Innovations in Audit Technology: A Model of Continuous Audit Adoption

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Investor confidence in the financial markets has been shaken by corporate frauds and many in the financial community are looking for solutions. The AICPA recommends a Model of Enhanced Business Reporting to improve the quality of financial reporting. The model emphasizes real-time, online financial reporting to provide timely information to the financial community. Real-time financial reporting requires continuous auditing (CA) to ensure integrity of the reported information. CA produces audit results concurrently with accounting events and is facilitated by eXtensible Business Reporting Language (XBRL), which enables seamless transmission of company financial information to auditor data warehouses.

The success of CA is dependent on the accounting profession's adoption, and client acceptance, of this innovation. CA offers opportunities for more effective auditing offset by implementation and training costs. This paper develops a theoretical model of the antecedents to CA adoption that is based on diffusion of innovation theory. The model addresses the influence of CA characteristics and audit firm attributes on CA adoption. The theoretical model provides a further understanding of technological adoption in the area of auditing innovations. Auditors and financial community members benefit from the paper by using the theoretical model to develop strategies to promote the use of CA.

INTRODUCTION

Recent financial frauds and resulting legislation, e.g., Sarbanes Oxley Act, have increased the need for more frequent evaluation of financial information by auditors. At the same time, due to changes in technology, organizations are increasingly able to produce financial reports on a real-time basis. The American Institute of Certified Public Accountants (AICPA) has recommended a Model of Enhanced Business Reporting to improve the quality of financial reporting. A significant feature of this model is real-time, online financial reporting to provide timely information to the financial community. Access to this timely information can help investors, shareholders, and other third-parties, but only if this information is accurate and verifiable. Real-time financial reporting requires real-time or continuous auditing (CA) to ensure integrity of the reported information. CA is facilitated by eXtensible Business Reporting Language (XBRL), which enables seamless transmission of company financial information to auditor data

warehouses. Data mining of these warehouses provides opportunities for the auditor to determine financial trends and identify erroneous transactions.

CA is poised to effectively allay investor concerns and address financial audit requirements. However, CA implementation is dependent on audit firms adopting this innovative audit approach. Accordingly this paper investigates the audit firm adoption of CA from the perspective of innovation theory.

The remainder of the paper provides background discussion of CA and XBRL, and develops a theoretical model of the antecedents to CA adoption that is based on diffusion of innovation and technology adoption theories. The model addresses the influence of CA characteristics and attributes of the audit firm on the adoption of CA. The theoretical model provides a further understanding of the adoption of auditing technological innovations. Financial community members benefit from the paper by using the theoretical model to develop strategies to promote the use of CA.

BACKGROUND

Continuous Auditing

Auditing is a "systematic process of objectively obtaining and evaluating evidence of assertions about economic actions and events to ascertain the correspondence between those assertions and established criteria and communicating the results to interested parties" (Konrath, 2002, p. 5). Continuous auditing (CA) " is a type of auditing which produces audit results simultaneously, or a short period of time after, the occurrence of relevant events" (Kogan, Sudit, & Vasarhelyi, 2003, p. 1). In CA, the collection of evidence is constant, and evaluation of the evidence occurs promptly after collection (Kogan et al., 2003).

CA has been enabled by the use of Computerized Assisted Auditing Techniques (CAATs). CAATs are computer programs or software applications that are used to improve audit efficiency. They offer great promise to improve audits but have not met expectations "due to a lack of a common interface with IT systems" (Liang et al., 2001, p. 131). Also, "concurrent CAATS…. often require that special audit software modules be embedded at the EDP system design stage" (Liang et al., 2001, p. 131). Many entities are reluctant to allow the implementation of embedded audit modules, which perform CA, due to concerns these CAATs could adversely affect systems processing in areas such as reducing response times. Considering these difficulties, it is not surprising that continuous transaction monitoring tools are the second least used software by auditors (Daigle & Lampe, 2003).

These impediments to CAAT usage are being minimized by the emergence of eXtensible Markup Language (XML) and eXtensible Business Reporting Language that minimize system interface issues. XML is a mark-up language that allows tagging of data to give the data meaning. XBRL is a variant of XML that is designed specifically for financial reporting and provides the capability of real-time online performance reporting. Both XML and XBRL enable the receiver of the data to seamlessly download information to the receiver's data warehouse

David and Steinbart (2000) suggest that data warehouses improve audit quality and efficiency by reducing the time needed to access data and perform data analysis. Improved audit quality should lead to early detection, and possible prevention, of fraudulent financial reporting. Auditor data warehouses may also be used in financial fraud litigations in providing evidence to evaluate the legitimacy of transactions and appropriateness of auditor actions in assessing transactions.

Data mining techniques are well suited to evaluate CA generated data warehouses but advances in audit tools are needed. Data mining and analysis software is the most commonly used audit software (Bierstaker, Burnaby, & Hass, 2003). Auditor data mining and analysis software typically includes low level statistical tools and auditor specific models like Benford's Law. Benford's Law holds that there is a naturally occurring pattern of values in the digits of a number (Nigrini, 2002). Significant variation from the expected number pattern may be due to erroneous or fraudulent transactions.

Audits involve three major components: audit planning, conducting the audit, and reporting on audit findings (Konrath, 2002). The CA approach can be used for the audit planning and conducting the audit phases. According to Pushkin (2003), CA is useful for the strategic audit planning component that "addresses the strategic risk of reaching an inappropriate conclusion by not integrating essential activities into the audit plan" (p. 27). "Strategic information may be captured from the entity's Intranets and from the global Internet using intelligent agents" (Pushkin, 2003, p. 28).

CA is also useful for performing the audit or what Pushkin (2003) refers to as the tactical component of the audit. "Tactical activities are most often directed at obtaining transactional evidence as a basis on which to assess the validity of assertions embodied in account balances" (p.27). For example, CA is useful in testing that entities comply with financial performance measures of debt covenants in loan agreements (Woodroof & Searcy, 2001).

One of the issues in performing CA is developing capabilities to perform this innovative auditing technique. For instance the firm must maintain a technology infrastructure for extracting data with differing file formats and record structures from heterogeneous platforms (Rezaee et al., 2002). Another consideration in developing a technology infrastructure is the degree of automation employed. The degree of automation can vary depending on the audit system design but at least two possibilities are:

1. Embedded audit modules where audit programs are tightly integrated with application source code to constantly monitor and report on exceptional conditions, (limited use of this approach due to potential adverse effects on entity processing) and
2. The automatic capture and transformation of data and storage in data warehouses and the use of data mining for trend analysis and exception reporting.

The first approach may be intrusive on client systems as the embed audit module may slow down processing of the client system. The second approach is a flexible CA solution that is facilitated by the emergence of XBRL.

XBRL

In response to financial scandals; politicians, regulators, and financial professionals have initiated reforms and improvements to increase investor trust in financial markets. One initiative is the online exchange of financial information through web based tools such as eXtensible business reporting language (XBRL). This will enable real-time, seamless exchange of financial information among financial community members; such as companies, investors, analysts, auditors, regulators, and government agencies. Real-time reporting provides the financial community with up to date information, which is in stark contrast with the current reporting process that typically involves quarterly or annual reporting. More timely reporting offers opportunities for improved investor decision-making and earlier detection of company financial problems.

XBRL allows tagging of financial data to make it meaningful for the receiver of the data. For example, a company's general ledger cash balance is tagged so that the receiver recognizes the meaning of the data to facilitate downloading of the data to the receiver's database. Using XBRL tags, data is entered once, extracted and formatted into various reports. It eliminates the duplicate data entry that occurs under paper-based and electronic documents using word or PDF files.

The meaning of data is established through an XBRL taxonomy, which is a data dictionary. Establishing standard taxonomies facilitates comparison of companies' performance. Separate taxonomies have been established to be in accordance with generally accepted accounting principles (GAAP), International Accounting Standards (IAS) and Governmental Accounting Standards Board (GASB) requirements (Rezaee and Turner, 2002). Under XBRL, the items used in a report are contained in an instance document and a style sheet is used to determine the layout of a financial report.

XBRL is positioned to drastically change and improve the financial supply chain. Financial supply chain communities include accountants, analysts, intermediaries, regulators, software and service providers, academics, exchanges, private sector preparers, public sector preparers, and tax agencies (About XBRL: Supply Chain Communities, 2003). This reporting language provides opportunities for cost reduction by eliminating duplicate entry of data. Also, XBRL, enables more frequent, possibly continuous, financial reporting that provides more timely information for investing, lending, and regulating decisions.

Potential issues with XBRL involve security of information, costs of supporting continuous financial reporting, and effects of more frequent financial reporting on financial markets. Strong security of XBRL information must be maintained to prohibit unauthorized access and manipulation of financial information. The costs of implementing XBRL have been minimized by efforts of software companies that are integrating XBRL into their software packages. Instead for companies with outdated information systems, the major costs involve establishing integrated systems to support frequent, possibly continuous, financial reporting. Under the current reporting model of quarterly or annual reporting, a combination of human and system resources can be undertaken to accumulate and organize information for financial reporting. The shorter cycle times of continuous financial reporting necessitate automated financial reporting which will be more expensive for companies that don't have integrated systems (Hunton, Wright and Wright, 2003).

In summary, the advent of XBRL and XML provide opportunities for auditors to perform CA by transferring client information to auditor databases. The CA may be performed in conjunction with on-line financial reporting or under a less frequent reporting approach. Under the latter, financial and non-financial information could be released continually to the auditors but not to other members of the financial community. The success of CA is dependent on its adoption by auditors.

LITERATURE REVIEW

Diffusion of innovation has been researched from the perspective of independent variables associated with adoption and the process of adoption. Rogers (2003) theorizes that innovations have five characteristics: relative advantage, compatibility, complexity, trialability and observability. Relative advantage "is the degree to which an innovation is better than the idea it supersedes" (Rogers, 2003, p. 15). Compatibility "is the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential

adopters" (Rogers, 2003 p. 15). Complexity "is the degree to which an innovation is difficult to understand and use" (Rogers, 2003, p. 16). Trialability "is the degree to which an item may be experimented with on a limited basis" (Rogers, 2003, p. 16). Observability "is the degree to which the results of an innovation are visible to others" (Rogers, 2003, p. 16). Relative advantage, compatibility, trialability and observability are expected to increase the rate of innovation adoption while complexity is expected to decrease it.

The Technology Acceptance Model (TAM) is based on two major concepts: perceived usefulness and perceived ease of use (Davis, 1989). Perceived usefulness is "the degree to which a person believes that using a particular system would increase his or her job performance" (Davis, 1989, p. 320). Perceived ease of use is the "degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). The researcher found that both usefulness and ease of use were associated with predicted system use but usefulness was more strongly linked than ease of use with predicted system use. TAM has two key variables of interest, ease of use and usefulness, in studying web based technologies.

Moore and Benbasat (1991) developed a seven item scale to measure the perception of adopting information technology. These researchers included four of Rogers' items: relative advantage, compatibility, observability and trialability; TAM's ease of use; and two additional constructs of voluntariness and image. Voluntariness addressed the perceived level of free will in making adoption decisions. Rogers considered image as part of relative advantage while others consider it as a distinct concept (Tornatzky and Klein ,1982; Moore and Benbasat, 1991).

Damanpour (1991) found that the scope of the innovation and type of organization are effective moderators of the relationship between determinants and innovation. Swanson (2003) theorizes that information systems innovation involves a technical core, information systems core and administrative core related to business innovation. He suggests that the pattern of adoption varies for these different types of innovations. Furthermore, researchers found that organizational attributes, such as technological knowledge resources and infrastructure, impact adoption of business process reengineering innovation (Grover, Fiedler and Teng, 1999).

Continuous auditing using XBRL represents an interorganizational system (IOS) where companies share financial information with auditors. In terms of IOS adoption, a major focus of the research has been on EDI. Researchers found that small firm adoption of EDI depended on three major factors: organizational readiness, external pressures to adopt and perceived benefits (Iacovou, Benbasat and Dexter, 1995). Organizational readiness refers to the firm having adequate financial and technological resources. These researchers found that management perceived EDI benefits of cost savings, improvement of businesses processes and relationships. More recently, web-based IOS have included Extranets between business partners and B2B virtual markets (Applegate, Austin and McFarlan, 2002).

Hart and Saunders (1998) analyzed the relationship between power and trust in relation to EDI use. These researchers found that a higher trust between partners correlated with more diverse use of EDI. These researchers suggest that a more cooperative approach builds trust and will encourage diverse use of IOIS.

Research Questions

Analyzing CA from the perspective of innovation and technology adoption theory raises the following questions:
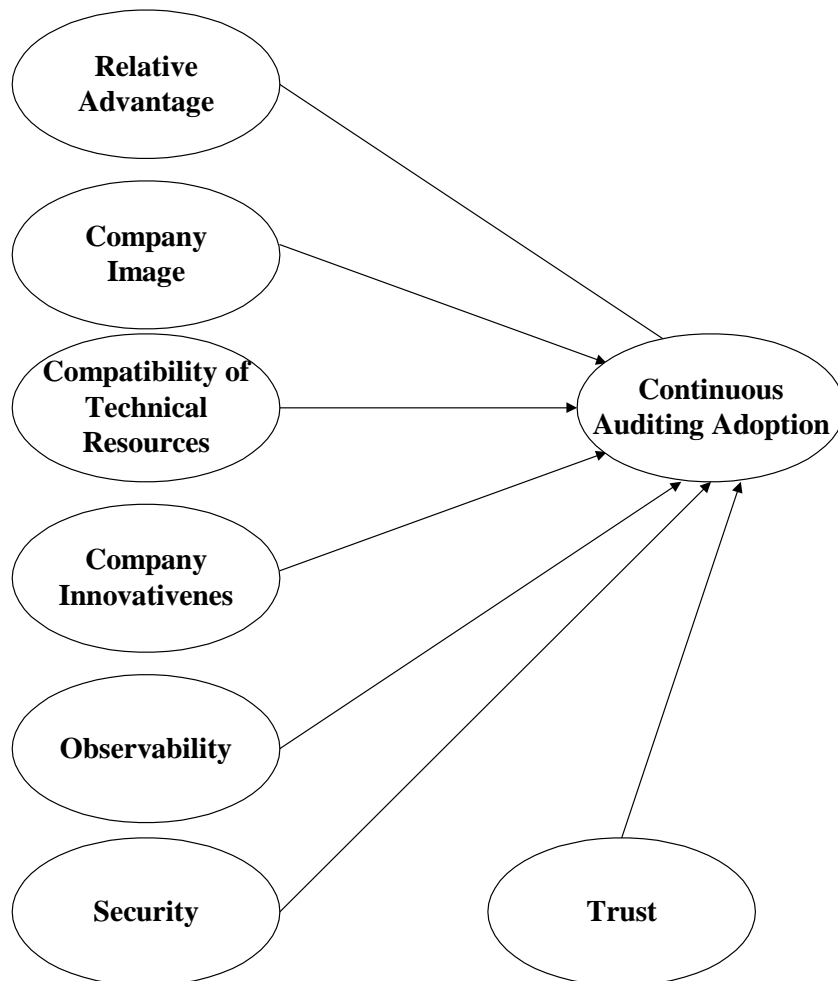
     1.   What are the antecedents to CA adoption?

     2.   Do the antecedents of CA adoption differ from those of IOS systems?

3. What is the role of IS technological capability in facilitating the initiation of CA adoption?

RESEARCH MODEL

Figure 1 presents the author's theoretical model for CA adoption. Seven independent variables: relative advantage, company image, compatibility of technical resources, company innovativeness, observability, security, and trust are expected to be positively associated with the dependent variable, CA adoption. The first concept, relative advantage, represents the audit firm's perception that adopting CA will be superior to existing auditing practices. Benefits of CA include more timely evaluation of financial information

FIGURE 1
CONTINUOUS AUDITING ADOPTION MODEL

Hypothesis 1 – CA adoption by the audit firm will be positively associated with the perceived relative advantage of CA.

The growth of the Internet and electronic commerce technologies has created an exciting business marketplace for entrepreneurs, inventors, and existing organizations. Alternatively

organizations ignoring new technology opportunities may be considered inflexible and stodgy. Therefore, it is believed that audit firms will adopt CA to promote an image of innovation, flexibility and technical proficiency.

Hypothesis 2 – CA adoption will be positively associated with the perception that adopting CA will improve the audit firm's image.

Level of technological resources was found to be associated with EDI adoption (Iacovou, et al., 1995). In addition, the composition of technological resources was found to be associated with adoption of business process reengineering (Grover, et al., 1999). The adoption of CA using XBRL will require the audit firm to have the capability of receiving XBRL data, transferring the data to a data warehouse, and maintaining analysis and data mining tools to search for patterns in the data. Accordingly, the author believes that adoption of CA using XBRL will be positively associated with IS technological capability.

Hypothesis 3 – CA adoption will be positively associated with the audit firm's use of compatible technological resources.

Innovativeness is the degree to which an entity is relatively early in adopting new technology over other members of a social system (Rogers, 2003). Accordingly more innovative audit firms would be expected to adopt CA before relatively less innovative companies.

Hypothesis 4 – CA adoption by audit firms will be positively associated with increasing levels of audit firm innovativeness.

According to diffusion of innovation theory, the easier it is for individuals to observe the results of an innovation, the more likely they are to adopt (Rogers, 2003). Thus, the more observable the CA benefits are to company members the more likely the organization will adopt CA.

Hypothesis 5 – CA adoption by auditing firms will be positively associated with the observability of the CA benefits.

Security concerns have been a major inhibitor of growth of web based communication of business information (Hof, McWilliams and Saveri, 1998). CA, using XBRL, security concerns include unauthorized access and manipulation of company financial information. Thus, audit firms with strong security capabilities, i.e., security controls and technical security expertise, would be more likely to adopt CA.

Hypothesis 6 – CA adoption by audit firms will be positively associated with the company's security capability.

Adoption of CA using XBRL would lead the audit firm relying on the client to provide an ongoing stream of financial information for the length of the audit which would be typically be one year. Should the audit firm not trust that the client ability to provide the information, it would not be worthwhile to undertake the investment involved with CA. Accordingly the audit firm's trust in the client's capabilities to provide financial information is expected to influence the audit firm's willingness to adopt CA.

Hypothesi7 – CA adoption will be positively associated with the audit firm's trust in the IT capabilities of the client.

The following concepts and measures, see Table 1, have been identified as a means for testing the hypothesis.

TABLE 1
CONCEPTS AND MEASURES

Concepts	Measure	Source
Company Relative Advantage	Relative Advantage*	Moore and Benbasat (1991)
Company Image	Image*	Moore and Benbasat (1991)
Compatible Technology Resources	Client server, PC and web resources	Grover, Fiedler and Teng (1999)
Company Innovativeness	Innovativeness*	Agrawal and Prasad (1998)
Observability of CA	Visibility*	Moore and Benbasat (1991)
Security	Security Capability	New Measure
Trust	Trust in Financial Supply Chain Members	New Measure
Intent to Adopt CA	Company Volume and Diversity	Massetti and Zmud (1991)

*Measures modified from personal to company level

OPPORTUNITITIES FOR FUTURE RESEARCH

This paper provides a theoretical model that is applied to CA adoption by audit firms. Studies could be performed to identify whether differences in adoption rates are influenced by audit firm size and industry specialization. Larger firms would be expected to be more likely to adopt than smaller firms due to a greater availability of resources. However, is there some size threshold where size of firm becomes unimportant? Also, will audit firms specializing in technologically advanced industries, such as financial services, be more likely to adopt CA than other industries? In addition, CA adoption patterns may vary among firms. For instance, are audit firms endorsing firm wide adoption of CA or are individual partners or managers pushing the move toward CA?

The adoption of CA requires not only adoption by the audit firm but also by the client. Investigating client characteristics and perceptions under the lens of innovation theory would extend researchers understanding of CA adoption. Also, this would provide auditors with effective strategies to promote client acceptance of CA.

CONCLUSION

The CA adoption model integrates theoretical foundations of diffusion of innovations, adoption of information technology, and CA characteristics. The paper provides a framework for the financial community's understanding of an audit firm's adoption of CA and a starting point for empirical research in this area.

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