Examining motivations to adopt Computer Assisted Audit Tools and Techniques (CAATTs): Cases of UK Internal Auditors

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Abstract
Adoption of Computer Assisted Audit Techniques and Tools (CAATTs) has not only become a beneficial choice for some businesses, but has become a fundamental part of many audit methodologies. (CICA, 1994; Progrob, Isenberg, 1999; Paukowits, 2000; Hudson, 1998). However, little is known about the adoption process for these tools which is crucial to ensure effective implementation and usage.

This research suggests that further knowledge about the motivations for successful adoption of CAATTs may be contained in general literature on IT adoption activity. It also argues this could be usefully supplemented to address wider implementation and operational issues by better understanding of existing practices of internal audit departments who use CAATTs extensively to illustrate best practice in this field that others could benefit from.

This paper therefore reviews, then makes use of, current theories that are seeking to better understand IT adoption processes (in particular, the most recent unified theory called the Unified Theory of Acceptance and Use of Technology - UTAUT) and explores the application of this theory to the specialized domain of CAATTs adoption for internal audit. This is undertaken using a series of ten mini-case studies.

Our findings revealed that within our cases two constructs from UTAUT are significant factors influencing CAATTs adoption by internal auditors. However, the social influence and effort expectancy are not found to be significant.

Keywords: Internal Audit, CAATTs, UTAUT

1. Introduction
CAATTs are computer tools and techniques that an auditor (external or internal) uses as part of their audit procedures to process data of audit significance contained in an entity’s information systems (Singleton and Flescher, 2003). Recent literature (for example, Grand 2001) has shown that the types of CAATTs embraced by internal auditors are classified to include the following groups: electronic working papers, fraud detection, information retrieval and analysis, network security, continuous monitoring, audit reporting, database of audit history, computer based training, electronic commerce and internet security.

The usage of CAATTs by internal auditors has evolved over time as the proliferation of information technology usage has developed in businesses (Ramamoorthi, 2004). The pervasive nature of information technology, the favourable economic and functional versatility of modern computing technology and the globally open and competitive market forces that drive the rate of technological evolution are together creating an era of profound change in the market place for audit automation (Berry, 2003; Bhimani, 1996; Abdel Hamed et al, 1999). While auditors have been partially successful in using existing technologies to automate elements of their functions, the businesses in which they work are also undergoing significant change themselves (Elliot, 2002). As organisations have opted to utilise sophisticated information technologies for developing their business process support as well as improving their information processing activities (Ramamoothri, 2004) this has increased the need for CAATTs in such businesses to allow auditors to continue to be able to perform their review and monitoring tasks effectively.

There is limited research that studies the behavioural aspects of IT adoption by auditors (for example Bedard et al, 2002; Schafer and Eining, 2002; Curtis and Payne, 2006) however there are several IT adoption theories that have been developed and applied in other fields (key examples of this literature include Davis, 1989; Venkatesh, 2000; Hu et al, 1999; Karahanna and Straub, 1999; Bhattacherjee, 2000). This research therefore seeks to examine the motivational criteria for CAATTs adoption, based on theory testing from academic literature on IT adoption.

The key research question addressed by this paper therefore is ‘to what extent are general theories of IT adoption applicable to helping improve our understanding of CAATTs adoption decisions in the internal audit domain’.

This paper is organised as follows; in the next section the prior literature on CAATTs adoption and use is explored further and the justification is outlined for use of wider IT adoption theories to aid understanding of the motivations for CAATTs adoption. Section 3 then discusses the theoretical framework used to study motivations of CAATTs adoption (i.e. Unified Theory of Adoption and Use of Technology – UTAUT). Section 4 elaborates on the application of the constructs from UTAUT used to explore adoption motivations. Section 5 details qualitative work undertaken to apply this model to CAATTs adoption using a series of mini-case studies in the UK and from Malaysia. Results are explored in section 6. Section 7 offers some conclusions and
implications for this research before the final section discusses limitations to this work.

The key contributions of this paper are:
- application and testing of general IT adoption theories in the CAATTs adoption for internal audit settings;
- the provision of new data on the current UK situation for CAATTs use in internal audit functions where very little had been previously known;
- an academic approach to better understanding of CAATTs use in the UK by internal auditors where previously only limited professional body surveys have been applied;
- theoretical foundations for development of a testable model to support adoption and successful implementation of CAATTs in an internal audit setting.

2. Literature Review

Previous studies have been conducted into CAATTs development and application by both internal and external auditors. This includes previously documented cases showing why CAATTs were adopted in particular cases (for example, see, Neuron, 2003; Paukowits, 2000; Progob & Isenberg, 1999; and Hudson, 1998).

While academic research on this topic is limited, there have been a number of surveys carried out by professional bodies to which auditors belong, outlining CAATTs usage in practice across a variety of industries. However, this work, even though limited in its scope generally is further limited by its geographical focus – the USA - with very little documentation on the use of CAATTs outside North America.

The insights that are available to us relating to internal auditors in particular to date, as the focus of this study, come from the results of the Institute of Internal Auditors (IIA) USA surveys, conducted annually since 1995, in which a range (albeit limited) of CAATTs related information is routinely collected and therefore some history of development practices of these technologies have been captured. However, such systematic review of even basic information about usage does not exist outside the USA. IIA (UK) conducted their first survey touching on CAATTs usage at the end of 2002 (IIA UK, 2003). The respondents to the survey were 65 heads of Internal Audit from organisations throughout the UK. This survey revealed hesitation amongst those overseeing internal audit departments in the UK related to automation development. The key reason cited for this was that they perceived there was a lack of software available in the market that met their needs as internal auditors. The survey suggested that some software packages were too ‘cramping’ in their requirements to be directly applicable to working audit methodologies in the businesses that evaluated them – requiring too big a change in the methodologies used to justify the costs for the benefits to be accrued. However, more than 40% of respondents suggested that they would be willing to adopt an amended audit approach if they could find a package, or packages, that otherwise met their needs. This suggests scope for wider automation to occur in the future if the right conditions for their adoption could be understood, and communicated to software developers.

Neither of these previous sets of surveys has addressed in any practically useful detail the early stages of CAATTs adoption processes, particularly the specific motivations for initially exploring and building a business case for adoption of CAATTs, and the limiting factors to wider adoption. They primarily report on detail of applications in place at the time of the survey being undertaken. Therefore, the information necessary to provide the next step forward in wider adoption for many other businesses is not currently widely available either in the professional or academic literature.

Also, no studies currently exist that focus on CAATTS adoption employing otherwise well known, and widely tested, IT adoption theories. This study therefore, addresses the lack of CAATTs adoption literature for internal audit using IT adoption literature elsewhere illustrated as providing valuable insight to technology adoption issues. The next section reviews this literature in more depth.

3. Theoretical framework to study motivations for CAATTs adoption

3.1 Theoretical foundations

The theoretical base underlying this paper is the model of technology adoption known as Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT is a unified model of IT acceptance by individuals that was developed by Venkatesh et al (2003) after reviewing, comparing and testing eight competing theories in this field of research that researchers have been working with for a number of years in seeking to find general factors
that influence users when making technology adoption choices across a variety of domains. These models originate in psychology studies and have been adapted, by a series of successive research projects, to IT adoption decisions.

The eight models reviewed, compared and tested 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.

The review and comparison undertaken by Venkatesh et al (2003) illustrated that there are five limitations noted in the eight extant models, which are related to technology being studied (relatively simple), participants are mostly students in academic settings, timing, nature of measurement and Voluntary vs. mandatory contexts. The above issues are addressed in by Venkatesh et al (2003) by selecting participants in non academic settings and through various stages of experience with new technology and compares all models on all participants.

Hence, having reviewed, examined and tested the eight competing models, Venkatesh et al (2003) developed UTAUT based upon conceptual end empirical similarities across the models (see figure 1).

Fig 1. Unified Theory of Acceptance and Use of Technology (UTAUT). (Source: Venkatesh et al., 2003)

There are four major elements (termed ‘constructs’) that this theory demonstrates are significant direct determinants of intention or usage in one or more of the individual models according to Venkatesh et al. (2003). They were performance expectancy (PE), effort expectancy (EE), social influence (SI) and facilitating conditions (FC). Performance expectancy is the degree to which an individual believes that using the system they are considering adopting will help him or her to attain gains in task performance. Effort expectancy refers to the degree of ease the adopter associates with the use of the system they are considering using. Social influence, in turn, refers to the degree to which the individual perceives that important others believe he or she should use the new technology they are considering and facilitating conditions is defined as the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the technology they are considering adopting.

In addition, Venkatesh et al. (2003) proposed that these four major constructs can be influenced by four key ‘moderators’; gender, age, voluntariness and experience.

The proposed theory (UTAUT) was then empirically validated using data from four organisations over a six-month period and found to outperform the eight individual models in explaining adoption activity for various technologies compared to these other models (Venkatesh et al, 2003).

We argue in this paper that the above factors also reflect the nature of CAATTs adoption decisions in internal audit settings as these are typically made by an individual who lead these departments – i.e. an individual adoption model rather than an institutional level model, is appropriate for our study.

Figure 2 therefore illustrates the theoretical view of this research. In comparison to the original UTAUT model, mediating factors (age, gender) are not included in figure 2 on the basis that this study uses a case study approach with only 10 selected cases and therefore it is not possible to adequately comment on the possible moderating effects of either age or gender form this study’s results. We recognise this as a weakness in the approach we have taken but this is
an initial attempt to examine motivation on CAATTs. These moderating factors will need to be addressed as part of wider validation of this model in this domain to evidence the extent to which they are applicable as moderators in this specific domain of study.

Some discussion of the possible impact of voluntariness and experience, as the other two moderators outlined by UTAUT, are however discussed in the following section.

4. Constructs adopted in this study
This section explores each of the constructs from UTAUT as are proposed for testing in this study to illustrate their theoretical application to our model development.

4.1 Performance Expectancy
Auditing standards and guidelines clearly suggest that usage of technology tools could help to enhance efficiency and effectiveness of internal auditor’s work (e.g. see IIA standard 1220.A2). In addition, other literature on CAATTs has shown that internal auditors adopt CAATTs to be able to perform various functions such as to test program controls (e.g. see Progob & Isenberg, 1999), to gain better understanding of their client IT controls (Neuron, 2003), to facilitate risk assessment during planning processes (Paukowitz, 2000) and to improve the efficiency of audit testing (Hudson, 1998). As such, CAATTs are perceived to be potentially an important tool for internal auditors in the performance of their audit work. This perception is consistent with perceived usefulness as included in the Performance Expectancy construct in UTAUT, which refers to the extent to which an individual believes that his or her use of the technology will enhance job performance (Davies, 1989).

4.2. Effort Expectancy
UTAUT’s effort expectancy construct, addressing perceived ease of use, is also tested in this study. UTAUT suggested that there was a direct (positive) effect of perceived ease of use via effort expectancy on behavioural intention (Venkatesh et al., 2003). All other things being equal, UTAUT would suggest that there is a higher likelihood that internal auditors would adopt CAATTs when they are easy to use and therefore do not have to undergo a difficult learning curve to make use of CAATTs.

Despite apparent support for this construct in UTAUT, Hu et al. (1999) concluded from their study that among knowledge workers no amount of ease of use would compensate for low perception of systems usefulness. Their investigation of physician’s acceptance of telemedicine revealed that as the level of knowledge of professionals differ significantly from other subjects of prior research (students, clerical staff etc) then their ability to assimilate new technology would be quicker (Hu et al, 1999). Therefore, ease of use was found to have no significant effect on attitude and perceived usefulness in the Hu study of technology adoption. However, Bedard et al. (2002), in looking more directly at auditors as professionals, found otherwise. Their results showed that ease of use perceptions were in fact important among a group of highly experienced auditors (Bedard et al., 2002) thus potentially supporting the use of this construct in modelling technology adoptions by auditors. Bedard et al.’s research examined the effect of technological and task knowledge on the basic TAM relationships. The positive relationship between task knowledge and ease of use implies that even individuals with requisite computer skills may consider a system difficult to use if they are uncertain about their proficiency with tasks that need to be performed using the system. In later research, Bedard et al. (2003) found that the perception of ease of use can be shifted with the effect of training.

Therefore, in this study, the effect of ease of use and training on CAATTs adoption by internal auditors is examined in seeking further confirmation of their applicability to internal auditor’s adoption decisions.

4.3. Facilitating Conditions
Facilitating conditions relates to the degree in which the infrastructure provided by the organization and external environment is perceived to influence the motivation to adopt (Venkatesh, 2003). In the context of CAATTs adoption by internal auditors, the facilitating conditions that can impact on their motivations to adopt CAATTs include the adequacy of information on what CAATTs can do, support
from vendors or software providers as well as support from top management in their organisations (CICA, 1994).

4.4 Social Influence
In the context of social influence, this study seeks to understand if any influence of image and normative belief towards intention to adopt CAATTs exists in this adoption domain, as found elsewhere by other UTAUT users. For example, the decision whether to adopt CAATTs or not, may be influenced by the Head of Internal Audit in the organisation or fellow auditors within their firm or from other professional contact. In testing UTAUT, Venkatesh et al (2003) found that the social influence construct is only significant with the inclusion of the moderating variables; age, gender, experience and voluntariness. In this study, we therefore include an analysis of the impact of voluntariness and experience within our analysis of this construct, however, exclude age and gender due to our small sample size.

4.5 Research Questions
Drawing from the above constructs, the wider literature and prior researcher experience in the field, we developed our general research question into a series of more specific possible interview questions to be incorporated into our research instrument for our case interviews. Several pilot interviews were conducted to test and refine these questions via a Delphi style approach into ones collectively considered to capture the core elements of the personal adoption decision making process. The key research questions arising from this process were:

I. When do internal auditors decide to use CAATTs in their audit process?
II. Why do internal auditors decide to use CAATTs in their audit process?
III. How do Internal Auditors evaluate the appropriateness and adequacy of staff skills?

Initially, there were several questions discussed when pilot interviews are conducted. The feedback from pilot interviews is used to refine the above questions.

5. Data Collection and Analysis
Qualitative based case studies were chosen as the data collection medium in which to explore the applicability of the UTAUT constructs to the CAATTs adoption domain. The use of case study methodology in TAM and UTAUT research has also proven useful in previous research when an in-depth description is sought on the implementation process (for example see Sieber et al, 2005; Rahim, 2008 and Andersen and Schwager, 2004) to demonstrate the validity of this exploratory approach used for this new domain to UTAUT application.

5.1 Qualitative data
The mini-case studies comprised of 8 internal auditors from different organisations in the UK and 2 internal auditors from Malaysia. Cases were selected based on leads from participants of ACL1 User Conference (2005), IDEA User conference (2006) and also with assistance of a consultant’s firm. The cases selected comprise a convenience sample of successfully adopting entities (only respondents who were both successful and significant users were chosen) but selected to represent different kinds of industries to enable some spread of coverage of CAATTs use to be included. Two comparative cases were selected from outside the UK (taken from Malaysia) to offer some, albeit very limited, international comparison information. The profile of the case study respondents is described in table 1:

Table 1: General summary of case studies respondents’ profile

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
<th>Case 5</th>
</tr>
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<tbody>
<tr>
<td>Sector</td>
<td>Insurance</td>
<td>Pharmaceutical company</td>
<td>Final</td>
<td>Final</td>
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<tr>
<td>Location</td>
<td>United Kingdom</td>
<td>United Kingdom</td>
<td>United Kingdom and</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Group</td>
<td>Adapte</td>
<td>Adapte</td>
<td>Adapte</td>
<td>Adapte</td>
</tr>
<tr>
<td>Years using CAATTs</td>
<td>Less than 5</td>
<td>More than 15</td>
<td>Less than 5</td>
<td>More than 15</td>
</tr>
<tr>
<td>GAS packages used</td>
<td>ACL</td>
<td>ACL and IDEA</td>
<td>ACL</td>
<td>IDEA</td>
</tr>
</tbody>
</table>

Case study data was collected during 2006 in face-to-face interviews with key individuals in each case study company (in each case CAATTs-particularly GAS experts in those businesses and also other senior internal audit staff where possible). Each interview was recorded and subsequently transcribed. Transcripts were supplied to each interviewee for their comments and amended accordingly for factual inaccuracies. Supplementary documentation was also provided by participants as additional data sources for the case analysis. This typically included written policies and procedures, training guides and related internal documentation.

The case studies are analysed using the pattern matching technique. According Yin (2003) the pattern matching techniques can be deployed in qualitative data analysis when there is a theoretical proposition supporting the research questions. In this

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1 ACL and IDEA are the two key generalised audit software tools used in the internal audit domain at the time of study. Their national user group conferences therefore represented an ideal place to obtain expert lead cases as required for this study.
study, we put forward that internal auditors are motivated to adopt CAATTs due to performance expectancy, facilitating conditions, effort expectancy, and social influence that are adapted from UTAUT making this technique applicable in this domain.

A pattern matching technique was applied in the analysis of the collected and transcribed case data, and supplementary documentation. Pattern matching is a method where a pattern of results from the data collected is matched with a pattern predicted from previous knowledge or research (Gibbs, 2004). The advantage of this method is to help strengthen internal validity if the pattern coincides with a predicted one (Yin, 2003).

6. Research Findings
6.1 Summary of General Feedback
In Appendix 1, we present the summary of responses received from each case on factors that influence motivations for CAATTs adoption. The types of CAATTs used across our cases are limited to GAS hence the discussions subsequently will focus on adoption of this type of CAATTs. Appendix 1 indicates that CAATTs adoption (particularly GAS) is primarily driven by the perceived benefits derived from CAATTs usage in the auditing process. There are several specific benefits that can be classified with the PE category identified from the cases which include cost saving (case one), greater audit coverage (case five and eight), increase audit quality (case five) and faster processing (case nine).

Further analysis is made by performing cross cases data tabulation presented in Appendix 2. The data is then analysed by identifying key words that can explain the existence of constructs adapted from UTAUT.

6.2 Analysis
Further analysis on the data is made using pattern matching as described in section 5. We use Nvivo, a research software to process the data. The transcripts were first condensed and uploaded into Nvivo. Then, the data is arranged based on each research question in a table format (see appendix 2). From the cross case tabulation in appendix 2, key words are identified (for example, the word ‘benefits’ is identified as one of the factors that motivates adoption) and categorized according to the four constructs adapted from UTAUT.

6.2.1 Performance expectancy
The construct of performance expectancy is strongly supported by findings from the case studies. It is related to perceived usefulness, which is originally from TAM (Davis et al, 1989). Perceived usefulness is defined as the degree to which a person believed that using a particular system would enhance his or her job performance (Venkatesh et al, 2003). Performance expectancy was the main motivation for CAATTs adoption in 6 out of 10 cases. They believed that benefits that can be derived from CAATTs could greatly enhance their job efficiency. In their opinion, adoption of CAATTs means that internal auditors are able to automate some part of the audit process or the overall process itself.

Case Six for example, has used CAATTs for more than 10 years now, beginning in 1995. The auditors decided to adopt GAS (ACL) because they believed that the audit software would improve the efficiency of the audit team. ACL was initially used for fraud investigations (to compare Housing Benefit data with Payroll data). The results were good e.g. the team became significantly more effective in producing ‘exception reports’ on housing benefit that is paid not according to the rules. Subsequently ACL was used for additional data matching tasks, exception reporting, sampling and other kinds of automated audit work.

Case Five has been using CAATTs for more than 20 years in the Internal Audit function. The type of CAATTs they adopted was IDEA. The adoption was due to the ability to perform 100% coverage during the audit by using GAS. In addition, CAATTs usage helps to increase the level of assurance and to improve the audit quality.

Two cases (Six and Nine) also adopted CAATTs not only because of its efficiency benefits, but also because it was considered to be sensible to do so within an electronic data processing system environment. In both cases, they are large departments handling large volumes of data. As such, usage of CAATTs is indispensable to them particularly for data extraction and analysis.

Performance Expectancy is therefore strongly supported by our case studies as a key motivation for CAATTs adoption.

6.2.2 Facilitating Conditions – Auditors’ Skills and Knowledge
This study probes into the auditors’ readiness (in terms of skills and knowledge) to adopt and maximize the value of CAATTs adoption. The evidence of our case studies suggests that it is important that prior to organisations adopting CAATTs, they know that somebody in the organisation would be able to implement and use the tools. From Appendix 2, it is noted that in 7 of the 10 cases, they already had personnel with either previous experience or basic knowledge of the use of CAATTs prior to the decision to adopt CAATTs. This knowledge facilitates the decision making process of CAATTs adoption. Another influencing factor is training, whereby three of the cases cited the availability of training as encouraging them to adopt
CAATTs. In Case Five, the ability to use CAATTs was made a pre-employment criterion for a newly recruited internal auditor. This was to promote the use of CAATTs for most audit work within the organisation.

There is strong evidence from the case study findings that the availability of facilitating conditions motivates CAATTs adoption. On the other hand would the absence of these conditions discourage non-users from adopting CAATTs? An interesting example cited in Case Nine is as follows:

“Our IT audit function had been visited by a multinational company that was interested in using IDEA. A presentation was made to their General Manager of Finance and Head of IT. They were impressed with what IDEA could do. If they were to use IDEA, they wanted to use it globally throughout all of their subsidiaries. The problem they faced was that they did not have the expertise to plan and carry out the implementation process; hence outsourcing was the only answer. Outsourcing however was very expensive and organisations did not have the necessary budgets for such expenditure.”

Given the above example it is evident that the existence of facilitating conditions plays an important role in motivating auditors to adopt CAATTs.

6.3.4 Lack of Support for Social Influence and Effort Expectancy

It was discussed in previous research (e.g. see Davis and Venkatesh, 2000) that constructs related to social influence have been found not to be significant in voluntary contexts but behave significantly within mandatory settings. Venkatesh et al (2003) also found that this construct is significant in the presence of the four moderating variables which are age, gender, experience and voluntariness. In all cases in this study, CAATTs usage is voluntary, even though professional standards prescribe that CAATTs should be used by the internal auditors in ensuring that they deliver due professional care (see ISACA, 1999). There is a lack of enforcement and monitoring of compliance to this prescription of use leaving internal auditors to make context specific decisions on adoption. Also, membership of professional bodies, such as the IIA, is not mandatory for all internal auditors in practice. Therefore, it is in keeping with prior studies, and current professional context, that the effect of social influence is not present within the context of these cases. Should the adoption of CAATTs be made mandatory, either by internal or external parties, the social influence construct may then play a greater role in influencing CAATTs adoption. As such, voluntariness is seen to negatively influence the applicability of this construct to internal auditors’ motivation to adopt CAATTs.

Similarly, effort expectancy is not found to be a factor influencing internal auditors’ motivation to adopt CAATTs. This finding is consistent with findings from Hu et al (1999) in his study on Physicin’s acceptance of telemedicine technology which found that perceived usefulness is supported in their findings while perceived ease of use was found to have no significant effect on physician’s intention to adopt telemedicine. A possible explanation of these findings is that internal auditors are professionals (similar to physicians) who work within a specialised knowledge domain and possess high levels of professional qualifications. Therefore, they are more likely to be independent of social/peer influence in their decision whether to adopt CAATTs or not. This finding imply that the moderating variable of experience influence the significance of effort expectancy in the adoption of CAATTs by internal auditors.

In addition, the description given by Succi and Walter (1999) of certain characteristics of knowledge workers (i.e. their ability to work without supervision, the use of peer review for evaluation of work and the underlying knowledge- oriented task that they completed) distinguished them from other IT users, and support the findings that internal auditors are not strongly influenced by social pressure.

7. Conclusions, Contributions and Research Implications

7.1 Conclusion

This research constitutes an attempt to obtain integrated knowledge of the motivating factors that contribute to successful CAATTs adoption by internal auditors. It concluded that the motivations for CAATTs adoption are well supported by the findings from the qualitative data; hence the motivating factors can be used as guidance when discussing issues on CAATTs implementation. While these factors may not be exhaustive due to limitations of this research (discussed in section 8 below), they were drawn from the results of the 10 mini-case studies conducted as a part of this study.

7.2 Academic Contributions

The present study contributes to the extension of UTAUT to another specialised domain; the internal audit domain (in the UK primarily but which is also, by extension and given the globally similar practices of this profession, arguably similarly applicable more widely). Since UTAUT was introduced in 2003 (Venkatesh et al, 2003), there have been a limited number of studies (for example, Curtis and Payne, 2006; Sieber et al, 2005) that extend the basic theory proposed for wider IT adoption domains, but none that have as yet examined the internal audit community.
This study has utilised a pattern matching technique in analyzing the data from a series of mini-case studies and found that facts from the cases provide support for two constructs from UTAUT (performance expectancy and facilitating conditions).

This study also found that the other two constructs of effort expectancy and social influence were not supported by the cases. This contributes to further explanation of the impact of certain attributes of knowledge workers previously found by Hu et al (1999), Succi and Walter (1999) and Bedard et al (2002). Consistent with extant literature discussed earlier, this study posits that the constructs of effort expectancy and social influence are not supported by these cases because internal auditors are knowledge workers operating in a voluntary decision domain when making adoption decisions on CAATTs. Hence they can make an independent decision on whether to use CAATTs or not within these settings. With regards to effort expectancy, the interviewees used for each of the mini-case studies were CAATTs expert users, and hence the decision to adopt CAATTs was not influenced by the effort expectancy construct.

Since this is the first study of its kind, this research provided the initial attempt at the applications of UTAUT to the internal audit domain. Subsequent work is needed to determine if similar results would also be found in a mandatory situation or with non-expert decision makers.

### 7.3 Implications for professional bodies and industry regulators

The discussion in the research findings section argued that a possible reason that social influence was not found to be important in our model as one of the key factors influencing motivations to adopt CAATTs is that it was not mandatory for internal auditors to use these tools. The argument was made based on the findings from Davis and Venkatesh (2000), where social influence on IT adoption was found not to be significant in voluntary contexts but to significantly influence adoption decisions within mandatory settings.

The above findings could give implications for a greater role encouraging use of CAATTs usage for internal auditors by professional bodies or industry regulators. Even though existing standards by the IIA, IAASB and ISACA provide recommendations and guidance on the use of CAATTs, the decision to use CAATTs in practice remains the prerogative of the auditors. Regulators may take the view that a stronger recommendation is going to be necessary to ensure auditors develop wider use of CAATTs (e.g. as has been the case by the NAO in the government environment). In this case, IIA has taken the steps by incorporating the necessity of CAATTs usage into their standards.

### 8. Limitations and Future Research

Despite achieving the key goals established for this research, i.e. identification of current cognitive factors influencing motivations for CAATTs adoption by our cases of internal auditors, this research is not without its limitations for application and should be interpreted in the light of these limitations.

This study is mostly conducted within one geographical area – the UK. Therefore the findings may only be applicable to the economic and regulatory environment in the UK. While two cases from Malaysia were included as international comparators, these clearly are inadequate to provide more than indicative data on issues that may differ between the UK and a developing country like Malaysia. This has led to the identification of a possible future work to be done to extend and replicate this study to other geographical and economic environments. A comparative study could also be conducted to identify the relationships between different environmental influences to each of the factors identified in the model in these different contexts (e.g. does social influence, or other factors not present in the UK study such as technology cost, have greater influence in other economic and cultural contexts perhaps?)

Another area of potential further research is to validate the model with empirical data. While case study research is useful in providing detailed explanation on practices in a specific set of circumstances, the generalisability is limited to theoretical replication or extension to new specific situations. On the other hand, empirical data can substantiate hypotheses through statistical methods and more formally testing relationships between various variables. Consequently, an empirical study could complement the findings from these case studies and in particular, aid examination of UTAUT moderators not possible in our limited case studies.

In conclusion, despite the limitations of this research, we believed that it has contributed to knowledge with respect to theoretical extension, practical implementations and regulatory implications. We are optimistic that these findings can be further developed and refined to the benefit of internal auditors, and also external auditors, IT auditors and other operational departments.

### 9. References


### APPENDIX 1: Summary of General Response

<table>
<thead>
<tr>
<th>Case number</th>
<th>General Response on Motivation to Adopt CAATs</th>
</tr>
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</table>
| One         | "The head of internal audit decided that ACL should be used by the audit function. He himself had more than 15 years experience in using ACL, I was employed to champion the adoption of ACL and during the trial period I have to provide proof on the benefits of using ACL. I proceeded to them cost savings and insurance claims that can be produced through data interrogation using ACL. The management are happy with the benefits derived from ACL and approved the adoption of ACL."
| Two         | "The company adopted CAATs initially due to the requirement for computer fraud. This was also the reason for the establishment of the internal audit function. Main emphasis then is to check computer controls. The task was carried out by a computer auditor who has an in-depth knowledge of computers. At the beginning, IDEAS was mainly used by computer auditors. Later, IDEA is also adopted by the management to check data accuracy."
| Three       | "ACL has been adopted for the past 3 years. One of the main factors to adopt CAATs was the benefit that could be derived from CAATs usage such as increased coverage. Apart from that it also makes more sense to use audit software to audit data that is available electronically."
| Four        | "In this organization, we have been using CAATs for more than 3 years. The IT auditors drove the usage. The reason for adoption was mainly due to the identification of data processing in the organization. It is much easier to audit electronic data in electronic form by using IT tools. IDEA is mainly used to audit the financial system run using SAP R1. We also think that when the legacy system is moved to a higher technology, the auditors need to use tools to be more efficient in their audits. For example it is easier to do random sampling using IDEA when the data is available electronically."
| Five        | "The adoption of IDEAS is due to benefits that can be derived from the software. Those benefits are an increased level of assurance, improved quality of audit and increased coverage of the test. In fact the usage of CAATs makes it possible to perform 100% coverage."
| Six         | "The decision to buy was driven by the belief that the audit software would improve the efficiency of the audit team. The team started to use GAIT, for fraud investigations, which was to compare Housing Benefit data with Payroll data. The results were good and the management was satisfied. Subsequently, ACL was used for data matching and to find exceptions in reports."
| Seven       | "Throughout my experience in providing audit automation solutions to internal auditors, I found that there are few factors that motivate adoption of audit software. One of the most important motivations would be to fulfil compliance requirements such as Sarbanes-Oxley. In the absence of such regulation, motivation may not be strong enough."
| Eight       | "The organization has adopted a fully computerized system, therefore it is more efficient to conduct the audit using CAATs. It enables a wider scope and coverage of the audit. The facilities and functions in ACL are powerful and these tests are not able to be carried out manually."
| Nine        | "Historically we started to use CAATs when the external auditors requested for data interrogation to be carried out on a particular area. When the organization shifted to a PC-based environment, we then looked at CAATs solution that is compatible with PCs. First, we used ACL to perform data interrogation as well as data extraction. The usage further expanded into data analysis for internal purposes. Later, the organization decided to use IDEA as audit tools because we found that the software is extremely powerful if it is properly utilized. Continuous and expanding usage of CAATs is due to fast processing as well as unimpaired audit coverage that is possible when conducting the test. Usage of IDEA has also enabled us to perform a few tests that can not be performed manually due to volume of data. The ability of the software to analyze, interrogate and extract data is also recognized by business units other than internal audit. For instance, the Purchase Order Processing Function use IDEA in order to generate reports on duplicate payments."
| Ten         | "We decided to use CAATs to be able to deliver extra value-added audit service for the organization. We know that CAATs has capabilities of performing data extraction and analysis that cannot be done manually."
Appendix 2: Cross cases tabulation summarises to analyse motivations for CAATTs adoption

<table>
<thead>
<tr>
<th>Questions:</th>
<th>When and why do they decide to use CAAT in their audit process and what are the motivation for CAATTs adoption? (Refer 4.5 RQ I and II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>Due to benefits that can be derived from CAATTs.</td>
</tr>
<tr>
<td>Case 2</td>
<td>Initially to detect computer fraud. Then to check computer control. Later on expanded to check data accuracy by CAATTs.</td>
</tr>
</tbody>
</table>
| Case 3     | 1) Adoption due to benefits that can be derived from the tools.  
            2) It makes more sense to use CAATTs when the data is processed and stored electronically. |
| Case 4     | Due to electrification of data processing and also the organisation moving to higher technology that such tools are needed to make the audit more efficient. |
| Case 5     | Benefits that can be derived from CAATTs.                                                                          |
| Case 6     | Driven by the belief that the tools will improve the efficiency of the audit team.                                  |
| Case 7     | Driven by externalities. Also due to benefits that can be derived from the tools.                                   |
| Case 8     | Due to computerisation of the operational systems and also due to benefits that can be derived from CAATTs.          |
| Case 9     | 1) Initially by requirement of externalities (external auditor)  
            2) More extensive usage due to benefits that can be derived from the software and certain tests cant done manually. |
| Case 10    | To deliver extra value added service for the organisation.                                                          |

Questions: III. How do Internal Auditors consider the appropriateness and adequacy of staff skills? (Refer 4.5 RQ III)

| Case 1     | The Head of Internal Audit is familiar with CAATTs. Before the organisation adopts ACL, an expert user is employed. She becomes CAATTs analyst and provides service to other auditors who are not directly involved with CAATTs. |
| Case 2     | The organisation has few auditors who possess IT knowledge, hence they can learn to use the tools without many problems. |
| Case 3     | During interview process, new auditors are screened on their ability to use CAATTs. They are also sent for training. |
| Case 4     | Most Auditors have basic understanding of CAATTs and all of them are sent for training to use IDEA. |
| Case 5     | Potential users need to have basic understanding of CAATTs. The users already have experience in using CAATTs before the organisation adopted CAATTs. |
| Case 6     | The organisation only has one expert user of audit software. He has been using the software for more than 15 years. At the initial stage, he went through the learning curve and he managed to master the usage of the software due to his strong interest and commitment. |
| Case 7     | Based on his experience, contact seven noticed that new adopters do not have a proper plan that takes into consideration staff’s level of expertise and readiness. |
| Case 8     | Before they adopt CAATTs, they already have one expert user. They expect that all auditors should be able to use CAATTs. They developed and conduct a regular in house training programme for all staff. |
| Case 9     | Within the internal audit function only IT auditors used IDEA. There are 3 of them who are expert users. They came from IT background and they do not face much problem in using audit software. |
| Case 10    | The organisation expects all auditors to be able to use CAATTs. All auditors were sent for training to use ACL. |