



**The Continuous Evolution of  
Continuous Auditing:  
Insights and Issues from the Outside In**

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*Paper to be presented at the  
13<sup>th</sup> World Continuous Auditing and Reporting Symposium (WCARS),  
University of Ferrara, Ferrara (Italy), June 15-16, 2007*



## **Introduction**

The emergence of e-commerce and electronic data interchange (EDI), growth of financial reporting using the Internet, hardware and software developments and improved user data analysis capabilities have made traditional reporting redundant in many circumstances. Traditional financial reporting takes place periodically and is essentially retrospective, offering limited relevance to users. Yet until recently, real-time reporting has been considered too costly, and in many cases, impossible.

Demands for real-time reporting create demand for continuous auditing (CA). CA is “a comprehensive electronic audit process that allows auditors to provide some degree of assurance on continuous information simultaneous with, or shortly after, the disclosure of the information” (Rezaee, Ahmad, Elam & McMickle, 2002, p. 150). The concept of CA is by no means a new concept. However, the demand for and viability of CA can no longer be ignored. Discussions regarding continuous auditing began in the early 1970s with the development of electronic data processing (EDP) and research followed in the late 1980s (Groomer & Murthy, 1989).

Continuous auditing provides unique implications, problems and opportunities for internal and external auditors, and members of the audit profession discuss these implications frequently. This paper intends primarily to review existing literature on CA and to provide suggestions for future research from what can be labelled as an “outside in” perspective, being the writer a sort of newcomer to the field.

The remainder of this paper is organised as follows: the next three sections outline the benefits of CA, developments in information technology (IT), and obstacles in undertaking CA as identified by members of the accounting and audit profession. The fifth section summarises some of the institutional efforts towards CA. Research regarding the economic and technical feasibility of CA is provided in sections six and seven, and section eight

provides some suggestions for future research based on the gaps and limitations of existing research.

### **Benefits of CA**

CA offers numerous benefits to all stakeholders. The potential benefits of CA include improved audit efficiency through reduced time and cost, and improved audit effectiveness through continuous monitoring and increased internal control focus (Rezaee et al., 2002). In addition, CA has been suggested to reduce agency costs (Kogan, Sudit & Vasarhelyi, 1999) and the cost of capital (Botosan, 1997).

### **Improved audit efficiency and effectiveness**

DeWayne & Woodroof (2003) claim that CA offers the elimination of the following “audit wastes”: “overauditing”, “waiting”, “time delays”, “inefficient audit processes”, “work-in-process”, “review process” and “errors and mistakes” (p.47). The writers also highlight that CA provides increased flexibility and opportunities to customise reports.

Analytical procedures are used at multiple stages of the audit process and have become an increasingly powerful means of collecting evidence. Kogan et al. (1999) assert that CA provides an opportunity to widen the scope and scale of analytical procedures, thus improving the efficiency and effectiveness of auditing. They also claim the quality of audits will improve because there will be less time for management to manipulate information, and human motivation and fatigue will not affect automated procedures. However, these claims are yet to be substantiated.

### **Reduced costs**

Agency theory plays a critical role in understanding why firms chose to engage in external auditing, as external audits are proven to provide a reduction in information asymmetry (Chow, 1982). Kogan et al. (1999) believe that by providing additional information to users, CA reduces information asymmetry and consequently reduces agency costs. Kogan et al. (1999) also support findings from Botosan (1997), which claim there is an inverse relationship between disclosure and the cost of capital (both debt and equity).

### **Developments in IT**

Numerous IT developments have revolutionised the audit environment and made CA technically feasible. Such developments include eXtensible Business Reporting Language (XBRL) and concurrent computer aided audit techniques (CAATs), such as, integrated test facilities (ITFs), continuous and intermittent simulation (CIS), snapshots and systems control audit review file (SCARF).

### **CAATs**

Concurrent CAATs gather and evaluate evidence on a real-time basis, which provides real-time auditing and consequently real-time action; these techniques can also create audit trails. There is a small body of research that discusses some of these developments and uses them to construct CA methods, some of which will be examined later in this paper (Groomer & Murthy, 1989; Vasarhelyi & Halper, 1991; Yu, Yu, & Chou, 2000; Best, Mohay, & Anderson, 2004; Shaikh, 2005).

## **XBRL**

Arguably, the most revolutionary development in business reporting is XBRL (an extension of XML). “Instead of treating financial information as a block of text, as in a standard internet page or a printed document – it (XBRL) provides an identifying tag for each individual item of data” (<http://www.xbrl.org/eu/>, 2006). Computers can use XBRL data, along with intelligent agents, to “recognise the information in a XBRL document, select it, analyse it, store it, exchange it with other computers and present it automatically in a variety of ways for users” (<http://www.xbrl.org/eu/>, 2006). XBRL has several perceived benefits, including its potential use for real-time reporting. Charles Hoffman, the founder of XBRL, foresees the following benefits of XBRL use: faster reporting and analysis, improved accuracy and reliability of information, cheaper and easier automation, reduced manual intervention, improved access to and analysis of information and improved communication (Tie, 2005). However, research reveals that there is a lack of knowledge about XBRL, which may explain why uptake has been very slow. Pinsker (2003) conducted a survey on American accountants and auditors. The survey revealed that participants had little knowledge of and experience with XBRL. However, various professional Websites currently disclose information regarding XBRL and the American Institute of Certified Public Accountants (AICPAs) recommend the use of XBRL in their proposed “business reporting model of the future”. These factors suggest knowledge of XBRL is now widespread. Yet, despite the benefits to all stakeholders, adoption of XBRL is very slow.

The implications of XBRL for external auditing are similar to conventional auditing. Auditing financial information in XBRL will require tests of controls, collecting and evaluating evidence, providing assurance on the ‘truth and fairness’ of information and on compliance with Generally Accepted Accounting Practices (GAAP). In addition, there is potential for

auditors to be more involved in preparation of such financial information, which may involve some 'independence' considerations. However, XBRL could have huge implications in terms of GAAP. Therefore, auditors must be conscious of any developments in GAAP and be proactive with generally accepted auditing standards (GAAS) to adjust the nature, timing and extent of audit procedures and the level of assurance provided.

### **Obstacles in undertaking CA**

The adoption of CA is not without its obstacles, some of which auditors have confronted since the commencement of auditing in the electronic environment. Other obstacles are specific to CA.

#### **General obstacles**

There have been dramatic changes in the nature of audit evidence; Nearon (2005) claims that more than 90% of all business documents are now digital. The audit profession recognises that the move from paper to electronic audit evidence requires "greater auditor skepticism" (Nearon, 2005, p34). This requires auditors to ask different questions to ensure that evidence is sufficient, appropriate and reliable. Munter (2002) identified six differences between paper and electronic evidence that should be considered when designing audit procedures. Firstly, electronic evidence is more easily altered without detection, consequently reducing credibility. Secondly, evidence from third parties generally provides greater assurance. However, when third party evidence is electronic, such as an electronic invoice, credibility is reduced. Thirdly, completeness may be more difficult to ascertain in the electronic environment. Fourthly, visible evidence of authorisation is often missing in the electronic environment. Fifthly, the electronic audit environment requires additional IT training. Lastly, it is not often clear what constitutes evidence in the electronic environment.

Because of the differences between paper and electronic evidence, auditors must pay closer attention to internal controls and approach their work with due care. Tests of controls, such as access controls, have become an essential element to obtaining the desired level of assurance. Moreover, auditors may need to rely on applications such as snapshots because observable audit trails are gradually disappearing (Yu et al., 2000). The auditing profession has introduced auditing standards, such as NZICA's AS-210: *Auditing in a Computer Information Systems Environment* and AICPA's SAS 94: *The Effect of Information Technology on the Auditor's Consideration of Internal Control in a Financial Statement Audit*, to combat these rising issues. Sarbanes-Oxley Act (SOX) section 404 also provides recognition and support for some of these issues. However, due to the frequent use of the Internet for financial reporting (Fisher, Oyelere, & Laswad, 2004; Richardson & Scholz, 1999; Iqbal, 2005) and developments in CA and XBRL there is great need for further regulatory guidance on auditing in the electronic and real-time reporting environment.

### **Specific obstacles**

Rezaee et al. (2002) identified three ways in which CA affects traditional auditing. Firstly, auditors must increase their knowledge of the business and industry in which the client operates, in order to assess the relevance and reliability of electronic information, to understand the business processes and to assess risks. Secondly, CA requires increased internal control reliance and therefore increased internal control testing. For CA to succeed, prevention and real-time detection of errors will be crucial. Lastly, CA requires auditors to use audit software tools capable of auditing through the computer, such as those mentioned in the preceding section. Aside from technical obstacles, DeWayne & Woodroof (2003) identified the following hurdles to implementing CA: auditee acceptance, direct access to



auditee's information systems and auditor training. Also, the technical competence of auditors, increased litigation risk and security of audit software embedded in an auditee's system must be considered before undertaking CA. In the event of CA, auditors may necessarily be involved in developing and implementing their client's systems (AAA, 2002). In addition, higher costs of undertaking a new engagement may increase financial dependence between the auditors and auditees. Because of these factors, independence issues must be addressed. It is vital that the above obstacles and additional requirements are recognised and acted on, to encourage the adoption and ensure the success of CA.

### **Institutional efforts**

The accounting profession recognises the changing business-reporting environment and the subsequent demand for real-time reporting and CA. Consequently, representatives of the profession have provided support and assistance, making real-time reporting and auditing increasingly viable. The AICPA's Elliott Committee proposed the development of new assurance services, such as information systems reliability and e-commerce assurance services. Following this, the AICPA and Canadian Institute of Chartered Accountants (CICA) established a Systems Reliability Task Force, which led to the development of WebTrust and SysTrust services. By providing assurance regarding the reliability of computer systems and Websites, these services represent a transitional step towards CA.

In 1999, the CICA and the AICPA established a committee to examine CA (CICA /AICPA, 1999). The research report published by the committee provides a definition of CA, emphasises the importance of CA, describes a conceptual framework for CA, discusses the differences between CA and traditional auditing including the prerequisites for and challenges of CA and describes some possible CA services. In addition, the committee recognises the

need for “research by academics, experimentation by practitioners and guidance from standard setters” to help CA evolve (p. xiv).

In 2003, the AICPA formed the Special Committee on Business Reporting known as the Starr Committee. The committee’s purpose was to improve the quality and transparency of information for decision-making. In doing this, they proposed a “business reporting model of the future”, which consists of online, real-time disclosure of performance measurement based information. Among other things, the committee advocates CA, XBRL and WebTrust and SysTrust services to achieve online, real-time business reporting objectives.

Institutional efforts have provided and continue to provide the support needed for CA adoption. The greater the involvement by the accounting profession, the more we will see CA progress.

### **Economic feasibility of CA**

Recognising the hesitance to embrace CA, partly due to the cost of implementation, Pathak, Chaouch & Sriram (2005) conducted research on the economic feasibility of CA. Testing in the CA environment can be either continuous or intermittent. Continuous monitoring involves testing all transactions, whereas intermittent monitoring involves testing transactions at specified intervals. Pathak et al. (2005) assert that continuous testing is not economically feasible in most cases, consequently their research extended to two types of intermittent testing: counting and periodic. Counting tests every  $n$  transaction and periodic tests after  $x$  amount of time. Counting was found to be more cost effective than periodic testing. Pathak et al. (2005) also offer suggestions for future research on the cost effectiveness of CA, although they note that economic feasibility should not be the only factor under consideration.

Pathak et al.'s study provides fundamental progress towards CA acceptance (2005). However, the study merely compares two types of intermittent testing. Future research should attempt to evaluate the economic feasibility of other CA techniques and compare each with the start-up and long-run costs of traditional audit methods.

### **Technical feasibility of CA**

Discussions regarding continuous auditing began in the early 1970s with the development of electronic data processing (EDP). Yet substantially, CA discussions have remained just that, discussions. One reason for this is the lack of research demonstrating the feasibility of CA. Research began in the late 1980s when Groomer & Murthy (1989) described an approach to continuous auditing of database-driven accounting applications using embedded audit modules (EAMs), and illustrated its use on the sales system. Their approach was designed to address the unique control and security issues in database accounting systems. EAMs were designed to capture and evaluate information and when predetermined integrity constraints were breached, the system records details of the activity and produces an exception report. The EAMs described by Groomer & Murthy (1989) are important in the development of CA and can be supplemented with intelligent agents to perform specific audit functions.

Still, it was not until the early 1990s (Vasarhelyi & Halper, 1991) that academic literature described the use of an operational CA system. Vasarhelyi & Halper (1991) studied the development of the continuous process auditing system (CPAS) at AT&T Bell laboratories, and the subsequent implementation of the system into AT&T for internal auditing purposes. CPAS was designed to deal with the issues surrounding an increasingly paperless audit environment. CPAS continuously monitors and audits AT&T's billing system. It extracts raw

data from the billing system and sends it to an audit workstation, where data is filtered and analysed and alarms issued where data deviates from predetermined rules. During the development and implementation of CPAS, Vasarhelyi & Halper (1991) observed that rules were difficult to devise and as a result, the development and monitoring of CPASs required experienced auditors. They also noted the high start-up cost involved, but believed these were offset by improvements in audit quality and reliability. Adding to these findings, Pathak et al. (2005) assert that although start-up costs are greater for CA, the ongoing costs of CA are lower than traditional periodic audits. Vasarhelyi & Halper's (1991) work is a milestone in CA literature. However, their study only reports on the CA of the billing system at AT&T. Further operational illustrations of CA on other aspects of accounting information systems would be valuable.

Regrettably, Vasarhelyi & Halper's (1991) study was followed by further conceptual illustrations of CA (Yu et al., 2000; Rezaee et al., 2002). Yu et al. (2000) discussed the potential impacts of e-commerce on auditing practices in the paperless on-line transaction environment. From this, they developed a continuous auditing process model (CAPM) which monitors an accounting information system, detects abnormal activities and generates exception reports on a continuous basis. CAPM is designed to ensure reliability and effectiveness of the accounting system and assure the truth and utility of real-time financial statements for interested users. Following this study, Rezaee et al. (2002) described how data marts could be used with data analysis tools to facilitate CA in a real-time business environment. They declared that CA requires the standardisation of data and consequently recognise the need for auditors to be involved in developing client's systems. The CA methodology described continuously extracts information from the client's system, standardises it and stores it in data warehouses. From there information is separated into

subject-based data marts, then the data is analysed and tested using CAATs. After testing, the system produces exception reports on which auditors can formulate their opinion. Both studies illustrate the theoretical feasibility of continuously auditing transactions in the e-commerce environment, but fail to provide working illustrations.

More than a decade after Vasarhelyi & Halper's groundbreaking research (1991), Best et al. (2004) developed and tested a machine-independent audit trail analyser (MIATA). MIATA is a knowledge-based system, which analyses activities in an auditee's operating system and provides reports regarding unauthorized user activity. Best et al. (2004) used case studies to demonstrate the use of MIATA and proved that MIATA would be a useful tool for CA of internal controls. However, their study only tested one general internal control, albeit a critical one in the electronic environment.

Following Best et al.'s (2004) publication, Shaikh (2005) constructed a system of electronic auditing (EA) and then used a field study to demonstrate the feasibility of EA. Shaikh (2005) supplemented generalised audit software (GAS) with intelligent agents, object-orientated distributed middle-wares and internet security technologies to facilitate EA. The field study involved auditing the loan accounts (accounts receivable) of the Commonwealth National Bank. Although the study only illustrated CA of one account type, it provides another valuable illustration of how emerging technologies can facilitate EA and be used to conduct CA.

### **Future research**

Literature has thus far provided some useful theoretical and operational illustrations of the technical and economic feasibility of CA. The foregoing review, however, highlights the need for further research to address some of the practical implications of CA adoption.

Future research should address the following issues regarding CA:

- Evidence of the foreseen benefits of CA (refer to the above section on *Benefits of CA*);
- Ways to ensure the security of audit software embedded in an auditee's system;
- New independence considerations arising from CA and possible conflicts with current legislative requirements;
- The accounting profession's plans and/or actions to improve the technical competence of auditors;
- The economic feasibility of CA techniques and comparisons of each with the start-up and long-run costs of traditional audit methods;
- Operational and theoretical illustrations of CA other aspects of accounting information systems;
- CA non-financial information and promising CA domains;
- Audit opinion frequency;
- Whether automated auditing gives rise to new competitive threats to the audit profession;
- Whether assertions can be broken down into elements that are auditable using automated audit procedures;
- Evidence of the demand for real-time reporting and CA;
- What drives the demand for real-time reporting and CA;
- Necessary changes to current GAAS;

- Changes to the level of assurance and audit risk;
- Illustrations using XBRL to facilitate CA;
- Illustrations of new analytical procedures;
- New auditor responsibilities and liabilities; and
- The ability of end users to comprehend and interpret real-time audited information.

### **Conclusion**

As traditional periodic reporting becomes increasingly irrelevant, discussions surrounding the desirability of online, real-time reporting are abundant. Consequently, desires for online, real-time reporting have necessitated discussions concerning continuous auditing. Although not predicted in the short-run, the time may come when CA is no longer a competitive advantage for auditors but instead a requisite tool for survival (DeWayne & Woodroof, 2003).

The development of EDP in the early 1970s led to discussions regarding continuous auditing and research followed in the late 1980s (Groomer & Murthy, 1989). Continuous auditing provides unique implications auditors, and members of the audit profession discuss these regularly. This paper has reviewed existing research concerning continuous auditing and provided suggestions for future research.

CA offers a number of foreseen benefits including improved audit efficiency and effectiveness and decreased costs of capital and agency costs (Rezaee et al., 2002; Kogan, Sudit & Vasarhelyi, 1999). Over the past decade, numerous IT developments such as XBRL and concurrent CAATs have revolutionised the audit environment and made CA technically feasible. However, the effect of CA on the nature and extent of audit procedures cannot be ignored. Auditors must increase their knowledge of their client's business and industry,

increase internal control testing and use audit software tools capable of auditing through the computer (Rezaee et al., 2002). Aside from technical obstacles, auditors must gain auditee acceptance, direct access to auditee's information systems and additional IT training (DeWayne & Woodroof, 2003). In addition, increased litigation risk, security of audit software embedded in an auditee's system and new independence issues must be addressed to ensure the successful adoption of CA.

The accounting profession acknowledges the changing business-reporting environment and the subsequent demand for real-time reporting and CA. Actions by the AICPA and the CICA resulted in the development of WebTrust and SysTrust services. By providing assurance regarding the reliability of computer systems and Websites, these services represent a transitional step towards CA. In 1999 the AICPA and CICA published the "continuous auditing" research report (CICA /AICPA, 1999), which provides a definition of CA, emphasises the importance of CA, describes a conceptual framework for CA and illustrates some possible CA services. Following these efforts, the AICPA formed the Special Committee on Business Reporting. Among other things, the committee advocates CA, XBRL and WebTrust and SysTrust services to achieve online, real-time business reporting objectives. Institutional efforts have provided and continue to provide the support needed for CA adoption. However, there is a great need for further regulatory guidance for the CA initiative to advance.

Discussions regarding continuous auditing began in the early 1970s. Yet three decades later, there is limited research demonstrating the technical and economic feasibility of CA. Research began in the late 1980s when Groomer and Murthy (1989) developed and described the use of EAMs. Still, it was not until the early 1990s that academic literature described the use of an operational CA system (Vasarhelyi & Halper, 1991). Vasarhelyi & Halper (1991)



studied the development of CPAS at AT&T Bell laboratories and the subsequent implementation of the system into AT&T for internal auditing purposes. Regrettably, the study was followed by further conceptual illustrations of CA (Yu et al., 2000; Rezaee et al., 2002). However, in 2004, Best et al. developed and tested MIATA; a knowledge-based system, which analyses activities in an auditee's operating systems and provides reports regarding unauthorized user activity. Following Best et al.'s (2004) publication, Shaikh (2005) constructed a system of electronic auditing (EA) and then used a field study to demonstrate the feasibility of EA.

To date, there has been only one published study on the economic feasibility of CA (Pathak et al., 2005). The study revealed that of two types of intermittent monitoring in the CA environment (counting and periodic), counting was the most cost effective in the long-run. To counter the limitations of this study, future research should attempt to evaluate the economic feasibility of other CA techniques and compare each with the start-up and long-run costs of traditional audit methods.

The foregoing review reveals the need for further research to provide operational illustrations of the technical, economic and practical feasibility of CA. Additional research may also expose some unforeseen benefits of and opportunities for CA.

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