The Current State of Continuous Auditing and Emergency Management's Valuable Contribution

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ABSTRACT

Continuous Auditing systems require that human judgment be formalized and automated, which can be a complex, costly and computationally intensive endeavor. However, Continuous Auditing systems have similarities with Emergency Management and Response systems, which integrate Continuous Auditing's detection and alerting functions with the tracking of decisions and decision options for the situations that could be more effectively handled by human judgment. Emergency Management and Response systems could be an effective prototype to help overcome some of the implementation obstacles that are impeding Continuous Auditing systems' implementation rate.

Continuous Auditing has the potential to transform the existing audit paradigm from periodic reviews of a few accounting transactions to a continuous review of all transactions, which thereby could vastly strengthen an organization's risk management and business processes. Although Continuous Auditing implementations are occurring, their adoption is slower than expected.

With the goal of providing an empirical and methodological foundation for future Continuous Auditing systems and possibly inspiring additional investigation into merging the Continuous Auditing and Emergency Management streams of research, this paper provides several definitions of Continuous Auditing, suggests possible architectures for these systems, lists some common implementation challenges and highlights a few examples of how Emergency Management research could potentially overcome them.

Keywords

Continuous Auditing; Decision Support; Emergency Management

INTRODUCTION

Continuous Auditing demands a complete formalization of an organization's business processes as well as their key control points, rules, metrics and exceptions. When the processes of testing controls and identifying meaningful control exceptions are formalized, these processes generally can be automated, which would enable organizations to perform control and risk assessments in real time, analyze business processes for anomalies at the transaction level, and utilize system-generated alarms and data-driven indicators to identify control deficiencies and emerging risks. This type of automation will allow organizations unprecedented capabilities to respond to the demands of today's rapidly changing and hypercompetitive business environment as well as meet the growing regulatory compliance requirements (e.g. Sarbanes-Oxley, Basel II, etc.) in a cost effective manner.

However to achieve this level of audit automation, human judgment would need to be totally replaced with a Continuous Auditing system, which is a complex, costly and computationally intensive endeavor. Some working in Emergency Management have suggested a hybrid approach that uses both Continuous Auditing and human decision-making. This approach integrates Continuous Auditing's detection and alerting functions with the tracking of decisions and decision options for the situations that can be more effectively handled by human judgment (Turoff, 2004). Turoff first recognized the potential that Emergency Management research could have on Continuous Auditing. This paper focuses primarily on the implementation obstacles currently impeding Continuous Auditing implementations and briefly provides a few examples of how Emergency Management concepts could help overcome them.

Historically, organizations have relied on manual control testing to assess and mitigate risk in their operating environments. Control testing tends to be performed on a retrospective and cyclical basis, which often occurs many months after the business activities were performed. The testing procedures employed have often been based on sampling methodologies and manual reviews of only a small percentage of the accounting transactions,

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policies and procedures, approvals, reconciliations, etc. Unfortunately, these antiquated testing procedures afford only a limited evaluation of an organization's business processes and operational risks. In today's hyper-complex operating environment, these antiquated auditing and risk management techniques are becoming increasingly inadequate as evidenced by the dramatic recent increase in the number of financial crises plaguing the world's economy.

Increasingly, decision support systems are being harnessed to reinvent audit and risk management processes with the ultimate hope of preventing the next financial crisis by helping executives make informed decisions and maintain compliance with the perpetually evolving bodies of law and corporate policy. Inevitably, Continuous Auditing requires a type of decision support system that will help transform the audit paradigm from periodic reviews of a few transactions to a continuous review of all transactions.

With the goal of providing an empirical and methodological foundation for future Continuous Auditing systems and possibly inspiring additional investigation into merging the Continuous Auditing and Emergency Management streams of research, this paper provides several definitions of Continuous Auditing, suggests possible architectures for these systems, lists some common implementation challenges and highlights a few examples of how Emergency Management research could potentially overcome them.

DEFINITION

An unequivocal Continuous Auditing definition would be an advantageous starting point in designing this type of system. However, the literature offers several overlapping and, sometimes competing, definitions for Continuous Auditing. Miklos Vasarhelyi, who is generally regarded as publishing the first significant paper on Continuous Auditing in 1991, defines it as "an audit that happens immediately after or closely after a particular event" (McCann, 2009). The Canadian Institute of Chartered Accountants (CICA) and the American Institute of Certified Public Accountants (AICPA) define Continuous Auditing as "a methodology that enables independent auditors to provide written assurance on the subject matter using a series of auditor's reports issued simultaneously with, or within a short time after, the occurrence of the events underlying the subject matter" (CICA/AICPA, 1999). Rezaee defines Continuous Auditing as "a systematic process of gathering electronic evidence as a reasonable basis to render an opinion on fair presentation of financial statements prepared under the paperless, real-time accounting system" (Rezaee, 2001). Helms and Mancino define Continuous Auditing as "software to detect auditors' specific exceptions from among all transactions that are processed either in real-time or near real-time environments. These exceptions could be investigated immediately or written to an auditor's log for subsequent work" (Helms et al., 1999). The Global Technology Audit Guide (GTAG) defines Continuous Auditing as a method generally used by internal auditors to perform control and risk assessments automatically on a frequent basis. However, the GTAG's Continuous Auditing definition also includes other audit procedures that occur in real-time or near real-time including: Continuous Monitoring (a process that management puts in place to ensure the policies, procedures and business processes are operating effectively, which includes defining the control objectives and assurance assertions and establishing automated tests to highlight activities and transactions that fail to comply), Continuous Control Assessment (a process that focuses on the early detection of control deficiencies) and Continuous Risk Assessment (a process that detects processes or systems experiencing higher than expected levels of risk) (Coderre, 2005). Although these definitions differ in semantics, they all share the notion of performing auditing processes very quickly.

ARCHITECTURE

One approach to dramatically accelerating the audit process is to create a specialized decision support software system that automates the audit process. These new systems will require a distinctive software architecture, which is defined as "the fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution" (ANSI/IEEE, 2000). In its simplest form the Continuous Auditing system architecture requires only a digitized data source, well-defined data validation engine, and an alarm and/or reporting mechanism to alert the appropriate parties when these rules are violated.

Alles and Kogan formally define seven components of a Continuous Auditing system: (1) a layer of software for process control and monitoring, (2) an instantiation of the control and monitoring process for business process assurance by both internal and external assurors, (3) a constant stream of measurements (metrics) engineered out of key processes, (4) a sophisticated dynamic set of standards (models) to compare with the metrics, (5) a set of dynamic exception metrics to determine when an alarm is to be issued and its degree of importance, (6) an analytic layer to perform additional analysis related to several corporate functions (e.g. auditing, fraud evaluation, accounting rule compliance and estimate review) and (7) a new level of statutory reporting that may include reports to governmental agencies (Alles et al., 2004).

Warren describes a web-enabled software architecture that receives a continuous feed of data from a variety of enterprise systems and performs continuous monitoring, audits and control checks on this data (Warren, 2005). Ye posits a service-oriented architecture would provide the most business value, rapid response capabilities and reuse for a Continuous Auditing system (Huanzhuo Ye, 2008). Woodroof adds the concept of continually combining data from multiple disparate organizations (Woodroof and Searcy, 2001).

Digitized Data Source

A critical building block to a Continuous Auditing system is digitized data. As technologies such as Electronic Data Interchange (EDI), Electronic Commerce (EC) and Electronic Funds Transfer (EFT) increase the number of digitized audit trails, the possible reach of Continuous Auditing increases. Although today's organizations are not entirely paperless, much of their information has been digitized. Redgrave estimates that 93% of information created today is in a digital form, 70% of an organization's records are stored electronically and 30% of electronically stored information is never printed. (Redgrave, 2005).

Alles, Bremmam et al. propose a large relational database application is an appropriate tool for an Audit Data Repository, which ideally contains all the data needed for an audit and organizes it from an audit perspective (Alles et al., 2006). Extract Transform and Load (ETL) tools could extract the data from the requisite systems, transform it to facilitate audit reporting and analytics, and then load it into the Audit Data Repository. Data Mining, which is a systematic process for extracting patterns from data (e.g. fraudulent transactions), could also be run against an Audit Data Repository.

Alternatively, Embedded Audit Modules (EAM) could be used to extract information of audit significance on a continuous basis and insert it into the Audit Data Repository (Groomer and Murthy, 1989). EAMs are generally application level code specifically written to identify and continually extract data for certain key business events. Because only data for key business events are extracted, this type of data extraction places minimal strain on the underlying systems in terms of processing time, disk I/O and network bandwidth.

Another view is that Continuous Auditing systems could leverage the data stored in an Enterprise Resource Planning (ERP) system. Alles et al. describe how Siemens' Continuous Auditing System was built on top of the firm's ERP systems (Alles et al., 2006). However, few organizations have a completely homogeneous information technology environment. The ACL 2006 survey of 858 audit executives in organizations with annual revenues in excess of $100 million illustrates this point. More than half of the respondents (58%) felt that fragmented and incomplete data structures constituted an extremely important issue facing their organization; 28% felt it was important; 11% indicated it was slightly important; and only 3% of respondents felt this was not a key challenge in their organization at this time (ACL, 2006). Typically, large organizations have a complex information technology environment, which could comprise a hodgepodge of ERPs or perhaps multiple instances of the same ERP, mainframe systems, off-the-shelf applications, and legacy systems, all of which may contain valuable data to the auditor. In highly fragmented information technology environments, this approach may be impractical.

Data Validation Engine

The data validation engine takes as input the digitized data stream and outputs audit procedure exceptions that generally either sound an alarm(s) and/or appear on an audit exception report. Many different types of algorithms have been suggested for the basis of the data validation engine: Belief Functions (Srivastava and Shafer, 1992), Continuity Equations (Alles, 2006), Expert Systems (Davis et al., 1997), Neural Nets (Coakley, 1995) and Regression-based Statistical Techniques (Vasarhelyi, 2004). Theoretically, the same Continuous Auditing system could use multiple data validation engines for different situations or even for the same one. By using a programming language these algorithms could be integrated together or supplemented with other arbitrarily complex handcrafted algorithms. However, these methods all share the following properties: observing events in real or near real-time, generating alarms or reports when audit exceptions occur, and performing repeat tests quickly, continually and with low variable costs (Vasarhelyi, 2004).

IMPLEMENTATION CHALLENGES

Although Continuous Auditing implementations are occurring, their adoption is slower than expected (Warren, 2003). In general, current efforts have focused only on the detection part of a Continuous Audit and neglected the real time response, which incorporates real time human decisions, the measurement of the impacts of those decisions and the determination of the effect of the responses. A Continuous Audit system that integrated detection and real time response would represent the merger of the current concepts in Continuous Auditing and the objectives of modern Emergency Management and Response systems (Turoff, 2003).

The Continuous Auditing literature mentions five obstacles to a Continuous Auditing system implementation: difficulty in formalizing business processes, cost, system acceptance test issues, information overload and system performance degradation. The following sections cover each of the aforementioned implementation challenges in more detail.

Formalizing Business Processes

Continuous Auditing requires the formalization of business processes, controls and audit exceptions. In general this formalization promotes precision and consistency, improves confidence in audit results and reduces long-run audit costs. Once a business process has been formalized, it can usually be automated. However, because many humans resist formal thinking, formalization can be highly laborious and costly, and some complex judgments are not amenable to formalization. As Alles commented, formalizing manual audit procedures to facilitate automation is much more difficult than what might have been anticipated (Alles et al., 2006).

Moreover, complex business decisions may require multi-criteria decision making, which refers to decisions that have conflicting criteria and require implicit or explicit tradeoffs between competing objectives. These types of decisions generally require the aggregation of input from various disparate parties that very well may have sharply different views, responsibilities and objectives. Consequently, conventional audit programs may not be designed for automation, because formalization and judgmental procedures are often intermixed to make these complex business decisions. In order to optimally automate the audit process, the whole process may need to be reengineered. Wherever practical, continuous automated procedures should be relied on while manual methods and informal judgmental procedures should be eliminated (Alles M., 2008).

One solution to the multi-criteria decision making problem suggested by Emergency Management research is to combined a real-time decision support system that provides consistent and comprehensive information with a structured approach that allows experts to model decisions and their effects (Geldermann et al., 2009). Another possible approach to lessen the requisite formalization taken from the Emergency Management research is to integrate human roles and human actions into a formal business process. For example, the Resource Interruption Monitoring System, developed for the United States Office of Preparedness in 1972, had templated solutions to various situations (e.g. a shortage of fertilizer). This system defined generic "steps" for handling these situations. Each step had a designated owner, responsible for performing an action on this step, as well as a set of possible actions. When the step owner performed an action, the owner of the next step was automatically notified. Each step had a configurable expected duration. If a particular step took longer than expected, the system would automatically send notifications to the relevant step owner as well as escalation notifications.

Using the above approach, audit processes that are difficult to formalize could still rely on human decision-making. For example, the process for resolving an audit exception identified by a Continuous Auditing system could have a structured workflow ensuring the appropriate parties reviewed and acted on this exception. The workflow module would define and enforce the requisite resolution steps, the appropriate owners and actions for each step in the process, and the escalation procedures.

Cost

Continuous Auditing systems tend to be perceived as expensive to implement. For example, in September 2008, the Economist asked 446 senior executives their views on the drawbacks of investing in automating their financial processes. The most frequently cited reason was the high level of investment required, for which 48% of the respondents gave as their answer. It was twice the frequency of the next highest response: difficulty of modeling complex financial processes (Fedorowicz, 2008). Unquestionably, these systems' perceived high implementation costs are a major obstacle currently impeding Continuous Auditing systems' implementation rate.

Moreover, only some of the benefits from a Continuous Auditing system are easily quantifiable: the cost savings associated with automating manual processes, consolidating systems and embedding controls into financial processes. Other possible benefits are difficult to quantify in terms of cost savings (e.g. fewer instances of noncompliance, better business decisions and risk management and reduced fraud risk). Because only some of the cost savings can be easily quantified, calculating a true total cost of ownership for a Continuous Auditing system is challenging, which could make justifying it purely from a cost perspective problematic.

However, one practical approach to containing costs is to limit the scope of the system implementation. Inevitably some auditing procedures will be more costly to formalize and automate than others. Consequently, one cost-effective implementation strategy is to limit the scope of the Continuous Auditing system to only the auditing procedures that can be easily formalized and automated. Alles suggests that formalizable auditing procedures should be separated from non-formalizable ones, where the formalizable auditing procedure's controls are executed with high frequency (perhaps continuously), while non-formalizable ones should continue to be done manually and periodically (Alles et al., 2006). Consequently, some audit procedures are either impossible or prohibitively expensive to formalize. One possible cost-effective approach to solving this design challenge is to use Continuous Auditing's detection and alerting functions for the formalizable auditing procedures, and use the tracking of decisions and decision options for the non-formalizable ones, which is the architecture recommended in some articles cited from the Emergency Management and Response literature.

System Acceptance

In order for Continuous Auditing to become a mainstream application, it will have to overcome the user acceptance issues that plague all new information technology implementations. Venkatesh developed and tested a Unified Theory of Acceptance and Use of Technology (UTAUT), which can be used as a starting point to understand the potential system acceptance issues that could occur for a Continuous Auditing system. Four constructs were identified as direct determinants of user intention and usage behavior: Performance Expectancy (the degree to which an individual believes that using the system will help attain gains in job performance), Effort Expectancy (the degree of effort associated with using and learning the system), Social Influence (the degree to which an individual perceives that important and/or powerful parties believe that the system should be used) and Facilitating Conditions (the degree to which an individual believes that an organizational and technical infrastructure exists to support system use). Gender, age, voluntariness and experience are key moderators of these four direct determinants. UTAUT predicts that behavioral intention to use a new Continuous Auditing system would be strongest when the end-users believe the Continuous Auditing system is supported by senior management, easy to use and well supported in terms of organizational and technical infrastructure, and will improve their efficiency and effectiveness at work (Venkatesh et al., 2003).

The UTAUT model's conclusions were supported by research conducted by Curtis. By surveying 331 members of the Institute of Management Accountants during the spring of 2009, Curtis concluded that accountants were more likely to champion Continuous Auditing systems that are perceived as easy to use and useful, (i.e. producing demonstrative and visible results.) Moreover, accountants supported less complex Continuous Auditing systems more frequently than very complex ones (Curtis, 2009).

Fischer's observations during his interpretive field study with several large accounting firms indicate that inertia in these firms could be a barrier to Continuous Auditing acceptance. Fischer observed these accounting firms were reluctant to rely on more sophisticated and/or effective audit procedures even when they were readily available. Their preferences tended to be anchored on the audit procedures and processes regularly performed in the past (Fischer, 1996). Finally, Hall and Khan suggest that adoption of a new invention might be slowed if it requires new and complex skills (Hall, 2003).

However, Bailey James identified the five system attributes that lead to the highest user satisfaction with an information system: accuracy (the correctness of the system's output), reliability (the consistency and the dependability of the system's outputs), timeliness (the output of information in a time suitable for its use), relevance (the degree of congruence between what a user wants or requires and what is provided by the system) and confidence in the system (the user's feeling of assurance or certainty about the system). (Bailey James, 1983). Therefore other things being equal, a Continuous Auditing system with a high degree of these attributes would be better accepted than one with a low degree of them.

Information Overload

Continuous Auditing systems could increase the quantity of data available for analysis, which could trigger information overload. Information overload occurs when the volume of information supplied in a given unit of time exceeds the limited human information processing capacity, which tends to lead to confused and dysfunctional behavior (Jacoby et al., 1974). Chewning and Harrell demonstrated that an overload of accounting data leads to decreased decision quality in accounting students (Chewning and Harrell, 1990).

However, there are several possible technical solutions to the information overload problem: installing voting structures to evaluate information (Hiltz and Turoff, 1985); using decision support systems (Cook, 1993); deploying intelligent agents to limit alternatives (Edmunds and Morris, 2000); providing flexible information organization, filtering and routing options (Hiltz and Turoff, 1985); utilizing data visualization tools (Chan, 2001); creating a measurement system for information quality (Denton, 2001); compressing, aggregating and categorizing data (Grise and Gallupe, 1999); defining decision models (Chewning and Harrell, 1990); exception reporting (Ackoff, 1967); and/or using search procedures (Olsen et al., 1998).

System Performance

Adding Continuous Auditing controls and/or data extraction methods to an existing information technology system may negatively impact system performance. Hoxmeier concluded that user satisfaction with an information technology system decreases as response time increases (Hoxmeier, 2000). In the best case, lengthy system response times would reduce user productivity and, in the worst case, render the system unusable.

Murthy examined the system performance implications of adding three types of controls (calculations, database lookups and aggregate function controls) to an e-commerce application. Calculation controls make comparisons between the current transaction and data retrieved from a single database lookup. Lookup controls are functionally equivalent to calculation controls. However, lookup controls require data from multiple tables. Aggregate function controls compare transaction values to the average, sum, maximum and/or minimum of a particular field. For example, one aggregate control compares the customer's current transaction amount to the customer's average historical amount. Murthy concluded calculation controls could be accommodated, regardless of system load. Lookup controls had a detrimental effect on system performance only during peak periods. Aggregate function controls had a dramatic negative impact on system performance irrespective of the system load (Murthy, 2004).

SUCCESSFUL IMPLEMENTATIONS

In spite of the implementation obstacles, several Continuous Auditing systems have been successfully implemented and discussed in the literature. The following sections discuss and compare several aspects of these systems.

AT&T's Paperless Billing System

Vasarhelyi described the Continuous Process Auditing System (CPAS) that AT&T Bell Labs used to audit a large paperless billing system in real time. CPAS extracts audit data from the billing system, uses it to calculate operational analytics and standard metrics, activates alarms alerting an auditor to potential issues, and generates audit reports. When predefined system rules are violated, alarms are triggered, which call attention to these system anomalies. There are four types of alarms: Type 1 alarms are minor and deal with the functioning of the audit system. Type 2 alarms are low-level operational alarms designed for operating management. Type 3 alarms are higher-level exceptions sent directly to the auditors. Type 4 alarms warn auditors and top management of a serious crisis. Moreover, the auditor had an interactive environment to review operational reports, specify audit procedures for continuous repetition and define custom alarms (Vasarhelyi and Halper, 1991).

Royal Canadian Mounted Police's Accounts Payable Departments

In the 2004-2005 fiscal year, the Royal Canadian Mounted Police (RCMP) implemented a Continuous Auditing system to assess its Accounts Payable (AP) control framework. The goals of this system were to provide reasonable assurance that the AP policies used by seven satellite offices complied with the central office's policies, the control framework effectively supported these AP activities and all financial transactions were processed consistent with these policies. The system used data extracted from the financial and human resources systems to compare cost, quality and time-based performance measures for each AP office. For example, labor cost for accounts payable, the average number of errors per invoice and the average number of days to pay an invoice were calculated and compared for each AP office. Using these data analysis techniques the audit team uncovered control weaknesses and sever(Alles et al., 2004)al instances of noncompliance with RCMP's policy (Coderre, 2006).

When humans are involved in the decision-making process, tracking how long it takes for an action to occur has long been an integral part of Emergency Management and Response systems. After a crisis occurs, evaluating the effectiveness of a crisis response to discover what could be improved in the process is an integral part of Emergency Management and Response systems. For example, audiotapes of operators in emergency operations regularly receive time stamps so that post-mortems and precise analysis of who did what when could be performed in an attempt to continually improve the process. Similarly, the Continuous Auditing literature describes a black box audit log, which is a confidential log of all of an organization's germane audit procedures and other economic events. The black box log creates a permanent and non-updatable record of the most important audit procedures with an audit trail of its own, which is kept private and secure. (Alles et al., 2004)

Siemens' SAP Security Settings

Siemens designed its Continuous Auditing system to monitor key security parameters (e.g. password complexity and expiration) for the firm's SAP systems. The system continually extracted information from SAPs' security tables and compared it to Siemens' security policies. When critical exceptions were identified, the system automatically generated alarms, which are emailed to all relevant parties. To prevent alarm floods, which occur when the same alarm is repeatedly sounded, from hampering the reaction to the underlying problems and, in the worst case, having the alarm ignored altogether, a hierarchical alarm structure was implemented where each node has an enabled/disabled flag. Disabling the node prevents its children's alarms from sounding, thereby preventing alarm floods. Moreover, the system intelligently monitors alarms, waits a predefined period before re-sounding an alarm and initiates escalation procedures if an alarm is not resolved within a given timeframe (Alles et al., 2006).

Summary

Table 1 summarizes the above Continuous Auditing implementations along four key dimensions.

	AT&T	RCMP	Siemens
Purpose	Audit a large paperless billing system	Assess Accounts Payable control framework	Monitor the key security parameters for Siemens' SAP application
Validation engine	Predefined system rules	Compare cost, quality and time-based performance measures for seven satellite AP offices	Siemens' IT security policy
Data	Extracted from source billing system	Extracted from the satellite offices' financial and human resources systems	Extracted from SAP security tables
Alarms	Type 1 for minor system issues. Type 2 for operating management. Type 3 for higher-level exceptions for the auditor. Type 4 for warning auditors and top management of a serious crisis	None	Hierarchical e-mail alarms that can be disabled at any level to prevent alarm floods and intelligent alarm monitors

Table 1. Summary of Continuous Auditing Implementations

CONCLUSION

Whether or not technology could be used to perform a consistent, credible and complete audit for an arbitrarily complex real-world organization in a manner equaling or surpassing the capabilities of a human audit team remains an open research question and a source of much debate. Some argue it is not possible to fully automate the auditing process, because it requires human judgment and estimation, which can never be fully automated or performed continuously (Krass, 2002). Although regulatory bodies painstakingly define standards and guidelines, and organizations spend significant resources defining their business policies and controls, determining whether an organization is in compliance with a particular standard, guideline or control still requires significant human judgment. Replacing human judgment tends to be difficult, costly and computationally intensive. Moreover, large-scale Continuous Auditing systems may be resisted because of their inscrutable complexity and novelty.

However, Section 5 illustrates Continuous Auditing, to date, has achieved some modest real-world successes. This paper suggests four practical recommendations that inspiring Continuous Auditing implementers could use to replicate these successes and, perhaps, improve on them. First, build the Continuous Auditing system on top of a solid architecture. Second, start on a small scale focusing on the audit procedures that are easiest to formalize and automate, which may help mitigate the initial cost objection. Third, design the Continuous Auditing system to have acceptable system performance, produce demonstrative and visible results, and be easy to use and understand (e.g. consider using the techniques outlined in Section 4.4 to reduce information overload). Fourth, maximize social influence by getting the support of executive level champions, which may help overcome the natural reluctance to adopt a new system.

One promising area for future research is how to integrate Continuous Auditing's detection and alerting functions with the tracking of human decisions and decision options into a cohesive system. The efforts to provide real time detection of possible financial anomalies seem very similar to the ones for Emergency Management and Response systems. Combining these efforts may be the means to overcoming some of the implementation obstacles currently facing Continuous Auditing as well as the foundation of a revolutionary new management tool.

For example, after a major fiduciary disaster in an organization, auditors are usually relied on to determine what caused this event. They must painstakingly reconstruct the decision trail from many different sources. However if the concept of Continuous Auditing could be expanded to include the tracking of the organizational human decision-making process that underlies the actual formulation, analysis and results supporting a particular decision, this system would become a central repository for the supporting details for all of an organization's major decisions. This system would track what authorizations, documents and/or results were produced to justify and execute any decision at all levels in the organization, which would impede the legal defenses used in cases like Enron where the high-level decision makers claimed they were completely unaware of some of the illegal and disastrous decisions being made. This type of Continuous Auditing system could make possible the accomplishment of the implicit goals of the Sarbanes-Oxley Act of 2002 (Turoff, 2004).

Making decisions at the highest levels of an organization an explicit process that can be tracked would be a new concept for most organizations. The Sarbanes-Oxley Act holds an organization's leaders accountable for the decision making process and limits their ability to claim ignorance for illegal decisions for which they now risk being held criminally liable. One way the leadership of an organization can protect itself from this risk is to define and track all types of decision processes that must occur at the upper levels of an organization. To date, most organizations have only applied this tracking to lower-level decision processes. Tracking the process does not necessarily ensure the resulting decision is optimal. However, if the tracking process ensures the responsibilities for various reviews and analyses by the relevant parties were, in fact, carried out and documented, including who was involved and what documents were produced, there would be much less chance that anyone involved could claim ignorance. Another positive side effect of this tracking would be to reduce, or eliminate, the potential number of clearly ridiculous, rash or illegal decisions made within an organization.

Moreover, the merger of human decision processes and automated functions for analysis also increases the ability of the organization to detect and deal with the unexpected on a cost-effective basis, whether it is a clear emergency or the more normal unexpected events such as the loss of a prime customer, a significant problem with a product, shortages of raw material due to unexpected increases in demand or sudden loss of skilled employees. The tracking of the decision process throughout the organization provides the foundation and the opportunity for detecting quickly the unexpected and incorporating more advanced real time support for the decision process at all levels of the organization.

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