The Acceptance and Adoption of Continuous Auditing by Internal Auditors: A Micro Analysis

Miklos A. Vasarhelyi, **Michael Alles, Siripan Kuenkaikaew**, Rutgers Business School

James Littley, KPMG

Working Paper

Abstract:

The umbrella of "advanced technology" covers a range of techniques widely used in the U.S. to provide strategic advantage in a very competitive business environment. There is an enormous amount of information contained within current-generation information systems, some of which is even processed on a real-time basis. More importantly, the same holds true for actual business transactions. Having accurate and reliable information is vital and advantageous to businesses, especially in the wake of the recent recession. Therefore, the need for ongoing, timely assurance of information utilizing continuous auditing and continuous control monitoring methodologies is becoming more apparent. To that end, we have conducted interviews with 22 internal audit managers and 16 internal audit staff members at 9 leading internal audit organizations to examine the status of technology adoption, to evaluate the development of continuous auditing, and to assess the use of continuous control monitoring. We found that several companies in our study were already involved in some form of continuous auditing or control monitoring while others are attempting to adopt more advanced audit technologies. We also made a large number of surprising observations on managerial, technology training and absorption, and other issues. Within the According to the audit maturity model (Vasarhelyi et al, 2009), all of the companies were classified between the "traditional audit" stage and the "emerging stage", not having yet reached the "continuous audit" stage. This paper, to our knowledge, is the first to study CA technology adoption in a micro level by an interview approach.

1. Introduction

> *"Continuous auditing is a progressive shift in audit practices towards the maximum possible degree of audit automation as a way of taking advantage of the technological basis of the modern firm in order to reduce audit costs and increase audit automation. Given the emphasis on the transformation of the entire system of auditing, the development of CA requires a fundamental rethink of all aspects of auditing, from the way in which data is made available to the auditor, to the kinds of tests the auditor conducts, how alarms are dealt with, what kinds of reports are issued, how often and to whom and many other issues, the importance of some of which will only become apparent as CA is implemented. It is important for the profession and other stakeholders to start thinking about the impact of CA on auditing now, when it is easier to put in place the foundations for this change rather than when technologies and practices have already become established."* Vasarhelyi et al (2010)

Continuous auditing (CA) is a methodology that enables independent auditors to provide written assurance on a subject matter using a series of auditors' reports issued simultaneously with, or a short period of time after, the occurrence of events underlying the subject matter (CICA/AICPA, 1999). In order to achieve its goal of reducing the latency between the occurrence of the business transaction and the provision of assurance on that transaction, continuous auditing relies heavily on such information technologies as ERP systems, data analysis and business intelligence softward, web application server technology, web scripting solutions and ubiquitous database management systems with standard connectivity (Sarva 2006).

Alles et al (2008) indicate that CA has moved over the last two decades from an academic vision (Vasarhelyi and Halper, 1991; Groomer and Murthy, 1989) to a vibrant and growing area of audit practice. Given the technological basis of CA, perhaps the best metric of the increasing acceptance of continuous auditing as an audit methodology is the nearly 100,00 hits that the term generates on Google (as of July 1, 2010)—more than double the number of hits returned just a year earlier. Practitioners and software vendors (such as SAP, ACL, Caseware, Approva and Oversight Systems) now outnumber academic researchers as attendees at the biannual global CA conferences organized by Rutgers University in the USA. Brown et al (2007) undertake a survey of more than sixty research papers into various aspects of continuous auditing.

The most striking confirmation of the importance and impact of CA on audit practice came from a set of surveys in 2006. A PricewaterhouseCoopers survey from June of that year finds that: *"Eighty-one percent of 392 companies responding to questions about continuous*

auditing reported that they either had a continuous auditing or monitoring process in place or were planning to develop one. From 2005 to 2006, the percentage of survey respondents saying they have some form of continuous auditing or monitoring process within their internal audit functions increased from 35% to 50%—a significant gain."[1]

A similar survey jointly undertaken by ACL and the Institute of Internal Auditors also shows that interest in CA is increasing rapidly, with 36% of responding firms stating that they have adopted a continuous auditing approach across all of their business processes or within select areas, and with another 39% planning to do so in the near future. The latter survey concludes: "*Whatever the reasons organizations may have had for neglecting continuous auditing in the past, regulatory demands, the push for real time financial reporting and the drive to automate resource draining manual audits are nudging them to adopt it now."*[2]

While these surveys provide evidence on the growing acceptance of continuous auditing, the macro-level nature of the surveys does not allow a full understanding of how precisely the survey subjects are implementing CA and the challenges and opportunities that these firms face when doing so. Moreover, continuous auditing is a concept rather than a well defined technological tool or practice and hence it is not clear what the responding firms actually mean when they say that they "*had a continuous auditing or monitoring process in place"* or the extent to which they have *"adopted a continuous auditing approach across all of their business processes"*.

The purpose of this paper is to undertake a micro-level study of the state of adoption and implementation of continuous auditing systems by internal auditors. Such an in-depth examination of how auditors actually perceive and use an emerging technology is meant to provide guidance to both audit practitioners and researchers about how CA is evolving as what was once a purely academic concept meets the reality of business. Despite the greater insights that they potentially provide, micro-level studies are less common that macro-level surveys because of the inherent difficulty in getting access to users and obtaining their cooperation. Thus the contribution we make is the unique degree of access we were able to obtain with internal auditors at some of the leading corporate users of continuous auditing systems.

[1] Available at: CFO.com, June 26, 2006.
[2] Business Finance Magazine, August 1, 2006. Available at: http://businessfinancemag.com/article/upfront-continuous-auditing-ready-prime-time-0801

This paper is one output of a major research program undertaken between the Continuous Auditing and Research Laboratory (CARLAB) at Rutgers Business School and its sponsor and partner, KPMG, whose aim was to obtain a 360-degree view of the state of the art of CA, encompassing its use by both external and internal auditors. This particular paper focuses on how CA is being implemented by internal auditors at firms known to be pioneers in its use. Thanks to the involvement of KPMG, as well as the Rutgers CARLAB's own contacts, the research team had privileged access to senior members of the internal audit departments of nine leading global businesses. We interviewed 22 internal audit managers and 16 internal audit staff from these companies using a detailed interview guide to obtain in depth and comparable information about how these internal auditors perceive the usefulness of CA, its ease of use and its costs and benefits.[3] From our interview results, most CA implementations remain in the preliminary phrases. By identifying the drivers and barriers that affect the adoption of continuous auditing and continuous control monitoring in organizations, we hope we provide a better understanding of the stage of development and usage of the methodology.

Section 2 explains the methodology of the field study. Section 3 provides a discussion of relevant research literatures, which leads the construction of the interview guide and the audit maturity model that is used to frame the discussion of the results of the interviews. Section 4 discusses our results, while section 5 offers concluding comments.

2. Motivation and Methodology

Our objective in this paper is to understand the current state of the art in continuous auditing adoption by internal auditors. As discussed in the Introduction, much of the information on this subject has come up to now from non-academic large scale surveys conducted by external audit firms or software vendors. Their methodology and the impact, if any, of their vested interests are hard to discern in their published reports.

It is even harder to assess what their conclusions imply. From our own experience working in very large companies in which a small scale CA project is undertaken by one group of internal auditors in one part of the business, it is not at all clear what response would be given by someone asked to fill out a CA survey in another part of the company, especially if that

[3] It should be emphasized that KPMG is not the external auditor at any one of our subject businesses.

respondent is in another geographic or functional area. An emerging methodology such as continuous auditing is particularly vulnerable to such constraints in information awareness within large organizations.[4] Certainly the degree of adoption revealed by the PwC and ACL/IIA surveys were surprisingly high, and based on the estimates of the rate of implementation, should be significantly higher by now, some four years later.

Our motivation for conducting this field study is not that we consider the survey results to be inaccurate, but rather, that they focus only on the big picture of awareness of CA and not the details, of how that awareness translates into an impact on internal audit practice. That information cannot be obtained by a generic survey and instead must be gathered by an onsite inspection and by detailed interviews with the internal auditors who actually implement and use the CA systems. Of course, field based research is no cure-all, and as with survey based research suffers from limitations, in this case, with sample selection and generalizability. On the other hand, it potentially provides far richer information and a more detailed understanding than alternative research methdologies (Clegg et al., 1997).

Our study examines the status of continuous auditing and monitoring adoption in leading edge organizations through directed interviews with internal auditors, internal audit management, and IT internal auditors applying technology related to continuous monitoring. A semi-structured interview provides a means of identifying and understanding individual viewpoints, attitudes and influences. Interviews were conducted face-to-face through site visits and lasted at total of at least 3 to 4 hours per company. Interviewees were selected from the internal audit department. A minimum of four employees were interviewed per organization to ensure validity, information completeness, and a range of points of view. In addition, to ensure objectivity, more than one interviewer conducted the interviews and results were analyzed simultaneously (Troshani and Doolin, 2005).

Given that this is a small sample field study, as opposed to one confined to a single site, it was essential to achieve consistency across the interviews. This was accomplished through the use of a master interview guide. Obviously, such a guide cannot be applied in a mechanical fashion to each and every interviewee in the way a survey instrument can. On the other hand, it

[4] To put this problem into an academic context, consider how a business school professor would respond if they were asked to assess for a survey, on the one hand, the extent of adoption of Windows XP in their university, and on the other, some specialized software used only by researchers in the biochemistry department. Our priors are that CA is closer to the latter example than the former, though obviously, determining that is the point of the survey in the first place.

was truly a guide and not a constraint, and served as a floor on the scope and coverage of the conversations with the internal auditors and not a ceiling. The guide also served as a medium for crystallizing the research objectives of the study by having its content shaped by a wide ranging survey of the literature on technology adoption and acceptance.

The sample of firms used in the study was chosen by the researchers in collaboration with KPMG on the basis of two criteria: that they were anecdotally considered to be experienced users of CA systems and that they spanned a broad range of businesses. Thus the sample consisted of an insurance company, two banks, two technology firms and four consumer goods companies. In addition, one of the banks is entirely based outside the USA. These firms are obviously not randomly chosen, but the aim here is not to analyze firms that use CA versus those that don't, but rather to study in depth the experiences and motivations of the firms that have adopted CA.

3. Technology Acceptance and Adoption

3.1 The TAM Model and the Construction of the Master Interview Guide

Our objectives in this paper are to understand the factors that shaped the acceptance of continuous auditing as a new methodology in internal auditing, and to provide some perspective for our results through developing a metric on the degree of adoption of the technology. Achieving these two goals requires us to draw on several strands of the research literature that examine the reaction of users to new technologies.

The most widely used paradigm for studying the acceptance of technology is the Technology Acceptance Model (TAM), first proposed by Davis (1985, 1989), and which is the subject of over 700 subsequent published research papers (Bagozzi, 2007). The TAM model assumes that acceptance is driven by the user's attitude towards the technology and that attitude is a function of its perceived usefulness (PU) of the technology and the perceived ease of use (PEU) of the technology. Davis (1989) defines PU as *"the degree to which a person believes that using a particular system would enhance his or her job performance",* while PEU is defined as *"the degree to which a person believes that using a particular system would be free from effort"*.

While there have been numerous variations of this basic model, PEU and PU remain the essential drivers of the TAM. Davis's (1985, 1989) model was intended to be applied, however,

and not remain a theoretical construct, and the hundreds of papers that have followed have used the TAM framework to examine numerous technologies, including email programs, voice mail, operating systems and office productivity software (Lee et al, 2003; Legris et al, 2003). Some of the criticisms leveled at this research are that it relies too heavily on students as subjects and that it depends largely on self-reported behavior, which may not correspond to actual usage of the technology (Chuttur, 2009).

While the TAM model is clearly relevant to our examination of continuous auditing, we cannot apply it in the standard way that it is has been in the TAM literature. Most applied TAM papers are essentially surveys of hundreds of users of a very specific technology, with numerous overlapping questions used to obtain measures of PU and PEU. Thus, Davis (1989) examined the attitude of 112 IBM employees to an email program by asking them 10 questions related to PU and another 10 on PEU. His questions on PU included *"Using electronic mail improves the quality of the work that I do"* and *"Overall, I find the electronic mail system useful in my job",* while the PEU questions ranged from *"I find it cumbersome to use the electronic mail system"* to *"Overall, I find the electronic mail system easy to use"*.[5]

Given that the strength of our approach to studying CA acceptance is the opportunity to talk in depth with CA users, the use of such a mechanistic set of questions to assess PU and PEU would have been counterproductive. Indeed, that approach would have been better suited for the kinds of surveys of CA use that we are trying complement rather than replicate. Moreover, a fundamental difference between CA and the kinds of technologies that have been examined in the TAM literature is that CA is an emerging business practice and not a particular piece of software. While there are indeed CA-related products, such as ACL or Approva, our objective is not to study their implementation in particular, but rather, how internal auditors perceive the set of technologies and audit practices that comprise continuous auditing, and which together differentiates CA from the standard way in which internal auditing has been carried out. Not having a specific product makes it much harder to ask the detailed, overlapping questions of the sort that the TAM literature relies on for obtaining data and conducting its statistical analyses.

[5] Looking back at Davis (1989), after 20 years, makes one realize that the "acceptance" that he is examining has to be put into context and is entirely relative to its time and place. Who, today, would bother to ask such questions about something that is so taken for granted as email? There is a lesson there, perhaps, for CA too if one looks forward sufficiently far ahead.

Hence, while we remain faithful to the spirit of the TAM model, and in particular, with having PE and PEU as the drivers of technology acceptance, we rely on that model only to the extent of using it to frame our interview guide. We do not attempt to replicate the survey type approach that is the stock in trade of the TAM literature, and instead, use the open ended interview technique to obtain an in-depth understanding of internal auditors' attitudes towards CA.

Thus, we use the following questions in the master interview guide to capture the perceived usefulness of continuous assurance in internal auditing:

PU Questions in Guide

1. *How much attention does management pay to exception reporting from the CA/CM tools?*
2. *To what extent is the CA/CM system used by operational managers for monitoring of business processes?*
3. *How should existing audit/control procedures be modified to increase the utilization of technology in monitoring / audit (e.g. timing, nature or extent)?*
4. *Did regulation and compliance affect the decision to adopt CA/CM? (e.g. SOX 404)*
5. *Has CA/CM had an impact on Control Self Assessment (CSA) (if used)? If so, how?*
6. *Does the implementation of CA/CM aid the organization's compliance efforts as expected?*
7. *How has CA/CM improved the quality and reliability of the evidence obtained?*

We use the following questions in the master interview guide to capture the perceived ease of use of continuous assurance in internal auditing:

PEU Questions in Guide

1. *What barriers were there in using the CA/CM tools effectively and efficiently?*
2. *How easy was it to extract the data from the system? What tools were used in data extraction?*
3. *How were the accuracy, completeness and validity of the extracted data verified?*

4. *Identify the resources required by the organization to utilize CA/CM and the demands imposed on the client's human and IT resources.*
5. *How would you describe the mix of skills necessary for a successful CM and CA capability?*
6. *How much effort does it take to obtain/change this skills base to accommodate change?*
7. *Were personnel in the organization trained in the use or interpretation of CA/CM? From what functions?*
8. *What kind of training was provided and by whom?*
9. *Was the amount of time assigned to training sufficient?*
10. *What difficulties were encountered in the training process? How were they overcome?*

The nature of these PEU questions are also related to the Theory of Technological Dominance of Arnold and Sutton (1998) that tries to explain the degree to which a user will rely on a decision aid, which CA certainly is. Their model postulates that reliance is a function of task experience, task complexity, decision aid familiarity and cognitive fit. While we used Arnold and Sutton (1998) to help shape our interview guide, we did not have the controlled experimental setting necessary to formally test the theory. Thus, while we analyze acceptance of CA, the actual outcome on behavior can only be ascertained anecdotally.

We also used the master interview guide to obtain background information about the history and experience of the internal audit departments with CA by including the following questions:

Overview and Process Related Questions in Guide

1. *Overview questions:*
    a. *How would you describe the current state of continuous monitoring / auditing in your organization? Discuss CM and CA separately.*
    b. *How are continuous monitoring / auditing techniques used in the organization?*
    c. *What specific applications [i.e. combination of people, process and technology] have been implemented?*

    d. *Has the focus been on controls or transaction monitoring (or both)?*

2. *Technology-related questions:*
    a. *What is the degree of automation in the CA/CM process? What percentage of prior audit procedures have been switched from manual to automated?*
    b. *How did the organization select the technology to adopt? What criteria were used and who had the final authorization authority?*
    c. *Discuss the quality of the data extracted from the company's ERP, legacy or data warehouse "ready to be used" by the CA/CM tools? How have these improved? Plans for further improvement?*
3. *Future directions:*
    a. *What is planned over the next two years to expand or improve in either the monitoring or auditing arenas?*
    b. *To what extent does the current audit methodology and guidance inhibit a fuller adoption of CA/CM tools? Same question re monitoring?*
    c. *What are the barriers to more widespread use of CA/CM technology?*
4. *Usage characteristics:*
    a. *What kinds of transactions can be analyzed using CA/CM?*
    b. *Is data extraction done in 'real time' or on an 'extract and analyze' basis?*
5. *Were the CA/CM extraction and analysis tools run by specialists or by the audit team?*
6. *How do you ensure data integrity?*

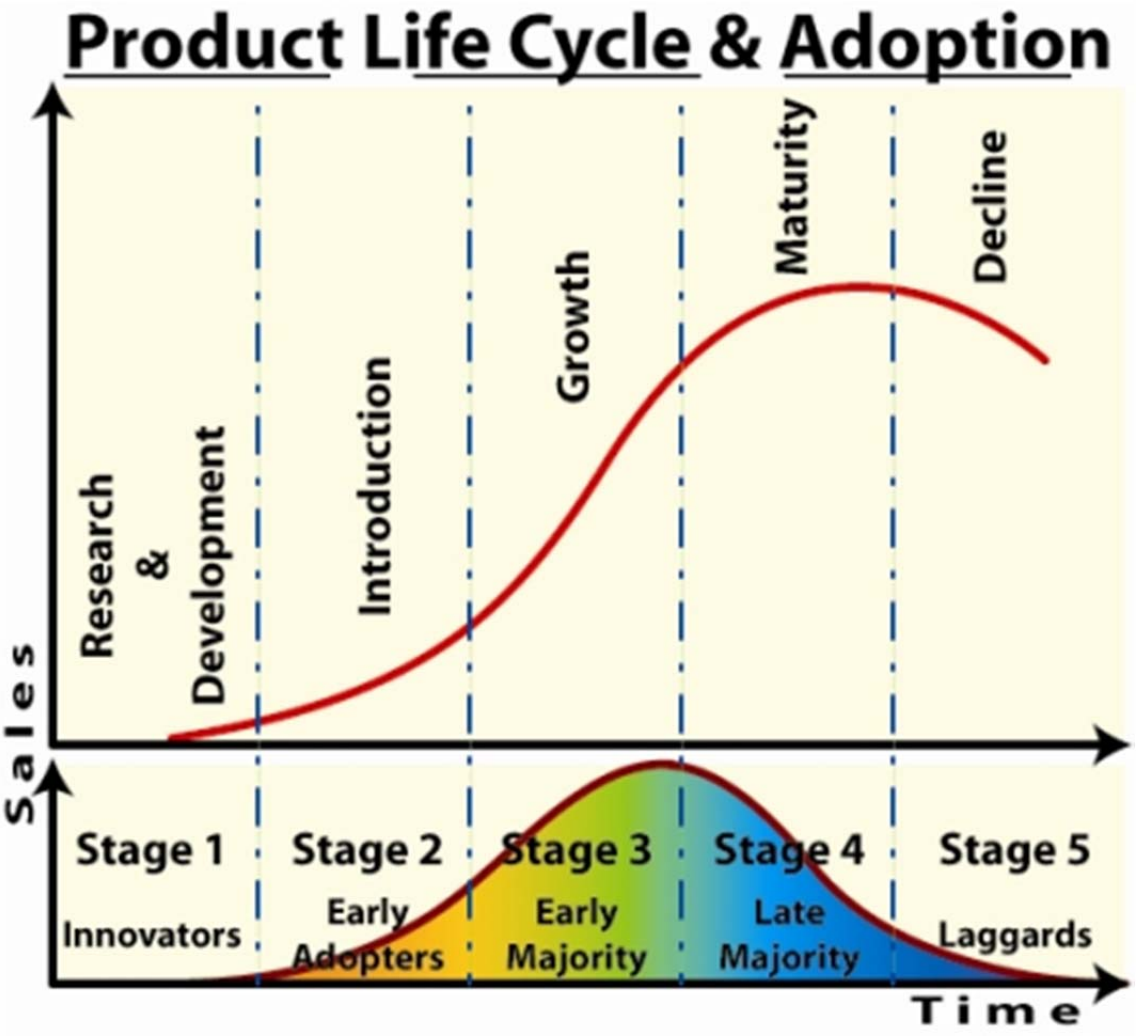
At all times during the interviews we were mindful of the difference between analyzing a well defined technological product and an emerging business methodology such as CA. While our interview format gives us more flexibility to ask probing questions and not rely on short queries, nonetheless, our access to the auditors is still time constrained. Hence, their answers had to be recorded verbally, as opposed to using some sort of numerical scale, which has the effect of precluding the application of statistical methods to our results, as does the fact that we speak to a few participants rather than hundreds. Essentially we are trading off depth of answers for statistical significance.

3.2 Measuring the Degree of CA Adoption

Our study is not only meant to examine the acceptance of CA by internal auditors individually, but also to assess the degree to which the methodology has been adopted by the internal audit departments. It is only by developing a metric of the state of CA adoption that we will be able to add context to the generic findings of the PwC and ACL/IIA surveys.

We develop a metric of CA adoption by building on the Technology Adoption Lifecycle model of Bohlen et at (1957) and Rogers (1962). Those papers, and the literature that has followed it, focuses on the distinct stages in the market penetration by high tech products. The famous finding by Rogers is that the rate of adoption for technology products by customers is described by a bell curve, as shown in Figure 1:[6]

[6] Image obtained from http://www.geoinformatics.com/blog/online-articles/the-natural-absorption-of-airborne-geospatial-technology.



Typical product lifecycle and adoption curves. Depending on the conditions surrounding a product, its life cycle may last months or decades. Adoption rates vary depending on such things as recognized advantages, price and operational costs, substitutes, promotional marketing efforts, and risk.

Figure 1: The Rogers' Product Life Cycle Curve

We are not concerned in this paper with the sales of CA products, but rather with trying to identify where in the product life cycle CA currently is. As Alles et al (2008) points out, research and development in CA began almost twenty years ago and Alles et al (2006) discusses a pilot study of one of the earliest CA applications at Siemens.[7] Hence, we are clearly past the first R&D stage are now somewhere in stages 2, 3 or 4 as the methodology has been introduced into practice from academia. Indeed, according to the PwC and ACL/IIA surveys, CA is already

[7] Leaving aside the very first CA application described by Vasarhelyi and Halper (1991).

a mature product in use by the great majority of firms, but as discussed above, that finding seems premature and the purpose of this micro study is to corroborate those results. One can be more confident that it is still too early for the fifth stage of declining interest to have been reached as far as CA is concerned.

Our interest in the Rogers' curve goes beyond classification of markets to what those stages tell us about the state of the technology itself. While the five basic stages of the product life cycle refer to the magnitude of sales and the nature of the customers, as one moves from left to right in this curve the product is also changing since technology is inherently dynamic but the curve omits a time dimension. Hence, by the time a product has reached maturity and is being adopted by the late majority, it is not the same product as that implemented by the early adopters or innovators, which, indeed, is what makes it now attractive to the customers whose strategy is to wait till a new product has "worked out its bugs" and come down in cost.

What we wish to do is to measure the extent of the adoption of CA in our sample in terms of the type of CA systems that these internal audit departments are using: Is it more consistent with the type of innovative product used by an early adopter, or is it the more widely applied mature systems that would appeal to a mainstream customer?

Of course, to implement such a metric requires a specification of the evolution of a CA implementation, from introduction to maturity. Based on the large CA literature (Brown, 2007; Vasharhelyi et al 2010; Alles et al, 2008) we have developed an "Audit Maturity Model" that corresponds to the Rogers' curve above in its emphasis on how products and markets change as the technology becomes more refined and widely adopted.

In place of Rogers' breakdown of the market into "R&D", "introduction", "growth" and "maturity", our model classifies the audit evolution into four successive stages of CA capability and the extent to which CA practices change the internal audit process, beginning with the traditional audit model that prevailed in the time period when CA was still a purely academic concept:[8]

1. The traditional audit.
2. The emerging CA audit.
3. The maturing CA audit.

[8] Again, omitting the "declining" stage.

4. The full continuous audit.

As Alles et al (2006, 2010) and Teeter and Brennan (2010) indicate, early adopters of CA will likely simply automate existing audit practices, going after the "low hanging fruit" of processes that are easily and simply automatable. Once the benefits of that are apparent, CA will grow into further areas of the audit, but this will necessitate reengineering the audit to make more processes capable of being automated. Finally, by the mature stage, much of the internal audit will be automated and conducted independent of location, with the human auditors focusing only on the audit tasks that demand the most subjectivity, such as in assessing the "tone at the top".

Each of these four stages can be further classified along the following seven categories:

1. **Audit Objective:** The scope of audit tasks that is undertaken by CA systems.
2. **Audit Approach:** The extent to which audit outputs shifts from being periodic to being undertaken continuously.
3. **Data access:** Level of access of the internal auditors to the firm's data systems.
4. **Audit automation**: The degree to which audit processes are automated.
5. **Audit and management overlap:** The extent to which internal auditors rely on IT systems intended for management use.
6. **Management of audit function:** Organizational relationship between the IT internal audit, the finance audit and other compliance departments.
7. **Analytic methods:** Degree of technical sophistication of analytical procedures that internal audit performs.

Table 1: The Audit Maturity Model

	Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
Audit Maturity Model Stages	Traditional Audit	Emerging CA Audit	Maturing CA Audit	Full Continuous Audit
Corresponding Stage in Rogers Model	R&D/Innovators	Introduction/ Early Adopters	Growth/Early Majority	Maturity/Late Majority
1. Audit Objectives	• Assurance on the financial reports presented by management	• Effective control monitoring	• Verification of the quality of controls and operational results	• Improvements in the quality of data • Creation of a critical meta-control structure
2. Audit Approach	• Traditional interim and year-end audit	• Traditional plus some key monitoring processes	• Usage of alarms as evidence • Continuous control monitoring	• Audit by exception

	Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
Audit Maturity Model Stages	Traditional Audit	Emerging CA Audit	Maturing CA Audit	Full Continuous Audit
Corresponding Stage in Rogers Model	R&D/Innovators	Introduction/ Early Adopters	Growth/Early Majority	Maturity/Late Majority
3. Data access	• Case by case basis • Data is captured during the audit process	• Repeating key extractions on cycles	• Systematic monitoring of processes with data capture	• Complete data access • Audit data warehouse, production, finance, benchmarking and error history
4. Audit automation	• Manual processes & separate IT audit	• Audit management software • Work paper preparation software	• Automated monitoring module • Alarm and follow-up process	• Continuous monitoring and immediate response • Most of audit automated
5. Audit and management overlap	• Independent and Adversarial	• Independent with some core monitoring shared	• Shared systems and resources where natural process synergies allow	• Purposeful Parallel systems and common infrastructures

	Stage 1	**Stage 2**	**Stage 3**	**Stage 4**
Audit Maturity Model Stages	Traditional Audit	Emerging CA Audit	Maturing CA Audit	Full Continuous Audit
Corresponding Stage in Rogers Model	R&D/Innovators	Introduction/ Early Adopters	Growth/Early Majority	Maturity/Late Majority
6. Management of audit function	• Financial organization supervises audit and matrix to Board of director	• Some degree of coordination between the areas of risk, auditing and compliance • IT audit works independently	• IA and IT audit coordinate risk management and share automatic audit processes • Auditing links financial to operational processes	• Centralized and integrates with risk management, compliance and SOX/ layer with external audit.
7. Analytical methods	• Financial ratios	• Financial ratios at sector level/account level	• KPI level monitoring • Structural continuity equations • Monitoring at transaction level	• Corporate models of the main sectors of the business • Early warning system

4. Results and analysis

Perceived usefulness (PU)

The companies in the study have different level of CA/CM adoption and various perspectives of the perceived usefulness of CA/CM. Automated and integrated technologies aid internal auditors in several ways and enable greater audit efficiency. The audit-aid technology implementation is initiated and supported by the head of the internal audit department or upper level management. The internal audit department of each company is responsible for monitor and assesses internal control effectiveness and report the assessment result in exception reports. If the irregularity event has been captured, CA/CM systems will generate alarm which will notify internal auditors and management.

One of the companies has implemented a system setting monitoring tools used by IT service staff. However, it is not CA/CM system yet. The internal audit director informed that "*Our IT service colleague already has the tools that monitor the configurable settings for the systems, databases, and network. What we need to do is work with them to get them into where they are continuously monitoring. Then, our audit can focus on how we are going to deal with the exceptions.*"

All of the companies in our study have to comply with SOX requirement, and they have specific divisions to monitor and ensure the compliance. Even though SOX requirement is not the main reason for the companies to implement CA/CM, they found that it tremendously facilitates SOX requirement. SOX review is very detailed, complicated and time consuming tasks. Interviewees reported that CA/CM assists the review activities and reduces the time allocated to SOX compliance. For example, the audit department of one company developed a monitoring tool to review the ERP system for both general internal control purposes and SOX compliance. This tool helps internal auditors work efficiently and supports comparison and benchmarking of the control components. External auditors are therefore able to rely on the work of internal auditors, which reduce time and effort required from both parties. As management mentioned *"…we developed out the tools that can dump everything out on the table... so much of our objective for this has been SOX and driven by [external auditor]."*

With the company's in-house developed CA/CM tools, internal auditors can test 100% of all SOX controls by themselves. Internal audit management indicated that *"To the extent of last year 100% of all the testing that [external auditor] would have performed for SOX is performed by the company. …They would rather get more efficient in terms of how they review."* and *"Then when it came time for SOX to come into play we needed to be more efficient in how we audit it."*

Not so many companies implement Control Self Assessment (CSA). One of the companies has CSA, but does not have CA/CM yet. The internal audit director said that *"We basically have the foundation for control self assessment solution. We have documentation control matrices, prepared by all of the management reporting. Then the finance organization has them as well for their side. They are all on Excel spreadsheets…every one of them. If you put them onto a web accessible portal it allows management reporting companies enter information directly there."*

The interview results show that internal auditors have positive attitude toward the usefulness of CA/CM. It facilitates a number of audit works, especially SOX compliance, and allows auditors to work more efficient. A certain amount of work can be automated and scope of work could be expanded.

Perceived ease of use (PEU)

Similar to any other projects, the continuous auditing and continuous monitoring projects require support from management, especially in the areas of access to data and implementation of audit-aid technologies. Most of the internal auditors do not have direct access to the data. In some companies, they required approval from the data owner or management before gaining access. Usually the access is time and function limited. Normally, data extraction is done by the IT division according to the auditor requests. One management said that *"We had some challenges [with the IT organization to get data] but generally not. The biggest challenge really is the time it takes to get it."* In the companies that have some level of CA/CM, the data can be automatically extracted without human intervention. Therefore, data integrity and security is maintained.

CA/CM involves audit-aid technology to a large degree. Therefore, it is necessary that employees have technical skill and knowledge required for their work. Some companies

have specific software and tools that require specialized training and all of the companies utilize more than one tool. Most of the companies prefer experienced staff to join their organization. One management mentioned that *"…half the people are looking for their next job. We have said that doesn't work. All you end up doing is spending your time training somebody and they leave in two or three years… Let's hire somebody with three or four years or five or six years experience or ten that know what they want to do."*

Another management has similar opinion in this matter. *"We have started to do more in the past couple years in terms of hiring people with the big 4 background. Someone who have been there for about 2, 3 or 4 years… There are some pretty technical areas there whether it be treasury, tax, corporate accounting…where it is very advantageous to have someone who does have an external audit background come in."*

Several other trends were discovered over the course of our interviews. One of the most interesting issues is that various companies have a staff rotation program. Some of the internal auditors will rotate in and out from the internal audit department to other business departments. We believe that this program will have an effect on the internal audit staff's breadth of knowledge and skill. Furthermore, all of the interviewed companies have a number of audit-like organizations which monitor internal controls in different areas. However, some of the audit areas overlap, and the results of the control review are not efficiently shared among them as one management declared *"Let me start with my administrative boss. He is the director of risk management for the organization. Underneath the Dean is internal audit. Credit examination and our risk management/Sarbanes-Oxley…there is another group that does testing that reports to Chief Legal Counsel. Fraud is handled in our securities group, which is in our service company. They perform investigations on internal and external fraud…We do [received feedback], but not as much as we should."*

Each company therefore must (and does) provide different types of training to its employees. All of the companies have developed standard training courses required to all the employees. Another approach is to offer customized training where the courses to be attended depend on specific needs of each employee. One of the companies also cooperates with a university to provide the MBA program necessary for their staff. Training covers general audit knowledge (e.g. internal control, audit methodology, etc.) as well as specific

technical knowledge such as data analytic, work flow and working paper instruments. One of the internal audit management clarified that *"From a technology perspective if we have people coming into IT that have no IT background we have to provide the training both from an IT broad perspective as well as IT sox."*

An internal audit manager mentioned a difficulty to leverage knowledge across the organization and to maintain knowledge within the company while reduce outsourcing. Thus, the IT rotation program was initiated to create expertise in specific areas such as CAATs. In this program, one person is assigned to be a domain expert and transfers knowledge to other colleague within the team. If anyone leaves the team, other members are still able to perform the task. The manager stated that *"When I came in we built an IT rotation, which is really good because I think we are building up some of that expertise…Also as I said I do not want to totally outsource everything to [consultant]. So we started to build that internal expertise. That is a concern because trying to keep people here to do that and keep some level of talent in the organization we are always going to have to be thinking of that from a succession planning standpoint. There should be a core team that knows how to use it and can show other people how to use it."*

One factor that could be a barrier for CA/CM implementation is perceived cost, which is the perception of managers on the setup and ongoing costs of continuous auditing and continuous monitoring implementation. From the interviews with internal audit department managers, we found that cost was not identified as a major barrier for the adoption of technology. Discussing this matter, executive management responded to the question that "Is the main objective more of coverage than to less labor or costs?":

"…we want to use the computer more to audit than before… clearly if you can get both it is a win-win. Ultimately, the business auditors should be happier. Nobody likes to test 50 things over and over again."

The internal audit management departments of some companies consider CA/CM as important components of advanced audit processes and frequent up-to-date reporting. They would like to invest in CA/CM as they believed that it would facilitate and enhance internal audit work. For instance, hi-tech companies and bank have developed specific tools for continuous monitoring and have employed developers to support the continual improvement of audit-aid technology.

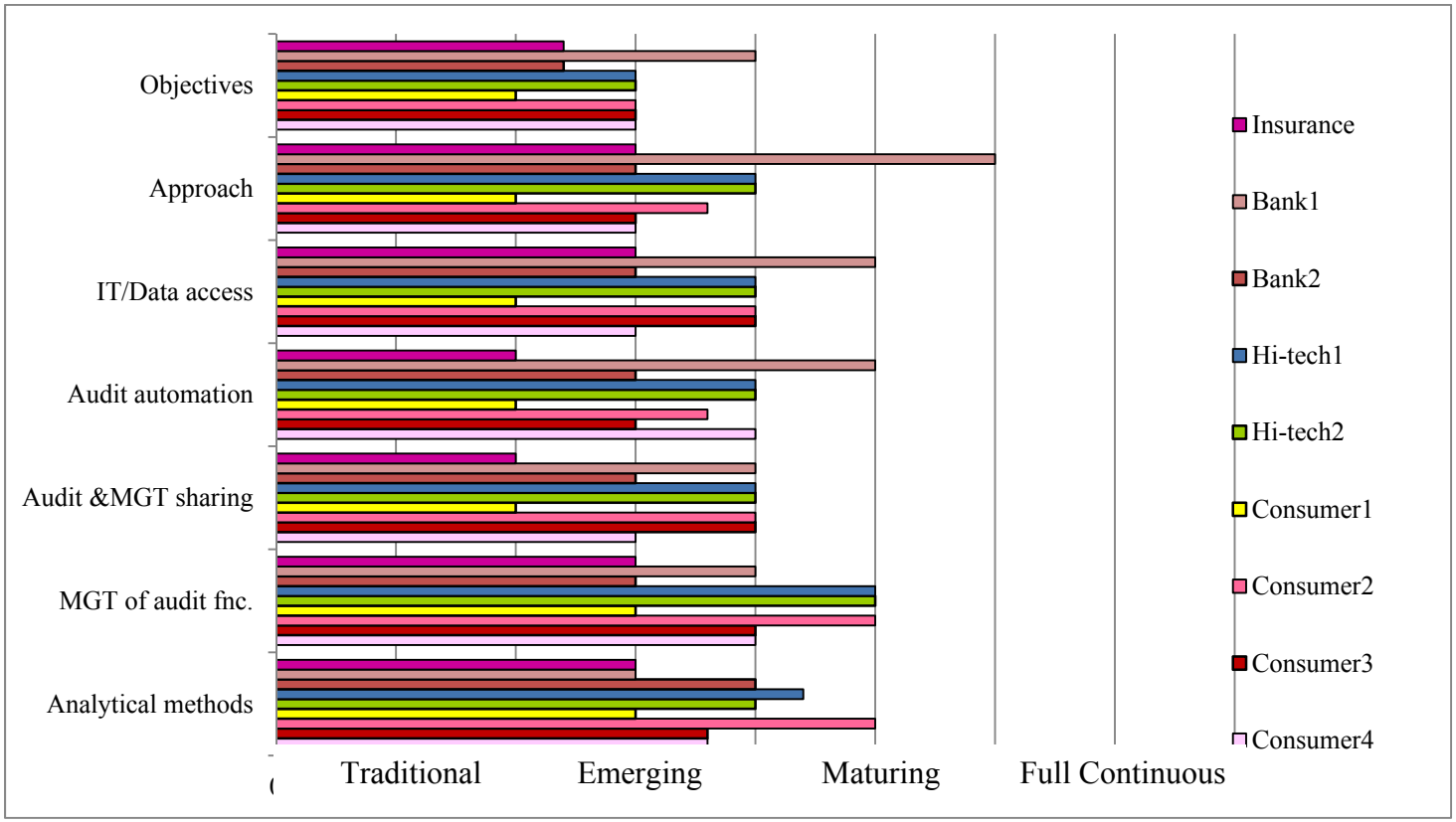


Figure 2: Results of the Audit Maturity Model Analysis

CA maturity model

By the metrics of the audit maturity model, the current level of adoption of CA by the internal audit departments of the companies in the sample is between stages 1 and 2, as shown in Figure 2. In other words, quite different to the findings of the PwC and ACL/IIA surveys, CA implementation is still largely at the introductory stage, with most users being best described as early adopters.

Looking in depth at our categories of CA maturity model, we can analyze the degree of CA/CM adoption as follow.

1. Audit Objectives

In addition to providing reasonableness assurance on the financial statements and financial reports, the internal audit department wants to implement and enforce effective control monitoring to the companies, and this objective is progressing. If CA technology is fully adopted, internal auditors will have continuous auditing and continuous control monitoring in place and do audit by exception. The audit objective of all companies is to have effective control monitoring and auditors try to assurance the quality of the controls.

2. Audit Approach

Most of the companies are in between stage 1 and 2 of the model. They have traditional interim and year-end audit, while try to review over key risk area and monitoring on those area more frequently. However, one company reaches maturing stage 3 as it implemented continuous control monitoring and has alarms to notify irregularity in the system. The company has been implementing continuous auditing for almost 10 years in each office location by constructing audit routines in the mainframe, and monitoring iterative processes. The company monitors over 5 million customer accounts on a daily basis, and the system sends out about 6 thousand alerts a month. Internal auditors analyze the alarm and report to management.

3. Data Access

Several companies extract key data periodically to support audit cycle. Even though internal auditors have more access to data than they were in the past, with cooperation from business data owner and IT department, limitation still exists. One of the interviewed companies'

management explained that they have 25 SAP-based systems installed across the organization. Each instance is managed by a different SAP team, and data extraction is done on a monthly basis using in-house software built on top of the SAP system. Data calculation then computes via the ABAP protocol, and reports are generated. The system can keep aggregate data for at least 13 months and detail data for 3 months. The company has an enterprise data warehouse, containing financial information, but usage is limited due to reconciliation issues.

4. Audit automation

Four out of nine companies are in stage 2 of this domain. They deploy some audit management software and have electronic working paper software to manage audit documentation. In this study, Microsoft office is not considered as an electronic working paper. The audit management software allows project manager to follow audit task status and work that assigned to audit members. Audit automation also embraces automatable audit processes as in the example of Bank1 that implemented continuous control monitoring module and has the alarm system as mentioned in the audit approach section.

5. Audit and management overlap

From the interview, we found that an internal audit department of each company shares audit reports and monitoring results in a form of reporting to management. Even though management has access to some monitoring systems, monitoring task is responsible by an internal audit department or audit-like departments. As we received comments from interviewees, they mentioned about management support and buy-in; visibility among the management team; each unit reports to its head and tasks among different departments often overlap. However, one company is implementing information sharing software in order to facilitate information sharing between departments.

6. Management of the audit function

Every company sets up IT audit function to audit the systems in addition to financial reporting systems. IT audit functions of some companies are still in the initial state and have only a few resources and capability, while these functions of other companies are more advance. As companies implement Enterprise Resource Planning (ERP) system such as SAP, more controls

are automated. Thus, IT audit function has a critical role to audit the system. One company developed in-house audit system to specifically monitor the ERP system. This system also facilitates external auditor including SOX audit.

7. Analytical methods

Most of the companies emphasize on auditing financial ratio at an account level. However, some companies progress to transaction level and develop key performance indicator (KPI) and dashboard to support monitoring purpose. For instance, the KPI tool of one company utilizes both leading indicators, such as percentage of system uptime, and lagging indicators, such as a number of incident tickets. The monitoring tool has the ability to generate graphs that show trends and compare activities of selected transactions. The KPI benchmark report is generated monthly and compares operations from two periods.

In all, there is opportunity for the companies to progress toward the higher stages. They can have more automated tools to support an audit review process, concentrate in a level of analytical procedures, invest more in information technology and personnel, and improve the level of cooperation between each unit.

4. Conclusion

With the emerging of a continuous auditing and continuous monitoring methodology, an on-going, timely review of financial data and internal control of the company is enhanced. From the interviews with internal audit managers of leading organizations, we could understand and evaluate the status of technology adoption and development in this area. There are some factors that affect the adoption such as management support and employee knowledge. To perform an audit review and data analysis efficiently, an internal auditor needs a certain level of information system and data access either via application programs or via extractions by the IT department. Generally, internal auditors are responsible for monitoring the internal controls with a continuous control monitoring technology, and report any exception to the auditee's management. Thus, internal auditors need some skills and knowledge about the technology used and the audit practice. For that purpose, training is provided to support their work and enhance their ability. Continuous auditing and continuous control monitoring technology also facilitates SOX

compliance. Field work time and iterative tasks can be reduced. All of the internal audit departments have some kind of tools and audit automation to support their work, such as electronic working papers and data analysis tools. Some companies are more advanced and have a continuous monitoring tool and an alarm system.

Based on the result of the interviews, the companies can be classified according to the audit maturity model to evaluate the status of continuous auditing and continuous monitoring. Most of them are ranked between stage 1, traditional audit, and stage 2, emerging. This means that although they have certain level of CA/CM, they are just in the initiation phrase, and there is opportunity for development in the future. This result is strikingly contrasted with the PwC survey, which stated that a large number of companies had continuous auditing in place.

The limitation of this research is the generalization because of the small samples. This study can be extended in two ways. First, a structural survey research can be conducted to get more detail characteristics and behavior of technology adoption by organizations. Additional measurements can be included, and the questionnaire method will get more sample size than interview technique. Second, the follow up interview with the organizations would provide useful information about the technology adoption trend and progress.

References

Arnold, V., and S. Sutton. 1998. The Theory of Technology Dominance: Understanding the impact of intelligent decisions aids on decision makers‟ judgments. Advances in Accounting Behavioral Research 1: 175-194.

Bagozzi, R. P. 2007. The legacy of the technology acceptance model and a proposal for a paradigm shift. Journal of the Association for Information Systems, 8(4), 244-254.

Behn, B. K., D. L. Searcy, J.B. Woodroof. 2006. A Within Firm Analysis of Current and Expected Future Audit Lag Determinants. Journal of Information Systems 20 (1): 65-86.

Bohlen, Joe M.; Beal, George M. 1957, "The Diffusion Process", Special Report No. 18 (Agriculture Extension Service, Iowa State College) 1: 56–77.

Canadian Institute of Chartered Accountants. 1999. Research Report on Continuous Auditing. Toronto, Canada.

Chuttur M.Y. 2009. Overview of the Technology Acceptance Model: Origins, Developments and Future Directions, Indiana University. Sprouts: Working Papers on Information Systems, 9(37).

Davis, F. 1985. A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results. Unpublished Doctoral Dissertation, MIT Sloan School of Management, Cambridge MA.

Davis, F. D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319-340.

Gray, W.B., and R.J. Shadbegian. 1998. Environmental Regulation, Investment Timing, and Technology Choice. Journal of Industrial Economics 46(2): 235-256.

Karahanna, E., S.W. Detmar, and N.L. Chervany. 1999. Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre- Adoption and Post-Adoption Beliefs. MIS Quarterly 23 (2): 183-213.

Hall, B.H., and B. Khan. 2003. Adoption of New Technology. University of California, Berkeley working papers (May).

Handscombe, K. 2007. Continuous Auditing From a Practical Perspective. Information Systems Control journal 2.

Heffes, E.M. 2006. Theory to practice: continuous auditing gains. Financial Executive:17-18.

Janvrin, D., J. Bierstaker, and J.D. Lowe. 2008. An Examination of Audit Information Technology Use and Perceived Importance. Accounting Horizons 22 (1): 1-21.

Lai, V.S., and J.L. Guynes. 1997. An Assessment of the Influence of Organizational Characteristics on Information Technology Adoption Decision: A Discriminative Approach. IEEE Transactions on Engineering Management 44 (2).

Lee, Y., K.A. Kozar, and K.R.T. Larsen. 2003. The Technology Acceptance Model: Past, Present, and the Future, Communications of the AIS, 12, 752-780.

Legris, P., Ingham, J., & Collerette, P. 2003. Why do people use information technology? A critical review of the technology acceptance model. Information & Management, 40(3), 191-204

O‟Reilly, A. 2006. Continuous Auditing: Wave of the future?. Corporate Board (September): 24-26.

PricewaterhouseCoopers. 2006.State of the internal audit profession study: Continuous auditing gains momentum. PricewaterhouseCoopers.

Rogers, Everett M. 1962. Diffusion of Innovations, Glencoe: Free Press

Sarva, S. 2006. Continuous Auditing Through Leveraging Technology. Information System Control Journal 2.

Searcy, D., and J. Woodroof. 2001. Continuous Audit Implications of Internet Technology: Triggering Agents Over the Web in the Domain of Debt Covenant Compliance. Proceedings of the 34th Hawaii International Conference on System Sciences.

Searcy, D., and J. Woodroof. 2003. Continuous Auditing: Leveraging Technology. The CPA journal (May).

Searcy, D., J. Woodroof, and B. Behn. 2002. Continuous Audit: The Motivations, Benefits, Problems, and Challenges Identified by Partners of a Big 4 Accounting Firm. Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS‟03).

Taylor, M., and A. Murphy. 2004. SMEs and E-business. Journal of Small Business and Enterprise Development 11 (3): 280-289.

Troshani, I., and B. Doolin. 2005. Drivers and Inhibitors Impacting Technology Adoption: A Qualitative Investigation into the Australian Experience with XBRL. 18th Bled eConference eIntegration in Action, Bled, Slovenia.