS has been poorly developed, security concern and auditors just reluctant to use GAS.

6.6 HOW GAS CAN BE IMPROVED

Based on the results of this study, as well as previous research, it seems that there are very limited uses of GAS among auditors in public accounting firms. In understanding the phenomenon, the suggestion and recommendation are requested from the respondents in the form of open-ended questions. Data have been collected by asking about how the use of GAS can be improved for both groups of auditors who use GAS and those who are not.

Appendix IV indicates the feedbacks on the suggestion from the respondents on how to improve GAS usage among them.

Those who are not using GAS suggested that:

1. GAS needs to be more user friendly that will help non-IT auditors to understand its usage in more simple and easy way.

2. Accounting body such as ICAEW, ACCA and ICAS should give full support to the public accounting firm to use GAS.
3. GAS needs to be developed with more flexibility and compatibility
4. Vendor of GAS should consider the reduced rate price for audit software to be used especially by small and medium audit size.
5. Integrating the software with the current accounting software

Auditors who are already implementing GAS had the following perspective in recommending how GAS could be improved:

1. GAS should be developed in more user-friendly layout
2. GAS should be developed in more simple way especially to be used by non-IT auditors
3. Integrating accounting and auditing software together
4. Develop an internet based GAS
5. Cost of GAS licensing should be reduced
6. More value added report and concise output should be integrated in GAS
7. GAS should be designed from a review perspective only
8. GAS needs to be scoped into specific audit procedure.

6.7 OTHER ISSUES

To conclude the survey, the auditors were asked if there is any other issue about GAS that they want to raise. Appendix V specifies other issue about GAS from both perspectives of auditors who use GAS and those who are not using GAS.

First of all, to make the successful implementation of GAS, *"Everyone needs to be on board if it is to work."* Supportive with this statement, another responded that GAS *"Needs to win hearts and minds!"* The researcher is more than agreeing with this statement. Top management, including the directors, partners, auditors and support staff, should play a role in making sure that its usage is fully utilised. Another respondent illustrates, *"Much of it is down to the education of leadership and the delegation of sufficient resources to implement it."*

The objectives of GAS implementation also need to be clear, as well as the planning strategies for at least for the first three years of implementation. The firms also need to expect that GAS implementation is not to benefit immediately. For example, one of the auditors mentioned that, *"Implementing any new system is costly and time consuming initially but provided the right software is used, and then long term benefits can be achieved."* Feedback also mentioned that, *"It always takes longer to implement than what the partner expects."* It is also not too easy to implement GAS. One of the auditors replied, "*It is way down a very long to do list to even consider this."*

As one of the respondents mentioned, *"Firms should allow enough time for staff to become familiar with the software. Should anticipate a significant requirement for training and migration of records in the first year."* This is important especially in order to produce an expertise of GAS within auditors in the firms. According to Brooks and Lanza (2006), the firms need to have more than one champion for the positive benefits of audit software and support the champions with steady budget and the freedom to attend training. In this case, training is a must in order to successfully achieve the audit objectives using GAS, to maintain the sustainability of GAS usage, and to improve the usage for upcoming audit tasks.

It is also believed that the external auditors know the importance of technology in businesses, as well as its impact in accounting and auditing. As mentioned by one of the respondents, *"I do believe that GAS is the way forward, society as a whole has become more computerised, and our profession does need to follow this, but I believe that the practicalities of an auditors day to day work needs to be considered. We are not computer experts, we are accountants!!"* In response to this feedback, auditors also need to cope with change. The information that they previously obtained is not the same as what has been written or documented in traditional invoices, receipts or accounting ledgers. The process within the accounting cycles has also changed radically. Although skills in IT are required, most basic knowledge should be gathered and understood by most of the auditors, as most of the accounting data does not exist anymore in paper format.

Last but not least, from most of the non-adopters view, GAS is too far to be implemented. Instead of its ineffectiveness for the smaller clients as well as for small audit firms, which has been discussed in the previous section, some of the auditors are just ignorant about the GAS existence. As one of them mentioned, *"We will not be implementing GAS!"*

One last, more lengthy comment from the respondent is as follows::
"I suspect GAS is some sort of academic creation that has little bearing on the audit of owner-managed companies in the real world. Audits are about understanding a client and understanding the risks present in that client that may lead to a material misstatement of the accounts. This is achieved through communication, testing of estimates, obtaining qualitative (not necessarily quantitative) corroborative evidence and ensuring that as auditors we can authoritatively provide evidence that the accounts support a true and fair view. Reliance on statistics is not enough to achieve this."

6.8 GAS MODEL

Subsequent to the discussions in the previous section, the model of GAS usage by external auditors in small and medium audit firms in the UK was developed. Figure 6-5 below shows the GAS model based on the findings from this study. It demonstrates the interaction between the variables that were investigated in this study as well as the findings from particular sections. Overall, this model shows the coverage and output of this study, and can be used by any interested parties such as auditors, audit professional, academician, researchers, standard setters, vendors, software developers and auditees.

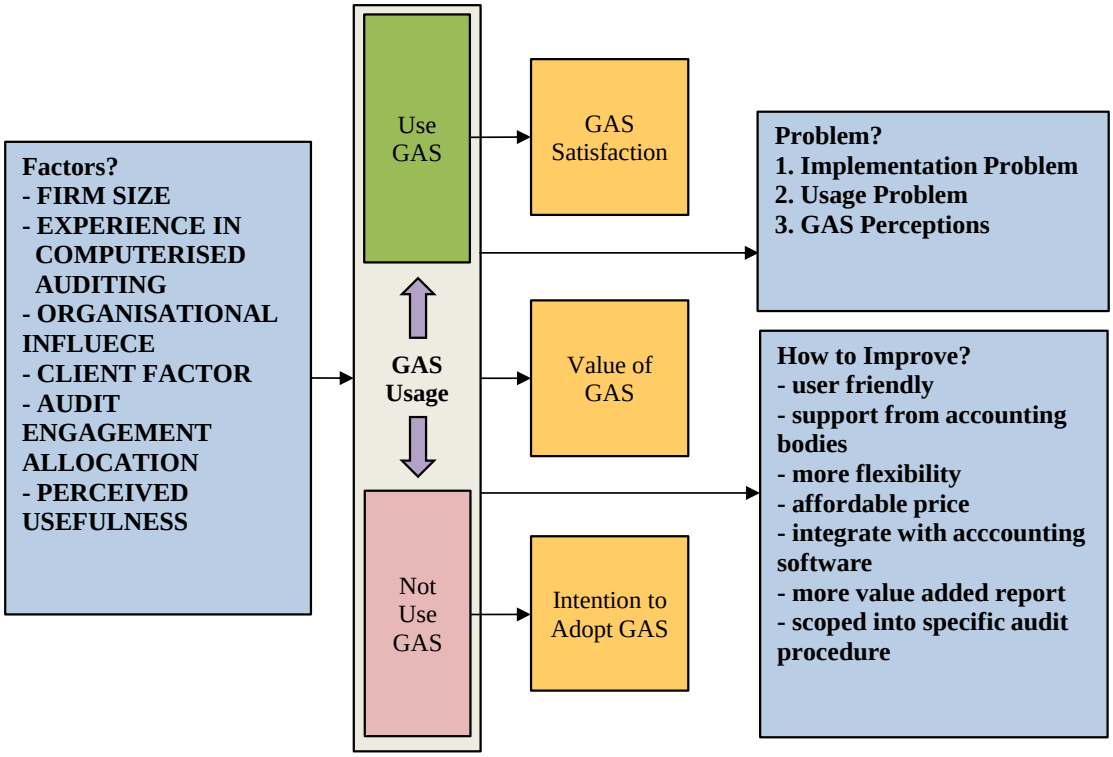


Figure 6-5: GAS Model

The factors that have been listed on the right side of the above model are similar to Figure 6-1 for the determinants of GAS usage which not only benefit the auditors who want to adopt GAS or any other technology but also any other community, such as researchers, academicians or standard setters. This model suggests that the use of GAS is significantly affected by the six factors listed above. In other words, in order to promote GAS usage or any other audit technology within audit firms, auditors have to ensure that these factors will be taken into account.

From the perspective of researchers or academicians, this model can be used to build a framework for other empirical tests in any suitable area, for future research. Standard setters can use this model to encourage the adoption of technology within audit firms. For example, these factors can be used as a basis for setting up a new guideline for technology usage.

This model also shows that those who are using GAS were satisfied with the implementation of it. However, there was very little or no intention to adopt GAS on the part of those who are not using GAS. This indicator can probably be used by auditors who plan to adopt GAS in the near future, or probably by researchers to

investigate further. In fact, this indicator is important to understand the perceptions of the user in terms of whether any particular technology will be adopted, or if it can be used as the indicator of the successfulness of technology implementation in the future.

From the above model, the value of GAS has also been gathered from both the perspective of the auditors who are using GAS and those who are not using GAS. These perspective have highlighted the different views that can be used by any audit profession, as well as academicians and researchers.

This model has also highlighted the problems of GAS which can enhance the understanding of the low, or non adoption of GAS among external auditors. From the feedback received, it is likely that the interested parties such as the board of directors or partners from the audit firms will realise the real issue of GAS. They can investigate these problems in order to achieve the success of technological implementation within their firm. For the software vendors or software developers, the problems of GAS might be useful in order to improve the feasibility of GAS implementation by external auditors especially in small and medium sized audit firms.

The suggestions to improve GAS might also be useful for both software vendors and developers.. This highlights the actual requirements needed by the external auditors. This model can be used to assist software vendors not only to develop marketing strategies that can target potential adopters, but also to develop strategies to increase the adoption of GAS among audit firms. Future development of GAS can also be proposed, either by software developers or by some prototype development on the part of researchers.

All in all, the above research model has highlighted the real perceptions of GAS among external auditors in small and medium sized audit firms in the UK which have not yet been covered by any other study. In general, this model can be applied in other similar or related studies as an empirical framework to understand the adoption of technology within small and medium size firms. Other parties can also use some of the variables in the model to investigate the specific issue of technology adoption within their firm.

6.9 CONCLUSION

This section has further discussed the results from the previous section, as well as the feedback from the open-ended questions. Some findings have been summarised and some of the results especially in hypothesis testing have been detailed in the determinants of the GAS usage section. The following part of this chapter discussed the subsequent issues about GAS i.e. about the worth of GAS, its problems and the recommendations on how the use of GAS can be improved in the future. The data has been tabled descriptively and discussed based on the open-ended answers from the respondents. The last part of this chapter summarised and developed the whole research model for this thesis.

Chapter 7: Conclusions

In this final chapter, an overview of the study is presented, the results are summarised, and the contributions are discussed together with the limitations of, and future extensions to the study. The chapter begins with a general overview of the study and a summary of the study's findings. In the next sections that follow, these findings are discussed more specifically in terms of their contributions and implications specifically in the field of auditing and generally to the accounting and information systems fields. The chapter concludes by identifying the limitations and outlining the possibilities for future direction within these areas.

7.1 SUMMARY OF RESEARCH FINDINGS

At the outset, this study aimed to examine the use of GAS by external auditors especially within small and medium size of audit firms in the UK. The research aim was subsequently broken down into five main objectives:

i. Exploring the current usage of GAS among external auditors;
ii. Investigating the factors that influence the usage and non-usage of GAS by external auditors;
iii. Identifying the problems of GAS;
iv. Identifying how the use of GAS by external auditor can be improved;
v. Develop a GAS adoption model;

The research objectives above were then restructured into ten research questions, after reviewing the literature on auditing and the use of GAS and identifying the gaps that currently exist. In general, this study has focused on the following questions:

RQ1: What is the current state of GAS usage among external auditors in the UK?

RQ2: What types of GAS have external auditors used?

RQ3: In which types of audit has GAS been implemented?

RQ4: What are the techniques that have been used in GAS?

RQ5: How satisfied are the auditors with GAS?

RQ6: What are the factors that influence the usage or non-usage of GAS by external auditors?

RQ7: Do external auditors who are not using GAS intend to utilise GAS?

RQ8: What are the problems of GAS?

RQ9: Does adoption of GAS give rise to the sufficient value in terms of cost and effort?

RQ10: How can GAS be improved to be used by external auditors?

In the sections that follows, each of these issues is discussed in terms of existing knowledge and the contribution of this study's results in furthering understanding in the area. The impact of each of the results will also be discussed.

7.1.1 Current Usage of GAS

Based on the sample data collected from the small and medium audit firms in the UK, this study showed that external auditors are still slow to adopt GAS. Results from the survey indicate that only 27% of the respondents used GAS. The importance of this finding is that it suggests that external auditors are still reluctant to adopt GAS. The result of the previous studies indicated that the adoption of GAS is minimal, and this study reinforced that most of external auditors from small and medium size audit firms still make no use of GAS despite ever increasing use of computing in business. This finding should affect the focus of academic and professional education in order to provide more training on GAS and promote the benefits of it to audit practitioners. Furthermore, software developers can also develop more specific or simple tools, especially for small and medium size of the audit.

7.1.2 Types of GAS

There are a few previous studies that have been conducted to rank the audit software used by auditors. However, those studies only applied for internal auditors who continuously use GAS in their audit work. There is limited evidence that a similar study has been conducted for external auditors in public auditing firms. This study seeks to explore the types of GAS that have been used by them and present the latest results.

For those using GAS, IDEA, Pro Audit and CCH are the most popular software packages that have been used. There are also a few audit firms that have their own proprietary GAS to cater for their audit needs. ACL, which has been promoted to be among the most popular audit software is ranked at number 5 in the list. Among others, IRIS and Mercia also named as being among the audit software that's currently being used by the external auditors. From the survey, it may also be seen that some of the auditors do utilise Microsoft Access and Microsoft Excel to be used as GAS.

This finding indicates that there are a few options for GAS available to be chosen from the shelf. This may provide some ideas to the prospective users of GAS about its popularity among them.

7.1.3 GAS Usage in Auditing

External auditors may be involved in many types of audit. Generally, most of them are involved in statutory annual financial statement auditing. However, they also provide other types of audit services for clients i.e. investigation auditing, continuous auditing, control monitoring, risk management, ad-hoc testing, etc. This study found that GAS has mostly been used in financial statement auditing. At the same time, GAS also has been implemented in investigation auditing, continuous auditing and control monitoring. This finding indicates that the use of GAS is not only limited to annual financial auditing, but has also been implemented in other types of audit.

7.1.4 GAS Techniques

GAS can be conducted in various techniques based on the objectives of the particular audit. With the 100% of the total audit sample available in auditor's hand, they can run whatever test they want. This study has successfully indicated that most GAS techniques have been widely used by the auditors. This study found that GAS has mostly been used to evaluate fraud risks and to identify journal entries and other adjustments to be tested.

Among others, with the mean result from the frequency analysis which is nearly 3.0, it is found that GAS has also been used to select sample transactions from key electronic files, sort transactions with specific characteristic, check the accuracy of the electronic files, obtain evidence about control effectiveness, re-perform procedures (i.e. aging of accounts receivables, etc.), evaluate inventory existence and completeness and test the entire population instead of samples. This finding indicates that there are many tests or techniques that can be conducted using this tool. Although this study has listed the techniques that are normally used in auditing which is gathered from the auditing standard, the benefits of GAS are not merely limited to the list. There are many techniques that need to be understood, and that can be used by auditors especially in order to fulfil the specific audit objectives.

7.1.5 GAS Satisfaction

This study attempted to understand the satisfaction of GAS among those who have already implemented it. It finds that only 27% of the respondents were fully satisfied with GAS while 47% of them reasonably satisfied, although some improvement may be required and 25% of them stated that GAS might need some improvements. This study gathered the reason behind this situation in which it suggested that GAS really needs to be ready to fulfil the specific audit requirements. The technical issues such as software flexibility, usability, difficulty and user friendly have to be taken into consideration by the vendor.

Although some of the users of GAS found it is easy to use, this finding indicated that a lot of things need to be done on the practicality of the software itself. This finding

should affect the focus of software developers in order to fully understand the requirements of auditors to be embedded in the audit software. It may be that new audit software prototypes can be proposed to justify the needs and requirements of these groups of auditors.

7.1.6 Factors that Influence the use of GAS

The main thrust of this study is to investigate the factors that influence the use of GAS in the specific context of small and medium sized audit firms. Based on the variables that have been identified in the earlier stage as well as the demographic variables of the auditors and audit firms, this study tried to identify the relationship among those variables with GAS usage. Four factors have been found to have a significant relationship with the GAS usage in the logistic regression analysis. These are organisational influence, client factor, audit engagement allocation and perceived usefulness. There are also two other demographic variables that influence the usage and non-usage of GAS, which are audit firm size and auditors experienced in computerised auditing.

Organisational Influence

The results suggest that organisational influence is important in deciding as whether to use GAS or not. All issues which are related to organisations or audit firms such as maintaining and implementing cost, internal and external training for staff, IT support and the availability of IT audit expertise, support from the top management and resources to use GAS are among organisational items that have an influence to use GAS. The findings of this study indicate that there is a positive relationship between organisational influence and GAS usage. In other words, the higher index on the organisational influence, the greater the probability that the auditors will use GAS.

Client Factor

It was found in this study that client factors (in the forms of client's business environment, the complexity of IT infrastructure, support, internal control system, business and their concern about data security) have a significant relationship with GAS usage. In fact, the qualitative results also show that client factors do affect the auditor's decision to adopt GAS.

Audit Engagement Allocation

This study has established a significant negative relationship between audit engagement allocation and GAS usage. The findings indicate that there are negative association between workloads, time allocated and financial budget on the audit engagement. It was found that auditors who have high workloads on audit engagement do not use GAS. Although the previous study conducted by Curtis and Payne (2008) found that the longer budgetary periods for audit engagement, auditors are more willing to adopt the audit software. This study, however, found that more time and budget allocated for particular audit engagement, the less probability that auditors will use GAS.

Perceived Usefulness

This study also found that the perceived usefulness of GAS in terms of usefulness, the regularity of use and audit requirement has a significant positive relationship with the GAS usage itself. As with Janvrin *et al.* (2008), who studied the important factors in technology acceptance research, this study suggests a positive relationship between the perceived usefulness and GAS usage.

Additionally, this study found that the regularity of the software to be used in the audit assignment and the requirement of the software to be used also affect the probability of GAS to be adopted.

Audit Firm Size

This study demonstrates that audit firm size is positively associated with GAS usage. The finding implies that medium sized firms tend to use GAS more compared to the small sized audit firm.

Auditor's Experience in Computerised Auditing

This study has also found a significant positive relationship between auditor's experience in computerised auditing and GAS usage. Auditors who have more experience in computerised auditing have more intentions to use GAS compared to those who have not had those experiences.

7.1.7 Intention to Utilise GAS

Although GAS has been developed since 1970s (Ramamoorti and Weidenmier, 2004) and a lot of benefits have been promoted since then, this study found out that the intention to use GAS by the auditors from the small and medium sized firms are still very low. Of the 150 respondents who are not adopting GAS, 45% of 68 of them have no intention at all to adopt GAS and 35% or 53 respondents have little attention to adopt GAS. Only 6% or nine respondents definitely want to adopt GAS. For those who are intending to adopt GAS only 16 of them have a plan to adopt it within two years while 21 of them plan to adopt GAS after two years. This finding indicates that the implementation of GAS by external auditors is really far to be realised by the audit profession within small and medium size of external audit firms.

7.1.8 Problems of GAS

The slow adoption of GAS may potentially be explained by the problems of GAS that have been found in this study. There are three main categories of the problems that have been identified. The first category is about implementation problems, which include the software licensing cost, training cost, hardware cost, time and support from management. The second category concerns the GAS usage problems that include GAS difficulty, required technical knowledge, compatibility and support from clients. The third category concerns the GAS perception problems. This includes the perceptions of the respondents which think that they are a small firm, having small clients or small numbers of clients, technophobia, GAS not encourage human judgement, GAS has been poorly developed, security concern and auditors just reluctant to use GAS.

These problems should affect the focus of related parties to resolve the issues that have been emphasised by the respondents. It is believed that all of these problems can be handled and all the benefits of GAS can be gained by all the audit professionals. Furthermore, this study has also highlighted a few recommendations in another section below in order to encourage the use of GAS by small and medium sized audit firms.

7.1.9 Worth of GAS

Of 205 respondents, 64% of the respondents do not agree that it is worth while the rest of them think it is worth. 22 out of 150 of respondents who are not using GAS feel that GAS is worth in term of cost and effort. It can show that the perspectives of GAS from both sides of auditors i.e. those who are using GAS and those who are not using GAS are different. For those who are using GAS, most of them agree that GAS is worth in terms of cost and efforts. While from the perspective from those who are not using GAS, they think the opposite. However, there are some auditors who do not use GAS that think it can bring benefit to them.

7.1.10 Recommendation for Future GAS

In order to utilise the use of GAS, a few recommendations have been sought from the respondents. Some of these issues have been highlighted. Firstly, the main concern, like any other software, is the issue of user friendly. Since GAS is going to be used by accountants or specifically auditors, the software should be developed from the perspective of them rather than from the general perspective from the IT experts. Although according to IFAC (2007), accountants should be competent in IT, there is still a need for the technology to be developed to suit its use by non-IT professionals. GAS needs to be more user friendly, which will help non-IT auditors to understand its usage in a more simple and easy way.

Secondly, GAS needs to be developed with more flexibility and compatibility. In other words, the usage of GAS should be flexible in order to work with the client's data and compatible to operate in any computing environments either in terms of different operating systems or probably in different hardware technology.

Thirdly, some respondents suggested that GAS should be designed from the reviewer's perspective as well. This is one of the requirements which form part of the audit process that need to be integrated in audit software. The output that has been generated from GAS should be presentable and understandable, especially for the senior auditors to come out with their professional audit judgments. Furthermore,

there is a need for more value added reports and concise outputs that should be included in GAS.

Fourthly, there is a suggestion for GAS to be focused on specific audit procedure. Instead of GAS being more “general”, which requires users to identify themselves in term of what they are suppose to do with the software, it would be worthwhile integrating all the audit procedures into GAS. In other words, there are specific modules for the specific audit objectives. All audit tasks should be there, and there is a checklist for the auditors to work on.

There is also a suggestion from a few of the respondents to integrate GAS with the current accounting software. This idea has not been thought of, or found, in any literature. Although it looks similar to EAMs that were discussed in Chapter 2, the implementation of it is slightly different. Since accounting data can be accessed directly from the accounting software, it is an excellent idea to audit the similar data directly from the same platform. It is likely that it needs to embed auditing modules in it. It is believed that accountants who use accounting software are familiar with “audit trails” menu, currently available in most of accounting software. Thus, it would not be impossible to add extra modules related to the specific audit procedures in the current accounting software. This recommendation should affect the focus of current accounting software developers to realise the integration of GAS.

With the current trend in ubiquitous technology, there is a recommendation to develop GAS based on the Internet platform in which all of the data can be accessed through online. This is another positive idea that came across in regards to GAS. With the multi platforms of the accounting data, GAS should also be prepared for future technology.

The use of GAS has been off-putting due to high implementations cost. The vendor of GAS should consider reducing the price for audit software to be used, especially by small and medium audit size. Instead of getting profit from the rich audit firms, the vendor should propose an affordable package plan so that they can gain more profit from small sized audit firms while at the same time the use of GAS can be spread out to the whole audit community.

Lastly, some respondents suggested that accounting bodies such as ICAEW, ACCA and ICAS should give full support to the public accounting firm to use GAS. There are a few roles that can be played by them in order to promote the successful implementation of GAS. For example, they can help by providing specific guidelines for GAS implementation, or probably give some relevant incentives for audit firms to use GAS or maybe to vendors to reduce the cost of GAS. Providing more affordable and regular training on GAS will also help the audit community cope with the latest trends in audit technology.

7.2 RESEARCH CONTRIBUTION

In this study, a GAS research model has been developed to allow for a better understanding of the status of GAS adoption, influential factors, problems, readiness to adopt, value of GAS and how the use of GAS can be improved in the context of small and medium size of audit firms in the UK. All these issues have been investigated and discussed.

In general, this study contributes by offering insights, as well as obtaining a better understanding of the issues of the adoption of GAS by auditors in the UK. First of all, this study has contributed in extending the literature to GAS usage, especially by external auditors from small and mid-tier practices. The adoption level of GAS among external auditors is still low. Lovata (1990) in her study on the use of CAATs 20 years ago, found only a few external auditors have extensively used GAS. Compared to the technology that we currently have to the technology 20 years ago, it seems that the adoption of GAS by external auditors is not much different. External auditors are still slow in adopting new technology even it has specifically designed for them. There were only 27% of respondents, which represent 55 total numbers of the auditors from small and mid-tier practices using GAS, while the rest still practicing the audit in traditional ways. This is particularly surprising, given the massive increase in the use of IT in other sectors and daily life.

This study has also provided insights into understanding the above phenomenon. The quantitative analysis of this study found that the audit firm size based on firm category, auditor experience in computerised auditing, IT skills, organisation, client, audit engagement and software are the variables or factors that influence the use of GAS among external auditors. Additional findings on qualitative data have strengthened the output of this study. As a result, a conceptual framework relating to the usage of technology, particularly on GAS as well as the perception on GAS has been developed as part of the contribution of this study. This study was conducted in the auditing field, a professional accounting area that can provide an ideal setting for IS and accounting theories.

This research also highlights the importance of GAS, especially in order to achieve audit effectively and efficiently. Instead of the lower level of GAS usage, there are a lot of benefits and potential use of GAS that needs to be understood by the audit practices. Although there are some limitations that restrict the use of GAS among external auditors, there are alternative ways that make the use of this kind of audit tools and techniques improve the audit process especially in terms of audit quality as well as audit efficiency and audit effectiveness. By providing insight into GAS in this study, it is hoped that audit professional career are aware about all the issues that have been raised.

This study focused on the research based on the online survey to get more responses from the audit practitioner across the country. There are several ways that this study has contributed to the researcher. First, the method used in this study is an online survey. The researcher may conduct future research using different approaches or techniques to get better results and findings. Furthermore, similar topics relating to this study, can also be covered in the future. For example, topics such as continuous auditing, e-commerce, enterprise resource planning (ERP), CAATTs or any other types of technology might have some intention to be explored. This study also found some difficulty in getting more responses from the auditors, due to nature of audit career, which is one of the busy professional. It may be that the researcher can think a better way to get more responses from this group.

For academia, this study provides a basis on the importance of GAS to be learnt by future auditor. This study would suggest that the educator provide practical training on GAS in the auditing subject. There are several studies conducted to review the implementation of conducting GAS in the university's auditing course. For example, the study by Mahzan *et al.* (2009), Lehman (2012), Boritz and Datardina (2007) and McCombs and Sharifi (2004) have shown that GAS is important to be learned by the future auditors as well as by current auditors. Instead of embedding the course in the current accounting curriculum, which has been designed for the current accounting student, educators also need to provide some practical courses that should be attended to by the current auditors.

Since the collapse of Enron, which resulted in the dissolution of one of the largest audit firms, Arthur Andersen, auditors have been exposed to the threats that may impact their career. A few regulations have been introduced which strengthen the requirement in auditing. For example, Sarbanes-Oxley Act 2002 has been enacted to be complied by all United States public company boards, management and public accounting firms. Under the act, it has been suggested that software should be used to test the transactions throughout the auditing period as well as to test 100 percent of the processed transactions for compliance with selected parameters (The IIA, 2008). Despite the failure of the big audit firm and big clients, small and medium sizes of firms are also exposed to the accounting fraud. Thus, GAS or similar technologies should be highlighted in the auditing standards or guideline to require, or at least encourage the auditors to use these technologies.

There are a few recommendations that have been proposed in this study which might give some interest in the vendor or the developer of the audit software. There are also some findings that should be concerned by the vendors. For example, the high cost of the software and the compatibility of the software especially to cope with the small audit. It may be that the vendor can provide some affordable scheme with the suitable GAS packages especially for small audit firms and clients.

An audit report is produced to give an assurance about the accounting reports that have been prepared are free from errors and misstatements. It does not matter what procedure has been chosen, what is important is to have a clean audit report which

shows that the accounting reports are valid. However, justifying the techniques used will probably enhance the public, especially the shareholders' perception of the audit quality. The awareness of technology will also give credit to the accounting reports.

Last but not least, this study contributes by offering insights into auditors, accountants, IT personnel, researchers, academicians, standard setters and software vendors, as well to obtain a better understanding of the issues of the adoption of GAS within the small and medium audit firms in the UK.

7.3 LIMITATIONS OF THE STUDY

Given the nature of this study as doctoral research work, it does impose some restrictions on the extent of scope and coverage due to time and financial constraints. Furthermore, in appraising the findings of this study, it is important to interpret the results in the light of the following limitations:

Firstly, this research was conducted as a context specific study. Instead of focusing on the other types of CAATTs, this study chooses GAS as the main subject of the research. Even GAS is among the popular CAATTs, this study however has not gathered any other information about other types of CAATTs from the respondents.

Secondly, this study specifically focused on the external auditors who work in the audit firms from small and medium size firms in the UK. More specifically, the external auditors are mainly works either as a director, partner or audit manager within audit firms in the UK. There are no other types of auditors has been involved in this study i.e. internal auditors or IS or IT auditors. Furthermore, this study focuses on auditors in smaller and mid-tier practices only. Auditors from Big 4 accounting firms are not involved in this study. Therefore, the results of this study can only be applied for such types of firms.

Thirdly, this study has been conducted in the UK. Criteria, which influence the results of this study, may only be applicable in the UK context. Therefore, the results of the

study may not be generalised at the global level because auditing in other parts of the world might not be similar.

Fourth, it is important to note that this study is based on an online survey. This approach has its shortcoming as it captures a situation or an event at a point of time. Future research could employ a more qualitative approach, such as an experiment, observations, case study or a longitudinal study.

Fifth, the quantitative part of this study has been analysed using exploratory factor analysis and logistic regression. As a result of the exploratory nature of this research, it will be interesting to investigate the usage of GAS using confirmatory factor analysis.

Lastly, it is important to note that this study got a very low response from the auditors. Although this study has received 205 full responses from the audit practitioner which is enough to do the analysis, however compared to the number of auditors that have been invited to fill in the survey (3,587), the rate is relatively low. The questionnaire requires the auditors to spend from 10-15 minutes of their times. However, a few of them replied that it is too much unless they are getting paid to fill in the survey. This study also received feedback from 171 auditors who refused to participate in the study, while many of them just ignored the invitations.

Some of the audit firms had also only permitted one single response which representing the audit firm's opinions instead of allowing the survey to be filled by all of the auditors within the firm. Some feedback was received from the follow up request mentioning that the survey has been filled by their colleague. Thus, this low response rate probably will do effect the insignificant result in a few hypotheses.

Based on the feedback received, it can be concluded that auditors were among the busiest professionals, and their participation in the study was on the basis of availability and interest. The same limitation has been faced by Omoteso (2006) in order to obtain responses to the similar group of respondents. This survey did not offer any incentive to fill in the questionnaire.

7.4 RECOMMENDED AREAS FOR FUTURE RESEARCH

The first recommendation would be to replicate this study in other countries, so as to reveal further insights into international comparisons and practice. Secondly, the data from this study is gathered from the online survey. Case study research is likely to be useful in future research, especially in providing a more detailed explanation on GAS adoption in the specific audit firm. Furthermore, the subject of this study is the external auditor from public accounting firms. Additional data collection either from vendors, software developers, audit clients or from the standard setters, might be useful in providing greater insights in order to understand the issues of GAS.

Based on the contributions and limitations of this study, it is also suggested that future research might focus on the development of GAS prototypes particularly for small and medium size of audit firms. This will probably be useful in understanding the specific audit and auditors' requirement to be embedded in GAS.

Since the study was able to identify the factors that influence the usage and the non-usage of GAS, future research can also probe deeper into other specific aspects of related GAS or other audit technology such as CAATTs, continuous auditing, audit automation, etc. Focusing the study on the impact of GAS or related technologies on auditing will probably also generate further interest.

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Appendix I: Prior Studies on GAS

Year	Author	Title	Respondent	Theory Applied	Method	Key Findings
1988	Lovata	The Utilization of Generalized Audit Software	251 Audit Manager and 202 EDP Auditors from Big Eight accounting firms	Audit Adaptation Model (Davis & Weber, 1986)	Mail survey	Environmental factors do appear to influence GAS usage. Understanding of GAS still is a major obstacle to implement GAS.
1990	Lovata	Audit Technology and the Use of Computer Assisted Audit Techniques	204 EDP Auditing Experts	Firms Audit Technologies & CAATs	Mail survey	Low structure firms tend to use CAATs the most followed by high structures firms and then medium structured firms
2001	Bierstaker, Burnaby and Thibodeau	The Impact of Information Technology on the Audit Process: An Assessment of The State of the Art and Implications for the Future	IT Professional from 3 large international accounting firms - Interview. and One author attending training session - Observation	None	3 interview and 1 observation by author in audit firm training session	On average it takes two to three years for a company to completely transfer their old software to enterprise-wide computing platforms.
2002	Schafer and Eining	Auditor's Adoption of Technology: A Study of Domain Experts	34 auditors from single Big 5 accounting firms which consist of 2 group: System Auditors and Financial Auditors	Theory of Planned Behaviour (Ajzen 1991) and Theory of Acceptance Model (Davis, Bagozzi and Warshaw, 1989)	Survey	Firms investing in technology tools should carefully consider the cognitive and emotional components of attitude, subjective norm and perceived behavioural control when investing in technology tools for use in the audit practice.
2002	Banker, Chang and Y.-ching	Impact of Information Technology on Public Accounting Firm Productivity	Auditors from 5 offices of Big 5 accounting firms.	Task-Technology Fit (Goodhue and Thompson, 1995)	Interview	The results indicated significant productivity improvement after the adoption of IT.
2003	Braun and Davis	Computer-Assisted Audit Tools and Techniques: Analysis ad Perspectives	90 auditors from legislative audit office in several states in US	Using interview and observation to design the survey	Survey [email and web based questionnaire]	Auditors perceive the potential benefits associated with ACL; however, they displayed a lower confidence in their technical abilities in using the application.
2005	Debreceny,	Employing	Interview with 3 External	Exploratory	Interview	Internal auditors see GAS primarily as a tool for

	Lee, Neo and Toh	Generalized Audit Software in the Financial Services Sector: Challenges and Opportunities	Auditors and 3 Internal Auditors from 2 banks in Singapore	qualitative research		special investigations rather than as a foundation for their regular audit work. External auditors make no use of GAS, citing the inapplicability of this class of tool to the nature of testing the financial statement assertions or the extent or quality of computerized internal controls maintained by the bank.
2005	Wehner and Jessup	Factors Affecting Generalized Audit Software Usage	26 Internal auditors 45 External Auditors 55 paper form & 21 e-mailed.	Unified Theory of Acceptance and Use of Technology (UTAUT)	Survey - Paper Form & Email	Auditors who have attended courses pertaining to audit software are more likely to use GAS. Staff and senior level auditors are more likely to use GAS than supervisory or management level auditors. Age does not impact GAS usage. Female auditors use GAS more than male auditors.
2007	Havelka and Merhout	Development of an Information Technology Audit Process Quality Framework	Internal Auditors in health care product and services organization The first group was composed of IT audit managers (4), the second group was composed of financial and operations audit managers and staff auditors (7); and the third group was composed of IT audit seniors and staff (5). TOTAL = 16	Nominal Group Technique	Focus group has been using to identify factors rated as critical by one or more of these groups and develop a first draft of a quality model.	This study seeks to determine factors that may influence the IT audit process and develop a model that can be used to improve process quality. Five factors which includes client, system, IT audit personnel, IT audit organisation and audit process has been determine that effect the IT audit quality.
2008	Mahzan and Lymer	Adoption of Computer Assisted Audit Tools and Techniques (CAATTs) by Internal Auditors: Current issues in the UK	11 Institute of Internal Auditors (IIA) UK & Ireland, 34 ACL uses, 25 Data Services UK & 25 IDEA User. TOTAL SURVEY = 95. Case Study with 8IA in UK & 2 IA in Malaysia	Unified Theory of Acceptance and Use of Technology (UTAUT)	Survey in UK & Case study in UK & Malaysia	Four dimensions proposed in the model of successful adoption (i.e. motivations for CAATTs adoption, best practices for implementation, challenges faced in the adoption process and methods for performance evaluation) are well supported by the findings from the quantitative and qualitative data.

2008	Curtis and Payne	An Examination of Contextual Factors and Individual Characteristics Affecting Technology Implementation Decisions in Auditing	181 Participants. In-charge auditors from one Big 4 accounting firm during firm training session. Participants were randomly assigned one of four versions of the research instrument, 9 which contained a case study and questionnaire. 139 responses	Unified Theory of Acceptance and Use of Technology (UTAUT) and budgeting theories	Case study and questionnaire	Auditors are more likely to implement new technology when they are aware that the managing partner is encouraging implementation within the firm.
2008	Janvrin, Bierstaker and Lowe	An Examination of Audit Information Technology Usage and Perceived Importance	181 auditors from Big 4, national, regional and local firms	Descriptive study	Survey	Auditors extensively use a variety of audit applications including analytical procedures, audit report writing, electronic work papers, Internet search tools, and sampling and perceive them as important, but use them infrequently. In addition, IT specialists use is infrequent, even by auditors who examine clients with complex IT. IT use and perceived importance vary by firm size.
2009	Janvrin, Lowe and Bierstaker	Auditor Acceptance of Computer-Assisted Audit Techniques	181 Auditors from Big 4, National, regional and local firms	Unified Theory of Acceptance and Use of Technology (UTAUT)	Survey	Performance expectancy and facilitating conditions such as organizational and technical infrastructure support influence the likelihood that auditors will use CAATs. The results suggest that audit firm management may want to develop training programs and enhance their technical support to increase CAAT usage.
2009	Janvrin, Bierstaker and Lowe	An Investigation of Factors Influencing the Use of Computer-Related Audit Procedures	181 Auditors from Big 4, National, regional and local firms	Descriptive study	Survey	Computer-related audit procedures are generally used when obtaining an understanding of the client system and business processes and testing computer controls. Furthermore, 43 percent of participants indicate that they relied on internal controls; however, this percentage increases significantly for auditors at Big 4 firms.

Appendix II: Statement of Ethics Approval

School of Information Systems, Computing and Mathematics
David Gilbert, Head of School, Professor of Computing
Jasna Kuljis, Head of Information Systems and Computing, Professor of Computing
Tony Rawlins, Head of Mathematical Science, Professor of Mathematics

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Date: 22nd November 2010

STATEMENT OF ETHICS APPROVAL

Proposer: Aidi Ahmi

Title: **The Use of Generalised Audit Software (GAS) by External Audit in the UK**

The school's research ethics committee has considered the proposal recently submitted by you. Acting under delegated authority, the committee is satisfied that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that you will adhere to the terms agreed with participants and to inform the committee of any change of plans in relations to the information provided in the application form.

Yours sincerely,

Dr. Laurence Brooks, Chair of the Research Ethics Committee
SISCM

Appendix III: Questionnaire

QUESTIONNAIRES

The Use of Generalised Audit Software (GAS) by External Auditors in the UK

Generalised Audit Software (GAS) is a data extraction and data analysis software designed to read, process and write data with the help of functions performing specific audit routines. It is a tool for implementing Computer Assisted Auditing Tools and Techniques (CAATTs). Functions of GAS include importing computerised data; to which various functions can subsequently be applied: the data can be e.g. browsed, sorted, summarized, stratified, analysed, sampled, and calculations, conversions and other operations may be applied to it.

Organisation Profile

[1] When is your firm established?
Please write your answer here:
[ ]
Please specify the year

[2] Where is the location of your firm?
Please write your answer here:
[ ]
Please state City/Town

[3] Category of Firm
Please choose only one of the following:
☐ Big Four
☐ Mid-Tier Practices
☐ Smaller Practices

[4] What is the size of your audit department?
Please choose only one of the following:
☐ Less than 5 auditors
☐ 5-9 auditors
☐ 10-20 auditors
☐ 21-50 auditors
☐ Over 50 auditors

[5] How many employees are there in your whole firm?
Please choose only one of the following:
☐ Less than 10 employees
☐ 10 - 49 employees
☐ 50 - 99 employees
☐ 100 - 499 employees
☐ 500 - 999 employees
☐ Over 1000 employees

Use of GAS

[6] Does your department use any Generalised Audit Software?
Please choose only one of the following:
☐ Yes
☐ No [please go to question '[21]')

Usage of Generalised Audit Software

[7] For how many years has your organisation implemented GAS?

Only answer this question if the following conditions are met:

° Answer was 'Yes' at question '[6]' (Does your department use any Generalised Audit Software?)

Please choose only one of the following:

- ☐ Don't know
- ☐ Less than 1 year
- ☐ 1 to 2 years
- ☐ More than 2 years

[8] If you use GAS, which of the following products do you currently use?

Only answer this question if the following conditions are met:

° Answer was 'Yes' at question '[6]' (Does your department use any Generalised Audit Software?)

Please choose all that apply and provide a comment:

- ☐ ACL
- ☐ Caseware IDEA
- ☐ Active Data
- ☐ Active Audit
- ☐ Top CAATs
- ☐ Microsoft Access
- ☐ Paisley
- ☐ SAS
- ☐ In house application (please specify)

☐ Other:

[9] Please indicate how frequently you use GAS in each of the following areas:

Only answer this question if the following conditions are met:

° Answer was 'Yes' at question '[6]' (Does your department use any Generalised Audit Software?)

Please choose the appropriate response for each item:

	Never	Rarely	Sometimes	Often	Always
Financial Statement Auditing	☐	☐	☐	☐	☐
Investigation Auditing	☐	☐	☐	☐	☐
Continuous Auditing	☐	☐	☐	☐	☐
Control Monitoring	☐	☐	☐	☐	☐
Risk Management	☐	☐	☐	☐	☐
Ad-Hoc Testing	☐	☐	☐	☐	☐
Other (please specify it in the next question)	☐	☐	☐	☐	☐

[10] If you tick other in Question 9 above, please specify it here:

Only answer this question if the following conditions are met:

° Answer was 'Yes' at question '[6]' (Does your department use any Generalised Audit Software?)

Please write your answer here:

[11] Please rate the extent to which you use the following techniques in GAS.
I use GAS...
Only answer this question if the following conditions are met:
° Answer was 'Yes' at question '[6]' (Does your department use any Generalised Audit Software?)
Please choose the appropriate response for each item:

	Never	Rarely	Sometimes	Often	Always
to evaluate fraud risks	☐	☐	☐	☐	☐
to identify journal entries and other adjustment to be tested	☐	☐	☐	☐	☐
to check accuracy of electronic files	☐	☐	☐	☐	☐
to re-perform procedures (i.e., aging of account receivables, etc)	☐	☐	☐	☐	☐
to select sample transactions from key electronic files	☐	☐	☐	☐	☐
to sort transactions with specific characteristics	☐	☐	☐	☐	☐
to test entire population instead of sample	☐	☐	☐	☐	☐
to obtain evidence about control effectiveness	☐	☐	☐	☐	☐
to evaluate inventory existence and completeness	☐	☐	☐	☐	☐

Factors that influence the use of GAS

[12] How important are the following factors in influencing your decision to employ GAS?
Only answer this question if the following conditions are met:
° Answer was 'Yes' at question '[6]' (Does your department use any Generalised Audit Software?)
Please choose the appropriate response for each item:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Technological Factors					
Compatibility of software	☐	☐	☐	☐	☐
Up-to-date firm's ICT infrastructure	☐	☐	☐	☐	☐
Ease of use	☐	☐	☐	☐	☐
Adequate and sufficient documentation to follow	☐	☐	☐	☐	☐
Easy to modify and upgrade	☐	☐	☐	☐	☐

[13]	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Organisational Factors					
Full support from top management	☐	☐	☐	☐	☐
Strong IT support from IT staff	☐	☐	☐	☐	☐

Availability of IT audit expertise in organisation	☐	☐	☐	☐	☐
Effective and adequate INTERNAL training for staff	☐	☐	☐	☐	☐
Effective and adequate EXTERNAL training for staff	☐	☐	☐	☐	☐
Sufficient implementing cost	☐	☐	☐	☐	☐
Sufficient maintaining cost	☐	☐	☐	☐	☐
Enough resource to use GAS	☐	☐	☐	☐	☐
Instructed by the management to use GAS	☐	☐	☐	☐	☐
Demand in auditor's promotion policies	☐	☐	☐	☐	☐
Workloads on multiple audit engagement	☐	☐	☐	☐	☐
Financial budget on audit engagement	☐	☐	☐	☐	☐
Sufficient time allocated to audit assignment	☐	☐	☐	☐	☐
[14]	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Audit Profession Factors					
Requirement by auditing standards	☐	☐	☐	☐	☐
Professional audit judgement	☐	☐	☐	☐	☐
The existence of audit methodology to follow	☐	☐	☐	☐	☐
Level of audit risk	☐	☐	☐	☐	☐
The usefulness of the application for auditing	☐	☐	☐	☐	☐
[15]	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Client Factors					
Strength of client's internal control systems	☐	☐	☐	☐	☐
Complexity of client's IT environment	☐	☐	☐	☐	☐
Complexity of client's business environment	☐	☐	☐	☐	☐
Client concern about data security	☐	☐	☐	☐	☐
Client business size	☐	☐	☐	☐	☐
Support provided by client's IT personnel	☐	☐	☐	☐	☐
[16]	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Personal Factors					
Experience with computerised auditing	☐	☐	☐	☐	☐
Experience with larger audit clients	☐	☐	☐	☐	☐

An attempt to ensure public accountability	☐	☐	☐	☐	☐
Adequate knowledge to use GAS	☐	☐	☐	☐	☐
Understanding of the application	☐	☐	☐	☐	☐
Easy to become skilful using GAS	☐	☐	☐	☐	☐
Prefer to use GAS rather than traditional audit	☐	☐	☐	☐	☐
IT Knowledge	☐	☐	☐	☐	☐
Use GAS regularly in audit assignment	☐	☐	☐	☐	☐
[17]	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
External Factors					
Adequate technical support from vendors	☐	☐	☐	☐	☐
The similar application has been used by other audit firms	☐	☐	☐	☐	☐

[18] Are there any other factors that not listed above that you think influence your decision to employ GAS?

Only answer this question if the following conditions are met:

° Answer was 'Yes' at question '[6]' (Does your department use any Generalised Audit Software?)

Please write your answer here:

Other GAS Usage and Satisfaction

[19] Are you NOT using GAS for any other audit assignment? If Yes, please explain why.

Only answer this question if the following conditions are met:

° Answer was 'Yes' at question '[6]' (Does your department use any Generalised Audit Software?)

Please choose only one of the following:

☐ Yes

☐ No

Make a comment on your choice here:

[20] How satisfied are you with your current GAS?

Only answer this question if the following conditions are met:

° Answer was 'Yes' at question '[6]' (Does your department use any Generalised Audit Software?)

Please choose only one of the following:

☐ Very satisfied, no improvement required

☐ Reasonably satisfied, although some improvement may be required

☐ Needs improvements, but still usable

☐ Dissatisfied, system requires major improvement

Make a comment on your choice here:

Not using GAS

If your organisation is NOT implementing or use any GAS, please answer the following questions.

[21] Please indicate the degree to which you agree with the following factors for NOT implementing GAS in your organisation:

Only answer this question if the following conditions are met:

° Answer was 'No' at question '[6]' (Does your department use any Generalised Audit Software?)

Please choose the appropriate response for each item:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Technological Factors					
Incompatibility of the software	☐	☐	☐	☐	☐
Old ICT infrastructure	☐	☐	☐	☐	☐
Difficult of use	☐	☐	☐	☐	☐
No sufficient documentation to follow	☐	☐	☐	☐	☐
Difficult to modify and upgrade	☐	☐	☐	☐	☐

[22]	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Organisational Factors					
Less support from top management	☐	☐	☐	☐	☐
Less IT support from IT staff	☐	☐	☐	☐	☐
Unavailability of IT audit expertise in organisation	☐	☐	☐	☐	☐
Ineffective and inadequate INTERNAL training for staff	☐	☐	☐	☐	☐
Ineffective and inadequate EXTERNAL training for staff	☐	☐	☐	☐	☐
Inadequate implementing cost	☐	☐	☐	☐	☐
Inadequate maintaining cost	☐	☐	☐	☐	☐
Insufficient resource to use GAS	☐	☐	☐	☐	☐
It is voluntary to use GAS	☐	☐	☐	☐	☐
No demand in evaluation and promotion policies	☐	☐	☐	☐	☐
Workloads on multiple audit engagement	☐	☐	☐	☐	☐
Financial budget on audit engagement	☐	☐	☐	☐	☐
Insufficient time allocated to audit assignment	☐	☐	☐	☐	☐

[23]	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Audit Profession Factors					
Not required by auditing standards	☐	☐	☐	☐	☐
Professional audit judgement	☐	☐	☐	☐	☐
The existence of audit methodology to follow	☐	☐	☐	☐	☐
Level of audit risk	☐	☐	☐	☐	☐
Not useful for auditing	☐	☐	☐	☐	☐

[24]	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Client Factors					
Strength of client's internal control systems	☐	☐	☐	☐	☐
Complexity of client's IT environment	☐	☐	☐	☐	☐
Complexity of client's business environment	☐	☐	☐	☐	☐
Client concern about data security	☐	☐	☐	☐	☐
Client business size	☐	☐	☐	☐	☐
Less support provided by client's IT personnel	☐	☐	☐	☐	☐

[25]	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Personal Factors					
Unfamiliar with computerised auditing	☐	☐	☐	☐	☐
Less experience with larger audit clients	☐	☐	☐	☐	☐
An attempt to ensure public accountability	☐	☐	☐	☐	☐
Insufficient knowledge to use GAS	☐	☐	☐	☐	☐
Hard to understand of the application	☐	☐	☐	☐	☐
Difficult to become skillful using GAS	☐	☐	☐	☐	☐
Prefer to use traditional audit rather than using GAS	☐	☐	☐	☐	☐
Less of IT knowledge	☐	☐	☐	☐	☐
GAS is not regularly used in audit assignment	☐	☐	☐	☐	☐

[26]	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
External Factors					
Inadequate technical support from vendors	☐	☐	☐	☐	☐
GAS is not being used by other audit firms	☐	☐	☐	☐	☐

[27] Do you have any other reason why you are NOT using GAS in any of your audit assignment?

Only answer this question if the following conditions are met:
° Answer was 'No' at question '[6]' (Does your department use any Generalised Audit Software?)
Please write your answer here:

[28] Does your organisation intend to adopt GAS?
Only answer this question if the following conditions are met:
° Answer was 'No' at question '[6]' (Does your department use any Generalised Audit Software?)
Please choose only one of the following:
☐ No intent to adopt
☐ Little intent to adopt
☐ Moderate intent to adopt
☐ Definite intend to adopt
☐ Already Adopted
☐ Don't know

[29] If your organisation is intends to adopt GAS, how soon do you anticipate that it will operationally implement?
Only answer this question if the following conditions are met:
° Answer was 'No' at question '[6]' (Does your department use any Generalised Audit Software?)
Please choose only one of the following:
☐ Less than 12 months
☐ 12 to 18 months
☐ 18 to 24 months
☐ More than 24 months
☐ No plans to adopt

[37] Do you generally believe that GAS worth the cost and the effort? Please state your reason in the box provided. *
Please choose only one of the following:
☐ Yes
☐ No
Make a comment on your choice here:

[38] What do you think the problem(s) with GAS?
Please write your answer here:

[39] How do you think GAS can be improved?
Please write your answer here:

[40] If there is anything else that you would like to tell us about the implementation of GAS?
Please write your answer here:

Personal Profile

[41] What is your gender?
Please choose only one of the following:
☐ Female
☐ Male

[42] Please specify your age group:
Please choose only one of the following:
☐ 18-24 years
☐ 25-34 years
☐ 35-44 years
☐ 45-54 years
☐ 55 years & above

[43] What is your current position in the firm?
Please choose only one of the following:
☐ Partner
☐ Audit Manager
☐ Senior Auditor
☐ Auditor
☐ Audit Trainee
☐ Other

[44] How many years have you been in the current position?
Please choose only one of the following:
☐ 0-5 years
☐ 6-10 years
☐ 11-15 years
☐ 16-20 years
☐ 21 years & above

[45] How many years have you been in the firm?
Please choose only one of the following:
☐ 0-5 years
☐ 6-10 years
☐ 11-15 years
☐ 16-20 years
☐ 21 years & above

[46] How many years of experience do you have in auditing?
Please choose only one of the following:
☐ 0-5 years
☐ 6-10 years
☐ 11-15 years

☐ 16-20 years
☐ 21 years & above

[47] How many years of experience do you have in computerised auditing?
Please choose only one of the following:
☐ None
☐ 0-5 years
☐ 6-10 years
☐ 11-15 years
☐ 16-20 years
☐ 21 years & above

[48] How do you rate your overall Information Technology (IT) skills?
Please choose only one of the following:
☐ Very Good
☐ Good
☐ Adequate
☐ Basic
☐ Very basic

[49] I consider myself more as
Please choose only one of the following:
☐ IT Auditor
☐ Financial Auditor
☐ Other

[50] Qualification(s) and Academic Specialisation (majors)
Please choose all that apply and provide a comment:
☐ HND/BA/BSc
☐ MA/MSc/MBA
☐ PIIA/MIIA/QiCA
☐ ACA/ACCA/CPFA
☐ Other:

[51] Certification(s) (Tick as many boxes as are applicable)
Please choose all that apply:
☐ Certified Internal Auditor (CIA)
☐ Certified Public Accountant (CPA)
☐ Certified Information System Auditor (CISA)
☐ Certified Management Accountant (CMA)
☐ Certified Financial Examiner (CFE)
☐ Certified Financial Planner (CFP)
☐ Other:

Thank you for taking the time to complete this questionnaire. Your assistance in providing this information is very much appreciated. I sincerely appreciate your time and cooperation.

Thank you for completing this survey.

Appendix IV: Responses on Worth of GAS

	Category of Firm	
	Mid-Tier Practices	**Smaller Practices**
Using GAS and Answer Yes		
Audited businesses are so software reliant that GAS is essential	0	1
Better access to paper. Less likely to get lost. Clearer documentation.	1	0
Brings a discipline not possible with paper systems	1	0
Can perform audit tests that cannot be undertaken when auditing 'round' the computer	1	0
Decrease in storage costs and multiple office location ease of use	1	0
eAudit has achieved consistency of work and levels of evidence obtained within the audit file	1	0
Enhanced assurance.	1	0
Helps with directional auditing and so efficient working	0	1
Huge boost to the consistency of provision of audit quality	1	0
If successfully implemented and embedded, with adequate staff training, GAS should improve audit efficiency and effectiveness.	0	1
Improves productivity	1	0
In certain circumstances, it can work well. Often the practical difficulties outweigh any potential benefit.	1	0
Increased Efficiency	0	1
It has brought audit efficiency, saved a huge amount of space in terms of filing.	1	0
Minimal cost, as use Excel, flexible software allows a flexible approach to work.	0	1
More efficient and more powerful output	1	0
More efficient audit	1	0
Only on larger audits if programmes tailored	0	1
Over two - three years - initial costs are high but recovered in subsequent years	0	1
Properly scoped and executed tests using GAS are more cost effective and provide higher levels of assurance.	1	0
Reducing time spent sampling transactions and giving additional comfort on key items, journal transactions.	1	0
Saves time and effort	0	1
The alternative would be more costly and may be more time consuming leading to delays in updating processes with changes in external audit requirement	1	0
This is but one tool in the toolbox. I don't use it on every assignment but there are times and places where it is high effective and efficient.	0	1
To eventually achieve effective audits which are profitable	0	1
When appropriate.	1	0
Using GAS and Answer No		
Currently no. There have been more implementation problems than first noted, a lot of frustration and down time amongst staff, and additional IT costs that have had to be incurred. That said once the system is up and running properly, and especially after it has been established for 12 - 18 months we are confident that the rewards will start to become more apparent.	1	0
Substantive auditing is still predominantly used	1	0
NOT Using GAS and Answer Yes		
Ability to deal with large volumes of data - reduces risk and enhances a valid statistical approach	1	0
Avoids admin element of storing and retrieving files and need to remove them before destruction. Cost of software offset by savings in files, paper and storage	0	1
But only at a certain scale automation of systems in the audited entity and firms with few clients to which this applies have only limited incentives to	1	0

implement given the intellectual investment required (IT expertise and training for auditors in liaising with IT auditors.)		
Depends on the level of costs involved.	1	0
It is likely to be beneficial on large audits where the costs can be recovered within the fee constraints	0	1
It is worth the effort for large-scale process driven entities but generally not in relation to SME's.	1	0
It would be worth it for the very small number of firms who have complex audits i.e. big 4 and certain mid-tier firms and for smaller firms with smaller audits with high volumes of transactions e.g. those selling in significant amounts over the internet.	0	1
It would improve the allocation of resource during audit process	1	0
Maybe, for large clients but not for our typical audit client.	0	1
Paper programmes are being updated later than GAS software, after 2 year period benefits will be seen.	1	0
Probably but I doubt it will be cost effective given the size of our organisation	0	1
Probably over time but certainly not in the first 2 years of use.	0	1
Process driven so will create efficiencies	1	0
Should enable better tailoring of tests and so improve focus during the audit.	0	1
Should supply a more systematic & rigorous approach to audit assignments	0	1
The issue is we don't know the software products available or their cost as despite asking service providers there does not seem to be any software applicable for small firms	0	1
Ultimately this will become the standard and replace all forms of manual audit systems	0	1
Yes if used correctly and efficiently.	1	0
Yes, but probably only on larger audit assignments where data volumes are significantly high.	1	0
NOT Using GAS and Answer No		
Although difficult to truly comment when have never used GAS	0	1
As above not considered effective in the context of or client base.	0	1
As previously noted there is nothing you need what you call GAS for that can't be now done perfectly well on standard MS Office tools	1	0
Can make the audit too procedural and less about the use of judgement to specify and identify risks and then develop testing to address the risks.	1	0
Computerised data extraction and analysis is not important part of the audit. Understanding company performance and mitigating audit risk is more important.	0	1
Cost is biggest problem	0	1
Cost prohibitive for limited number of audits held at present	0	1
Cost to buy and implement. "Not broke so don't mend" at present.	0	1
Depends on number and size of audit clients that it may be applied to.	0	1
Depends upon the individual client base and the system used	0	1
Don't use GAS so N/A	0	1
For the audits that we conduct, the cost of implementing, maintaining and using would far outweigh the benefits of faster testing / information gathering.	0	1
For the smaller incomplex audit no efficiencies would be gained from adopting such software	1	0
For us, no, for the reasons given before	0	1
GAS as defined may not be worth the cost and effort for the smaller company audit - limited analysis is required as evidenced by both our internal and external audit review processes.	0	1
Generally with the increase in audit threshold, we are unlikely to have sufficient audits to warrant the cost of the software	0	1
I do not know. I have never seen GAS in operation.	0	1
I don't think it is relevant to small audits who tend to have very straight forward accounting systems.	0	1
Ignorance of it	0	1
Inefficiencies in form filling and less tailoring of work programmes	1	0

It depends on the size of the client & format of the accounting software. For our firm, what little I know of it, I believe it would be borderline as to whether it would be cost effective.	0	1
It is only worthwhile for very large audits such as the FTSE quoted companies.	1	0
It only becomes financially viable when you have a full time audit team.	0	1
My view is exclusively from the position of my firm as a small provider of audit services to small companies. I can understand the need for GAS for larger firms who undertake numerous audits on a continual basis. However, their costs would be significantly higher fr the companies I deal with and the client would get no benefit from the use of GAS.	0	1
Needs clients to have good controls	0	1
No effective on smaller clients	0	1
No idea	0	1
No requirement for it	0	1
Not appropriate to small audits especially where much of the accounts preparation work is also carried out as part of the assignment	0	1
Not at the moment. Clients' accounting software, and hence databases, are far to varied for the current techniques to make implementation worth the time and effort.	0	1
Not convinced that the volume of transactions on our client base warrants it	0	1
Not enough flexibility at present therefore some processes will still need to be done "outside the system" which would not be efficient.	0	1
Not for a small firm auditing entities using unsophisticated proprietary systems.	0	1
Not for a small firm with small audit clients	0	1
Not for our client base - we don' t have enough clients of a similar enough nature to get any benefit from this type of analysis	1	0
Not for our firm. It may be of use to larger firms with more complex audits.	0	1
Not for our practice	0	1
Not for our size of audit clients	0	1
Not for the size of most of our clientele	1	0
Not for us at present although we do use IT a lot for various clients during our audit and other support work. Still quite rare for pure audit to apply	0	1
Not given our audit client base. Circumstances may otherwise be different.	0	1
Not given the relatively small number of audits we do	0	1
Not in our case	0	1
Not in our case. If we did more audits, I am sure it would be worth exploring	0	1
Not on small audit assignments possibly on large i mainly do audits up to 10m	0	1
Not re our client base	1	0
Not suitable for the smaller auditor with limited audit assignments	0	1
Not to us on specialist assignments	0	1
Not use in our organisation	0	1
Not used GAS.	0	1
Not worth it unless the client is large and sophisticated in terms of its IT systems, in which case use of GAS will help sort and interrogate data. If a client runs its accounts on Excel or Sage, there is little benefit to be gained.	0	1
Not worth the effort for a few small audit clients.	0	1
Other than in the limited circumstances, which are already identified.	1	0
Our audit clients are insufficiently complex	0	1
Our audit clients are just not compatible with a gas. We can extract all the data we need from their systems without GAS.	0	1
Our average audit fee is about £6k. Not enough in it financially to bother with.	0	1
Our business is not of a size to make it worthwhile	0	1
Perhaps on larger audits. For owner managed business audits, I do not consider that this would improve the quality of the work performed from that of using a manual approach.	0	1
Recently adopted other audit software	1	0
Simply replaces other processes and may well lead to increased work with no additional benefit to the audit opinion	1	0

Small firm with straightforward audit assignments. Experienced staff. Doesn't warrant cost of implementing expensive new system.	0	1
The correct answer is actually, "don't know"	1	0
The current paper based system we use seems to work perfectly fine	0	1
The right audit opinion is currently obtained. Human input will always be required.	1	0
The software is very expensive and I can only see it benefitting the top 10 firms of whom have clients that pay £100,000's for an audit. Private client audits are much more price sensitive and it is difficult to justify the cost of implementation of the software.	0	1
Too few audits to absorb cost	0	1
Too few audits to make the learning curve worthwhile	0	1
Unsure as we haven't used it.	0	1
We have a defined audit process and most of our clients fall within the small company size	1	0
We have looked at various suppliers of this technology. None have convinced us that it is better then combination of traditional files and technology.	0	1
With an increasing number of companies becoming audit exempt as the threshold rises, the incentive in our market place to introduce GAS lessens	0	1
With the low level of IT used by our clients there are no likely benefits	0	1
Would not be worth it for the size of audit client we have	0	1

Appendix V: Problems with GAS

	Category of Firm	
	Mid-Tier Practices	**Smaller Practices**
Using GAS		
Accommodating changes to auditing requirement can be time consuming and adds extra cost.	0	1
Accountants now have to be computer experts, learning and understanding complex systems, reading computer language to tag accounts, linking systems etc. In many cases the systems are not designed by those that are actually actively still practising, and so therefore the real life happenings are often overlooked with an idealistic version of how things work.	1	0
Becomes impersonal	0	1
Being able to accommodate a wide range of software types	0	1
Compatibility and cost	0	1
Could become too robotic	0	1
Efficiency, review can be difficult, training costs	1	0
Getting (a) strategic leadership and (b) training "front-line" staff to use GAS effectively.	0	1
Hard to adapt for Charity clients.	1	0
If not set up well, can be cumbersome to complete in practice.	1	0
Initial software and hardware upgrade costs and training	0	1
Interfacing with client systems. Cost of first year set up.	1	0
Lack of flexibility in some instances. Technical problems still exist and need to be dealt with.	1	0
Lack of understanding and ability to use and cascade knowledge	1	0
Methodology not always the same as ISAs e.g. emphasis on risk at overall level and account balance level rather than assertion level. Does not copes well with auditing IFRS accounts or audits of groups (group audit methodology)	0	1
Multiple access in and out of the office	1	0
One size fits all	0	1
Only specialists can use it and having spent a fair amount of time setting up the tests the results can often be insufficiently precise to place reliance on them.	1	0
Planning resource into audit	1	0
Poorly developed and tested software. Partial implementation by firms.	1	0
Reliability of hardware use of Wi-Fi	1	0
Still difficult to tailor so that minimum work conducted. Lay out of software. Still can access everything in one area.	0	1
The main issue is getting the right data from the client in a timely manner.	1	0
The review process for the RI is more difficult. The computer file fragments the flow of the audit "story" so arriving at an opinion is more difficult	0	1
Too formalised, does not encourage independent thought and judgement	1	0
Too general	0	1
Understanding the requirement of the ISAs	1	0
	35	20
Not Using GAS	11	63
1. Scanning paper in then changing something then having to scan it in again. 2. Increased hardware purchasing e.g. mobile scanners/ printers/ laptops	0	1

3. Increased software licensing 4. Not as flexible		
Additional time and cost on introducing and evaluating GAS	0	1
Although GAS can be useful, it can lead people to stop thinking for themselves and relying on what a computer programme is telling them to do.	0	1
Applicability to SME's more limited - and capital outlay/ training for audit staff expensive if only applicable to a minority of clients.	1	0
Audit programmes (in particular at planning and completion) are already rigid in design and structure. Software will continue to enforce. These are the areas of the file generally completed by expensive members of the team, therefore potential for savings is less than vendors believe and experience from other firms is just that. Efficiencies can be gained in staff pulling files together and not getting side tracked by carrying out unnecessary tests in low risk areas. Problem with senior individuals reviewing electronic files - until this personal issue is addressed will always be a problem in our organisation	1	0
Auditors will stop thinking for themselves	0	1
Bigger audit firms tend to use to appear "modern" to clients.	0	1
Clients tend to spend time adapting and altering their software products away from the software houses' base products to aid with their business in a more effective way. This reduces the effectiveness of GAS.	0	1
Complexity and compatibility with client accounting software systems	0	1
Complexity needs a large-scale project to justify set up costs.	1	0
Consistency across the firm and time for implementation	0	1
Cost	0	1
Cost and flexibility	0	1
Cost and reluctance to change where only a small number of audits are held	0	1
Cost of implementation and training	0	1
Costly	1	0
Danger of a press the button attitude with no thought processes.	0	1
Data can already be extracted & sorted etc from accounts systems as sage using sage reporting and excel therefore GAS is a duplication of existing capability	0	1
Do not use GAS. We have looked at a number of packages, but there are not cost effective for our size of business.	0	1
Don't know, as we haven't used it.	0	1
Expensive and not geared for smaller audits	0	1
For SME's - the quality of the working papers provided, with partial spread sheet, and still too much hand written support schedules	0	1
For the vendors, the problem is that no-one seems to have failed an audit inspection for not using GAS	1	0
Great for those auditors who need it.	0	1
Harder for files to be reviewed by more expensive partners and managers	0	1
High implementation and running costs make it uneconomical for many registered auditors.	0	1
High set up costs and inefficiencies as noted above	1	0
High training and hardware/software costs	0	1
I do not believe that using GAS will enhance our firm's audit work.	0	1
I don't know of any other than GAS is not a product I have ever known any audit firm to use nor have I ever heard of it being recommended.	0	1
It is really only seen as a tool for the largest audits.	0	1
Lack of flexibility, loss of judgement, review process cumbersome.	0	1

Mistakes can led to significant errors of omission (e.g. if area marked n/a at start it will be edited out completely). Review process should pick up but needs to be good.	0	1
Needs to be an embedded process within the audit methodology to be effective	1	0
Never seen them	0	1
Niche market, no need for product to work properly- sees related software in accounts production software Viztopia. Last two updates broke this badly but incentive for a quick fix isn't there as it's a captive market.	1	0
No problems, not just relevant to smaller clients.	0	1
None known	1	0
Not all client systems will be able to be tested using GAS	1	0
Not enough audit income to warrant introduction.	0	1
Not have enough knowledge about it.	1	0
Not relevant to small OMB audits.	0	1
Not the most effective way of auditing SME businesses. A manual substantive approach is more effective where total transactions per annual less than £10,000.	0	1
Not transferrable to the smaller audit	1	0
Often too rigid process	0	1
Only of benefit to very large firms with large numbers of clients in one sector	1	0
Only relevant for the very largest multi - sited clients. For the usual client, irrelevant and onerous.	1	0
Problem is that its use is irrelevant to our client base.	0	1
Reliance on IT, requirement for IT ability to implement and maintain, especially in small to medium audit firms where IT resources are tight.	0	1
Reliance solely on a computer package doing the audit work could mean insufficient thought actually put into audit evidence gathering - garbage in- garbage out?	0	1
Restricts the lack of professional judgement & ability to make decisions taking into account the specific needs of businesses in different sectors.	0	1
Security, extraction of clients data from different systems, IT knowledge	0	1
More relevant in complex scenarios.	0	1
Suitability on small client audits	0	1
Tailored purely to very large audit assignments and complex systems not suitable for small or medium sized audits with more straightforward systems	0	1
There are still many aspects of the audit that it cannot do.	0	1
Time and cost involved in staff training	1	0
Time costs	0	1
We perceive some staff resistance. Also doubt it would lead to any reduction in time or costs	1	0
Year 1 implementation will be hard work	1	0

Appendix VI: How GAS can be improved?

	Category of Firm	
	Mid-Tier Practices	**Smaller Practices**
Using GAS	24	10
Better software development. More user-friendly layout.	1	0
Better understanding by audit staff rather than using IT staff	1	0
By promoting links to accounts production and tax computations and also incorporate iXBRL reporting requirement to cut down on the amount of time that is spent on administrative tasks such as linking the accounts on-line.	0	1
Combine accounting and audit outcomes and deal with IXBRL	1	0
Create environment to encourage own thought process	0	1
Design from review perspective only	0	1
GAS need to be properly scoped and executed to provide real benefits. Too many times they are used as "fishing" exercises, not providing the level of assurance required, nor adding any value.	1	0
Have some sympathy for those using the system on a day-to-day basis from the grass roots level. Systems should replica basic packages that are already used, such as excel or word, use the same style prompt boxes, so that there is a familiar feeling to it, instead of EVERYTHING having to be learnt again.	1	0
Internet based system so van be accessed by multiple people in multiple locations at the same time	1	0
More co-ordination and understanding between the software developer and end users	1	0
More competitive providers	0	1
Pre-written standard audit check routines with concise output report instead of pages and pages of general report	0	1
Resolve above problems. Produce more value added reports for clients.	0	1
Simpler interfaces.	1	0
Simplified for smaller audits	0	1
Simplify the ISAs	1	0
Tailor ability to sectors is needed, while keeping cost lower,	0	1
Yes- Opportunities for efficiencies in documentation.	1	0
Not Using GAS		
Build in more flexibility	0	1
By implementing with support of ICAEW and ICAS	0	1
By its nature it is a standardised product. It may be effective for a particular class of entity but the only way to make it relevant to most audit firms is to have one developed for each different type of organisation, which would be impractical.	1	0
By making it more user-friendly and simple to use.	0	1
By us not using it	0	1
Deal with pricing	0	1
Flexibility of approach/product	0	1
I have to pass in grounds that I have not seen the products in many years	1	0
I think they are redundant as defined	1	0
Implement a standard low cost easy to use solution for smaller clients?	0	1
Improved compatibility	0	1
Introduce simple version for small audits which can be adapted for use in non statutory audits	0	1
It is seen as not accessible by small/medium-sized firms and the GAS providers need to educate them or perhaps produce a simplified version if they are going to convince them otherwise.	0	1
Larger development teams, better field testing before updates	1	0
Less rigid structure	1	0
Make very user friendly, so everybody can understand, at all levels, in the benefits it has.	0	1

More data and case studies aimed at the smaller entity	0	1
Needs to be integral to the statutory accounts software for us to see any real benefit, whilst the 2 are separate you have the problem of maintaining 2 systems and synchronising between the 2	1	0
Never thought about it. I only know that I do not want to use the current products available.	0	1
No, it all depends on clients internal systems and software and they will not spend to upgrade just to allow auditors to use GAS	1	0
Not appropriate for our audits	0	1
Reduce the purchase cost and have a smaller company system	0	1
To be adaptable to small company audits	0	1
Training in practical use	1	0
Unsure as I don't use it - but I would think cheaper, more intuitive products integrated with audit management software (we use CCH Audit Automation) would be a way forward.	1	0
	33	117

Appendix VII: Other issues on GAS?

	Category of Firm	
	Mid-Tier Practices	**Smaller Practices**
Using GAS		
Everyone needs to be on board if it is to work.	0	1
Firms should allow enough time for staff to become familiar with the software. Should anticipate significant requirement for training and migration of records in the first year.	1	0
I do believe that GAS is the way forward, society as a whole has become more computerised, and our profession does need to follow this, but I believe that the practicalities of an auditors day to day work needs to be considered. We are not computer experts, we are accountants!!	1	0
Implementing any new system is costly and time consuming initially but provided the right software is used, and then long term benefits can be achieved.	0	1
It always takes longer to implement than what the partner expects	1	0
Much of it is down to the education of leadership and the delegation of sufficient resources to implement it.	0	1
Needs to win hearts and minds!	1	0
Needs upfront training budget	0	1
Too complex in parts and does not allow blank sheet approach	0	1
Not Using GAS		
It is way down a very long to do list to even consider this	1	0
Has no place in small scale audit assignments	0	1
I suspect GAS is some sort of academic creation that has little bearing on the audit of owner-managed companies in the real world. Audits are about understanding a client and understanding the risks present in that client that may lead to a material misstatement of the accounts. This is achieved through communication, testing of estimates, obtaining qualitative (not necessarily quantitative) corroborative evidence and ensuring that as auditors we can authoritatively provide evidence that the accounts support a true and fair view. Reliance on statistics is not enough to achieve this.	0	1
Its not relevant and never will be	0	1
Only relevant to larger clients and firms	0	1
We will not be implementing GAS!	0	1