

## **An Examination of Audit Information Technology Usage and Perceived Importance**

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### **ABSTRACT**

Although IT has significantly changed the audit process, few studies have examined information technology (IT) and the perceived importance of IT usage across a diverse group of audit firms. Our study fills an important void by exploring audit IT usage and perceived importance since IT usage can directly impact audit judgment and ultimately, audit effectiveness and efficiency. Furthermore, to address regulator concerns about barriers to entry in public accounting and advance auditing research, we examine whether audit IT usage and perceived importance of IT varies by firm size. A field-based questionnaire was used to collect data from 181 auditors representing Big 4, national, regional, and local firms. Our results suggest that auditors utilize a variety of audit applications to a great extent while using others less often. Interestingly, there are several audit applications that are viewed as important by auditors, although they did not appear to use these tools extensively. IT specialists do not appear to be used extensively, even by auditors who examine clients with complex IT. Finally, findings suggest that audit IT usage and perceived importance vary by firm size. These results should be of interest to: (1) researchers considering how IT may influence audit judgment and decision-making, (2) standard setters evaluating barriers to entry in public accounting and auditors usage of IT, and (3) practitioners examining their own IT investment levels.

**Keywords:** information technology usage; firm size; audit process.

**Data Availability:** Data used in this study are available from the first author on request.

# **An Examination of Audit Information Technology Usage and Perceived Importance**

## **INTRODUCTION**

While the impact of information technology (IT)<sup>1</sup> in the business world has grown exponentially in the past two decades, few studies have examined audit IT usage and the perceived importance of IT usage<sup>2</sup>, particularly outside of the largest audit firms (Fischer 1996; Banker et al. 2002). This is an important issue since IT has dramatically changed the audit process and may be a potential barrier to entry in public accounting. Standards now encourage audit firms to adopt IT and use IT specialists when necessary (AICPA 2001, 2002b, 2005, 2006b; PCAOB 2004b). Auditing researchers and practitioners have little guidance available on what IT has been, or should be, adopted by CPA firms. While it is commonly known that large CPA firms have made significant investments in IT (Banker et al. 2002; O'Donnell and Schultz 2003), little descriptive research exists that documents (1) the extent audit firms use IT for specific audit applications, or (2) IT usage by non-Big 4 audit firms. Concerns have been raised that smaller audit firms may not be able to compete with larger firms on IT investments resulting in potential economic barriers to entry as well as audit effectiveness and efficiency issues (POB 2000; GAO 2003). Furthermore, previous research has not addressed the extent to which “second tier” or national firms have utilized IT applications, despite the fact that these firms have many SEC clients (International Accounting Bulletin 2005). National firms are likely to have more resources to devote to audit IT than local or regional firms, but less than Big 4 firms. Therefore,

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<sup>1</sup> *Information technology* refers to “the automated means of originating, processing, storing, and communicating information, and includes recording devices, communication systems, computer systems (including hardware and software components and data), and other electronic devices” (AICPA 2006a, AU 319.02).

<sup>2</sup> *Audit IT usage* refers to the extent auditors employ or use IT throughout the audit process. *Perceived importance of IT usage* refers to the degree of importance that auditors attach to the usage of IT during the audit process.

an open question is whether national firms' audit IT practices resemble that of the Big 4 firms or are they more like smaller firms?

Our study provides current data on how auditors employed by firms of diverse sizes examine audit IT and the perceived importance of audit IT usage. We obtained data from 181 auditors representing Big 4, national, regional, and local firms. Our results suggest that auditors utilize a variety of audit applications to a great extent while using others less often. Interestingly, auditors view several applications as important, although they did not appear to use these applications extensively. IT specialists do not appear to be used to a large extent. Our findings also suggest that IT usage and perceived importance varies by firm size. In general, auditors employed by larger firms are more likely to use audit applications and rate their importance higher than auditors from smaller firms for the majority of applications, including audit planning, electronic workpapers, internal control evaluation, and sampling. Furthermore, national firm auditors tended to utilize audit IT similar to the Big 4 auditors for some applications but were more comparable to auditors at smaller firms for others. Our findings for national firms suggest that they may concentrate their IT resources in relatively high risk areas (i.e., fraud).

These findings are important to researchers, standard setters, practitioners, and educators. Solomon and Trotman (2003, 409) suggest that the audit profession is "rapidly advancing in response to changes in its environment." Environmental changes place pressure on auditors to improve audit judgment. Ultimately, audit judgment impacts audit quality and effectiveness (Bonner 1999; Bell et al. 2002; Wright 2002). To understand audit judgment, researchers need to determine which decision tools (including IT) auditors are using since researchers and practitioners argue that decision tools may impact audit judgment. However, few studies

examine actual audit IT usage or factors that influence audit IT usage such as firm size (Fischer 1996; Arnold and Sutton 1998).

Further, several researchers and regulators have raised concerns about the ability of small audit firms to compete in today's environment (Manson et al. 1998; POB 2000; GAO 2003). For example, the Panel on Audit Effectiveness (POB) recently suggested that the American Institute of Certified Public Accountants (AICPA) develop tools to enhance the effectiveness of small firm client acceptance processes (POB 2000, 18). In addition, regulators are currently studying barriers to entry within public accounting (GAO 2003). A wide discrepancy in IT usage and perceived importance between small and large audit firms may (1) suggest that barriers to entry exist, and (2) identify areas where smaller firms may need assistance to remain competitive.

Finally, recent standards encourage audit firms to adopt IT (AICPA 2001, 2002a, 2002b, 2002c, 2006b; PCAOB 2004a). Our work provides standard setters with information on the extent to which audit firms have adopted and are using IT, and areas where IT could be, but generally is not currently used. In addition, practitioners may use our results as a benchmark as they evaluate their IT adoption and usage efforts and assess the extent to which they are able to compete with other firms. Auditing educators may also find the results of this study useful when considering the technological skills needed by their students to succeed in practice.

The remainder of the paper is organized as follows. In the next section we review the impact of IT on the profession and discuss how firm size may be an important factor in this process. Next, we discuss the methodology and present the results of our study. Finally, we discuss the results and offer important implications for future research.

## **BACKGROUND**

### **Impact of IT on the Audit Profession**

IT has significantly impacted the audit profession in the past two decades. First, firms are increasingly using electronic workpapers to facilitate documentation (PricewaterhouseCoopers 2003). Second, large firms are developing computerized decision aids to assist them in going concern decisions, client acceptance issues, analytical procedures, etc. (Bell and Carcello 2000; O'Donnell and Schultz 2003; Leech and Dowling 2006). Third, even small audit firms have been encouraged to adopt IT such as electronic workpapers (POB 2000). Fourth, IT impacts the behavior and attitudes of individuals working in the firm, and the structure and processes of the firm (Coombs et al. 1992). For example, IT usage could reduce the time auditors spend performing computational and/or clerical tasks and improve the quality of audit judgments by structuring audit decision processes (Manson et al. 1998). Fifth, IT appears to increase audit quality and productivity through audit automation, eliminating certain audit procedures, and enhancing information and knowledge sharing capabilities (Manson et al. 1998; Vera-Munoz et al. 2006). Finally, several recent standards codify the increased role for IT in audit practice (AICPA 2001, 2002b, 2005, 2006b; PCAOB 2004b).

Despite the impact of IT on the audit profession and calls by prior research (i.e., Bailey et al. 1988), few studies have examined audit IT usage, or the perceived importance of specific applications and tools (Arnold and Sutton 1998; Liang et al. 2001). That is, prior research has examined different facets of audit technology without successive research studies building upon each other into a coherent framework. The changing role of IT in auditing as well as rapid changes in IT may help explain the sparseness and disjointed nature of this research stream. These significant changes in IT also limit the extent to which the findings of earlier studies can

be generalized to the current audit environment. Further, what little research has been conducted has primarily focused on the impact of IT in large audit firms. Therefore, it is unclear whether audit IT usage or perceived importance varies by firm size. Our study fills this void by examining audit IT usage and perceived importance in the current audit environment across Big 4, national, regional, and local firms.

### ***Impact of Firm Size on IT Usage and Perceived Importance***

Firm size varies greatly within the audit profession, from local one-office firms to international Big 4 firms (Brierley and Gwilliam 2001). As noted earlier, regulators are concerned that small audit firms may not be able to compete with larger firms in terms of IT investment (POB 2000; GAO 2003). Consistent with this concern, information systems research indicates that IT adoption is driven by the availability of firm resources (Riemenschneider et al. 2000). Prior research finds that broad audit IT usage is more extensive in Big 4 firms as compared to smaller firms (Manson et al. 1998). This may be due to the differences between the size of the clients serviced by these firm types and their corresponding IT needs. Thus, we expect that IT usage and perceived importance will be higher for Big 4 firms. Finally, given the lack of research into the IT audit practices of national firms, it is unclear whether they operate more like the Big 4 firms or tend to be similar to smaller firms.

## **METHOD**

### **Participants**

Participants included a total of 181 auditors from Big 4, national, regional, and local firms. One author attended the AICPA National Advanced Accounting and Auditing Technical Symposium to obtain responses from 109 auditors. We also contacted local offices of each Big 4

firm and one national firm. From these offices, we collected data from 72 auditors. All responses were collected after the Sarbanes-Oxley Act of 2002 (SOX).

Respondents averaged 12.7 years of external audit experience; their average age was 36.6 years.<sup>3</sup> Thirty-one percent of respondents were employed by Big 4 firms, 17 percent by national firms, 15 percent by regional firms, and 37 percent by local firms. The highest education level for a significant majority (82.8 percent) was a bachelor's degree. Most respondents (86.2 percent) held CPA certificates. The majority of the respondents (70.9 percent) were male. Participants varied in IT expertise with 70.5 percent indicating intermediate IT expertise, 16.7 percent stating they were IT novices, and 12.8 percent indicating that they were IT experts.<sup>4</sup>

## **Instrument Development and Validation**

### ***Pilot Testing***

To increase construct validity, we conducted two rounds of pilot testing. First, four researchers with significant audit and systems knowledge examined the instrument. We then pilot tested the revised instrument with eight auditors from four firms (Big 4, national, regional and local) who had an average of 4.5 years of experience. Based on the pilot testing we revised the wording of some audit applications and eliminated one productivity tool, verified that participants were able to consistently define each IT, and confirmed that participants interpreted the wording of the frequency and extent of the IT specialist question.

### ***Types of Audit IT***

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<sup>3</sup> Since experience varied by firm size, we include experience as a covariate when analyzing the impact of firm size on IT. In spite of these experience differences, we find that our results are driven primarily by firm size differences.

<sup>4</sup> Prior research indicates that gender, IT expertise, and audit approach may have an effect on IT usage and importance. Our analyses of these variables indicate that IT usage and perceived importance does not differ by any of these variables, with the exception of IT expertise. Specifically, respondents with more IT expertise were more likely to use and assign higher importance ratings to two audit applications (electronic workpapers and graphs) and one productivity tool (personal digital assistants).

We designed our instrument to elicit a wide variety of audit IT types. Following prior research, we adopt a relatively broad definition that suggests that *audit IT* refers to “the auditor’s tool kit” (Elliott and Jacobson 1987, 198; Fischer 1996, 220). Elliott and Jacobson (1987, 198) argue, “A tool may be thought of as anything that enhances an individual’s capacity to perform a task. Audit IT consists of all the things designed to enhance the auditor’s capacity to perform an audit task.” We propose that audit IT encompasses audit applications, productivity tools, work paper review technology, and the use of IT specialists.

**Audit applications.** We use the term *audit applications* to describe software designed to assist auditors in completing one or more tasks. We reviewed prior literature and held discussions with both practitioners and researchers to identify twenty audit applications. These applications range from those that have been examined by prior researchers (e.g., analytical procedures (Knechel 1988), internal control evaluation (Bailey et al. 1985), and sampling tasks (Kachelmeier and Messier 1990)) to relatively recent applications such as those developed to assist with audit tasks (e.g., fraud review (Bell and Carcello 2000), and testing on-line transactions (Wright 2002)) and administrative/practice management tasks (e.g., client relationship management (Bauman et al. 2006), and knowledge management (O’Leary 2002)).

**IT productivity tools.** We define *productivity tools* as IT tools such as cell phones, email, instant messaging, personal digital assistants, etc. that are intended to increase personnel productivity. Increasing personnel productivity often increases product quality and efficiency (Hunton 2002).

**Workpaper review methodology.** Several recent studies examine the audit workpaper review process (Sprinkle and Tubbs 1998; Bamber and Ramsey 2000). In a recent study, Brazel et al. (2004) report that electronic review of workpapers rather than a traditional face-to-face

meeting between the preparer and reviewer may reduce auditors' feelings of accountability, and they may perform their work less thoroughly. We examine the use of three methods: e-mail, face-to-face meetings, and telephone.

**Use of IT specialist.** IT specialists are individuals within an audit firm who have detailed knowledge in computer auditing. Audit standards encourage the use of IT specialists when: (1) the client's business has complex systems and IT controls, (2) the client replaces or makes significant changes to its IT systems, (3) the client shares data extensively between systems, (4) the client participates in electronic commerce, (5) the client uses emerging technology, or (6) significant audit evidence is only available electronically (AICPA 2006a, AU 319.30). We asked respondents to indicate both how frequently they used IT specialists in the past year, and the extent of IT specialist usage. We anticipate that the use and extent of IT specialists will vary by client IT complexity and firm size.

### *Measuring Extent of Usage and Perceived Importance*

The impact of IT on audit firm performance is not directly observable (Banker et al. 2002, 209). Once audit firms adopt IT, whether the IT improves firm performance depends not only on the IT investments (that is, if IT matters), but also on whether and how the IT is used (Malhotra and Galletta 2004). Thus, IT does not improve organizational performance or create business value; users (auditors) do (Markus and Keil 1994).<sup>5</sup> During our initial research development phase, we carefully considered whether to measure the benefits of IT at the firm or individual level. As noted earlier, one of our research goals is to examine IT usage at audit firms of various sizes (i.e., Big 4, national, regional, and local). If we measured IT benefits at the firm

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<sup>5</sup> Once audit firms adopt IT, there is a high likelihood (at least higher than in other industries examined by prior information systems research) that they will incorporate usage of the adopted IT in their audit procedures since auditors are generally held responsible for completing each audit procedure through a sign-off process (Malone and Roberts 1996).

level, we would need to obtain consent from each firm to examine their audit manuals and interview key personnel. Obtaining this consent and conducting these procedures would significantly reduce the number of firms we could examine. Thus, we measure the impact of IT at the individual level, consistent with prior research (cite). An advantage of this approach is that we can assess the IT auditors actually use, instead of inferring this from firm policy data.

For each audit application and productivity tool, respondents indicated (1) the extent of usage on a typical audit, and (2) the perceived importance for a typical audit. Several information systems studies use *extent of usage* to represent the IT usage theoretical construct (Straub et al. 1995; Venkatesh et al. 2003). Data on perceived importance were collected from auditors to measure differences in perceived importance between various applications and tools (see Sprinkle and Tubbs 1998, 477). Frequency of usage (i.e., how frequently was an IT specialist used during audit engagements over the past year) and extent of usage are used to examine utilization of IT audit specialists.

### ***Firm Size***

To collect firm size information, each respondent indicated if he/she was currently employed by a Big 4, national, regional, or local firm. Prior research generally compares data from Big 4 firms to smaller firms (Manson et al. 1997, 1998). However, given our interest in understanding the IT audit practices of national firms, we report means for all four firm sizes and perform additional analysis to determine if the IT audit practices of national firms are more similar to Big 4 or smaller firms.

## **RESULTS**

### **Use and Importance of Audit Applications**

Descriptive statistics, shown in Table 1, indicate that application usage and perceived importance vary significantly. For example, respondents rated the extent of usage as being moderately high (means ranged from 4.53 to 5.39) for five applications (electronic workpapers, analytical procedures/financial ratio tools, internet search tools, audit report writing, and sampling) while assigning lower extent of usage ratings to newer applications such as expert systems, digital analysis, database modeling, test of on-line transactions, and continuous transaction monitoring. Similarly, participants assigned the highest importance ratings to electronic workpapers, analytical procedures/financial ratio tools, electronic audit report writing, audit planning software, sampling, internet search tools, internal control evaluation, and risk assessment. Interestingly, auditors indicated that IT was important for several applications (audit planning, risk assessment, internal control evaluation, client acceptance, client relationship management, and fraud review) although not used extensively, suggesting some potential applications where audit firms could consider expanding the use of, or training with, IT. Standard setters may also consider issuing guidance to practitioners regarding the use of IT in these areas.

[INSERT TABLE 1 HERE]

### **Use and Importance of Productivity Tools**

Descriptive statistics for productivity tool usage and perceived importance also vary significantly as shown in Table 2. E-mail, cell phones, and remote network access had the highest extent of usage means while respondents assigned lower extent of usage ratings to

extensible business reporting language and instant messaging. Similarly, respondents assigned higher importance ratings to e-mail, remote network access, and cell phones.

[INSERT TABLE 2 HERE]

### **Workpaper Review Method Used**

The most common method of workpaper review, reported in Table 3, is face-to-face meetings (60.9 percent), followed by e-mail (27.7 percent). Therefore, given concerns about reduced accountability for electronic review of workpapers (Brazel et al. 2004), it appears somewhat reassuring that face-to-face reviews are still used in a majority of cases. However, as discussed below, these results vary by firm size.

[INSERT TABLE 3 HERE]

### **Use of IT Specialist**

As shown in Table 4, Panel A, auditors did not use IT specialists frequently, as the average response to the question ‘how frequently was an IT specialist used during audit engagements over the past year’ was 24.5 percent. The extent of IT specialist usage was also fairly low as the mean extent response was 2.59 on a scale anchored with 1 = none and 7 = extensively. These findings may echo concerns that auditors are reluctant to consult IT specialists because of audit efficiency considerations (Carmichael 2004, 132) and potential overconfidence in their ability to recognize IT risks (Hunton et al. 2004).

[INSERT TABLE 4 HERE]

Standards encourage auditors to use IT specialists for clients with complex financial reporting systems (AICPA 2006a; AU 319.31). To determine if use of IT specialists is related to the complexity of the client’s financial reporting systems, we ran cross tabulations and Pearson correlations examining: (1) frequency of IT specialist usage and client IT complexity, and (2)

extent of IT specialist usage and client IT complexity. To obtain information about client IT complexity, respondents were asked to rate the complexity of their typical client's IT using a seven point scale with 1 = manual processing and 7 = highly computerized financial reporting system. The mean client IT complexity rating for all respondents was 4.63. Cross tabulation results, shown in Table 4, Panels B and C respectfully, suggest that the frequency and extent of IT specialist usage is lower when auditors examine clients with low IT complexity. Pearson correlation results indicated that both frequency of IT specialist usage and client IT complexity ( $r = 0.48$ ;  $p < 0.001$ ) and IT specialist extent of usage and client IT complexity ( $r = 0.46$ ;  $p < 0.001$ ) are positively correlated.

### **Impact of Firm Size on Audit IT Usage and Perceived Importance**

Since regulators are concerned that small audit firms may not be able to compete with larger firms due to the level of IT investment required (GAO 2003), we examine whether audit IT usage and perceived importance vary by firm size. We utilized ANCOVA tests with experience as the covariate and firm size as the independent variable.<sup>6</sup> For audit applications where usage or perceived importance varied by firm size, we conducted planned contrasts<sup>7</sup> to determine whether the usage and perceived importance of the particular audit IT varied between (1) Big 4 and non-Big 4 firms, (2) Big 4 and national firms, and (3) national and smaller firms (i.e., regional and local).<sup>8</sup>

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<sup>6</sup> We ran the ANCOVA tests using weighted least squares regression to account for differences in firm size sample cells.

<sup>7</sup> We also ran Krushal Wallis nonparametric tests since the Brown Forsythe F test of homogeneous variances indicated our data contained non-homogeneous variances. Results are qualitatively similar to the reported results.

<sup>8</sup> Before grouping responses from regional and local firms together, we ran an initial planned contrast to identify any differences between these responses. Results indicated that only four responses from regional firms (analytical review usage, remote network access perceived importance, frequency of IT specialist usage, and extent of IT specialist usage) were statistically different than those from local firms.

As shown in Table 5, ANCOVA results suggest that firm size is associated with auditors' use and perceived importance for several audit applications. Further analysis indicates that auditors from Big 4 firms were significantly more likely to use IT and rate its importance higher than non-Big 4 auditors for electronic workpapers, expert systems, fraud review, internal control evaluation, knowledge management systems, reviewing client web site financial disclosures, and testing on-line transactions. However, auditors from non-Big 4 firms were significantly more likely to use audit report writing applications than Big 4 auditors.

[INSERT TABLE 5 HERE]

Finally, IT audit practices of national firms vary by application as to whether they are more comparable to Big 4 or smaller firms. For example, auditors employed by national firms rated their usage and perceived importance for audit report writing, knowledge management systems, and reviewing client web-based financial disclosure applications similarly to auditors from small firms. However, auditors from national firms rated their usage and perceived importance for electronic workpapers, sampling, and their usage of expert systems, fraud review, and internal control evaluation as being more consistent with Big 4 auditors.

Table 6 displays ANCOVA results for productivity tools. Auditors from Big 4 firms were significantly more likely to use and assign higher importance to e-mail and remote network access tools than non-Big 4 auditors. Firm size also appears to impact auditor usage and perceived importance for instant messaging. Finally, auditors employed by national firms tend to use and rate importance more similar to Big 4 rather than smaller firms for e-mail and remote network access tools.

[INSERT TABLE 6 HERE]

We also used ANCOVA tests to examine the relationship between workpaper review methods and firm size while accounting for experience as a covariate. Results, shown in Table 7, suggest that Big 4 auditors reported the use of e-mail (55.78 percent) and telephone (19.00 percent) more often than non-Big 4 auditors. Conversely, non-Big 4 auditors used face-to-face meetings (59.80 percent, 65.38 percent, and 70.75 percent for national, regional and local firms respectively) more often than did Big 4 auditors (49.87 percent). Further analysis suggests that auditors from national firms tend to use workpaper review methods, particularly e-mail and telephone, similar to auditors employed by smaller firms, rather than Big 4 firms. The frequent use of e-mail by Big 4 auditors for workpaper review may be of concern given the findings of Brazel et al. (2004), who suggest that feelings of accountability and thoroughness of workpaper preparation may be reduced in an electronic environment.

[INSERT TABLE 7 HERE]

Finally, as shown in Table 8, IT specialists are used more frequently, and to a larger extent, by Big 4 auditors as compared to non-Big 4 auditors. Also, the frequency and extent of IT specialist usage by auditors from national firms is more likely to be similar to auditors from smaller firms, rather than Big 4 firms. A likely explanation for this finding is that Big 4 firms are more likely to have clients with greater IT complexity than non-Big 4 firms. In fact, respondent firm size is highly positively correlated ( $r = 0.37$ ,  $p < 0.01$ ) with the degree of client IT complexity.<sup>9</sup>

[INSERT TABLE 8 HERE]

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<sup>9</sup> As expected, the mean client IT complexity rating for Big 4 respondents (5.43) was significantly higher than the mean client IT complexity rating for non-Big 4 respondents (4.31).

## **CONCLUSIONS, IMPLICATIONS, AND FUTURE RESEARCH**

The objective of this study is to provide current data on how auditors employed by a wide range of firms use IT. Results indicate that some audit applications (e.g., analytical procedures, audit report writing, electronic workpapers, internet search tools, and sampling) are used extensively, but others (e.g., digital analysis, expert systems, test of on-line transactions, database modeling, and continuous transaction monitoring) are not. In addition, auditors indicated that several audit applications (audit planning, client acceptance, client relationship management, fraud review, internal control evaluation, and risk assessment), were important, although not used extensively. Thus, practitioners may want to consider expanding their use of IT to include these applications. IT specialists do not appear to be used extensively, even by auditors who examine clients with complex IT.

We also found that auditors employed by Big 4 firms are more likely to use and assign higher importance to several IT audit applications and certain productivity tools. Similarly, auditors from Big 4 firms are more likely to use email and telephone workpaper review methods and rely on IT specialists. Auditors employed by national firms are more likely to use and assign perceived importance ratings similar to auditors from Big 4 firms on certain applications such as fraud review, expert systems and internal control evaluation, but are more similar to auditors from smaller firms on other applications like audit report writing. It appears that national firms may be investing their IT resources in relatively high risk areas, such as fraud. Future research could investigate whether the IT usage of national firms becomes increasingly similar to Big 4 firms over time, as they continue to acquire more SEC clients with sophisticated internal control systems.

These results are important since IT usage may be a significant barrier to entry within public accounting. In fact, the Public Oversight Board has suggested that the AICPA develop tools to help smaller firms with client acceptance issues (POB 2000) and the GAO is examining barriers to entry within public accounting (GAO 2003). Furthermore, the use of technology for workpaper review by Big 4 firms may be of concern, since auditors' feelings of accountability may be reduced in an electronic work environment (Brazel et al. 2004).

These results provide important insights for researchers, standard setters, and practitioners into how audit firms currently use IT and also identify related research opportunities. An important component of audit judgment research is obtaining an understanding of the underlying cognitive processes auditors employ and modeling auditor expertise in various task contexts. This process is often impacted by the IT auditors use (O'Donnell and Schultz 2003; Vera-Munoz et al. 2006). We provide researchers with information on general audit IT usage. Additional research examining which IT auditors typically use in a task may provide clues to exploring the influence of IT on auditors' cognitive processes and task performance.

Similarly, IT varies in complexity from simple or deterministic aids to decision support systems to expert systems (Messier 1995, 215). Researchers often classify IT by the complexity of the task (structured, semi-structured, and unstructured) and the decision-making activities (information acquisition, information evaluation, action/choice) required for that complexity (Abdolmohammadi 1999; Messier and Hansen 1987). For parsimony, we did not ask participants to rate specific IT applications by complexity or indicate what decision-making activities each IT application is used in. Future research could examine how complexity and/or decision-making activities impacts audit IT usage. Furthermore, IT usage may be driven by individual or

organizational pressures. Thus, future research could explore whether auditor IT usage is driven more by firm policy or individual auditor choice.

This study also provides insights for standard setters in determining the extent of audit IT adoption and more importantly whether audit firms are in compliance with current audit standards. Recent standards and congressional legislation have encouraged audit firms to adopt IT (PCAOB 2004a; AICPA 2006b). For instance, the Sarbanes-Oxley Act of 2002 tightened internal control and financial reporting requirements (Winters 2004). This has led practitioners to propose that audit firms adopt internal control documentation IT (Winters 2004). Our results indicate that although auditors perceive internal control evaluation IT as important, fewer auditors than expected have adopted internal control evaluation IT. Future research could determine the extent audit firms plan to adopt internal control documentation IT to address Sarbanes-Oxley issues. Furthermore, standard setters have raised concerns about the lack of communication between computer auditors and general auditors (Carmichael 2004, 132). Our results on the use of IT specialists suggest that these concerns may be well founded. Finally, our study allows practitioners to benchmark their current IT practices to firms with similar (or different) size characteristics. This information may be useful to practitioners as they consider how to allocate financial resources over various types of IT investments, and the types of IT investments that will help them to remain competitive with other firms.

### **Limitations**

Our results should be interpreted in light of certain limitations. First, due to data availability limitations, we use auditor IT usage and perceived importance to proxy for audit firm IT adoption. Obtaining audit firm level IT investment information would improve the extent to which our results can be generalized to practice. Furthermore, we asked respondents to self-

report the extent of their IT usage. A better proxy may be actual system usage (Straub et al. 1995; Venkatesh et al. 2003). Second, participants' mean experience varied across different-sized accounting firms. To control for the effect of experience we used ANCOVA in our analyses. Results revealed that in most cases, firm size was significant and experience was not. Third, our respondents did not identify whether audit application and productivity tool usage was mandatory or voluntary. Prior IT usage research generally examines voluntary usage contexts. Venkatesh et al. (2003, 13) caution that voluntary usage results may not generalize to mandatory usage settings. Additional research could investigate whether our findings differ in voluntary versus mandatory usage settings.

## REFERENCES

- Abdolmohammadi, M.J. 1999. A comprehensive taxonomy of audit task structure, professional rank and decision aids for behavioral research. *Behavioral Research in Accounting* 11: 51-92.
- American Institute of Certified Public Accountants (AICPA). 2001. *The Effect of Information Technology on the Auditor's Consideration of Internal Control in a Financial Statement Audit*. Statement of Auditing Standards No. 94. New York NY: AICPA.
- \_\_\_\_\_. 2002a. *Audit Documentation*. Statement of Auditing Standards No. 96. New York NY: AICPA.
- \_\_\_\_\_. 2002b. *Consideration of Fraud in Financial Statement Audit*. Statement of Auditing Standards No. 99. New York NY: AICPA.
- \_\_\_\_\_. 2002c. *Interim Financial Information*. Statement of Auditing Standards No. 100. New York NY: AICPA.
- \_\_\_\_\_. 2005. *Audit Documentation*. Statement of Auditing Standards No. 103. New York NY: AICPA.
- \_\_\_\_\_. 2006a. *AICPA Professional Standards*. New York NY: AICPA.
- \_\_\_\_\_. 2006b. *Risk Assessment Standards*. Statement of Auditing Standards No. 104-111. New York NY: AICPA.
- Arnold, V., and S. Sutton. 1998. The theory of technology dominance: Understanding the impact of intelligent decision aids on decision maker's judgments. *Advances in Accounting Behavioral Research* 1: 175-194.
- Bailey, A.D., Jr., G.L. Duke, J. Gerlach, and C. Ko. 1985. TICOM and the analysis of internal controls. *The Accounting Review* 60 (April): 186-202.
- \_\_\_\_\_, L.E. Graham, and J.V. Hansen. 1988. Technological development and edp. In *Research Opportunities in Auditing: The Second Decade*, edited by A.R. Abdel-khalik and I. Solomon, 57-94. Sarasota FL: American Accounting Association.
- Bamber, E.M., and R.J. Ramsey. 2000. The effects of specialization in audit workpaper review on review efficiency and reviewers' confidence. *Auditing: A Journal of Practice & Theory* 19 (Fall): 147-157.
- Banker, R.D., H. Chang, and Y. Kao. 2002. Impact of information technology on public accounting firm productivity. *Journal of Information Systems* 16 (2): 209-222.

- Bauman, C.C., K. Hurtt, and K. Mantzke. 2006. Knowledge management systems and the practice of tax. Working paper, University of Northern Iowa, Baylor University and Northern Illinois University.
- Bell, T.B., and J.V. Carcello. 2000. A decision aid for assessing the likelihood of fraudulent financial reporting. *Auditing: A Journal of Practice & Theory* 19 (Spring): 169-184.
- \_\_\_\_\_, J.C. Bedard, K.M. Johnstone, and E.F. Smith. 2002. KriskSM: A computerized decision aid for client acceptance and continuance risk assessment. *Auditing: A Journal of Practice & Theory* 21 (September): 97-113.
- Bonner, S.E. 1999. Judgment and decision-making research in accounting. *Accounting Horizons* 13 (December): 385-398.
- Brazel, J.F., C.P. Agoglia, and R.C. Hatfield. 2004. Electronic vs. face-to-face review: The effects of alternative forms of review on audit preparer performance and accountability perceptions. *The Accounting Review* (October): 949-966.
- Brierley, J.A., and D.R. Gwilliam. 2001. *Human Resource Management Issues in Accounting and Audit Firms A Research Perspective*. Aldershot England: Ashgate.
- Carmichael, D. R. 2004. The PCAOB and the social responsibility of the independent auditor. *Accounting Horizons* (June): 127-133.
- Coombs, R., D. Knights, and H. Willmott. 1992. Culture, control and competition: Towards a conceptual framework for the study of information technology in organizations. *Organization Studies* 13 (1): 51-72.
- Elliott, R.K., and P.D. Jacobson. 1987. Audit technology: A heritage and a promise. *Journal of Accountancy* (May): 198-217.
- Fischer, M.J. 1996. "Real-izing" the benefits of new technologies as a source of audit evidence: An interpretive field study. *Accounting, Organizations and Society* 21 (February-April): 219-242.
- General Accounting Office. 2003. *Public Accounting Firms: Mandated Study on Consolidation and Competition*. GAO office: <http://www.gao.gov/atext/d03864>.
- Hunton, J.E. 2002. The impact of digital technology on accounting behavioral research. In *Advances in Accounting Behavioral Research*, V. Arnold (ed.). Amsterdam: Elsevier Science: 2-17.
- \_\_\_\_\_, A.M. Wright, and S.Wright. 2004. Are financial auditors overconfident in their ability to assess risks associated with enterprise resource planning systems? *Journal of Information Systems* 18 (Fall): Forthcoming.

- International Accounting Bulletin. 2005. [Interview - BDO Seidman: Grabbing New Opportunities](#). *International Accounting Bulletin*. London: September 8: 5.
- Kachelmeier, S.J., and W.F. Messier, Jr. 1990. An investigation of the influence of a nonstatistical decision aid on auditor sample size decisions. *The Accounting Review* 65 (January): 209-227.
- Knechel, W.R. 1988. The effectiveness of statistical analytical review as a substantive accounting procedure: A simulation analysis. *The Accounting Review* 63 (January): 74-96.
- Leech, S.A., and C. Dowling. 2006. An investigation of decision aids in audit firms: Current practice and opportunities for future research. Working paper, University of Melbourne.
- Liang, D., F. Lin, and S. Wu. 2001. Electronically auditing edp systems with the support of emerging information technologies. *International Journal of Accounting Information Systems* 2 (June): 130-147.
- Malhotra, Y., and D.F. Galletta. 2004. Building systems that users want to use. *Communications of the ACM* 47 (December): 89-94.
- Malone, C.F., and R.W. Roberts. 1996. Factors associated with the incidence of reduced audit quality behaviors. *Auditing: A Journal of Practice & Theory* 15 (2): 49-64.
- Manson, S., S. McCartney, and M. Sherer. 1997. *Audit Automation: The Use of Information Technology in the Planning, Controlling and Recording of Audit Work*. Edinburgh: Institute of Chartered Accountants of Scotland.
- \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and W.A. Wallace. 1998. Audit automation in the UK and the US: A comparative study. *International Journal of Auditing* 2: 233-246.
- Markus, L., and M. Keil. 1994. If we build it, they will come: Designing information systems that people want to use. *Sloan Management Review* (Summer): 11-25.
- Messier, W.F., Jr. 1995. Research in and development of audit decision aids. In *Judgment and Decision Making Research in Accounting and Auditing*, edited by R.H. Ashton, and A.H. Ashton, 207-228. New York: Cambridge University Press.
- \_\_\_\_\_, and J.V. Hansen. 1987. Expert systems in auditing: The state of the art. *Auditing: A Journal of Practice & Theory* 7 (Spring): 94-105.
- O'Donnell, E., and J. Schultz. 2003. The influence of business-process-focused audit support software on analytical procedures judgments. *Auditing: A Journal of Practice and Theory* 22 (September): 265-279.

- O'Leary, D.E. 2002. Knowledge management in accounting and professional services. In *Researching Accounting as an Information Systems Discipline*, edited by V. Arnold, and S. Sutton, 273-283. Sarasota FL: American Accounting Association.
- PricewaterhouseCoopers. 2003. TeamMate. <http://www.pwcglobal.com/extweb/service.nsf/docid/443881f8a1da32d0852568b6001a514e>.
- Public Company Accounting Oversight Board (PCAOB). 2004a. *Release No. 2004-001: Auditing Standard No. 2. An Audit of Internal Control Over Financial Reporting Performed in Conjunction with an Audit of Financial Statements*. (March 9). Washington, D.C.: PCAOB.
- \_\_\_\_\_. 2004b. *Release No. 2004-005: Auditing Standard No. 3. Audit Documentation*. (June 9). Washington D.C.: PCAOB.
- Public Oversight Board (POB), Panel on Audit Effectiveness. 2000. *Report and Recommendations*. Stamford, CT: POB.
- Riemenschneider, C., D. Harrison, and P. Mykytyn, Jr. 2000. Understanding IT adoption decisions in small business: Integrating the theory of planned behavior and the technology acceptance model. Working paper, University of Arkansas.
- Solomon, I., and K. Trotman. 2003. Experimental judgment and decision research in auditing: The first 25 years of AOS. *Accounting, Organizations and Society* 28 (May): 395-412.
- Sprinkle, G.B., and R.M. Tubbs. 1998. The effects of audit risk and information importance on auditor memory during working paper review. *The Accounting Review* 73 (October): 475-502.
- Straub, D., M. Limayem, and E. Karahanna. 1995. Measuring system usage: Implications for IS theory testing. *Management Science* 41: 1328-1342.
- U.S. House of Representatives, Committee on Financial Services (2002). Sarbanes-Oxley Act of 2002 (SOX). Public Law No. 107-204. Washington D.C.: Government Printing Office.
- Venkatesh, V., M. Morris, G. Davis, and F. Davis. 2003. User acceptance of information technology: Toward a unified view. *MIS Quarterly* 27 3 (September): 425-478.
- Vera-Munoz, S.C., J.L. Ho, and C.W. Chow. 2006. Enhancing knowledge sharing in public accounting firms. *Accounting Horizons* 20 (2): 133-155.
- Winters, B.I. 2004. Choosing the right tools for internal control reporting. *Journal of Accountancy* (February): 34-41.
- Wright, A. 2002. Foreword forum on continuous auditing and assurance. *Auditing: A Journal of Practice & Theory* 21 (March): 123.

**TABLE 1**  
**Use and Importance of Information Technology Audit Applications**

<u>Audit Application/Tool</u>	<u>Extent of Use<sup>a</sup> Mean</u>	<u>Extent of Use Std. Dev.</u>	<u>Level of Importance<sup>b</sup> Mean</u>	<u>Level of Importance Std Dev.</u>
Electronic workpapers	5.39	2.11	5.79	1.74
Analytical procedures / financial ratio tools	5.06	1.63	5.50	1.36
Internet search tools	4.60	1.84	4.75	1.87
Audit report writing	4.55	2.28	5.05	2.00
Sampling	4.53	2.07	4.91	2.05
Audit planning software	4.20	2.33	4.99	2.01
Risk assessment	4.09	2.33	4.73	2.28
Internal control evaluation	3.90	2.36	4.77	2.30
Client acceptance	3.58	2.41	4.45	2.22
Client relationship management	2.90	2.09	3.95	2.18
Fraud review	2.83	2.02	4.18	2.29
Graphs	2.69	1.59	2.92	1.73
Data mining	2.60	1.93	3.82	2.16
Review client's financial disclosures on web site	2.55	2.00	3.02	2.21
Knowledge management systems <sup>c</sup>	2.45	2.01	2.97	2.34
Continuous transaction monitoring	1.90	1.56	2.92	1.97
Test of on-line transactions	1.87	1.63	2.61	2.16
Database modeling	1.85	1.51	2.62	1.75
Digital analysis	1.67	1.37	2.31	1.70
Expert systems	1.64	1.43	2.19	1.90

<sup>a</sup> Participants were asked to rate 'the extent of usage for each audit application on a typical audit' using a seven point scale with 1 = none and 7 = extensive.

<sup>b</sup> Participants were asked to rate 'the importance of each audit application for a typical audit' using a seven point scale with 1= not important and 7 = very important.

<sup>c</sup> Knowledge management systems refer to efforts to (1) capture knowledge, (2) convert personal knowledge to group-available knowledge, (3) connect people to knowledge, and (4) measure knowledge (O'Leary 2002).

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**TABLE 2**  
**Use and Importance of Information Technology Productivity Tools**

<u>Productivity Tool</u>	<u>Extent of Use<sup>a</sup></u> <u>Mean</u>	<u>Extent of Use</u> <u>Std. Dev.i</u>	<u>Level of</u> <u>Importance<sup>b</sup></u> <u>Mean</u>	<u>Level of</u> <u>Importance</u> <u>Std. Dev.</u>
E-mail	6.17	1.41	6.17	1.49
Cell phones	4.69	2.05	4.76	2.08
Remote network access	4.28	2.49	4.92	2.37
Personal digital assistants (PDAs)	2.63	2.23	2.81	2.20
Wireless networks	2.62	2.19	3.39	2.37
Instant messaging	2.08	1.94	2.12	1.99
Extensible business reporting language (XBRL)	1.16	0.69	1.72	1.57

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<sup>a</sup> Respondents were asked to rate 'the extent of usage for each audit application on a typical audit' using a seven point scale with 1 = none and 7 = extensive.

<sup>b</sup> Respondents were asked to rate 'the importance of each audit application for a typical audit' using a seven point scale with 1= not important and 7 = very important.

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**TABLE 3**  
**Frequency of Workpaper Review Methods Usage**

<b>Workpaper Review Method<sup>a</sup></b>	<b><u>Mean</u></b>	<b><u>Std. Dev.</u></b>
Face-to-face	60.87 %	34.67
E-mail <sup>b</sup>	27.69 %	34.23
Telephone <sup>c</sup>	9.97 %	16.99
Other <sup>d</sup>	10.61 %	19.78

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<sup>a</sup> Respondents were asked to estimate how frequently (0 to 100 % ) each method was used when conducting a typical audit workpaper review (e.g., between staff and senior, or senior and manager).

<sup>b</sup> Email refers to ‘preparer forwards workpapers electronically to the reviewer, the reviewer examines the file on-line, and sends his/her comments back electronically’.

<sup>c</sup> Telephone refers to ‘feedback provided via phone conversation and voice mail messages’.

<sup>d</sup> The most common other response was ‘hard copy review’.

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**TABLE 4**  
**Frequency and Extent of IT Specialist Usage and**  
**Cross-Tabulation with Client IT Complexity**

<b>Panel A: Frequency and Extent of Usage of IT Specialist:</b>		
	<u>Mean</u>	<u>Std. Dev.</u>
Frequency of IT specialist usage over past year <sup>a</sup>	24.46 %	33.68
Extent of IT specialist usage over past year <sup>b</sup>	2.59	2.23
<b>Panel B: Frequency of IT Specialist Usage Cross-Tabulated with Client IT Complexity</b>		
	<u>High Client IT Complexity N<sup>e</sup></u>	<u>Low Client IT Complexity N<sup>e</sup></u>
High frequency of IT specialist usage over past year <sup>c</sup>	46	14
Low frequency of IT specialist usage over past year	44	68
Chi-Square = 21.9; p < 0.01		
<b>Panel C: Extent of IT Specialist Usage Cross-Tabulated with Client IT Complexity</b>		
	<u>High Client IT Complexity N</u>	<u>Low Client IT Complexity N</u>
High extent of IT specialist usage over past year <sup>d</sup>	55	23
Low extent of IT specialist usage over past year	35	59
Chi-Square = 18.9; p < 0.01		

<sup>a</sup> Respondents were asked to estimate how frequently (0 to 100 %) an IT specialist was used during audit engagements over the past year.

<sup>b</sup> Respondents were asked to rate the extent of IT specialist usage during audit engagements over the past year from 1 = none to 7 = extensively.

<sup>c</sup> Frequency of IT specialist usage is split at the mean of 24.46 percent.

<sup>d</sup> Extent of IT specialist usage is split at the mean of 2.59 using a scale of 1 = none to 7 = extensively.

<sup>e</sup> Client IT complexity is split at the mean of 4.63 on a scale of 1 = manual processing to 7 = highly computerized financial reporting system.

**TABLE 5**  
**Impact of Firm Size on Audit Application Usage and Perceived Importance**  
**Means, ANCOVA, and Planned Contrast Results**

	Extent of Usage <sup>a</sup>					Planned Contrast <sup>d</sup>	Importance <sup>b</sup>					Planned Contrast <sup>d</sup>
	Big 4	National	Regional	Local	ANCOVA <sup>c</sup>		Big 4	National	Regional	Local	ANCOVA <sup>c</sup>	
Analytical review / financial ratio tools	4.76	4.97	4.54	5.55	*		5.22	5.47	5.42	5.82		
Audit planning software	4.96	3.97	3.38	3.97	**	**A *B	5.36	4.72	4.42	5.03		
Audit report writing	3.55	4.84	4.65	5.37	**	**A **B	4.44	5.31	5.46	5.41	*	**A *B
Client acceptance <sup>e</sup>	3.89	3.63	2.77	3.68			5.27	4.30	3.46	4.35		
Client relationship management	3.02	3.00	2.35	3.03			3.90	4.41	3.73	3.97		
Continuous transaction monitoring	2.13	2.03	1.35	1.72			3.14	3.04	2.35	2.85		
Data mining	2.04	2.16	1.50	1.53			2.59	2.96	2.13	2.58		

<sup>a</sup> Participants were asked to rate 'the extent of usage for each audit application on a typical audit' using a seven point scale with 1 = none and 7 = extensive.

<sup>b</sup> Participants were asked to rate 'the importance of each audit application for a typical audit' using a seven point scale with 1 = not important and 7 = very important.

<sup>c</sup> ANCOVA results for usage/importance rating differ based on firm size where \*\* indicates  $p \leq 0.01$  and \* indicates  $p \leq 0.05$  level.

<sup>d</sup> Planned contrast results for usage/importance rating differ based on (A) differences between Big 4 and non-Big 4 firms, (B) differences between Big 4 and national firms, and (C) differences between national and smaller (i.e., regional and local) firms where \*\* indicates  $p \leq 0.01$  and \* indicates  $p \leq 0.05$  level.

<sup>e</sup> Experience, rather than firm size, is significant at  $p \leq 0.01$  level.

**TABLE 5 (continued)**  
**Impact of Firm Size on Audit Application Usage and Perceived Importance**  
**Means, ANCOVA, and Planned Contrast Results**

	Extent of Usage <sup>a</sup>					Importance <sup>b</sup>						
	Big 4	National	Regional	Local	ANCOVA <sup>c</sup>	Planned Contrast <sup>d</sup>	Big 4	National	Regional	Local	ANCOVA <sup>c</sup>	Planned Contrast <sup>d</sup>
Database modeling	2.04	2.16	1.50	1.53			2.59	2.96	2.13	2.58		
Digital analysis	1.92	2.20	1.48	1.28			2.31	2.92	2.09	2.15		
Electronic workpapers	6.77	6.23	4.12	4.39	**	**A **C	6.62	6.17	4.96	5.22	**	**A *C
Expert systems	2.27	1.93	1.19	1.20	**	**A *C	3.00	2.40	1.70	1.73	**	**A
Fraud review	3.43	3.43	1.92	2.38	**	**A **C	4.78	4.47	3.42	3.92	*	*A
Graphs	2.53	2.74	2.19	2.86			2.63	3.03	2.54	3.15		

<sup>a</sup> Participants were asked to rate ‘the extent of usage for each audit application on a typical audit’ using a seven point scale with 1 = none and 7 = extensive.

<sup>b</sup> Participants were asked to rate ‘the importance of each audit application for a typical audit’ using a seven point scale with 1 = not important and 7 = very important.

<sup>c</sup> ANCOVA results for usage/importance rating differ based on firm size where \*\* indicates  $p \leq 0.01$  and \* indicates  $p \leq 0.05$  level.

<sup>d</sup> Planned contrast results for usage/importance rating differ based on (A) differences between Big 4 and non-Big 4 firms, (B) differences between Big 4 and national firms, and (C) differences between national and smaller (i.e., regional and local) firms where \*\* indicates  $p \leq 0.01$  and \* indicates  $p \leq 0.05$  level.

**TABLE 5 (continued)**  
**Impact of Firm Size on Audit Application Usage and Perceived Importance**  
**Means, ANCOVA, and Planned Contrast Results**

	Extent of Usage <sup>a</sup>					Planned Contrast <sup>d</sup>	Importance <sup>b</sup>					Planned Contrast <sup>d</sup>
	Big 4	National	Regional	Local	ANCOVA		Big 4	National	Regional	Local	ANCOVA <sup>c</sup>	
Internal control evaluation	4.94	4.35	2.73	3.42	**	*A C	5.76	4.94	3.88	4.35	**	**A
Internet search tools	4.85	4.42	4.12	4.77			5.09	4.42	4.46	4.78		
Knowledge management systems	3.91	2.39	1.31	1.80	**	*A *B	4.35	2.94	2.31	2.26	**	**A **B
Review of client's financial disclosures on web sites	3.81	2.26	1.69	2.02	**	**A **B	4.36	2.90	2.54	2.23	**	**A **B
Risk assessment	4.70	4.26	3.50	3.88			5.54	4.93	3.69	4.51	**	**A *C
Sampling	5.06	5.42	3.54	4.17	**	*C	5.57	5.77	3.73	4.52	**	*A **C
Test of on-line transactions	2.70	1.84	1.42	1.31	**	*A B	3.89	2.90	2.07	1.84	**	**A *C

<sup>a</sup> Participants were asked to rate 'the extent of usage for each audit application on a typical audit' using a seven point scale with 1 = none and 7 = extensive.

<sup>b</sup> Participants were asked to rate 'the importance of each audit application for a typical audit' using a seven point scale with 1 = not important and 7 = very important.

<sup>c</sup> ANCOVA results for usage/importance rating differ based on firm size where \*\* indicates  $p \leq 0.01$  and \* indicates  $p \leq 0.05$  level.

<sup>d</sup> Planned contrast results for usage/importance rating differ based on (A) differences between Big 4 and non-Big 4 firms, (B) differences between Big 4 and national firms, and (C) differences between national and smaller (i.e., regional and local) firms where \*\* indicates  $p \leq 0.01$  and \* indicates  $p \leq 0.05$  level.

**TABLE 6**  
**Impact of Firm Size on Productivity Tools Usage and Perceived Importance**  
**Means, ANCOVA, and Planned Contrast Results**

	Extent of Use <sup>a</sup>						Level of Importance <sup>b</sup>					
	Big 4	National	Regional	Local	ANCOVA <sup>c</sup>	Planned Contrast <sup>d</sup>	Big 4	National	Regional	Local	ANCOVA <sup>c</sup>	Planned Contrast <sup>d</sup>
Cell phones	4.65	4.77	4.19	4.78			4.85	5.32	4.31	4.63		
E-mail	6.71	6.32	5.46	5.88	**	**A **C	6.65	6.48	5.61	5.88	**	**A **C
Instant messaging <sup>e</sup>	3.51	1.32	1.69	1.38	**	**A **B	3.33	1.63	2.00	1.48	**	**A **B
Personal digital assistants (PDAs) <sup>f</sup>	2.71	1.90	2.35	3.06			2.96	2.55	2.88	2.86		
Remote network access	5.87	4.97	3.35	2.97	**	**A **C	6.13	5.77	4.85	3.646	**	**A **C
Wireless networks	3.87	2.52	2.00	1.94	**	**A **B	4.09	3.58	2.96	3.05		
<u>XBRL</u>	<u>1.12</u>	1.39	1.15	1.05			1.59	2.23	1.73	1.60		

<sup>a</sup> Participants were asked to rate ‘the extent of usage for each audit application on a typical audit’ using a seven point scale with 1 = none and 7 = extensive.

<sup>b</sup> Participants were asked to rate ‘the importance of each audit application for a typical audit’ using a seven point scale with 1 = not important and 7 = very important.

<sup>c</sup> ANCOVA results for usage/importance rating differ based on firm size where \*\* indicates  $p \leq 0.01$  and \* indicates  $p \leq 0.05$  level.

<sup>d</sup> Planned contrast results for usage/importance rating differ based on (A) differences between Big 4 and non-Big 4 firms, (B) differences between Big 4 and national firms, and (C) differences between national and smaller (i.e., regional and local) firms where \*\* indicates  $p \leq 0.01$  and \* indicates  $p \leq 0.05$  level.

<sup>e</sup> ANCOVA results suggest that experience and firm size are both significant at  $p \leq 0.01$  level. Bootstrap analysis indicates that usage/importance ratings differ based on (A) differences between Big 4 and non-Big 4 firms, and (B) differences between Big 4 and national firms where \*\* indicates  $p \leq 0.01$ .

<sup>f</sup> Experience, rather than firm size, is significant at  $p \leq 0.01$  level.

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**TABLE 7**  
**Impact of Firm Size on Frequency of Workpaper Review Method Usage**  
**Means, ANCOVA, and Planned Contrast Results**

<u>Workpaper Review Method<sup>a</sup></u>	<u>Big 4</u>	<u>National</u>	<u>Regional</u>	<u>Local</u>	<u>ANCOVA Results<sup>b</sup></u>	<u>Planned Contrast<sup>c</sup></u>
Face-to-face	49.87	59.80	65.38	70.75	*	**A
E-mail <sup>d</sup>	55.78	24.70	12.88	12.46	**	**A **B
Telephone	19.00	7.32	3.65	6.09	**	**A **B

<sup>a</sup> Respondents were asked to estimate how frequently (0 to 100 % ) each method was used when conducting a typical audit workpaper review (e.g., between staff and senior, or senior and manager).

<sup>b</sup> ANCOVA results for usage/importance rating differ based on firm size where \*\* indicates  $p \leq 0.01$  and \* indicates  $p \leq 0.05$  level.

<sup>c</sup> Planned contrast results for usage rating differ based on (A) differences between Big 4 and non-Big 4 firms, (B) differences between Big 4 and national firms, and (C) differences between national and smaller (i.e., regional and local) firms where \*\* indicates  $p \leq 0.01$  and \* indicates  $p \leq 0.05$  level.

<sup>d</sup> ANCOVA results find experience and firm size are both significant at  $p \leq 0.01$  level. Bootstrap analysis indicates that usage rating differs based on (A) differences between Big 4 and non-Big 4 firms, and (B) differences between Big 4 and national firms where \*\* indicates  $p \leq 0.01$ .

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**TABLE 8**  
**Impact of Firm Size on Frequency/Usage IT Specialists**  
**Means, ANCOVA, and Planned Contrast Results**

	<u>Big 4</u>	<u>National</u>	<u>Regional</u>	<u>Local</u>	<u>ANCOVA Results</u>	<u>Bootstrap Analysis</u>
Frequency of IT specialist usage over past year <sup>a</sup> ,	59.33	13.74	19.04	3.45	** <sup>c</sup>	**A <sup>d</sup> **B <sup>d</sup>
Extent of IT specialist usage <sup>b</sup> ,	4.75	1.94	2.42	1.22	** <sup>c</sup>	**A <sup>d</sup> **B <sup>d</sup>

<sup>a</sup> Participants were asked to estimate how frequently (0 to 100 %) an IT specialist was used during audit engagements over the past year.

<sup>b</sup> Participants were asked to rate 'the extent of usage for each audit application on a typical audit' using a seven point scale with 1 = none and 7 = extensive.

<sup>c</sup> ANCOVA results indicate that experience and firm size are both significant at  $p \leq 0.01$  level.

<sup>d</sup> Bootstrap analysis finds that frequency/usage rating differs based on (A) differences between Big 4 and non-Big 4 firms, and (B) differences between Big 4 and national firms where \*\* indicates  $p \leq 0.01$ .