Which factors predict the chances for optimal deployment of CAATs in organizations
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1 Introduction

In this section, I will explain my reasons for dealing with the topic ‘CAATS and its critical success factors’, how I set out my work and I will offer a summary of the research.

1.1 Objective

According to many accounts Computer Aided Audit Techniques (CAATs) are considered to offer many advantages to the audit / governance profession (Curtis & Payne, 2008) (Zhao, Yen, & Chang, 2004), such that standards (in- or explicitly) point to the use of (AICPA, 2002) (AICPA, 2006) (AICPA, 2002) (AICPA, 2001). There is a fair body of research as well as many personal accounts that the blind application of CAATs does not yield such advantages. Therefore the application of CAATs in many contexts is seemingly sub-optimal.

In this paper I propose a context explaining why CAATs might be less than optimal. I will aim to offer:

Which organizational factors predict the chances for optimal deployment of CAATs?

In order to settle this quest I am building my paper as such:

- Which factors predict the chances for optimal application of CAATs?
  - What are CAATs and why/how are they used?
    - I will define CAATs as meant in this paper
    - Based on history and various regulations I will outline the case for CAATs
  - What are current experiences on the use of CAATs
    - Prior Research on the application of CAATs
    - Based on interviews I will outline the advantages and disadvantages
    - A conclusion of my assessment of CAATs application
  - What effort is required to achieve optimal use of CAATs
    - Based on maturity models I will propose a guiding model for beneficial application of CAATs
    - I will elaborate on this model in a framework.
2 What are CAATs en why are they used?

2.1 What are CAATs

Because of the increase of data volumes, massive transaction processing and computing in business operations, performing audits, without technology, is hardly an option (Anantha Sayana, 2003). As a result the toolset has changed accordingly. In a variety of subjects the amounts of auditable data is far and beyond what one is able to process manually. CAATs can be classified into four broad categories (Anantha Sayana, 2003):

- Data analysis software
- Network security evaluation software / utilities
- OS and DBMS security evaluation software/utilities
- Software and code testing tools

This paper will primarily discuss computer tools that extract and analyze data from computer applications (Braun & Davis, 2003). Based on personal experience these tools are different from specialized tools in that they are application independent. Where for instance specific security logging software is geared towards detecting specific threats, these tools tend to be mere containers for the analysis of large datasets. These generic products available under this segment are termed as general purpose audit software, also known in some parts as generalized audit software. (so-called ‘GAS’; Anantha Sayana, 2003). They require knowledge about the software application and challenge the auditor to think out the test or logic to be performed.¹

2.2 Typical users of CAATs

CAATs are applied in a variety of applications. In general one can discern three distinct users with each his own attributes which make the application distinct from the other group. Because of the particular demands of their roles the actual application of CAATs is different. Later in this paper I will explain the effects of materiality, but the external audit, who deals (in large companies) with substantial materiality might not require specific fine detail analysis, as they do not materially impact the group, while it is worth it for an internal auditor to delve into a smaller business unit’s operations. Given that compliance does not know materiality as such, any possible red flag requires inspection.

¹ In this paper we will use the abbreviation CAATs as an acronym for the application of database tools in the audit: Computer Aided Audit Techniques. The first A and last T in the acronym also stand for; assisted and tools.
The table below outlines the three specific types of auditors.

<table>
<thead>
<tr>
<th>Description</th>
<th>External Auditor / Advisor</th>
<th>Internal Auditor</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>The external auditor is an auditor acting as an external party tasked to give his opinion on the financial statements. When the auditor performs services not in the course of offering an opinion on the financial statements, he offers other assurance-related services.</td>
<td>The internal auditor is retained by the organization and therefore can be used twofold: in a capacity of ‘auditor’ or offering services (value added) by which the internal auditor uses his training in a variety of projects. (Revenue assurance, risk, IA, etc.)</td>
<td>The compliance officer is a specific type of governance profession. Currently the vast population of compliance officers have law as an academic background, which sets them apart from the other two types of governance professionals</td>
<td></td>
</tr>
</tbody>
</table>

**Typical roles:**

- Auditor, IT-Auditor,
- Internal Auditor, Operational Auditor, Financial Auditor, IT-Auditor, Risk, Business Analyst
- Compliance officer

### 2.3 Reasons for using CAATs

In this section I will outline what the reasons are for using CAATs. Changes in the expectations of the public on the accounting profession and the growth of computing, has evolved into new regulations. These regulations have not specifically mandated the use of CAATs but they did inevitable point to the direction of substantive testing.

#### 2.3.1 Historically grown reasons for using CAATs

Whether auditing predates the invention of writing (8,500 B.C.) or was first documented by Lucia Pacioli in 1494, modern day accounting is shaped by two major influences:

1) The perception of accounting changes from a function specifically geared to verifying the accuracy for internal purposes, to catering to external stakeholders like government (Sixteenth Amendment (Amendment XVI) to the United States Constitution) and investor’s (Ultramares Corporation v. Touche, Niven & Company, 1931)

2) Of more recent times, the volume of information processing, more precisely the discrepancy between human capabilities and computing power

#### 2.3.1.1 Changes in Accounting

Until the early 1900s the audit was largely devoted to the accuracy of the bookkeeping detail (Cangemi & Singleton, 2003). But in the beginning of the 20th century this started to change en emerge to modern audit practices. The increased liability and regulatory requirements required the auditor to substantiate and document it’s audit work (AICPA, 2002). Additionally the audit firms started offering value added services, some of which were highly analytical.
2.3.1.2 Information growth
Based on industry reports the size of corporate database has grown accordingly, as is illustrated below.

Winter Company does periodical research into the size of very large databases. In the underlying I have listed the top ten Very Large (OLTP) databases ('VLDB') they have taken into their survey. Between 2001 and 2005 the top ten VLDB’s grew 250%.

<table>
<thead>
<tr>
<th>Top Ten Companies with VLDB</th>
<th>2001</th>
<th>2003</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average of DB Size</td>
<td>4.03</td>
<td>7.00</td>
<td>10.17</td>
</tr>
<tr>
<td>Growth over previous survey</td>
<td>74%</td>
<td>45%</td>
<td></td>
</tr>
</tbody>
</table>

Most research in the field of information overload focuses on the interpretation of unstructured data. The main theme of the studies in the area of accounting is the impact of the level of information load on decision quality or accuracy for example regarding budgeting decisions or predictions of bankruptcy (Eppler, 2003). The sheer growth of databases itself poses specific issues for assessing this data. Databases become larger and more complex.

Therefore, I argue that the growth of databases on which any type of auditor or compliance expert has had to pass judgment, has its ramifications on:

1) the risk of unnoticed anomalies,
2) the difficulty of understanding the data contained in the databases,
3) The difficulty understanding the complex of various databases including the interfaces between them.

2.3.2 Regulatory reasons for using CAATs

2.3.2.1 Regulatory reasons for using CAATs
As a reaction on the various changes, governing bodies instituted guiding principles and regulations regarding the use of substantive testing. Some guidelines directly address CAATs, some advice strongly to use substantive testing. Although there is no ‘though shalt use CAATs’ law, various governing bodies have clearly hinted towards the use of CAATs (AICPA, 2002) (AICPA, 2006) (AICPA, 2002) (AICPA, 2001).

2.3.2.2 Financial Audit
Recent audit standards encourage auditors to adopt CAATs in order to improve audit efficiency and effectiveness. In the table below I have outlined some standards and their motives for using CAAT’s

<table>
<thead>
<tr>
<th>Audit Standard</th>
<th>Title</th>
<th>Advise</th>
</tr>
</thead>
</table>
| SAS-94         | The Effect of Information Technology on the Auditor’s Consideration of Internal Control in a Financial Statement Audit (.65) | • Advises on the use of ‘substantive tests  
• Advise to: Auditing around the computer, Auditing with the computer & Auditing through the computer (Cerullo & Cerullo, 2003) |
<table>
<thead>
<tr>
<th>Audit Standard</th>
<th>Title</th>
<th>Advise</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAS-99</td>
<td>Consideration of Fraud in a Financial</td>
<td>• Identifying anomalies</td>
</tr>
<tr>
<td></td>
<td>Statement Audit</td>
<td>• Enhanced testing in order to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>detect</td>
</tr>
<tr>
<td>SAS-96</td>
<td>Audit Documentation (Superseded by SAS-</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td>103)</td>
<td></td>
</tr>
<tr>
<td>SAS-103</td>
<td>Audit Documentation</td>
<td>• Substantive tests</td>
</tr>
<tr>
<td>SAS-106</td>
<td>Audit Evidence (.10, .26)</td>
<td>• recalculate information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inspection of Documents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reperformance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Analytical Procedures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Identifying anomalies</td>
</tr>
</tbody>
</table>

2.3.2.3 Computer Aided Audit Techniques in the IT-Audit

Computer aided audit techniques touch the IT-auditor in various dimensions:

- Proper application of Computer Aided Audit Techniques is addressed in the S14 – Audit Evidence (ISACA, 2006).
- The IT assurance framework section 3600 offers audit approaches, methodologies, and techniques for the performance of assurance work. Chapter 3670 specifically offers guidance on the application of computer aided audit techniques.²
- The complexity of IT-systems containing relevant data is such that the IT-auditor should be consulted about the proper procedures for acquiring the relevant data.
- The complexity of the IT-systems containing relevant data is such that the identification of the appropriate dataset is often up to the auditor to pass judgment on.
- The volume of data in many computer systems demands specialized tooling, which in general is more often within the domain of the it-auditor.
- The IT-auditor is experienced with inspecting logging of IT-systems, a process comparable with the application of CAATs for the financial audit.
- The programming of CAATs should conform to standards similar to software development (quality and transparency of coding, version control, etc), which are standards the IT-auditor is supposed to be familiar with. This point is especially poignant in light of inherent risks with spreadsheets, something the financial auditor is often more familiar with. *The risk of spreadsheets is out of scope in this paper.*

In order to further use of CAATs ISACA has published Auditing Guidance No.3 ‘Use of computer assisted auditing techniques’ (G3).

2.3.2.4 G3 USE OF COMPUTER-ASSISTED AUDIT TECHNIQUES (CAATs)

The G3 standard was enacted on March 1st 2008. The standard addresses two issues:

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² Within the ITAF references are given to COBIT
• The embedding of computer aided audit techniques within the IT audit frameworks
• The procedures and planning-aspects surrounding the application of computer aided audit techniques.

In describing the need for a guideline the standard offers the following argument for using CAATs within the audit: “The use of CAATs can lead to increased audit coverage, more thorough and consistent analysis of data, and reduction in risk.” (ISACA, 2008)
3 What are current experiences on the use of CAATs

3.1 Prior Research

3.1.1 Research Opportunities in Internal Auditing
In the 2003 Research Opportunities in Internal Auditing Anderson states that ‘a trend of organizations to form strategic alliances and advancements in technology has led to a significant increase in the interconnectivity of organizations. As these trends continue and e-commerce becomes a fundamental way in which organizations operate, there will be increasing demands for assurances of the quality of computer systems, information security, controls over privacy of data, and quality assurance practices’ (Anderson, 2003). Later in the conference (Ramamoorti & Weidenmier, 2003) expand on this argument to build the business case for Computer Aided Audit Techniques. CAATs would meet the demands of intense competition, increasing productivity, (cost) efficiency, and information requirements.

“While some auditors view CAATs as a way to automate manual tasks, to truly add value to the organization, (internal and external) auditors need to shift to a new paradigm that redefines CAATs as “Computer Aided Audit Thought Support” (Will, 1995). This paradigm views CAATs as freeing auditors from manual/routine tasks so they can focus on exercising judgment and thinking critically. For instance, neural networks can be used to evaluate soft business information and data generated by management’s judgments (AICPA/CICA, 1999). The interactive, real-time nature of CAATs, especially GAS, allows auditors to quickly evaluate results, adjust initial audit plans, and test new hypotheses improving the effectiveness and efficiency of assurance and consulting services ....”

Later in this paper I will argue that CAATs as such do not free the auditor, as it cannot replace the expert knowledge about the control environment, nor can CAATs interpret anomalies which in essence are all a CAAT reports.

3.1.2 Unified Theory of Acceptance and Use of Technology
The assumption that based on the above, CAATs are applied widely within the various parts of audit does not find support in various research. Recent research suggests that CAATs acceptance is fairly low and varies among firms (Liang, Lin, & Wu, 2001) (Debreceny, Lee, Neo, & Toh, 2005) (Curtis & Payne, 2008) (Kalaba, 2002).

To grasp the reasons for suboptimal usage of CAATs (Curtis & Payne, 2008) (Janvrin, Lowe, & Bierstaker, 2008) and others point to the Unified Theory of Acceptance and Use of Technology as a model to explain usage of CAATs. (Venkatesh, Morris, Davis, & Davis, 2003)

The UTAUT aims to explain user intentions to use an IS and subsequent usage behavior. The theory holds that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of usage intention and behaviour (Venkatesh et. al., 2003). Gender, age, experience, and voluntariness of use are posited to mediate the impact of the four key constructs on usage intention and behavior. The theory was developed through a review and consolidation of the constructs of eight models that earlier research had employed to explain IS usage behaviour (theory of reasoned action, technology acceptance model, motivational model, theory of planned behavior, a
combined theory of planned behavior/technology acceptance model, model of PC utilization, innovation diffusion theory, and social cognitive theory). Subsequent validation of UTAUT in a longitudinal study found it to account for 70% of the variance in usage intention. (Furneaux, 2005)

![UTAUT Research Model](source: Venkatesh et al. (2003))

(Curtis & Payne, 2008) Argue that the use of CAATs is will increase if the auditor can spread out the application over a longer period of time (three years). Additionally the influence of superiors, risk appetite and budget pressures do influence the deployment of CAATs.

3.2 Interviews
I have conducted five extensive interviews with in total 8 people and eight smaller interviews on specific topics in order to assess the current experiences with computer aided audit techniques or with the ability of auditors (people in general) to comprehend aspects of the CAAT usages. Most people interviewed have gained extensive experience in the external audit practice, in general with one of the Big Four accountancy firms. Based on these interviews I have distilled the top drivers (positive or negative) for using CAATs.

In the assessment I have specially focused on the process of using CAATs, more than the actual technical application or specific examples in which a specific application of a CAAT turned out to be relevant.

The topics are put in logical order and do not necessarily reflect the level of importance, nor was there any data collected which would allow for research in such a classification.

3.2.1 Materiality & independence
All interviewees pointed out that the ability for CAATs to work on a low level of detail (actual database records) allows for the tool to be potentially extremely powerful, but effectively to detailed to yield effective results with substantial levels of materiality. One clear example given was the verification of payables in the car-lease company, which yielded a substantial increase in revenue on a business unit
level. By the time the company was reconciled within the large financial conglomerate it was part of, all gains and entries for the management letter were washed away with bigger ticket items.

This argument does not hold with internally based auditors or compliance related topics where materiality is less of an issue or is not an issue at all. CAATs turn out to be specifically useful when detail is relevant (which more often is the case in value added services (revenue assurance) than in the external audit.)

Interviewed also mentioned the risk for firms who have a audit relationship in performing CAATs, as certain CAATs applications can be perceived as ‘revenue assurance advice’. Many obvious CAAT-applications which are introduced in audit guidance’s can easily turn into revenue assurance applications, like a test for ‘Unsupported or unauthorized balances or transactions’ (AICPA, 2002).³

In interviews conducted with experts employed in the compliance function it was pointed out that the lack of materiality as a concept caused information overload to be such an issue (after all everything needed to be looked at) that the practicality of using any form of substantial testing disappears quickly in general compliance audits.

3.2.2 Tone at the Top
Two different interviewed parties mentioned tone at the top as a slightly negative influencer in the decision to apply computer aided audit techniques. Interestingly the two influences were of a different paradigm. One party was tasked to introduce CAATs as an advanced method of weeding out fraud of compliance issues, but the mismatch between the expectancy of management and the ability to integrate CAATs in the day to day operation caused a management of expectations issue, therefore management support eventually turned against the introduction of CAATs. The other party mentioned that ‘old-style’ accountants who were not interested in modern techniques would block the introduction of CAATs as they felt uncomfortable with it. All interviewed agreed that without proper tone at the top the introduction on CAATs is doomed per definition, but having the right tone at the top does not necessarily predict a successful outcome.

3.2.3 Perceptions surrounding CAATs
Distinct from perceptions by management or superiors in interviews, experts in CAATs also pointed out the perceptions of computer aided audit techniques held by team members which hamper the use of CAATs in general. Among the frequently mentioned perceptions are:

- To time consuming
- Excessively steep learning curve
- Just as efficient to use current toolset (incl. professional judgment)

Even though some of these arguments with respect to CAATs are addressed in different context, the mere fact that these barriers are raised is poses an issue in itself. A ‘marketing issue’.³

³ The author has personal experience of this occurring.
3.2.4  Education & Training in CAATs
All interviewed pointed towards the lack of training and familiarity of the auditor with CAAT’s. The training mend was for IT-auditors to understand the financial audit and for financial auditors to understand the IT environment and IT-Audit. IT & Financial Auditors who were active in financial compliance pointed out IT-illiteracy of the compliance profession at large. As a consequence, the application of CAATs has led to many misunderstandings.

In general internally based auditors have more knowledge about the audit object; therefore they tend to appear more knowledgeable. Interviewees complain that very few auditors are able to work on an intellectual level which should be expected of them. During training many students ask for checklists, ranging per degree from 50-95% (interviewed source). The desire of auditors to do things they are used to. Follow the beaten path. The quality of the audit degree and time spent on relevant issues like, IT.

3.2.5  General Audit knowledge
Although this paper does not address the capabilities of auditors at large, given the level of detail CAATs are capable of analyzing on, any gap in audit knowledge or the incapacity to properly gauge the typology of an organization does cause issues in utilizing CAATs in audit.

Interviewees also affirmed the general observations of the PCAOB on auditors’ implementation of SAS-99 (PCAOB, 2007) and interview candidates recognize this as a general behavior. In this report: “PCAOB inspection teams ... observed, however, that auditors often document their consideration of fraud merely by checking off items on standard audit programs and checklists. PCAOB standards require additional documentation evidencing the actual performance of certain of the procedures outlined in those programs and checklists.”

3.2.6  Need for efficiency
The need for checklists addressing the auditable object is generally explained as the need for efficiency of the audit. “Efficiency is the model of choice for accounting firms; efficiency is not achieved by thinking creatively”. The desire for productivity & efficiency causes working based on instructions.

3.3   Summary and conclusion of current experiences on the use if CAATs
Where (Curtis & Payne, 2008) and (Janvrin, Lowe, & Bierstaker, 2008) aim to explain the use of CAATs by following the UTAUT model, interviews with people in the field give reason to suspect that prerequisites for using CAATs as defined as general audit knowledge (experience) or facilitating conditions which are not directly linked to the tooling itself (they are in effect indirect determinants) but are ‘business’ drivers might have a far greater impact on the suitability for using CAATs.
I therefore propose to move away from the UTUAT model and move more towards a capability or maturity model, which contains a structured collection of elements that describe relevant aspects of an organization in order to assess the applicability of a required level of CAATs or to aid in the understanding of certain gaps.
4 What effort does one need to put in to achieve optimal use

4.1 Model
In order to measure the state of an organization tasked to perform software development, Carnegie Mellon’ Software Engineering Institute\textsuperscript{4} developed a maturity model. This model identifies five states or levels of an organization (CMMI Product Team, 2009):

1. Ad hoc (Chaotic)
2. Repeatable
3. Defined
4. Managed
5. Optimizing

In shaping this model I have built upon two well-known and proven maturity models.

Based on this maturity model two of them were devised which are proper inputs for us to describe the state of CAATs, Thomas Davenport’s model published in Competing on Analytics (Davenport & Harris, 2007) and Wayne Eckerson’s model to ‘Gauge your Data Warehouse Maturity’ (Eckerson)\textsuperscript{5}

4.2 Analytics Maturity Model
In 2006 Thomas Davenport published his article ‘Competing on Analytics’ in the Harvard Business Review, followed by the publication of his book with the same title in 2007 (Davenport & Harris, 2007). The book is split in two parts: ‘The Nature of Analytical Competition’ and ‘Building an Analytical Capability’. The second part of the book offers a model for qualifying the maturity of analytical capabilities in a company, using three main categories: Organization, Human, and Technology. These three main categories are the grouping mechanism for a couple of key elements:

- **Organization**: insight into performance drivers, choosing a distinctive capability, performance management and strategy execution, process redesign and integration

- **Human**: leadership and senior executive commitment, establishing a fact-based culture, securing building skills, managing analytical people

- **Technology**: quality data & Analytic technologies

\textsuperscript{4} The first maturity models were described earlier, like in “Watts (1989). Managing the Software Process. Massachusetts: Addison-Wesley Professional. ISBN 0-201-18095-2.” Still the CM SEI’s version is widely assumed to be the mother of all maturity models.

\textsuperscript{5} There is a fair amount of debate on the applicability of Maturity Models, specifically the SEI’s. The most known arguments are: the lack of formal theoretical basis, focus on process instead of effect of people, institutionalization of process for its own sake, and the lack of process dynamics. Additionally there is an abundance of literature on effective and successful technology development in ‘low range’ Maturity companies. For more documentation on this issue I refer to among others (Terry B. Bollinger, 1991) (O’Connel & Saidian, 2000). I nevertheless choose to use a maturity model as it offers a usable framework for heuristics.
‘Many of us have managed data warehousing projects for years. Some have delivered highly strategic systems that are treasured by users and valued by top executives. But others have struggled to sustain interest and funding in their data warehouses even though users are crying out for better, more accurate information’ (Eckerson, 2007). Based on this premise Eckerson developed a maturity model for Data Warehouses. His model recognizes the following characteristics:

- scope,
- analytic structure,
- executive perceptions,
- types of analytics,
- stewardship,
- funding,
- technology platform,
- change management and,
- administration

I observed that the Davenport’s model is more opportunity driven and less based on actual experience. Additionally, Davenport focuses strongly on the business and environmental drivers (organization and human) over Eckerson’s model which places heavy emphasis on technical requirements (Technology platform, Change management, and administration). Eckerson’s model leaves more room for movement in the beginning stages of his model and he splits his model in three distinctive phases, by identifying a gulf (between infant and child) and chasm between teenager and adult). Eckerson therefore implicitly addresses the common critique of many that most successful companies are stuck in the low zones of SEI’s model (see also footnote 3). Eckerson’s model is focused on the actual (technical) Data Warehouse while for Davenport to proof his case; he needs to show gain much more on the effective analytics of business data.

### 4.3 The CAATs Maturity Model

Built upon related disciplines, as discussed above, I propose a model which during the course of writing this paper I have discussed with various experts in the field of Internal Audit and Compliance. In the table below I have drawn the model, and in the next coming paragraphs I will elaborate on this model.

1) I will detail each phase and each influencer
2) I will analyze the critiques mentioned in the interviews.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Management Sponsorship</th>
<th>People, Culture</th>
<th>Control Environment</th>
<th>Problem set / Metrics</th>
<th>Audit Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ad Hoc</td>
<td>None</td>
<td>Allergic for numbers</td>
<td>Incidental addressing of control issues</td>
<td>Ad-Hoc, limited</td>
<td>None</td>
</tr>
</tbody>
</table>
### 4.3.1 The stages

The various stages of this model relate to different maturity levels or stages in the development of CAAT’s as a standard application in the organization. Although the measure is frequently used to gauge the overall state of the organization, the level and/or influencer combination can be fine-tuned with the complete organization. For instance, it may well be that a specific business unit of a company has a (very) analytically inclined manager in a line of business which has clear metrics, while the overall company is less mature.

In the interviews, I also noted stark differences between compliance and internal audit or internal audit (and the application of CAATs) and embedded monitoring (integrated in the MIS of the actual business).

In order to give a concrete application to each stage I have accompanied each stage with a practical example for the IT-Auditor.
4.3.1.1 Ad Hoc

The Ad Hoc state is characterized by a discrepancy between the understanding of the control environment and the actions to be performed. Often tasks are performed: ‘because that’s how it is’ while the staff carrying out that task do not fully understand why or what the underlying systems do. It is therefore difficult to ask questions beyond the normal day-to-day operations. Typically few subject-matter experts devise complicated spreadsheets\(^6\) for pricing or margin calculations. These spreadsheets cannot always be transferred to other personnel to replace the subject matter expert who might be unavailable.

In the Ad Hoc state causes every issue is ‘new’ and needs to be rethought out or recalculated. This is time consuming and prone to errors as different iterations might very well be based on different data definitions.

4.3.1.1.1 Implications for the IT Auditor

In the ad-hoc state the IT-Auditor needs to fully comprehend the underlying request and processes before embarking on any analysis, without the help of trustworthy documentation. Not doing so will inevitably lead to disappointments as the auditor might not be able to generate the requested information from the available data. In this state one often finds (as an example) overly complex spreadsheets, mixing data with calculations, so difficult to understand, that issuing a confirmation on the accuracy of the underlying data or calculations is questionable.

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\(^6\) In order to give a fair depiction of the business climate which one encounters in these stages I have used spreadsheets as the exemplary tool. It is entirely possible the toolset used in these businesses is a different one.
4.3.1.2 Repeatable / Managed
The repeatable stage sets is different from the ad-hoc stage because works are generally performed under commonly agreed operations. Users till lack sufficient understanding to withstand more thorough questioning about the underlying reasons for specific calculations. They therefore cannot judge the implications of possible shortcuts, errors or anomalies. This stage is similar to “The organization uses informal control reports to initiate corrective action initiatives. Internal control assessment is dependent on the skill sets of key individuals.” (ISACA ME2, Monitor and Evaluate Internal Control). Whereas in the ad hoc stage few people command vast knowledge on a specific process, in the repeatable phase spreadsheets are often a vital part of material processes. The spreadsheets present some indication of repetition according to prior behavior, but generally do not carry a stamp of approval of any authoritative body.

4.3.1.2.1 Implications for the IT Auditor
The IT-auditor encountering such an environment will probably be able to define the required data needed for answering the question at hand, but he might consult with his superiors to what extent he can rely on the underlying assumptions, the application of the correct version of the used spreadsheets. It is therefore warranted for the superior to consider circumventing the used calculation to use more reliable data for re-performance.

4.3.1.3 Defined
The defined stage characterizes itself by having procedures in place that guard not only that repeating processes occur in the same fashion, but the processes are defined or documented, “Management .. institutes internal control monitoring” (ISACA ME2). The processes tend to be defined in static systems, meaning the systems do not easily allow for tweaking or alteration.

This typically becomes apparent in situations where extended reporting is requested for incidental issues. A good example is the introduction of balanced scorecards which drive bonus structures. The defined state of the underlying transactional processing system and possibly the feed from such a system into accounting packages are generally well defined and documented, but the add-on in effect is ad-hoc or repeatable at best.

An additional issue in defined situations is the false sense of security that can occur when a situation is defined. Once the auditor lives under the perception that the situation is defined, therefore audit is repetitive, bypassing the procedures can go unnoticed.

4.3.1.3.1 Implications for the IT Auditor
Auditors in such an environment should be able to audit the general or main processes as they are defined and controllable. Auditors should be careful not to bypass basic risk assessments as things might have changed which are not yet reflected in the documentation or procedures as there is a risk for outdated procedures.

4.3.1.4 (Quantitatively) Managed
When organizations are able to utilize their transactional environments in order to produce reliable reporting which can be used to use in multiple dimensions and possibly drive triggers which warn when
certain thresholds are passed one speaks of a quantitatively managed system. Examples of such system range from hotel room or airline seat booking systems, to chemical production systems which trigger a warning as soon as certain safety measures are not adhered too. In the financial services industry these systems generally are able to display live credit ratings or risk appetite vs. portfolio exposure for each client. “The organization establishes tolerance levels for the internal control monitoring process.” and “a metrics knowledge base for historical information on internal control monitoring is established” (ISACA ME2). Functionality of these systems can be set up to warn for possible control aberrations. The systems have defined rules to warn for thresholds.

4.3.1.4.1 Implications for the IT Auditor

IT audit staff regularly participates in control assessments or audits whether data (or interfaces) conforms of previously defined standards so not to supply data which will bypass standardized triggers. Additionally the auditor should asses the value of the metrics knowledge base to asses risks arising from a false sense of security.

4.3.1.5 Optimized

Optimized systems introduce the predictive modeling systems (for instance data mining) into the control or governance systems. Here rules are not necessarily fed into the systems at first but via complicated logic the system either proposes its own logic or it is being trained by feedback from prior warnings. These systems are pioneered in (financial products) trading and predictive fraud warning systems.

The challenge of understanding these systems lies in the difficulty of the underlying engines.

Given the complexity of the financial markets risk warning systems have for long experimented with predictive models. Shortly after LTCM’s collapse\(^7\), in Merrill Lynch wrote in their 1996 annual report; ‘MANAGEMENT’S DISCUSSION AND ANALYSIS’ under section ‘Market Risk’:

“Merrill Lynch believes that the use of mathematical risk models alone may provide a greater sense of security than warranted and therefore reliance on these models should be limited. In fact, because of the inability of mathematical risk models to quantify large-scale potential financial events with any precision, Merrill Lynch only employs these models to supplement other risk management efforts.” (Merrill Lynch, 2002)

4.3.1.5.1 Implications for the IT Auditor

In auditing these systems, the auditor needs a thorough understanding of the engine and the applied methods. As the complexity of these models often surpasses the complexity of the single product or

\(^7\) Long-Term Capital Management (LTCM) was a U.S. hedge fund which used trading strategies such as fixed income arbitrage, statistical arbitrage, and pairs trading, combined with high leverage. It failed spectacularly in the late 1990s, leading to a massive bailout by other major banks and investment houses, which was supervised by the Federal Reserve. Initially enormously successful with annualized returns of over 40% (after fees) in its first years, in 1998 it lost $4.6 billion in less than four months following the Russian financial crisis and became a prominent example of the risk potential in the hedge fund industry. The fund folded in early 2000. (Wikipedia)
transaction assessed in those systems, extensive analysis needs to be done on quality and sturdiness of
the model.

4.3.2 Phases within stages
Within these five stages of the proposed maturity model we distinguish three phases. Within each phase
the paradigm for audit is unique.

4.3.2.1 Data Quality
In the first two stages, it is the auditor’s responsibility to provide assurance for the correctness of the
primary registration. In effect it is the container which is the object in question. Systems (if one can call
the applications encountered in such an environment) often lack basic controls, documentation or other
essential requirements for assurance.

4.3.2.2 Governance Control
Once essential general application controls can be guaranteed, the actual audit of the data in question
can be performed.

4.3.2.3 Governance Analytics
In the analytics phase the paradigm is not the container, nor the data, but the calculations which are
being performed around them. While in the control phase the business rules are fairly easy to
comprehend, in the analytics phase the actual execution of the model is the auditable question.

4.4 The influencers

4.4.1 Management Sponsorship
Management sponsorship is the support given to any objective. Sponsorship can be articulated in a
variety of forms, special earmarking of projects or budgets is a tangible form of sponsorship (push from
management), by asking for analytical analysis a certain tone at the top is set which can also be
considered sponsorship (pull from management).

The G26 Business Process Reengineering (BPR) Project Reviews defines sponsorship issues as:

- CEO not supportive
- Insufficient top management commitment
- Management skepticism
- Wrong executive leading the effort
- Wrong members on the design team
- Poor communication of importance

All interview candidates agreed that negative support is a definite predictor the possible success of
CAATs in any organization, while positive support does not guarantee the eventual execution of CAATs
to be optimal.
4.4.2 People, Culture
People and culture addresses the relevant stakeholders of CAATs, the experts using CAATs as well as the people who are supplied CAATs based reports.

Are they analytically inclined, can they read reports? Can they address or mentally filter for issues as false positives and false negatives within any report? These are questions which fall under the umbrella of people & culture.

The G26 Business Process Reengineering (BPR) Project Reviews defines skill issues as:

- Insufficient exploration of new ideas
- Absence of out-of-the-box thinking
- Closed to new ideas
- Design misconceptions
- Cultural change not calibrated to organization
- Inadequate consideration of human resource issues
- Beyond the ability of IS department to support

4.4.3 Control Environment
Control environment is the basket attribute for:

- Regulatory Control
- Typology / Internal Control / etc. (incl. typology)
- IT Control

COSO defines internal control as a process, affected by an entity’s board of directors, management and other personnel. This process is designed to provide reasonable assurance regarding the achievement of objectives in effectiveness and efficiency of operations, reliability of financial reporting, and compliance with applicable laws and regulations.

Whether internal control is considered a process or not is not within the scope of this paper, what can be assumed is that to execute internal control, a clear definition of the environment needs to be established.

4.4.4 Problem set / Metrics
To have some form of internal control or a control framework does not necessarily mean CAATs are the tool of choice, one might call this ‘translation issues’. In many situations the proper application of CAATs (or a more specific type of CAATs) is related to the auditable object. ‘Translation issues’ can occur because of a variety of reasons:

- The objective does not lend itself for simple tests for example:
- The Netherlands Authority for the Financial Markets has guidance on churning\(^8\) if the regulator considers the turnover of a portfolio to be such that commissions spoil the possible return on investments, the regulator will consider this in light of the applicable laws. However easy one might consider testing on turnover, as soon as the account on which the portfolio is stored (the bank account) is also used for regular checking purposes or one uses protective measures for its portfolio (option-like products). The actual guidance to calculate the possibility of churning becomes extremely difficult to use as a ‘simple test’
  - If the audit object is not stored in databases for instance:
    - When customs or incise documents need to be verified for stamps in order to allow for tax or vat deductions on the underlying product, manual inspection and sampling is a much more efficient approach.

### 4.4.5 Audit Technology

All interviewees agree that this is, barring technical causes as extremely difficult calculations or large datasets, the least defining attribute. ‘It is not the camera, but the composition of the picture which makes it a perfect shot’ as a photographer told me.

Nevertheless there is good reason to use audit technology and in certain situations specific tools are a basic requirement to complete the required analyses.

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\(^8\) [http://www.afm.nl/marktpartijen/upl_documents/beleidsregel_churning_0204.pdf](http://www.afm.nl/marktpartijen/upl_documents/beleidsregel_churning_0204.pdf)
5 Conclusion

In writing this paper I set out to answer:

Which factors predict the chances for optimal application of CAATs? (In a given organization)

In doing so I developed a model which assess the usability of CAATs to be applied in an organization, based on 5 attributes. By assessing these factors one can improve on specific attributes in order to achieve optimal use.

What are current experiences on the use of CAATs?

CAATs are used in the organizations I audited, but the abundance of regulatory advice is not the main focus of use. The external audit practice (IT or Financial) contains inherent issues which hamper the optimal use, while the internal audit practice has a certain scope and expertise of the internal organization (at least the ability to get the know the organization) in order to use CAATs as efficient as possible.

Prior research seems to suggest that CAATs introduction should be analyzed along the lines of as regular IS Research; interviews with experts in the field tend to warn for ‘prior constraints’ such as understanding of the audit object, knowledge of control environments, and the proper application of CAATs.

The model proposed in this paper is more aligned with the audit profession than with IS research and addresses attributes which are part of the audit environment. As one interviewed said:

“The application of CAATs are tools for standard analysis, it all depends on people”
6 Bibliography


ISACA. (2008). *G3 USE OF COMPUTER-ASSISTED AUDIT TECHNIQUES (CAATs)*. Rolling Meadows, IL: ISACA.


