

## **Continuous Auditing: A Literature Review**

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Recent fraud scandals involving highly known corporations like Enron, WorldCom, and Xerox have eroded public confidence in financial reporting. At the same time, the auditing profession has suffered a big hit. In this scenario, Continuous Auditing (CA) seems to have emerged as a response to recover the credibility of the auditing profession as well as meeting Sarbanes-Oxley (SOX) requirements. This study, that adopts an exploratory approach, analyzes the existing literature on this topic. First, we address the concepts, models and implications of CA. After, throughout a search on the journals indexed at the CAPES's Basis, a literature review is conducted. A total of 57 articles were selected. We analyze authorship, affiliation, publications, year and type of research of papers that have addressed CA. Findings evidence that most articles addressing CA are non-empirical and adopt a conceptual approach. Also, there is an increasing tendency of continuous auditing studies. Rutgers University seems to be the World's leading research center on CA. This study aims to contribute to the Accounting Science by evidencing possibilities for research and publication in CA.

**Keywords:** continuous auditing (CA), financial reporting, literature review.

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## 1. Introduction

One of the main purposes of financial statements disclosure is to inform external users about the economic and financial situation of an organization. Specially, after the path-breaking works of Ball and Brown (1968) and Beaver (1968), there has been a consensus among the accounting community that financial statement disclosure should help to reduce the information asymmetry existing between internal and external users. Thus, one might assume that information published in financial statements should be both useful and credible.

However, recent fraud scandals involving highly known corporations like *Enron*, *WorldCom*, *Adelphia*, *Global Crossing*, *Parmalat*, *Lucent*, *Tyco* and *Xerox* have led to restatement and bankruptcies that have harmed several stakeholders. According to Rezzae (2005) fraudulent reporting has generated losses of more than 500 billion to investors in the last years. Not surprisingly, it has resulted in a financial statement's credibility loss, raising questions about its integrity. At the same time, fraud scandals have eroded the public confidence in the auditing process (REZZAE, 2004).

Despite the difficulty in fighting financial statement fraud, auditors should not ignore this issue. Instead, it is necessary to mechanisms to combat fraudulent acts (TURNER, 1999). At the same time, information technology is dramatically changing the way financial statements are prepared, audited and used (ZHAO, YEN and CHANG, 2004). In this line of thinking, Flowerday and Solms (2005) suggest that auditors must find new ways to of verifying information in financial reports. In this sense, auditors and accounting scholars have been working in the development of mechanisms and technologies to audit financial statements and prevent fraud.

Considered by the AICPA, one of the emerging technologies that will impact CPA firms, Continuous Auditing (CA) apparently could help to detect misstatements and frauds in financial reporting. In comparison with tradition financial statement audit, CA is more timely, comprehensive, accurate and less costly (ALLES, KOGAN and VASARHELYL, 2005). CA refers to the audit of an accounting moving picture instead of the old accounting snapshot (YANG, 1990).

Wishing to evidence opportunities for research on continuous auditing (CA), this study analyzes the existing literature on this topic. Throughout a search on the journals indexed at the CAPES's Basis, a literature review is conducted. First, we address the origin, concepts and systematization of CA. After, we analyze authorship, affiliation, journals, year of publication and type of research of papers that have addressed CA. Finally, we present implications for future research on this topic.

The remainder of this paper is organized as follows. Section 2 reviews continuous auditing; section 3 presents this research's methodology; section 4 analyzes the results and section 5 presents this paper's conclusions and recommendations.

## 2. Continuous Auditing (CA)

Porter, Simon and Hatherly (2003) define a financial statement audit as “an examination of an entity’s financial statement, which have been prepared by the entity’s management for external users, and of the evidence supporting the information contained in those financial statements. In this line of thinking, one important issue about the auditing services regards the consistency of the information been examined.

In this sense, one of the primary functions of an auditor during an audit process is to verify the quality of the data under audit. A principle measure of data quality is the numbers of errors within a database. Errors are minimized when database is monitored for errors (PATHAK, CHAOUCH and SRIRAM, 2005). At the same time, the change in business process that removes traditional source of information requires the creation of new audit procedures to conduct financial audit (REZAEE, ELAM and SHARBATOGHLIE, 2001).

Following this line of reasoning, the development of auditing tools is important with regard to the workload and demands of auditors in today’s business environment (KOSKIVAARA, 2007). In this sense, the accounting profession needs to help to modernize and expand financial and performance reporting models, including the use of continuous auditing process (WALKER, 2005).

The CICA/AICPA (1999) defines continuous auditing (CA) as “a methodology that enables independent auditors to provided written assurance on subject matter using a series of auditors’ reports issue simultaneously with, or a shot time period of time after, the occurrence of events underlying the subject matter”.

In other words, CA is a process of gathering and evaluating evidence to determine the efficiency and effectiveness of real-time accounting systems in safeguarding assets, maintaining data integrity, and producing reliable financial information (REZAEE, ELAM and SHARBATOGHLIE, 2001). According to Coderre (2006) CA is a unifying structure that brings together risk and control assessment, audit planning, digital analysis, and other audit technologies and techniques.

Zhao, Yen and Chang (2004) present the primary similarities and differences between traditional auditing and continuous auditing. Those are exhibited on table 1 below.

**Table 1 – Traditional Auditing X Continuous Auditing**

	<b>Traditional Auditing</b>	<b>Continuous Auditing</b>
Similarities	Independent professional attestation services Use GAAP as criteria	Independent professional attestation services Use GAAP as criteria
Differences	Used in paper-based accounting information systems Once a year	Used in paper-less accounting information systems Evergreen or report on demand

Source: Adapted from Zhao, Yen and Chang (2004)

Despite its benefits, CA has a few requirements. According to Searcy and Wooldroof (2003) in order run a continuous auditing (CA) system six components are necessary:

- I. *The web servers* must be concerned and given authority to communicate
- II. *The continuous audit environment* represents the data flowing through the client's system and the auditor's monitoring devices within the system.
- III. *The continuous audit agreement* is the contract between the parties participating in a continuous auditing.
- IV. *The continuous audit* is completely dependent upon the reliability of the interconnected systems.
- V. *Transmission of information* between parties must be authorized and provide confidentiality, integrity and authentication.
- VI. *Evergreen reports* are audited reports available whenever a user accesses a webpage in the CA environment

Throughout a search in the existing literature, one might note several continuous auditing models. However, few of them have been seem implemented in real time systems. The paper "Continuous auditing technologies and models: A discussion" elaborated by Flowerday, Blundell e Solms (2006) presents a comparison of three continuous auditing models.

**Table 2 – Comparison of Three Continuous Auditing (CA) Models**

	MODELS		
	Rezaee et al.	Onions	Woodroof & Searcy
<b>Accuracy (fraud and error)within transactions</b>	Standardized audit tests are built into data marts (running either continuously or at predetermined times)	Transactions are checked at time of entry and later  GAATTS: real time Expert Systems: continually	Rule-based detection by digital agents  Data are analyzed by devices integrated system
<b>Reliability of internal control systems</b>	CAATS are used  Included Integrated Test Facilities (ITFs)	Parsing of keystrokes to detect database management utility  Password control, audit logs, operating system's security	Adapt and apply SYSTRUST principles  Web-based valuation sites  Must be in the auditor-defined rules for the digital agents
<b>Real-time</b>	Is the aim of the system	Run in parallel with operational systems	Is on of the aims of this model
<b>Reporting method</b>	Web-enabled data delivered of the auditors workstation,	Graded alerts sent through virtual private networks (VPNs)	Three levels of reports alerts are sent to the auditor via email.

	where reports can be generated		
<b>Proposed data format</b>	Data mart, data warehouse, XBRL	XCAL, data marts	Does not have interface with legacy systems

Source: Adapted from Flowerday, Blundell e Solms (2006)

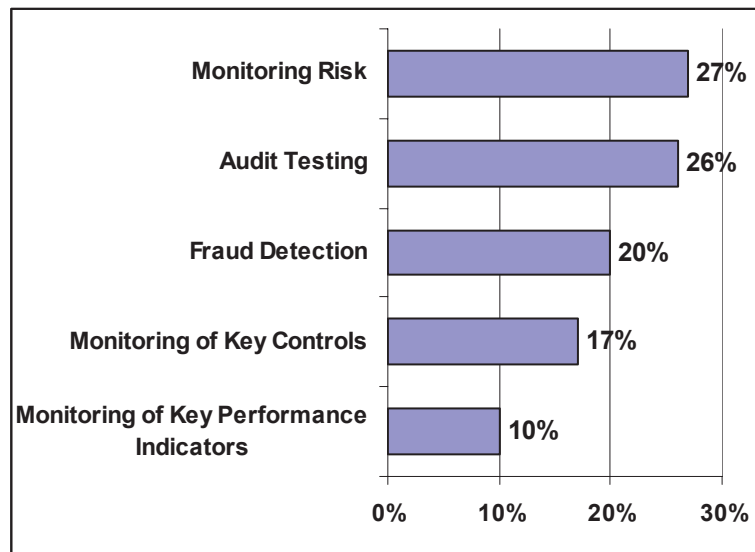
One of the main advantages of CA is that it systematically and continually tests transactions using intelligent software tools (FLOWERDAY and SOLMS, 2005). Thus, the audit routines are performed daily or in a real time. In this sense, CA allows firms to produce audited financial statements immediately as demanded by interested parties (SEARCY and WOODROOF, 2003).

According to O'Reilly (2006) using continuous auditing (CA) methodologies, you can:

- Make the audit process faster, cheaper, more efficient and more effective
- Shorten audit cycle times to provide more timely risk and control assurance
- Achieve greater audit coverage without the need to expand your resource base
- Conduct audit on a daily, monthly, or quarterly basis
- Automate periodic audit testing and improve audit cycle times
- Audit 100 percent of data population instead of just data samples
- Compare and recalculate population of data
- Improve assurance quality as well as speed

In the same manner, it seems that corporations are already implementing some kind of continuous auditing and monitoring. Organizations ranging from Siemens, HCA, the Royal Canadian Mounted Police, BIPOP Bank and the Internal Revenue Service are already developing tools and practices that will bring assurance closer to the transaction and reduce through automation, the cost of auditing (ALLES, 2006).

The 2006 State of the Internal Audit Profession Study evidenced that CA is already a reality. According to this study, 81% of the 392 companies surveyed either had a continuous auditing and monitoring process in place or were planning to develop one. This study also evidenced the uses of Continuous auditing and monitoring. Graph 1 evidences these results.



**Graph 1 – Continuous Auditing and Monitoring Uses**

Source: 2006 State of the Internal Audit Profession Study, PricewaterhouseCoopers, 2006

Turoff et al. (2004) assert that “in the future most organizations will have enterprise wide process systems, continuous audit systems and emergency response systems. That might true, particularly if corporations want to meet SOX requirements, what has not been completely done yet. As Heffes (2004) states “half of large U.S. companies are still less than 60% complete in meeting Sarbanes-Oxley section 404 filing requirements.

Section 404 of SOX requires management to issue an annual report that states its responsibility for establishing and maintaining adequate internal controls over the financial reporting process. At the same time, “With respect to the internal control assessment, each registered public accounting firm that prepares or issues the audit report for the issuer shall attest to, and report on, the assessment made by the management of the issuer” (SOX, <http://www.sarbanes-oxley.com>). In this sense, external auditors are required to render an opinion annually on management’s assessment of internal controls. According to Flowerday and Solms (2005) continuous auditing and monitoring have increased in importance especially if one considers compliance to the Sarbanes-Oxley Act.

In this same line of thinking, SOX creates the needs for companies to have in place some form of continuous monitoring or auditing process to assist management in meeting its reporting responsibility (WARREN and SMITH, 2006). Thus, it suggests opportunities for internal auditors to assist senior management in these responsibilities. According to Pushkin (2003) a comprehensive continuous auditing plan will also provide timely information to satisfy inquiries from an entity’s audit committee.

### 3. Methods

The CAPES’s Basis, which is available at all public Brazilian universities, provides access to more than 11.000 journals of different areas of scientific knowledge. Journals are usually offered by electronic distributors (databases). In



the CAPES's Basis, one might find 8 databases: Blackwell, Emerald, Infotrac, Proquest, Sage, Science Direct, Springer and Wilson.

For this paper, instead of searching all the accounting, auditing and technology journals, we opted to search all the 8 available databases. In this sense, the entire CAPES's Basis was covered, which means more than 11.000 journals. The objective of this search was to select all papers addressing continuous auditing. Thus, this selection involved all articles that contain the expression "continuous auditing" either in their title, abstract or keywords.

A total of 104 articles were selected. However, 20 articles were eliminated because they were available at two or more databases. For instance, an article published in the Managerial Auditing Journal in 2002 would show up twice in the quest because this journal is offered in the Proquest from 1992-2006, but also offered in the Emerald from 1994-2006. Thus, a total of 20 duplicated articles were eliminated.

The next step involved the elimination of the articles that were not "complete papers" (full text). Following these criteria, 20 articles were eliminated because only the abstracts were available. Finally, 7 articles that address audit of other areas like health and medicine have also been eliminated. Therefore the final sample consisted of 57 articles. The data analysis involved the following characteristics (questions):

- **Year of publication:** Is the number of articles addressing CA increasing?
- **Journal:** What journals have published articles addressing CA?
- **Authorship:** How many authors per paper?  
Where are they affiliated?  
Who are most prolific authors in CA?
- **Type of Study:** Are of articles addressing CA empirical? If not, what type of non-empirical studies?

The analysis of the non-empirical articles has been based on Alavi e Carlson's (1992) study. According to their approach, there are three types of non-empirical studies:

- I. **Conceptual:** Define models and theories. Uses clarified and justifiable reasons and explanations.
- II. **Illustrative:** Present a practical guide and offer recommendations for different stages in specific circumstances. Focus on "what" and "how", instead of "why"
- III. **Applied Concepts:** combine characteristics of illustrative and conceptual studies.

### 3.1 Study's Limitations

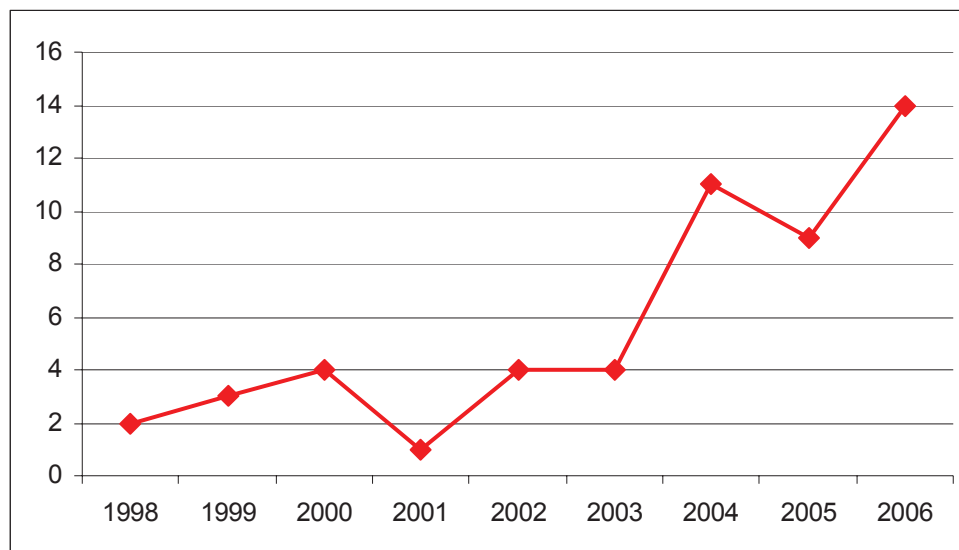
The first limitation of this study is regarding its sample. As mentioned earlier, CAPES's Basis offers access to more than 11.000 journals. However, some journals like The Journal of Emerging Technologies in Accounting and The International Journal on Information Systems and Technology Management that address issues regarding technology and accounting (auditing) have not been analyzed because they were not available at this Basis. These journals do have studies that address CA. In this sense, this a research restriction

Also, due to the fact that CA is a relatively fresh topic, some articles might have been submitted Journals and not published yet, due to the lag time existing in these publications. In this sense, future studies might encounter a greater number of articles addressing CA as this is an emergent topic.

Finally, this study has adopted an exploratory approach. In this sense, future studies could employ more sophisticated methods and use larger samples that could enable further generalizations.

#### 4. Results

In 1975, William Sprague already addressed CA in an article titled “Interim Financial Reporting and Continuous Auditing” published in the CPA Journal. However, as expected, the discussion regarding continuous auditing is relatively recent. Of the total of 57 articles selected for analysis, 52 of them were published during the 1998-2006 period. At the same time, the number of articles addressing CA is increasing, as evidenced on graph 2 below.



**Graph 2 – Articles Addressing CA during the 1998-2006 period**

Source: The authors

The analysis also evidenced that the CPA Journal has published more articles addressing CA than any other journal. However, as we know, this journal’s objective is not to publish “articles whose major contribution consists of pure research or of research methodology applications as readership consists of members in both public and private practice, with diverse backgrounds and specialties” (CPA Journal, 2006). In this sense most articles addressing CA in this journal bring only a brief discussion on this topic. Table 3 evidences the journals, where at least, three articles were found.

**Table 3 – Journals that published articles addressing CA**

Journal	N. of Articles
The CPA Journal	6
International Journal of Accounting Information	5



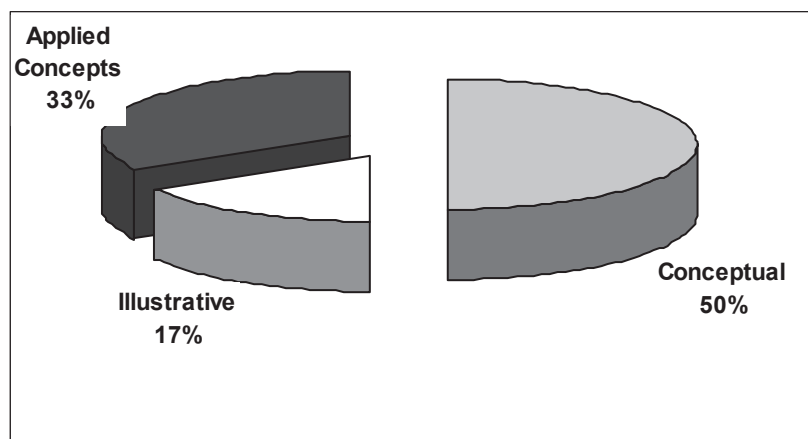
Systems	
Internal Auditor	4
Internal Auditing	4
Financial Executive	3

Source: The authors

In this same line of thinking, Internal Auditor and Financial Executive publish mostly non-empirical articles, focused mainly on practitioners. Consisted with these findings, the analysis on the type of research (methods) showed that most articles are non-empirical. Out of the 57 articles selected, only 1 presented an empirical research:

Alles et al. (2006) reported a pilot implementation of a continuous auditing system at Siemens. They developed a completely independent continuous monitoring of business process controls (CMBPC) system running on to of Siemens' own enterprise information system.

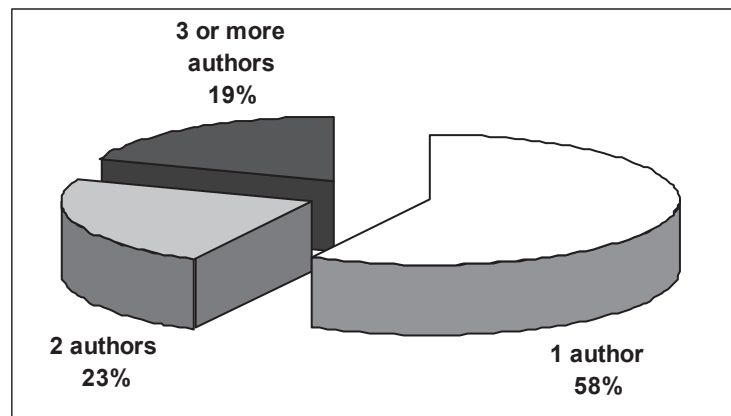
The other 56 articles in the sample are theoretical and most of studies adopt a conceptual approach.



**Graph 3 – Analysis of Non-Empirical Studies Addressing CA**

Source: The authors

At the same time, 58% of the articles addressing CA are written by only one author. This corroborates with the other findings, as most articles are non-empirical, published in a practitioners oriented journal and written by few authors. Graph 4 illustrates number of authors in the studies addressing CA.



**Graph 4 – Number of Authors per Article**  
Source: The authors

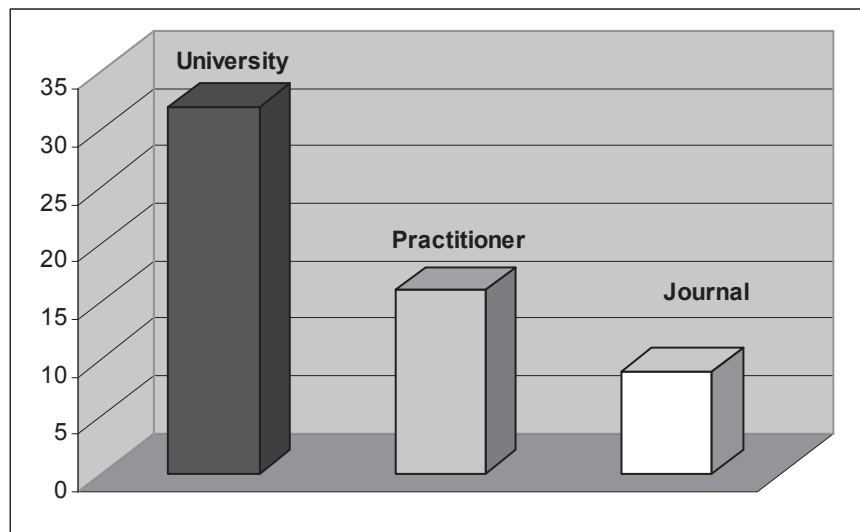
Only 4 authors published three studies addressing CA. Another 7 authors published 2 studies, as showed on table 4.

**Table 4 – Most Prolific Authors in CA**

Author	N. of Articles
Alexander Kogan	3
Glenn Helms	3
Michael Alles	3
Miklos. Vasarhelyi	3
Ahmad Sharbatoghlie	2
Ellen Heffes	2
Jane Mancino	2
Rick Elam	2
Rossouw Solms	2
Stephen Flowerday	2
Zabihollah Rezaee	2

Source: The authors

Authors' affiliation has also been analyzed. Although, most of the authors are affiliated at Universities, some of them are also professionals (accountants, auditors, TI managers, etc.).



**Graph 5 – Author's Affiliation**

Source: The authors

The analysis of author' affiliation also showed that Rutgers University, Newark, New Jersey (USA), is the main research center on continuous auditing. Three of the four most prolific authors in CA are Rutgers' professors: Miklos Vasarhelyi, Alexander Kogan and Michael Alles. This University also has a specific center to research this topic called "Continuous Auditing Research Lab" (<http://raw.rutgers.edu/continuousauditing>).

#### 4. Conclusions and Recommendations

Recent increase in the number of financial report restatements, frauds and bankruptcy cases has raised questions about the integrity of accounting information and the audit profession. At the same time, Sarbanes-Oxley assigns greater accountability to managers and external auditors. In this momentum, Continuous Auditing (CA) seems to have emerged as a technology that can assist internal and external auditors, as well as managers.

Adopting an exploratory approach, this study aimed to analyze the existing literature on continuous auditing (CA). Based on data analysis, one might conclude that:

- Most articles addressing CA are non-empirical. Out of the 57 articles selected in this study's sample, only 1 presented an empirical research: a case study at Siemens (ALLES, et al., 2006).
- Approximately 50% of these non-empirical studies adopt a conceptual approach, mainly defining CA models and theories and presenting reasons and opportunities for its uses.
- The CPA Journal, The International Journal of Accounting Information Systems and The Internal Auditor published together a total of 15 studies addressing CA. However, it is worthwhile mentioning that The CPA Journal and The Internal Auditor are more practitioner's oriented journals, publishing most of the time short articles, by one or two authors.

- There is an increasing tendency of continuous auditing studies and one shall expect to see more empirical studies as publication in the top journals usually takes a couple years due to the reviewing process.
- Rutgers University, located in Newark, New Jersey (USA) seems to be the World's research center on CA. Three of the most prolific authors in CA belong to this university's faculty. Rutgers also has a "continuous auditing research lab" and this year they are holding the "12th World Continuous Auditing and Reporting Symposium" (<http://raw.rutgers.edu/continuousauditing>).

Finally, this aims to contribute to the Accounting Science by evidencing possibilities for research and implementation in CA. As Singleton and Singleton (2005) state "the progression in auditing is certainly in a direction toward a truly continuous auditing, monitoring and reporting environment.

For those interested in learning more about CA, Singleton and Singleton (2005) present a few resources:

- ✓ **Article on how to use as audit tool and options**  
([www.auditsoftware.net/community/excell/index.htm](http://www.auditsoftware.net/community/excell/index.htm))
- ✓ **Book on using Access as audit tool**  
([www.nigrini.com/data\\_abalysis\\_books?data\\_analysis\\_using\\_aces.htm](http://www.nigrini.com/data_abalysis_books?data_analysis_using_aces.htm))
- ✓ **List of audit software vendors from Google**  
([www.directory.google.com/top/computers/software/accounting/audit](http://www.directory.google.com/top/computers/software/accounting/audit))
- ✓ **Annual CA Conference** ([www.accounting.rutgers.edu/raw](http://www.accounting.rutgers.edu/raw))
- ✓ **AuditNet-CA Section** ([www.audinet.org/contaudit.htm](http://www.audinet.org/contaudit.htm))
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