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Continuous Auditing: Technology Involved

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Abstract

This study will concentrate on the latest factor causing changes in the domain of accountancy: technological advances. With a great deal of creativity and ingenuity, accountants around the world were able to find solutions to one of the problems that arose: increased fraudulent behavior. These, at times, involved a level of technology that was still not fully understood by all its users. This paper is going to focus on one of the ways that technology was applied to react to these changes: continuous auditing and monitoring. The idea of continuously auditing/monitoring the events and transactions of companies is not a new one, but innovations in technology have redefined it. Through explanation and demonstration of three continuous auditing models, this paper will attempt to bring some light on the topic and give an insight on the technology required for such a practice to be carried out effectively. Possible drawbacks and obstacles of incorporating the system in a company's day-to-day activities will be also looked at, and recommendations will be made.

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CHAPTER ONE- LITERATURE REVIEW

Reasons for change.

Changes in accounting practices have always been caused by shifts in the economic climate on a general scale; shifts that would affect all industries within an economy. Between 1912 and 1940, events such as the threats imposed on bankers by the Federal Trade Commission, the collaboration between NYSE and the AIA to improve reporting practices and the creation of the Securities and Exchange Commission (SEC), have caused the accounting profession to react by making changes in the way they approach new situations that arise (Ram, S. S., & Vollmers, G., 1997). As a result, the system became more error proof, at least until the next economic change happened.

Accountants always have to make a number of decisions in reaction to the issues they face. Triggered by all these rapid changes, resolutions such as the enforcement of Continuing Professional Development (CPD) have been made compulsory as a means of keeping up with the quickly transforming economy they are operating in ("Employers accept the development challenge.", 2005). The question now would be: “what is the profession reacting to this time?”

Innovation in technology is one of the recent causes of economic shift as it has affected the economy as a whole. On one hand, new ways of conducting business have resulted in greater convenience for the involved parties. The establishment of multiple payment methods, the introduction of better ways of conservation and distribution of merchandise or the increasing acceptance of online currencies such as Bitcoin (BitPay surpasses 10,000 Bitcoin accepting merchants), among others, are benefits that companies have been able to derive with the introduction of technology.

On the other hand, these innovations have made the work more difficult for accountants. Complex situations, such as the recording of longer and more cumbersome transactions or the need to make information available to interested groups of people within a more restricted time frame, arose and cast doubt on the role and performance of accountants; the possibility of material misrepresentations on the financial statements or unethical behavior at any level of a business organization became a more serious threat. These factors can easily be seen at play in corporate governance scandals, of which ENRON would be a perfect example.

As a reaction to such critical events, provisions of the Sarbanes-Oxley Act (2002) have put more stress on auditing practices (Lisa, M. P., O'Sullivan, S.A., & Shannon, J. H., 2007). Sarbanes-Oxley provided that management would be responsible for design and implementation of internal controls and improvement of accuracy and reliability of financial reporting and disclosures, which would reduce the likelihood of and assign accountability for fraud (Keila et al. 2005, Kotsiantis et al. 2006). The act also requires external auditors to audit and report on effectiveness of the internal controls that their clients have in place.

An industry report from IBIS World further stresses the importance that auditing has in our current economy. According to the data, the accounting industry is at maturity; the growth of the firm depends on the economy of the country in which they operate. Auditing accounts for 46.2% of the total number of services offered. However, coming out of the recession, the demand for accounting services is booming; this is mostly attributed to public clients, the clients that are required by Sarbanes- Oxley (2002) to have their financial statements audited by CPAs on a yearly basis, and who account for about 68% of the total accounting services clientele.

The report also details the areas in which the firms have been able to generate the most income. Just as expected, the revenues mostly came from assurance, assistance (consulting) and

risk assessment services. The major companies who have taken advantage of such an opportunity are the big four accounting firms: PwC, Ernst & Young, Deloitte & Touche and KPMG. The need for auditing services is present and has taken a more serious note over the last decade, as a result of the various scandals and innovations that happened.

In order to be able to audit a client, auditors first have to understand the client and the market they operate in from inside out; they must familiarize themselves with the internal controls, the accounting system employed by the client and the various outside forces that impact the clients' activities. This implies that the role of the auditors now includes adaptation to those factors to which their clients respond: gone are the days where everything was paper-based. Today, computer software, called Enterprise Resource Planning (ERP) systems, have taken over.

These models have enabled companies around the world to work with great efficiency by performing the work with speed and precision. They also serve as useful tools of internal control. However, they can only monitor events out of which they can make sense, through their formats, and can be modified by users who have appropriate levels of access. While this does limit the number of possible misstatements that would otherwise be present in the system, it does not reduce them to the extent it could if used to its fullest.

While this may be the case, the ERP systems produce a lot of documentation. It becomes the role of the auditors to know how to make use of the available data. One of the biggest advantages of having such a vast amount of data at their disposal is that they have a wider variety of dependable resources they can rely upon. The focus then becomes design of a system that makes use of technology that can monitor the various transactions that take place within a particular period of time or, even, on a day to day, continuous basis.

Continuous auditing

Continuous auditing was one solution that auditors found to help restore the confidence lost in the audit reports generated by CPAs because of various fraud scandals of recent occurence. The most typical definition for continuous auditing can be found in a book written by Rezaee, Sharbabatoghlie and McMickle entitled: Auditing: A Journal of Practice and Theory. They define it as follows:

"A comprehensive electronic audit process that enables auditors to provide some degree of assurance on continuous information simultaneously with, or shortly after, the disclosure of the information" (Rezaee, Sharbatoghlie & McMickle, 2002).

Other definitions have been produced. Some indicate that the reports are to be used only by internal auditors only, others stand for it to be used by external ones only (Alles, Kogan & Varsarhelyi, 2004). A few others, such as that of the ISACA Standards Board, believe that it should be used by both of them (ISACA Standards Board, 2002).

The focus, whichever the definition of continuous auditing this paper will follow, is that they all to agree on three points:

1) Continuous auditing adds additional assurance in the reports that are created
2) The reports are created in a timely manner, very shortly after the events they relate to are being recorded
3) It involves a certain level of technology

According to the literature, the establishment of a very sophisticated, technology focused, system is required for the seamless running of a continuous audit (Shields, 1998). As continuous auditing relies on an uninterrupted flow of data throughout the system, technology plays a

pivotal role in achieving this purpose. However, the technology involved in continuous auditing has only become known and cost efficient in the recent years.

Problem.

Without proper knowledge of these possibilities, the auditors may be doing work at higher cost and with less assurance than they would have with the use of the new technologies.

This has been precipitated by the need to have information ready on a real-time basis. In addition, some legislation, such as Section 9 of the Sarbanes Oxley Act (2002), have resulted in added regulation of this sector of accounting. However, this paper is not going to be focused on the legislative, but rather the technology effect; in other words, focus on the "how" it should be done rather than the "what" should be done.

One of the areas of focus will be the integrity and quality of the data/ information gathered by the system. This is actually the main reason for financial statement auditing: provide reasonable assurance that the information in the financial statements is materially free of material misstatements (Flowerday and Von Solms, 2005). The conclusions in the auditor's report should be based on reliable and accurate data (Wessmiller, 2002). Keeping this in mind, the technology that would be adopted should ensure the accuracy and reliability of the data it will gather. This paper will thus start with an explanation of the terms mentioned above.

The main focus of the paper will be on the new technologies involved in setting up a continuous audit system. As explained earlier, much is known about the legislation that covers continuous auditing, yet very little is known about the technology that enables these systems to function. This paper will focus on those technologies that are critical to the proper working of a continuous audit model. These are:

- Technologies such as embedded audit modules

- XLM technologies, such as XBRL (eXtensible Business Reporting language), XARL (eXtensible Assurance Reporting Language) and XCAL (eXtensible Continuous Auditing Language).

As some tools have been used in the past by accountants in their activities during audit, the history of Computer Aided Tools and Techniques (CATT), Electronic Data Processing (EDP) and auditing will also be reviewed.

There are a number of technologies that exist in order to help the auditors. These have to be adapted to for the needs of the continuous auditing system in use. Still newer technologies may also be required, but very little is known about them at this time.

Objectives

The objectives of this paper are to explore and explain the ways in which technology can be used to help auditors in their tasks. Emphasis will be placed on explanation of the technologies required in a continuous auditing system and the environment in which they are used. It is important to keep in mind that auditors use these technologies in order to provide continuous reasonable assurance, which will also be discussed in this paper.

Methodology

The very core and base of the paper are founded on the important literature study that has been done. Because of my data, which is mostly archival in nature, this paper will be organized as a synthesis. My contribution is, thus, to bring all these sources together: an archival synthesis.

The first part of the paper will be an introduction to the environment in which continuous auditing systems are used. This includes the technological environment and elements of security. A review of the history of auditing and information technology will be done to establish the firm relationship that has bonded these two sectors. Then the technologies that lead to the rise of

continuous auditing will be discussed: the paper will spend some time on eXtensible Business Reporting Language (XBRL) as it enables the real time reporting aspect of continuous auditing.

The second part will focus on the continuous auditing models discussed above. This part is about bringing together the various technologies that will be explored. It shall also talk about the difference in formats and how that problem can be attacked. Finally, a summary of the whole thesis will be given.

CHAPTER TWO- METHODOLOGY

Continuous auditing defined

There are a number of definitions that exist for the term "continuous auditing". For the sake of this paper, we will use that of the Canadian Institute of Chartered Accountants, which defines continuous auditing as "a methodology that enables auditors to provide assurance on a subject matter using a series of auditor reports issues simultaneously with, or within a short period of time after, the occurrence of the events underlying the subject matter" (CICA/AICPA, 1999).

It is relevant to explain that continuous auditing is not merely a traditional audit carried out with technology; it changes the focus of the entire audit (Bierstaker, Burnaby & Thibodeau, 2001). For instance, instead of focusing on discovering misstatements through the use of many substantive tests, the audit can now focus on the adequacy and effectiveness of internal control, since reliability of the information would have already been provided by the continuous audit system. These systems aim at being more preventive and deterrent of misstatements in the financial statements (Bierstaker, Burnaby, & Thibodeau, 2001; Rezaee, Elam, & Sharbatoghie, 2002). In addititon, continuous auditing methodologies differ in two major ways from traditional audits:

1) The reports are produced at smaller intervals than under traditional audits. They may be produced weekly, daily or even on demand (Shields, 1998).
2) The audit can focus on any type of decision making information, not just financial statement reporting. It could even report on the non-financial measures of a company's performance (Shields, 1998).

The literature points out some slight differences between the way continuous auditing is used by internal and external auditors. On the one hand, for external auditors, the systems aim at the establishment of efficient real time reporting in order to maintain data integrity and reliability. On the other hand, when continuous auditing is used as an instrument of internal auditing, the focus is on putting procedures in place in order to test for business processes, management's continuous monitoring process, and the disclosure environment (Krell, 2004).

The business processes are tested by examining a large number of transactions as they occur; in other words, the reliability comes from the fact that everything is entered correctly in the system and that internal controls are effective. As those two are ascertained, the auditor can go ahead and provide assurance on the quality and credibility of the information produced by the continuous accounting system (Rezaee, Sharbatoghlie, Elam, & McMickle, 2002). According to Srinivas (2006), internal auditors may derive the most benefit from continuous auditing as they are already acquainted with the procedures and internal controls existing in the company they work for. External auditors would benefit too: they will have the assurance provided by the internal auditors on the practices of the client and they can benefit from better knowledge of the industry in which the client operates (Srinivas, 2006).

A few terms are also discussed in the literature that will need to be explained for this paper to be successful.

A term that is also commonly referred to in the literature is continuous assurance**.** This is much related to continuous auditing. It refers to the same methodology, but with the difference that continuous assurance is rather a result, an end product of continuous auditing.

Another term that needs some attention is continuous online auditing**.** A report published by CICA in 1999. Concluded that continuous auditing needs to be a fully automated model to

function correctly. It is at its best when the data in the transactions and events that occur is readily available at any moment. The most logical way to implement this is through internet. In this case, a constant network is setup between the client and the auditor's systems. This makes the system both continuous and online, Continuous Online Auditing, or C.O.A. COA may require adequate knowledge of the client's practices; thus internal auditors may be able to make better use of it (Kogan, Sudit, & Varsarhelyi, 1999).

The last term that appears regularly is continuous monitoring. This is not the same as continuous auditing. It is a tool used by management to assess performance of the processes, system and data gathering. It does not have the aim of providing an audit report as does continuous auditing. Continuous auditing requires data from a higher level as it is trying to attest on conformity with various standards, where continuous monitoring merely gives information on performance in the areas mentioned above (ISACA Standards Board, 2002).

In order to examine the reasons for the development of continuous auditing, it is relevant for this paper to discuss the joint histories of auditing and Information Technologies (IT).

History of Auditing and Electronic Data Processing (EDP).

Continuous auditing is rooted in EDP. The first EDP was used in the 1950s. Back then, the systems processed data in batches. The only thing auditors had to do back then was to compare the inputs in the systems to the generated outputs. The punched cards provided the paper trail and these were straightforward to follow (Rezaee et al., 2001).

In the 1960s, computer technology grew and a trend to adopt it has been seen in the business world. Online, real-time, processing became possible during this period thanks to the increased speed of computers. Punched cards were replaced with tapes, which took the paper trail to an electronic format. This was also the time when auditors realized that computers could

be used as a tool for auditing and the creation of sampling applications quickly followed. Some auditors went as far as creating some programs that helped them in their tasks: some performed tests on mathematical accuracy or compiled files. These programs were called Generalized Auditing Software (GAS). The mindset of the auditors started shifting towards a "auditing through the computer" approach ((Ramamoorti & Weidenmier, 2004). There has been a shift from viewing auditing "around the computer", which viewed the computer as irrelevant, to "auditing through the computer", which realizes that computers have to be integrated into the audit and that auditors will need IT experience (Cerullo et all., 2003).

In the 1970s, the use of mainframe computers became a growing trend in business. Internal auditors, however, found it difficult to adopt the new "auditing through the computer" methods that were being created: integrated test facility, parallel simulations or controlled processing, to name a few. A plausible reason was maybe the higher degree of computer skills that these techniques required. Luckily, in the 1980s, with the introduction of personal computers (PC), data has been made readily available and those auditing techniques became more user friendly to put in place. This is when their use started spreading quickly among auditors. The proprietary class of GAS were replaced by commercialized tools such as ACL and IDEA. These worked on various platforms (Ramamoorti et al., 2004) and were intended to test automated controls (Cerullo et all., 2003). The progress of IT and ITC in audit has been summarized in figure 1.

In the 1990s, the role of auditors changed. This was due to the rise of value added services, such as improving standard processes, performing financial performance reviews and the like. These value added services were desirable as they helped in the decision making process (Glover & Romney, 1997).

Communication increased proportionally to the development of world networks. This lead corporations to start using Enterprise Resource Planning (ERP) systems in order to aid in the implementation of routine processes, such as sales and accounting. The development of intra- and extra-nets have also made communication easier for internal branches and potential partners or traders. The extranet lead to the extension of the enterprise and gave birth to Supply Chain management (SCM) and Customer Relationship Management (CRM) (Ramamoorti et al.,2004).

One of the key changes that occurred in communication technologies over the 1990s was Electronic Data Interchange (EDI). These have enabled business partners to exchange data within their particular network. From there, a major change could be observed and has definitely impacted the way auditors worked: everything was done in an electronic manner. By then, the paper trail that used to exist, pre-numbered documents or sales orders for example, had fully been converted to an electronic equivalent. The focus of the audit was no more the substantive tests of transactions; it had to adapt to the new electronic environment with which they were faced. The focus was now on making sure that the controls to key in those events in the system were right, that they met the requirements laid out by COSO and COBIT (Rezaee et al., 1998).

With the implementation of EDI and ERP systems, the availability and longevity of the information changed: auditing had to adapt. Samples could no longer always be gathered at the end of the period but rather during the audit period. Continuous auditing was a natural fit given the existing circumstances (Rezaee et al., 1998). At the same time, all the innovations that had been made in the domain of technology surely enabled the creation of continuous auditing.

Benefits of continuous auditing.

As the rate at which technological innovations were being adopted increased, the benefits of continuous auditing became more obvious. The following are some of them:

- The possibility to test bigger samples, maybe all of them. Computers do the work faster and almost instantly (Rezaee et al., 2001)
- Reduced time needed to audit compared to traditional audits (Rezaee et al., 2001). Time being the main cost incurred by auditors, we can conclude that continuous auditing reduces costs.
- Quality of the audit increases as the auditors can now focus on other things than the accuracy of what has been processed. There is now bigger chunk of the audit period spent understanding the industry in which the client operates (Rezaee et al., 2001).
- Better flexibility in terms of reporting. Reports are easier to tailor to meet the needs of the various stakeholders of the financial information (Srinivas, 2006a).

However, what may be seen and thought to be the most prevailing reason for the development and adoption of continuous auditing is the fact that it is more a preventive and deterrent approach. Where traditional auditing would focus on detecting the misstatements and then trying to correct them, continuous auditing would just avert them: "the focus of the audit will shift from manual detection to technology based prevention" (Bierstaker, Burnaby & Thibodeau, 2001). The prevention of misstatements, through the assurance of the integrity of data, became more desirable especially after financial scandals, such as those of ENRON or TYCO, which deteriorated the trust that the stakeholders had in the financial statements (Flowerday & R. von Solms, 2005a). A good continuous auditing system would also report to supervisors and higher placed posts in order to deter fraud (Varsarhelyi, kigan & Alles, 2002).

The scandals mentioned above led to the creation of the Sarbanes-Oxley Act of 2002. This was one of the major driving forces of continuous auditing which became desirable mostly through sections 404 and 409 of the said act. Section 404 relates to the assurance of controls and supports more than anything the implementation of continuous auditing systems. Section 409 relates to financial reporting and requires them to be on a "rapid and current basis" (Alles et al., 2004, Srninivas, 2006a).

Core components of continuous auditing.

In the 1990s, although great technological innovations have been made, there were still some barriers to the implementation of an effective continuous auditing system. According to Shields' article in 1998, three basic conditions had to be met by a system for continuous auditing to function well:

1) Information that will be audited must be the fruit of a very reliable system.
2) Continuous auditing systems should be highly automated and integrated in the client's system.
3) There should be good communication between the client and the auditor's systems. The communication established should be strong and fast in order for the flow of data to not stop (Shields, 1998).

In the last decade, technology became way more competent than it used to be and did so for a lower cost. Five innovations have been identified to be crucial in a continuous auditing system:

- A powerful processor— in order to conduct real-time reporting.
- Disk mirroring— Redundant Array of Independent Disks (RAID) have allowed for the possibility of mass storage.

- Extensive amounts of inexpensive storage—this has been permitted through the development of petabytes; they are the next unit of measure after terabytes and allow for greater storage space for the same cost.
- Security— this has been stepped up because the data would have to be transferred or stored in an electronic manner. Reliability of the data is one of the assurances the system should bring.

Computer Aided Tools and Techniques.

It has been proven that, in order to verify that information produced by a system is reliable, testing of controls must occur simultaneously with some tests of transactions (Helms & Mancino, 1999). There are various tools and techniques that can be used to help in the process of analyzing the transactions as they arise. These can either be from commercialized software or internally developed by auditors. In any case, they will be referred to as Computer Aided Auditing Tools and Techniques (CAATTs) for the purposes of this paper.

In general terms, CAATTs can be understood as being any technology that helps the auditors in their tasks, such as working papers and word processors (Braun & Davis, 2003). They also include items such as utility software, presentation tools, flowcharting software, etc. (Coderre, 2001). CAATTs can be grouped under the following titles:

- Package programs— these are general computer program used in data processing. Examples include some GAS tools such as ACL and IDEA.
- Purpose written programs— these are used to perform auditing tasks when specific instances are present. They are either written by auditors or programmers overseen by auditors. They are usually developed off the client's system, instead of starting from scratch.

- Utility programs—perform functions such as sorting, creating and printing. Examples of these may be Microsoft Excel or Access.
- System management programs—they are usually made part of the operating system of the client and are specifically designed for auditing purposes. They include data retrieval tools and comparison code software.
- Embedded audit routines— or commonly known as embedded audit modules (EAMs), gather information on the behalf of the auditors from the client's systems. The two most used approaches to run EAMs are the snapshot and the System Control Audit Review File (SCARF) methods (Razaee et al., 2001). The snapshot method, as the name indicates, involves taking a picture of the transaction as it is recorded and the SCARF method involves gathering data related to the transaction into one file that is then sent to the auditor. This gives the auditor a real chance at continuously monitoring the client's systems.

Now that the paper has explained what CAATTs are, it will focus on the ones that are the most commonly used:

- **Generalized audit software (GAS)**

  This is the most frequently used of all CAATTs (Braun & Davis, 2003). This may be attributed to a few reasons: they are simple to use (compared to other CAATTs), they are easy to customize, they adapt to various systems and cause minimal disruption to the client's system on which they do not rely to a great extent.

  GAS can be used to perform a vast range of tasks, such as analyzing data and extracting it from the client's system to help the auditor in his/her job. These are mostly

used in substantive tests of controls but can also serve to reduce tests of controls. (Cerullo et al., 2003).

The two most available GAS commercial tools are ACL (Audit Command Language) and IDEA (Interactive Data Extraction & Analysis) (Bierstaker et al., 2001; McCollum &Salierno, 2003).

- **Artificial Intelligence (AI)**

For the purpose of this paper, AI will be looked at under the following groups: autonomous agents, expert systems and neural networks.

There are a good number of existing autonomous agents. These may be control agents, digital agents, autobots, softbots etc. (Debreceny & Gray, 2001). An autonomous agent can be defined as "a system situated within and as a part of an environment that senses that environment and acts in it, over time, in pursuit of its own agenda and so to affect what it senses in the future". They are different from regular programs in that they are reactive and can be proactive (Kogan, Nelson, Srivastava, Vasarhelyi & Bovee, 1998). More towards the continuous auditing topic, "a digital agent is a set of electronic instructions (software) that acts [sic] on behalf of the auditor in a semi-autonomous manner to perform some service related to the subject matter being audited" (Woodroof & Searcy, 2001).

The literature outlines many ways in which agents can be used in the domain of continuous auditing: they can be used to perform actions such as performing analysis and making suggestions related to financial data (Debreceny et al., 2001). Financial Reporting and Auditing Agent with Net Knowledge (FRAANK) is an example of agent and is labeled to extract data from the financial statement and translate them into XBRL

statements (Kogan et al., 1998). Again, this could be used in a variety of manners when it comes to continuous auditing.

In real time accounting systems, these agents are used in the verification of payables and receivables. They perform queries into the client's system in order to give more up to date information on fluctuations than the traditional ways to account for those titles and, they enable COA to be used.

Expert systems, another important AI technology, are able to process a vast number of data in a way that is similar to human thinking: they clarify the data in order to find patterns. While the traditional audit processes looked only for patterns that were already known, experts systems discover and analyze those patterns even if they did not previously exist (Dalal, 1999). They are advantageous in that they allow for the analysis of vast amounts of data in an inexpensive way, compared to if actual humans were used.

One of the latest AI technologies is neural networks. They work similarly to expert systems but are more effective at recognizing patterns because they work by trial and error; this implies that the bigger the data set, the more precise the information on the patterns is going to be. Neural networks are mostly used in assessing the control risks. They can be used to predict instances of fraud, which is the major way in which they are put to use (Cerullo, 2006). They take advantage of the fact that they can make sense of very imprecise data and find trends that may be too elaborate for the human brain (Koskivaara, 2003).

- **Embedded Audit Modules (EAMs)**

These are methods of capturing and transferring information from the client's system to the auditors that have existed since 1989 (Groomer & Murphy1 1989). They are

commonly used along with Integrated Testing Facilities (ITFs) and are given the name of continuous audit approaches (Cerullo et al., 2003).

They are viewed as routines in the applications; they continuously monitor the transactions that take place and transfer that information to the auditor's system. For this to be, there should be a pre-set criteria the EAM will have to look for. This means that the EAMs have to be highly automated and uninterrupted as they work.

As they are built into the client's system, it is harder to implement since IT knowledge is required. In case the client switches his/her system, the coding for the EAM has to be reviewed. This also forces auditors to stay in close relationship with their clients (Braun et al., 2003).

- **Integrated Testing Facilities (ITFs)**

As mentioned earlier, these are relevant especially in the domain of real time accounting. The difference between ITFs and EAMs is that EAMs examine the data that is processed by the application while ITFs try to assess the logic in the use of the application (Braun et al., 2003). They are a very effective tool in assessing and reducing control risks from applications. They do so by splitting the data in two groups: "dummy" data and "live" data. ITFs are codes written on the client's programs and basically let the "dummy" data roll through the system and then compare the results they generate to the forecasts they had.

eXtensible Business Reporting language (XBRL).

After the previous parts of this chapter extended themselves on the explanation of the various technology that were part of continuous auditing, this one will focus on tagging them. For this purpose, eXtensible Business Reporting Language (XBRL) will be used.

XBRL was created by a consortium created in 1999. This was a combined effort of industry and government, including the American Institution of Certified Public Accountants (AICPA). Some technology companies and some of the larger accounting firms were also part of the effort (Coderre, 2004).

These standards were created to help auditors in selecting relevant financial information, compile it into the financial statements and then publish, exchange and analyze them (Hannon, 2005). Stakeholders can then have access to the statements, which can be saved in various formats such as HTML or PDF, online (The Canadian Institute of Chartered Accountants, 2002). The aim of XBRL is to make the decision making process easier through the assurance of the reliability and integrity of the data it communicates.

XBRL was developed around eXtensible Markup Language (XML), which is a standard for data exchange on the internet. It uses tags to keep track of the data which are placed between tags: "<" and ">". Think of this as being a grammatical rule in a real language. As you learn and apply it, it consistently works. The same applies here with XML (Garthwaite, 2000): the tags represent the grammar through which the language is written.

Unlike HTML, XBRL dos not give any indication of the way the data it contains is supposed to be presented. The biggest use of XBRL is the storage and transfer of data. They thus standardize the data, making it easy to upload and straightforward interpretation by the various browsers in use. An example of an XBRL language sequence is provided in Figure 2. While the standards allow for quick and efficient transfer of data, as mentioned earlier, it is up to the recipient of the information to have a "style sheet". This is basically a tool that makes sense out of the XBRL file and transforms it in a way that is more user friendly: the data can now be stored in PDF, Excel or other presentation programs. There are various types of style sheets, including

Cascading Style Sheet (CSS) and Extensible Style Sheets (XSL) (The Canadian Institute of Chartered Accountants, 2002). The output from the XBRL file shown in Figure 1 after using a Style Sheet is illustrated in Figure 2. XBRL standards in themselves consist of specifications, taxonomies, instance documents and style sheets.

Specifications are technical documents. They outline the way data is supposed to be translated into XBRL. This involves a syntax of taxonomies and instance documents (Srinivas, 2004). It is the point of departure of all XBRL reporting as it lays out the way the other components are to be used.

Instance of documents and taxonomies are necessary elements of XBRL. While instance of documents encloses the raw data, taxonomies tag it using a pre-approved list of symbols to codify the (financial) data (Hannon, 2005). Taxonomies provide information on the concepts and relationships between financial information, commonly through the use of set standards such as Generally Accepted Accounting Principles (GAAP) (The Canadian Institute of Chartered Accountants, 2002). Taxonomies are standards and guarantee that the XBRL language is the same used for all financial information, thus permitting their comparison. Taxonomies are made up of two parts: schemas, which contain a list of document to be used from the instance documents, and linkbase files, which describe the information present in the schemas. The relationship between taxonomy and instance documents is that while taxonomy describes the procedures to translate the data, instance documents hold the data to be used.

XBRL has proven to be beneficial in a number of ways, including the following:

- Users of financial information are able to access the data in a faster and more efficient way. The format in which the data is sent is also very efficient as various Style Sheets can

be used by different companies to clarify the files transferred. This is way quicker than EDI, which would have otherwise taken days (Pinkster, 2003).

- XBRL also leads to better data quality, which is attributed to the automation of data exchanges (Willis, 2005). Poor data quality most often arises during the transmission stage as the data loses context.
- Auditing efficiency is increased as XBRL provides standard data; it can be used by a vast number of presentation programs and operating systems (Naumann, 2004).
- Increased transparency of the audit as users have ready access to the data (Pinkster, 2003).

These benefits also fit in continuous auditing as two of its requirements are that the information should be reliable and timely. XML related technologies achieve these goals as mentioned above but, more specifically, help in the functioning of web- based audit programs.

Limitations also exist with the introduction of XBRL:

- It has primarily been designed to convey financial information and, thus, there is a difficulty that can be noticed when it comes to transferring charts, graphs, etc.
- There is also a potential security problem that exists because of the fact that data is interchanged and so done through online means (Coderre, 2004).

To tackle some of those limitations, other XML based technologies have been created. Among these is XARL. This method aims to add an additional amount of reliability to the data translated. This is done through a modification of the tags being used to translate the data. These new tags specify the time frame, signatures and other control mechanisms.

CHAPTER 3- MODELS, RESULTS AND CONCLUSIONS

The three continuous auditing models.

Three of the most prominent continuous auditing models are going to be discussed in this paper. They have been found in 3 articles: "Continuous Auditing: Building Auditing Capacity" (Razaee et al., 2002), "Toward a Paradigm for Continuous Auditing" (Onions, 2003) and "Continuous Audit: Model development and Implementation within a Debt Convenant Compliance Domain" (Woodroof & Searcy, 2001)

- **Razaee et al. (2002)**

Here, Razaee starts by pointing out the biggest challenge when it comes to setting up a continuous auditing model: the standardization of data. Various operating systems and software produce various types and formats of data which have to be adapted to the continuous auditing model for its proper functioning. He also points out that it creates a risk of data duplication, hence errors.

He outlines two ways of stocking the data. In the first one, a "scalable data warehouse" is used. This is a method where all data is being gathered and stored for the auditor to use. As the data here includes everything that happened overtime, it requires a lot of memory and has proven to be relatively expensive. The second method was developed from that flaw and is executed through the storage of only that data that is necessary to the audit.

Razaee's continuous auditing model, an illustration of which is shown in figure 4, runs using servers and works as follows:

a) Data is collected from the client server through various means, such as linking tables or storage drives, etc., and stored on the auditor's server.

b) As the data is transferred to the audit server, it is extracted and downloaded from a wide range of sources. There is a need to standardize it in order for it to be used by the model. The data is then validated and reshaped into usable information for the auditors.

c) Data marts, metadata storage platforms, are used for storage as they prove to be cheaper than data warehouses. Tests are then designed on the data marts to continuously examine the stored data for unusual trends according to standards set (usually GAAP).

This model seems to be widely used because it allows for a bigger scope in terms of data collected and tested. The focus here is on data standardization.

- **Onions, 2003**

Unlike the previous model, this one is focused more on the integrity of the data. It tries to do so by examining the transactions as they are being entered and uses expert systems to find suspicious tends. It concerns itself with three major areas: keystrokes, transactions and data pattern analysis.

Keystroke area refers to examining the various commands that have been entered in the software while typing for potentially fraudulent ones. In order to commit any fraud, something has to be altered in the system; this requires the fraudster to use some kind of database interface, such as Structured Query Language (SQL).

Transactions area refers to the reporting of each transaction as a standalone. The transactions are tested at the time of entry and this is done to make sure that the transactions recorded are entered according to standards (GAAP). This is achieved through the use of CAATTs.

Pattern analysis area refers to looking for usual patterns in the data. After the transaction is verified above, it is stored. Expert systems are used here to inspect each transaction added and its role in the trend and its effect. An issue that may arise using as the expert systems is the difference in formats from various software in use. The solution is to have a general master file where all data can be stored and used regardless of its format. This is where XCAL comes into play as it provides that platform, being an XML based technology. An illustration of Onions' model is shown in Figure 5:

a) Transactions are entered in the system.
b) Transactions and the keystrokes are tagged using the XCAL standards in real time.
c) The keystrokes and transactions are examined using CAATTs on a real time basis. This is where the data is verified for anomalies. In the event some exist, alerts will be sent to the auditors, usually the Online Systems Audit Center (OLSAC) which verifies that all standards have been met for the transfer, through private networks to which no one else has access.
d) Expert systems examine the information for trends over long periods of time. They compare the information to predefined standards.

- **Woodroof et al., 2001**

This model is more specific and focused on one area: debt covenant compliance. The model is based in a web interface as it tackles the problem of readily available reports for the client's stakeholders.

A covenant is a legal agreement between a lender and a borrower. It gives information on the loans, duration, interest rate, compliance standards, etc. and value of the collateral given for

it. This model allows the lender to verify that the debt covenant is respected. This is achieved through the following stages, as shown in figure 6:

a) Client's loan covenant requirements are sent from lender to auditors
b) Various agents and sensors are used to look for deviations from predefined standards in the client's systems. Any deviation is sent to the auditors who are thus alerted via the Web.
c) A software digital agent is used to request real time balances of all the accounts from the client's system related to the event that put the client out of the covenant's requirements.
d) The auditor's digital agent extracts the information that is needed in case too much is sent
e) A report is generated on the event and sent to the loan officer. The report includes information on what went wrong, reliability, and possible technical errors.

As the report is sent through the Web, it needs to be put in a format that is suitable. XBRL is used in this case as it allows the officer to use his browser to view the report the way he wants.

Summary.

This paper has focused on explaining the technology involved in continuous auditing and the way it can be used. It did so through

- Reviewing the history of auditing in relationship to that of IT. A context has also been formed to explain the way continuous auditing is used
- Detailing the technologies involved and the possible problems arising from them
- Providing an answer through the three proposed models.

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Figure A

Evolution of IT and Internal audit Function (Ramamoorti & Weidenmier, 2004, p347)

Time Frame	**IT Developments**	**Internal Audit Function Developments**	**Evolution of IT Audit**
Mid 1950s	Computer processes business applications using punched cards	(Internal) auditors audit "around the computer"	1st generation EDP Audit: Compliance
1960s	Tape drives replace punched card Emergence of generalized audit software	Exploration of sampling applications Beginning of audit "through the computer" Internal auditors begin to do operational audits	
1970s	25 proprietary GAS packages Creation of ACL Multitude of test created to check computerized systems	IIA issues the influential *Systems Auditing and Control (SAC)* reports	

1980s	Creation of Personal Computers (PC) IDEA software created for PC	(Internal) auditors continue to slowly experiment with IT	2nd generation IS audit: control frameworks
1990s	Introduction of Enterprise Resource Planning (ERP) systems Growth in internet use Ethical hacking Enactment of privacy laws	Auditors continue to adapt to GAS and expand its use in operations Rate of IT adoption escalates with intro of internet	3rd generation IT audit: risk control
2000s	Internet and global technologies change the business world Beginning of computer forensics	Auditing focuses on Sarbanes Oxley Act Sec. 302, 404 and 409 (real-time reporting by issuers)	4th generation IT audit: Risk management process

Figure 2

Financial data XBRL mapping (xbrl.org)

```
<ifrs-gp:AssetsHeldSale contextRef="Current_AsOf" unitRef="U-Euros"
  decimals="0">100000</ifrs-gp:AssetsHeldSale>
<ifrs-gp:ConstructionProgressCurrent contextRef="Current_AsOf"
  unitRef="U-Euros" decimals="0">100000</ifrs-
  gp:ConstructionProgressCurrent>
<ifrs-gp:Inventories contextRef="Current_AsOf" unitRef="U-Euros"
  decimals="0">100000</ifrs-gp:Inventories>
<ifrs-gp:OtherFinancialAssetsCurrent contextRef="Current_AsOf"
  unitRef="U-Euros" decimals="0">100000</ifrs-
  gp:OtherFinancialAssetsCurrent>
<ifrs-gp:HedgingInstrumentsCurrentAsset contextRef="Current_AsOf"
  unitRef="U-Euros" decimals="0">100000</ifrs-
  gp:HedgingInstrumentsCurrentAsset>
<ifrs-gp:CurrentTaxReceivables contextRef="Current_AsOf" unitRef="U-
  Euros" decimals="0">100000</ifrs-gp:CurrentTaxReceivables>
<ifrs-gp:TradeOtherReceivablesNetCurrent contextRef="Current_AsOf"
  unitRef="U-Euros" decimals="0">100000</ifrs-
  gp:TradeOtherReceivablesNetCurrent>
<ifrs-gp:PrepaymentsCurrent contextRef="Current_AsOf" unitRef="U-Euros"
  decimals="0">100000</ifrs-gp:PrepaymentsCurrent>
<ifrs-gp:CashCashEquivalents contextRef="Current_AsOf" unitRef="U-
  Euros" decimals="0">100000</ifrs-gp:CashCashEquivalents>
<ifrs-gp:OtherAssetsCurrent contextRef="Current_AsOf" unitRef="U-Euros"
  decimals="0">100000</ifrs-gp:OtherAssetsCurrent>
<ifrs-gp:AssetsCurrentTotal contextRef="Current_AsOf" unitRef="U-Euros"
  decimals="0">1000000</ifrs-gp:AssetsCurrentTotal>
```

Figure 3

XBRL sequence in Fig 2 using a Style Sheet (XBRL.com)

CURRENT ASSETS	
Assets Held for Sale	100,000
Construction in Progress, Current	100,000
Inventories	100,000
Other Financial Assets, Current	100,000
Hedging Instruments, Current (Asset)	100,000
Current Tax Receivables	100,000
Trade and Other Receivables, Net, Current	100,000
Prepayments, Current	100,000
Cash and Cash Equivalents	100,000
Other Assets, Current	100,000
Current Assets Total	1,000,000

Figure 4

Razaee et al. (2002) Continuous Accounting Model

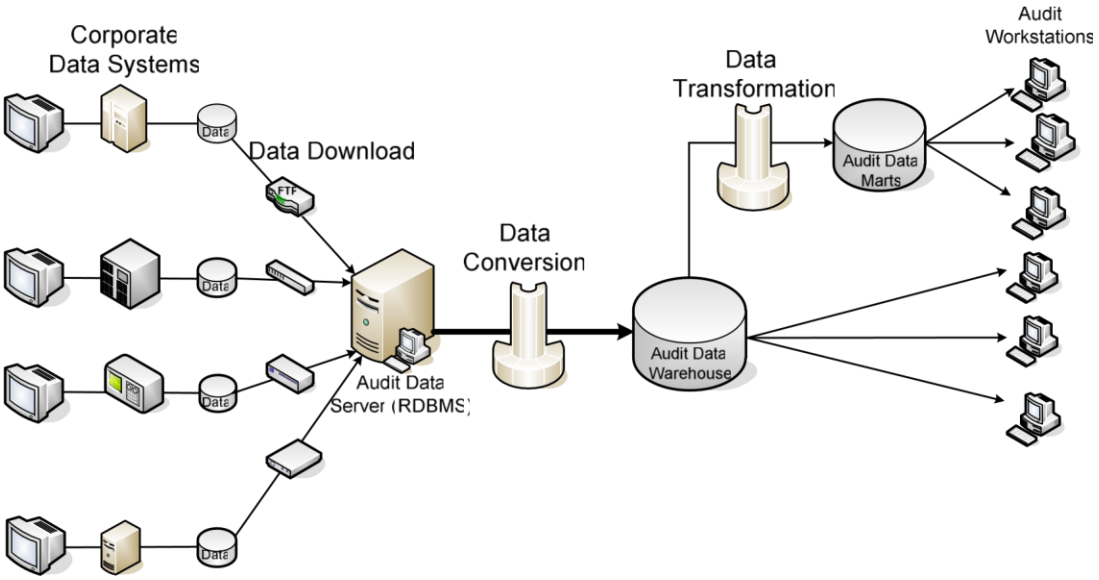

Figure 5

Onions, 2003 Continuous Audit Model

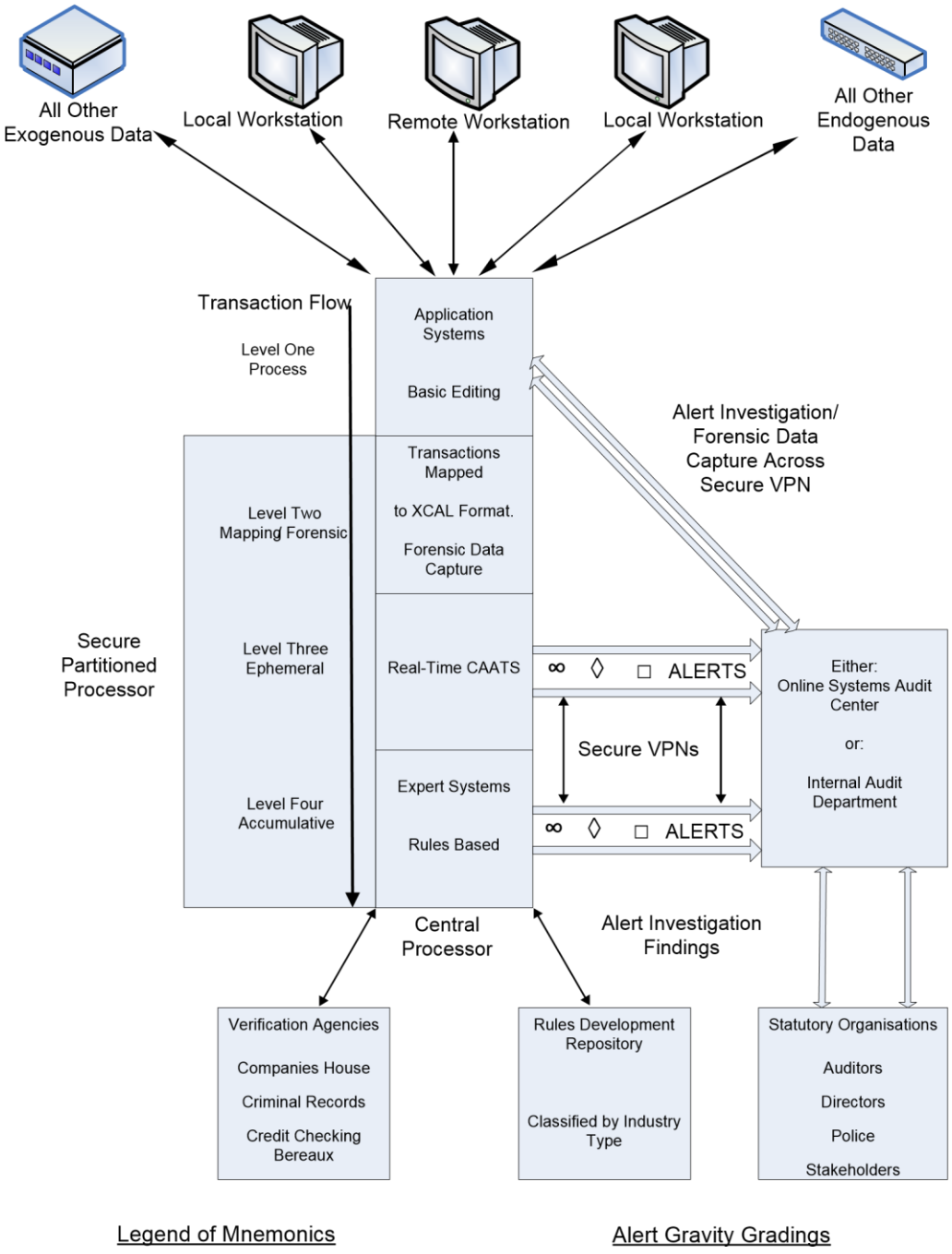

Figure 6

Woodroof et al., 2001 Continuous Audit Model