A Big 4 Firm's Use of Information Technology to Control the Audit Process: How an Audit Support System is Changing Auditor Behavior*

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1. Introduction

The last decade has seen an increase in regulatory pressure on audit firms (Kinney 2005; O'Regan 2010). Regulators now strictly enforce compliance with auditing standards, impose penalties for misconduct, and require audit firms to demonstrate the effectiveness of their control systems for ensuring audit quality (Bedard, Deis, Curtis, and Jenkins 2008; DeFond and Lennox 2011). However, unlike the production of tangible products whose quality can be assessed objectively and/or at relatively low cost, the quality of the audit output, the audit opinion, is in principle unobservable (DeAngelo 1981). This creates monitoring difficulties for third parties, which regulators partially resolve by using evidence from the firm's policies, technologies, and workpapers to assess audit quality (Church and Shefchik 2012).

An electronic workpaper system is an information technology tool (Janvrin, Bierstaker, and Lowe 2008) that is an important component of an audit firm's risk management process (Bedard et al. 2008). In contrast to the early electronic systems which replicated paper-based systems, audit firms have more recently developed sophisticated audit support systems (Dowling and Leech 2007). These systems provide firms with an alleged competitive advantage (Carson and Dowling 2012) by increasing efficiency (Banker, Chang, and Kao 2002), symbolically signaling the sophistication of the firm's audit process (Manson, McCartney, and Sherer 2001), and, when used as a process control, they promote the effective and efficient delivery of audits (Bedard et al. 2008; Dowling 2009).

When using an audit support system as a process control, audit firms need to balance auditors' desire for professional independence when performing their audit tasks (Bamber and Iyer 2002; Francis 1994) with pressure by regulators to demonstrate audit quality through compliance with the firm's methodology, policies, and auditing standards. To be an effective process control, a system needs to actively restrict auditors' independent behavior. This creates an operational risk because auditors could respond positively or negatively to a system. Auditors could respond negatively if they perceive the audit firm is using the system to coerce their effort and compliance with firm policies (Adler and Borys 1996). Auditors who react negatively could disengage with their audit tasks because they perceive their tasks as routine (Bamber and Snowball 1988) or reject the system and work

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around it (Bedard, Ettredge, and Johnstone 2007; Bedard, Jackson, Ettredge, and Johnstone 2003), thereby reducing the effectiveness of the system as a control. Auditors who work around the system might not perform an audit that complies with the firm's methodology and auditing standards. This increases the risk of the firm being liable if nonreliance is used as evidence that the auditor did not exercise professional care (Anderson, Jennings, Kaplan, and Reckers 1995; Messier 1995). Conversely, auditors may respond positively to a structured system if they perceive that the structure clarifies their tasks and responsibilities (Adler and Borys 1996; Bamber, Snowball, and Tubbs 1989). But, even if they respond positively, they may overrely on the system (Glover, Prawitt, and Spilker 1997) and not sufficiently assess the applicability of the system's recommendations for a specific client.

When audit support systems are used as a process control, audit firms are faced with the challenge of designing a system that balances features that ensure compliance with features that enable auditor autonomy and reduce overreliance on the system. We use Adler and Borys's (1996) enabling and coercive framework to analyze auditors' reactions to a new audit support system in one Big 4 firm. This system has features that actively or passively guide audit teams to comply with the firm's methodology and features that enable real-time and ex post monitoring. We investigated auditors' reactions to the system's features because they influence the effectiveness of the system as a process control. Prior to deployment, senior management were concerned that auditors might react negatively to the more coercive features of the system. However, we found that auditors reacted positively to the new system and viewed many of the features as enabling rather than coercive.

Two primary factors emerged that explain the auditors' reaction: the interventions management used when deploying and implementing the new system, and the way the system's design ensures compliance by providing audit teams with constrained choices for how to apply the system's recommendations. By requiring auditors to be accountable, the system promotes an auditor's sense of empowerment by leveraging his or her skills and knowledge. Empowerment became stronger following management interventions that encouraged audit teams to challenge the system's recommendations.

This study contributes to the academic literature and practice by providing evidence of how information technology, in the form of an audit support system, is changing auditor behavior and audit team interaction. We document how the system improves audit review effectiveness and increases the frequency and timeliness of auditor interaction. Prior research has concluded that reviews conducted electronically are more efficient but less effective than when the reviewer and preparer are face to face. Reviewers find navigating electronic workpapers is difficult (Bedard et al. 2007) and complex (Rosman, Bible, Biggs, and Graham 2007), and they are less likely to identify and adjust for errors (Bible, Graham, and Rosman 2005) and poor quality documentation (Agoglia, Hatfield, and Brazel 2009). However, because extant studies compare electronic review to paper or face-to-face review, the effect of different system designs on reviewer effectiveness has not been investigated. This study finds that the design of an audit support system can impact reviewer effectiveness. This suggests that the results of extant studies are unlikely to be generalizable to all forms of electronic review and that future research is needed to understand how different system designs affect reviewers' judgments.

This study also provides evidence that, when used as a process control, audit support systems can have unintended consequences for auditor behavior and audit team interaction. We find that many of the system's features that enable monitoring and force reviewer involvement also increase the frequency and timeliness of preparer and reviewer interaction. Although the auditors reported that this was improving audit effectiveness and efficiency, they did not appear to have considered how this may reduce the independence of preparers' judgments. Increased interaction between preparers and reviewers increases

the risk that preparers stylize their workpapers (Rich, Solomon, and Trotman 1997) or align their judgments with reviewers' beliefs (Peytcheva and Gillett 2011; Wilks 2002). Our findings have important implications for audit firms that use information technology to facilitate engagement monitoring. They suggest that system features that enable monitoring can inadvertently reduce preparer and reviewer independence, which may decrease the effectiveness of the audit review as an independent control mechanism. This study provides guidance for future research by retrospectively comparing the firm's old and new system to identify the features that auditors reported improved reviewer effectiveness.

An important conclusion of this study is that, to fully understand how audit support systems, or information technology in general, impacts auditor behavior, studies need to consider the system's design and how auditors use it in practice. This conclusion implies that the extant literature has an incomplete understanding of the effect of information technology on the audit process and auditor behavior because prior studies (e.g., Agoglia, Brazel, Hatfield, and Jackson 2010; Agoglia et al. 2009; Banker et al. 2002; Brazel, Agoglia, and Hatfield 2004; Bible et al., 2005) have not considered the effect of alternative system designs. This study contributes to this literature by providing a detailed analysis of the features in a new audit support system and how the deployment of this system is changing auditor behavior and interaction.

The remainder of this paper is structured as follows. Section 2 describes the research methods. Section 3 describes the rationale for the new system and its deployment and classifies the system's features. Section 4 analyzes auditors' reactions to these features using Adler and Borys's (1996) framework and discusses the implications for research and practice. Section 5 concludes the paper.

2. Research methods

Data collection and analysis

We collected archival and interview data from auditors at a Big 4 audit firm that deployed a new audit support system. Table 1 summarizes the data sources. The audit firm provided internal documents, including memoranda outlining the reasons for the system change, system manuals, user documentation, and internal surveys of system use conducted by the firm. We conducted two preliminary interviews where an audit partner and manager demonstrated the system, and through prior research (Dowling and Leech 2007; Dowling 2009) we had exposure to the firm's old system. We used the internal documents and interviews when developing the interview scripts.[1]

We conducted 17 group interviews with audit partners, managers, seniors, staff, and "champions" from three large Australian cities of the Big 4 firm.[2] In total, we interviewed 51 auditors and one ex-regulator. The average audit experience of the participants was seven years (ranging from 2 to 37 years). The auditors worked in several industries.[3] Interviews were conducted at the point in time when 75 percent of the firm's engagements had

1. Please see supporting information, "Appendix S1: Example Interview Scripts" as an addition to the online article. Although the interview scripts do not contain many questions about the features of the new system, during the interviews we drew from the firm's internal documentation that we had reviewed prior to the interviews. As we conducted the interviews, we used this knowledge to expand on points to explore the impact of specific features.
2. Champions are auditors in the firm's business units who were appointed to facilitate the deployment of the system. Their role is discussed in section 3.
3. The auditors worked in the following industries: retail and commercial industrial products; manufacturing; telecommunications, communications and entertainment; mining, energy and utilities; strategic growth markets; real estate, hospitality and construction; and infrastructure and property. We did not observe differences in auditor reactions across industries. The diversity of industries provides assurance that the findings are not confounded by industry. This is important because audit support systems contain industry-packs that tailor the engagement file to a client's industry (Dowling and Leech 2007).

TABLE 1
Data sources

	Number of individuals	Number of interviews[a]
Interviewees		
Champions[b]	8	2
Partners/Executive directors	8	5
Managers	11	3
Seniors	15	4
Staff	8	2
Ex-regulator[c]	1	1
Total	**51**	**17**

Documentation reviewed	Number of documents
Internal documents provided to staff before the new system was deployed. These included the system manual, guidance on the link between the system and the firm's methodology, and reference cards.	14
Internal survey on old system	1
Internal surveys on new system	2
Internal documents on requirements for new system	1
ASIC reports	2
PCAOB firm reports	3
Audit firm's websites (Australia and global)	2

Notes:

[a]All interviews were face-to-face. Interviews were recorded and transcribed. Both researchers attended all interviews. With the exception of one partner and the ex-regulator, all interviews were group interviews. Groups were organized according to auditor rank. The duration of each interview was approximately one hour.

[b]The firm appointed champions across all auditor ranks. Champions were the "go-to" people on the audit team and trained the auditors in how to use the system. We interviewed the champions as a group and we focused on obtaining their reactions of how other auditors perceived and used the system. The champions provided independent validation of the reactions we obtained from the auditors.

[c]The ex-regulator provided very general comments and opinions of audit support systems and their role in delivering effective audits. The ex-regulator did not discuss specifics in relation to any audit firm.

migrated to the new system. The remaining 25 percent were very small engagements. Nearly all of the auditors we interviewed had used the new system for a full cycle (i.e., establishing the engagement file, archiving, and rolling-forward the following year). The auditors reported that as this was their second year using the new system, they felt comfortable that they had a good understanding of the system.

Both researchers participated in all interviews. The interviews were semistructured. Each group interview lasted approximately one hour (the range was from 50 to 90 minutes). All interviews were recorded and transcribed. The accuracy of the transcripts was independently validated by one of the researchers. With the exception of two interviews, one with an ex-regulator and one with an audit partner, all interviews were group

interviews. Group interviews were used to reveal similarities and differences in the auditors' reactions and use of the new system (Kaplowitz 2000; Minichiello, Aroni, Timewell, and Alexander 1995). Consistent with this approach, the interview script was used as a prompt rather than a structured data collection tool.

A manager at the audit firm constructed the interview groups based upon our criteria that participants represent different industries, different sized clients, and had experience with the firm's old and new systems, both of which are electronic systems. Having experience with both systems is important because system structure is akin to restrictiveness (Dowling and Leech 2007) and can only be assessed relatively, not absolutely (Silver 1988). Ensuring all participants had experience with both systems should improve response validity because the old system was a common reference point to discuss the new system.[4] We terminated interviews at the point of saturation (Eisenhardt 1989); that is, when we elicited no new information that informed our understanding of how the auditors reacted to the system.

To reduce the possibility that the group interview approach might create social bias and/or auditors "cheerleading" for the firm, we took several steps. First, each interview group only included auditors of the same rank. This enabled interviewees to discuss how they used the system for the tasks they undertook at their rank. Second, we requested and obtained auditors from different audit teams, industries and business units. Third, the only people in the room during the interviews were the interviewees and the two researchers. Fourth, if different group interviews were on the same day, we scheduled a one-hour gap between the ending and commencement of the interviews to protect the confidentiality of group members. Fifth, we requested that the auditors not discuss the interviews with their colleagues. Sixth, prior to commencing the interviews, we provided all interviewees with a statement outlining the university's ethical guidelines and explained that the research was being conducted as an independent university study and not at the request of the firm, only aggregate results would be reported, and participants would not be identifiable. Seventh, the only feedback the firm obtained is a draft copy of this manuscript, and the only restriction the firm placed on the research was that it remained anonymous.

We analyzed the interview and archival data iteratively through a process of reflection, discussion, and reanalysis. After all interviews were conducted, we obtained a preliminary understanding of the data by independently coding the interview and archival data using the broad themes in the interview script.[5] Each researcher independently prepared summary tables and reflection notes of the themes that emerged from their analysis. We used these to identify, discuss and agree on the major themes. Many of the themes that emerged resonated with Adler and Borys's (1996) framework (discussed in section 4). At this stage, we adopted this framework as a theoretical lens to structure our data analysis. As we iteratively analyzed the data, we developed three sets of themes to capture: (1) the system's features; (2) Adler and Borys's (1996) framework; and (3) the system's deployment and implementation. The data were coded in NVIVO to facilitate sorting and extraction of the data. The data were coded separately once for each of the three sets of themes to ensure that no single set dominated. We continually discussed our interpretation and reflections of the data as we moved back and forth between the data, the literature and writing the paper.

4. As noted in section 4, the unstructured design of the old system enabled auditors to use the system in different ways. Individual auditors reported using the system differently across engagements, and most auditors were aware of the many different ways the old system was used. The auditors contrasted the variance in use of the old system with the homogeneity enforced by the new system.

5. Please see supporting information, "Appendix S1: Example Interview Scripts" as an addition to the online article.

3. The research site

The rationale for the new system

A ten-member executive team comprising audit partners from Australia, Germany, France, and the United States, as well as representatives from the firm's global technology group, managed the development of the new system. An oversight committee and core project, design, content development, and knowledge integration teams were established. A top-down development approach was used. During the design phase, users in all regions of the firm's global network were consulted.

Our analysis of the internal documentation and interviews with audit partners involved in the development of the new system identified that internal and external pressures influenced the design of the new system. The old electronic system did not impose how audit teams structured an engagement file, which increased the difficulty of navigating and retrieving information. An audit partner used the analogy that the old system was "like having a bucket of water into which you tip more water and once it's in there, it's really hard to separate one thing from another." It was not mandatory to use the old system and many auditors used paper-based workpapers; or if the old electronic system was used, many audit teams performed extensive workarounds. Because the audit firm did not have central control over the creation and management of engagement workpapers, the firm was exposed to the risk of losing workpapers. According to an audit partner, this was a concern because they "had a number of close calls where people from overseas had come in, created their own [engagement in the old system], done the work … left the firm and we'd nearly lost an engagement [file]."

The limitations of the old system became problematic as regulatory changes increased the external monitoring of audit firms. An audit partner reflected that "the first pressure [for the new system] really came from the U.S. regulators." This partner expressed that the extent of structure and control embedded in the system were a direct result of the new regulatory regime; "like all good regulators, they like a set of rules that you can apply, especially the Americans like rules. They would have liked more prescription around some of the decisions." Some audit partners reported that the power of the U.S. regulator to cross borders was a significant incentive for offices in non-U.S. countries to support developing a system that imposed control over the audit process. However, the partners did not appear to consider the risk that such a system can lead to technology dominance if auditors inappropriately overrely on the system (Arnold and Sutton 1998).

The new system was designed to achieve the dual purposes of being an electronic repository for the engagement and an active process control to ensure compliance. Prior to deployment, the audit firm was "expecting a little bit more push back … because there is way less flexibility around documentation and a lot more structure … and reminders around applying the methodology … we expected some initial rumblings [like] … it won't let me do whatever it was I used to do" (partner).

System deployment

The system was deployed incrementally (Robey, Ross, and Boudreay 2002). In each business unit, a few engagements were initially migrated to the new system. This enabled the auditors to "concentrate on getting it right for one or two engagements" (manager). Use of the new system was mandated and auditors were told that the old system would not be available in 18 months. According to an audit partner, this meant that "you had to [use it]… this was a very strong positive signal" that encouraged adoption. A partner's "willingness to use … be involved with [and] supportive of" the new system was incorporated into each partner's performance review (partner). This incentivized partners to support the new system. This was an important intervention because visible top management support facilitates the successful

deployment of a new system (e.g., Sharma and Yetton 2003). As the new system was deployed, a concurrent upgrade of hardware was rolled out; but auditors had to complete the face-to-face training before they were provided with a new computer and wireless card. The upgrade provided an incentive to undertake the training, signalled that the firm was investing resources to support the new system, and enabled the operational effectiveness of the new system by ensuring auditors had the appropriate hardware.

Each auditor had to complete one to two days of face-to-face training.[6] Approximately 20 partners, managers, and senior and staff auditors from the same business unit attended the same training session. The audit firm used collaborative task training (Kang and Santhanam 2003–04), which promotes the development of a shared understanding of how others use the system (Brandon and Hollingshead 2004). A shared conceptualization is important when a system is used for interdependent tasks (Sharma and Yetton 2007) that enforce work practices (Kang and Santhanam 2003–2004), both of which are relevant for audit support systems used as a process control. The formal training explained "why" the system required something to be done in a particular way (i.e., it was aimed at developing auditors' understanding of the system's enforcement of the firm's methodology); this type of training develops users' contextual knowledge of how to use the system (Kang and Santhanam 2003–04). This training is different to application knowledge training, which develops users' knowledge of how to use a system's tools and commands (Sharma and Yetton 2007). Manuals, reference cards and online videos were provided for auditors to develop their application knowledge of the new system.

Senior management appointed champions for each business unit. These were predominately managers and senior auditors who had good knowledge of the firm's audit methodology. The champions trained the auditors in their business unit. All champions completed the same five-day train-the-trainer program, which was conducted by global experts from the United States and local experts in Australia. Each week, the champions participated in a conference call and shared their experiences about the new system and the issues they were encountering. Senior management frequently used this information to inform the weekly emails they sent to all auditors, which contained tips on how to use the system. The knowledge sharing between champions and the way management utilized the information ensured that a consistent message was delivered from senior management and the champions.

The champions facilitated the promotion of "what the [system] is actually about [and] how it's meant to help the audit team" (champion). Having the champions embedded in the business units was important because most learning occurs when people use a system in their daily work activities (Kang and Santhanam 2003–04). The champions' "key aim was to facilitate the roll out of [the new system] as smoothly as possible across the practice … not to be a technical champion … [but to be] a sounding board for people looking for guidance" (champion). Many of the champions reported intervening to ensure auditors understood how the system was implementing the firm's methodology. For example, champions reported that they would tap auditors "on the shoulders, and ask, how are you going? Do you need any help? Can I sit with you?." The champions became a "community of practice" (Brown and Duguid 1991); they were repositories for new organizational knowledge and instrumental in the distribution of this knowledge throughout the firm (Robey et al. 2002).[7] In the words of one partner, the champions "helped maintain the visibility [of the system]… and get the transition over the line." The champions played an important role in encouraging the adoption of the system and how auditors used it.

6. The length of the training varied across offices.
7. A national help desk was also established. Its role was to provide technical support. Questions about how the system implemented the firm's audit methodology were directed back to local champions.

TABLE 2
A description of the controlling and monitoring features in the audit support system

Feature	Description
Panel A: Active control features	
Diagnostics	Program scripts check the completeness of the engagement file. There are numerous checks, including ensuring all significant accounts are mapped to lead schedules, all mandatory fields contain data, all assertions are associated with risk assessments and significant accounts, all review notes are closed, all evidence is associated, and all sign-offs are complete. An engagement can only be archived if a clean diagnostic report is produced.
Knowledge-in-context	The system imports the required mandatory substantive procedures relevant to the engagement. These procedures must be completed by the audit team, or, if they are not to be completed, an explanation must be provided in a rationale box.
Rationale boxes	If auditors override a default option, a rationale box appears. Auditors are required to document their justification for not using the default option. The box must contain text, and it must be entered into the box before the auditor can proceed to the next field.
Sign-off	The system contains extensive mandatory sign-offs. Work must be signed off by the preparer and then the reviewer. Auditors can only sign off on work using their own computer (i.e., auditors cannot log onto another computer and sign off). This minimizes the risk of preparers logging in and signing off the work as reviewers. It also ensures reviewers log into the engagement file. Managers and partners can be reviewers, but certain sign-offs must be completed by partners.
Panel B: Passive control features	
Context-sensitive help	Clickable icons that direct users to information on how to use the system are provided throughout the engagement file.
Methodology icon	A clickable icon provides immediate access to relevant sections of the firm's methodology. Auditors are provided with an explanation of what is required and why it is required.
Scalability	Auditors can choose from the "full" system or a "small" version for less complex engagements.
Panel C: Features that facilitate monitoring	
Communication tools	The system contains electronic meeting tools, message sending, asynchronous discussion, and synchronous chat workspaces to facilitate the sharing of information among team members.
Home page	Provides a snapshot of the significant risks, key documentation, and engagement status. Facilitates monitoring of the engagement as it progresses.
Linked information	Data integrity is enhanced because the information is only required to be entered into the system once. The data is then used to populate linked workpapers. This ensures data consistency across the engagement file. The underlying data structure that supports the linked information also ensures consistency in file presentation across engagements. These factors can enhance reviewer effectiveness and efficiency.

(The table is continued on the next page.)

TABLE 2 (continued)

Feature	Description
Navigator	This screen is a graphical hyperlinked index for the engagement file. The links are grouped by the key audit tasks completed in each of the following phases: planning and risk identification, strategy and risk assessment, execution, and conclusion and reporting. This structure provides an intuitive way for auditors to navigate the engagement file.
Real-time connectivity	Microsoft's Groove Virtual Office platform is used to continuously share information between all audit team members. A central copy is maintained on the firm's server. All members are sent an updated copy of the engagement file as work is completed. Providing reviewers with real-time access to the engagement file facilitates monitoring of the engagement as it is conducted.
Summary screens	Auditors can view snapshots of the engagement from three perspectives: class of transactions/process, accounts/disclosure, or risks. Providing users with alternative summaries of the engagement data facilitates reviewers utilizing the tool in a manner that suits their decision-making process rather than enforcing a standardized process across all reviewers.
Work allocation	The progress of the engagement can be monitored by viewing the allocation of audit tasks by status, assignee, timing or entity.

The key features of the new system

A description of the new system is in the appendix. The system includes several features that control and facilitate monitoring. Table 2 provides a description of each feature classified according to whether the objective of the feature is to be an active control, a passive control, or enable monitoring.

Panel A of Table 2 lists the system features that are active controls; these are control features that auditors cannot override. For example, these features ensure sign-offs are completed by the authorized auditor and in the specified order (i.e., preparer before reviewer); the audit team address the firm's mandatory prescribed procedures or provide a written justification; the audit team associate all risks, assertions and significant accounts; and prior to archiving, the engagement file is complete. Panel B of Table 2 lists the passive control features that enable auditors to seek context-sensitive help or guidance from the firm's methodology. These features are a passive control because the system does not force auditors to use them. Panel C of Table 2 lists the features that enable reviewers to intuitively find information in the engagement file and monitor the status of the engagement. These include: the structure of the engagement file; a graphic navigator; a home-page that summarizes important information; alternative options for viewing the engagement file; and a summary of the allocation and progress of audit tasks. To facilitate real-time review, the system automatically sends updates of any changes made by a team member to all other members of the audit team. The features described in Table 2 reflect that a key objective of the new system was to be an active process control that facilitates monitoring.

4. Theory, analysis and discussion

We use Adler and Borys's (1996) formalization framework to structure our analysis. This framework provides a general approach for understanding how a structured system can take an enabling or coercive form (Free 2007). Formalization embodies an organization's rules, policies and procedures. How formalization is instantiated affects employees' attitudinal outcomes and can enable or coerce behavior (Adler and Borys 1996). Enabling formalization leverages employees' knowledge and skills and provides guidance to help

"employees do their jobs more effectively" by mastering their tasks, dealing with contingencies, and identifying rules and systems (Adler and Borys 1996, 83). Coercive formalization produces "a foolproof system" (Ahrens and Chapman 2004, 279) that dictates how employees should perform their tasks and restricts their autonomy (Adler and Borys 1996).

An audit support system embodies the rules of the audit firm. These rules reflect the manner and extent to which the system formalizes the firm's audit process. Adler and Borys's (1996) framework provides a theoretical and validated structure for interpreting whether auditors view the system features in Table 2 as enabling or coercive.[8] How a formalized system is designed and instantiated will determine if a system enables or coerces employee behavior and this will be reflected in their attitudinal outcomes and response to the system (Adler and Borys 1996). We analyze auditors' reactions and classify each system feature into one of the following four design principles that determine if formalization enables behavior: repair, internal transparency, global transparency, or flexibility. A summary of our analysis is presented in Table 3.

Repair

The premise underlying repair is that events and tasks are not entirely programmable. The difference between enabling and coercive repair is how the system supports actors to resolve uncertainties, contingencies or breakdowns. In a coercive system, actors are restricted to the programmable tasks controlled by the system. Actions not covered by the formalized rules are dealt with by "others." It is assumed that the actor does not have the knowledge or skills to identify or resolve an issue not supported by the system. In contrast, enabling systems provide capabilities to facilitate an actor's resolution of an unexpected issue. We define repair to be how the audit support system assists auditors to identify and/or deal with issues related to the performance and documentation of audit tasks. An enabling audit support system would facilitate identification of unexpected issues and/or provide tools to enable auditors to resolve the issues. A coercive audit support system would constrain auditors from dealing with unexpected issues and would not provide tools to facilitate the identification or resolution of issues.

Two features emerged that partially encapsulate repair: diagnostics (an active control), and context-sensitive help (a passive control) (Table 3, panel A). Diagnostics are an active control that ensures auditors identify and rectify incomplete data. Auditors cannot archive the file until the diagnostic report is clear. This ensures that the archived file is complete. The resolution of problems identified in a diagnostic report is the responsibility of the senior auditor. The senior auditors initially found clearing the diagnostic report an onerous task that consumed significant hours. This was due, in part, to their lack of familiarity with the system which increased the difficultly of identifying the cause of the problem.

Many seniors reported that a significant limitation of the diagnostic report was that although it identified an error or problem, the system does not provide guidance on how to fix the error. Many seniors found this frustrating and they wanted a hyperlink from the diagnostic report to the relevant part of the engagement file. However, not providing guidance had a positive effect. A consistent view among the senior auditors was that having to fix the problem improved their understanding of the system and the firm's audit process. By the second year of deployment the diagnostic reports were shorter. Although an empirical question, the shorter reports could reflect a better understanding of the workings of the system and not the auditor's knowledge of the audit process. As auditors became more

8. This framework has been used in prior accounting studies (e.g., Ahrens and Chapman 2004; Chapman and Kihn 2009; Free 2007; Wouters and Roijmans 2011; Wouters and Wilderom 2008), mainly of management accounting settings.

TABLE 3
An analysis of the system's features through Adler and Borys's (1996) formalization framework

Panel A: Repair	
Context-sensitive help	Hyperlinks provide auditors with immediate access to guidance to resolve issues. However, many auditors felt the information was too generic. Although potentially enabling, this feature was of limited value for most auditors. Because accessing help is voluntary, it is not coercive.
Diagnostics	Prior to archiving the file, a clean diagnostic report must be produced. This requirement coerces auditor behavior to ensure high-quality documentation. The feature is partially enabling in that the report identifies fields that are incomplete or not linked. However, the report does not provide any assurance on the content of the fields nor does it provide guidance to fix errors. The mandatory requirement to obtain a clean report prior to archiving may create a false sense of audit quality.
Panel B: Internal transparency	
Communication tools	The system contains synchronous and asynchronous communication tools. The auditors did not use them and preferred to rely upon their firm's email and telephone. Because the tools were not used they did not have an enabling or coercive impact on auditor behavior.
Home page	The home page provides a snapshot status of the audit, including a summary of all key information. This page facilitates reviewer monitoring. However, because this screen forces auditors to commence from an aggregated view of the data, it may impact auditor judgment. Although this feature could have been used coercively by managers, this was not the case. The preparers reported that this page provided a "big-picture" view of how the engagement was progressing.
Navigator	The navigator screen provides a graphical hyperlinked index. Grouping the hyperlinks by audit phase enables experienced auditors to intuitively search for information. By improving review effectiveness this feature could have a coercive effect on junior auditors. Instead, preparers embraced the visual summary because it enhanced their understanding of where their tasks fit in the broader audit engagement.
Linked information	Because the data only needs to be entered once, it ensures all audit team members working on interlinked screens use the same data. This enables audit effectiveness through ensuring data integrity. However, because members can work offline, data conflicts may occur and data may be accidently overwritten. There are no obvious coercive implications for this feature.
Real-time connectivity	The system continuously updates all team members' version of the engagement file. Although this feature could be used in a coercive manner because it enables reviewers to continually and secretly monitor the audit engagement, reviewers and preparers reported that they use it to interact more frequently as the engagement progresses.
Sign-off	The system requires several sign-offs. The granularity of the sign-offs require reviewers to engage with the audit. Although all auditors said there were too many sign-offs, they had an enabling effect by promoting internal transparency through forcing reviewers to interact with the audit team as the engagement progresses.

(The table is continued on the next page.)

TABLE 3 (continued)

Summary screens	The summary screens provide auditors with alternative perspectives to review the engagement. Use of these screens is voluntary. They provide auditors with the option of viewing the data in a manner that matches their mental model rather than forcing a particular mental model on each auditor. The provision of alternative perspectives enables internal transparency through facilitating an understanding of the engagement.
Work allocation	This screen provides a snapshot of the status of engagement tasks and facilitates reviewer monitoring. However, reviewers found that the information was not granular enough because it only has four status levels (i.e., task not started, task started, preparer signed off, reviewer signed off). The use of this screen enables internal transparency. Use is voluntary and there is no evident coercive aspect in how the feature was used at this firm. However, if reviewers used it to pressure preparers, it could be used coercively to monitor progress.
Panel C: Global transparency	
Knowledge-in-context	The importation of mandatory prescribed procedures ensures compliance with the firm's methodology since all required procedures must be addressed by the audit team in the engagement file.
Methodology icon	This icon provides hyperlink access to explanations of what is required by the firm's methodology. The guidance enables global transparency, but because auditors are not forced to read the information the enabling effect of this the feature is limited. Because use is voluntary there is no explicit coercive implication.
Panel D: Flexibility	
Knowledge-in-context (PSPs)	Because the system does not prescribe the timing and extent of the prescribed substantive procedures imported into the engagement, audit teams have implicit flexibility in how they address these on an engagement. When the system was first deployed, the auditors did not use this flexibility and reacted as if the prescribed procedures were coercive. After the senior management intervened by conducting efficiency reviews that encouraged auditors to challenge the system, auditors felt empowered to question the applicability of the system's prescribed procedures for an engagement.
Rationale boxes	The system provides auditors with the flexibility to override a prescribed procedure. However, auditors are required to provide an explanation in a rationale box. The flexibility to override a prescribed procedure is constrained by the requirement to provide a written explanation. Although auditors could have found the requirement to provide a rationale threatening, and therefore not override the system, we found no evidence to support this. On the contrary, being forced to provide a recommendation empowered the auditors by increasing their confidence in their decision.
Scalability	Auditors can choose between a "small" and a"large" version of the system for smaller clients. Larger clients must be completed on the "large" system.

familiar with the system they began to understand how they could work around the control features. A senior gave the example that "you can just put a full stop in a [rationale] box and you won't get an error" on the diagnostic report. This behavior is consistent with "working backwards" (Kachelmeier and Messier 1990), and has important implications for audit firms because it suggests that as an auditor's familiarity with a system increases,

the effectiveness of the system as a control is reduced if they employ workarounds, particularly those that are difficult to detect.

The objective of the diagnostic feature is to ensure that the documentation complies with the firm's requirements. The tight controls around documentation are a response to regulatory pressure (Church and Shefchik 2012). However, there is a risk that by emphasizing documentation quality, the diagnostic feature may misdirect auditor effort from substantive audit work. Because the diagnostic reports do not assure audit quality, overreliance on a "clean" diagnostic report could create a false sense of security that does not reduce the risk of material misstatement.

The other design feature which emerged as instantiating repair is context-sensitive help. The auditors have mixed views of this feature. One senior reported that "some staff don't really have any idea that there's all this other information and reference material … but some staff are all over it." Some auditors reported that they found the "help" function useful if they were uncertain about the task they needed to perform. These auditors reported that by accessing the information they felt more confident that they had complied with the firm's policies. However, other auditors reported that the information was "too generic" and did not provide detailed help. It is not surprising that many auditors did not use the context-sensitive help because it is similar to lower-level, definitional explanations (Gregor and Benbasat 1999), which are used by novices, not experts (Arnold, Clark, Collier, Leech, and Sutton 2006). In terms of the dimension of *repair*, context-sensitive help provides auditors with some guidance, but as a passive control it is limited to the auditor identifying that they need to seek information. Although we identify two features that instantiate *repair*, we conclude that the extent of *repair* facilitated by the system is low.

Internal transparency

Internal transparency enables actors to develop an understanding of the workings of their local processes (Ahrens and Chapman 2004). We define the audit engagement as the local process because the objective of the audit support system is to facilitate the production of audit engagements.[9] An enabling audit support system would facilitate an auditor's understanding of where their tasks fit into the engagement and the status of the engagement as it progresses. A coercive system will not facilitate transparency. A highly coercive system would isolate the work of each team member and only reviewers would have an overall view of the engagement. For example, auditors would only have access to the screens relevant to their allocated tasks.

9. Establishing the boundary of the local process can influence what is classified as enabling internal or global transparency. Depending upon the research question, the local process could, for example, be classified as the auditor, the audit team, industry specialization group, or the audit firm's office. The classification is arbitrary, but should be determined by the research question. For example, if a specific audit task is the subject of a research question, the local process would be the task, and the unit of analysis would be defined by the actor or actors that perform the task. In complex systems, where the boundary of the local process is subjective, and the boundaries of the local process and global system overlap, the boundary defined for the local process will affect the boundary of global transparency. In this study, because the audit support system is used by an auditor and we interviewed auditors, one option is to classify the local process as an auditor's use of the system when completing specific audit tasks. However, because an audit support system is a collaborative tool designed to control and monitor the production of audit engagements and our research question investigates how auditors use the system on audit engagements, we posit that the audit engagement, not the auditor, is the most appropriate boundary for the local process for this study. We recognize that this decision impacts our contextualization of the definition of internal transparency and could affect which features emerge as enabling internal transparency and global transparency. Importantly, we do not believe that this choice changes our overall conclusion that the auditors view the system as enabling.

We identified eight features that facilitate internal transparency (Table 3, panel B). Seven of these features facilitate monitoring, and the other feature is an active control. The partners and managers were overwhelmingly positive about the features that enable monitoring. They reported that many of these features improved their review effectiveness by providing alternative snapshot summaries and increasing the ease of navigating through the electronic engagement file. For example, a partner described the home page as a summary of the key documents they need to "look at on every job irrespective of whether they're just signing it [as the second partner] or whether they are actually a detailed engagement partner doing a lot of the work." The system also contains work allocation and summary screens that facilitate "an understanding of where the team is at" (manager). The summaries provide reviewers with key information before drilling into the details in the engagement file. Although the system summaries provide alternative views of the data, by requiring auditors to start with the home page the system pushes auditors into following a decision-making process that moves from aggregated to disaggregated information. Although the home page improves perceived effectiveness, it is an empirical question as to whether it improves actual review effectiveness. Because reviewers check the consistency of the preparer's judgment with the available evidence (Libby and Trotman 1993), forcing reviewers to commence from an aggregated view may cause auditors to anchor on the summary information and bias their information search; or it may improve review efficiency and effectiveness by focusing reviewers on the key issues and risks (Gibbins and Trotman 2002).

Auditors reported that retrieving information from the engagement file was more effective in the new system because it standardized the structure of the engagement file. This enables auditors to complete "more detailed" reviews and increases their confidence that "what you're actually signing off is consistent with what we've audited" (partner). The hyperlink index provides an intuitive tool that more experienced auditors can leverage to navigate the engagement file. In the words of one partner: "well I know there are bits that I want to look at and I've got this great navigation page on the front, and I click on that and it takes me straight into the abyss to wherever it's been stored in the back." This finding contrasts to prior studies that have concluded that the complexity of navigating in electronic systems reduces review effectiveness (e.g., Bedard et al. 2007; Bible et al. 2005). These studies have compared face-to-face and electronic review modes, but have not considered how system design impacts effectiveness. Our analysis suggests that the design of the system is an important omitted variable in the extant literature.

Since nearly all of the features instantiating internal transparency facilitate monitoring, it is not surprising that the managers and partners view these features positively. However, the overwhelmingly positive response by the senior and staff auditors was surprising. Although auditors may have responded positively because electronic review can reduce preparer accountability and effort (Brazel et al. 2004), this is not consistent with what we observed. Preparers expressed that the structured system and the graphical layout improved their understanding of the audit process and how their tasks fit within the audit. This is illustrated in the following quote from a senior auditor who felt that the home page provided a "big picture of how [the engagement] flows … [so] you know where you're up to … [and] you can see what's been done and what needs to be done." The structure reduced auditor uncertainty by making clear what is required on the engagement and where it fits in the engagement. In the words of one manager, the system

> probably gives people a bit more guidance, especially the newer staff as to how things flow because sometimes what we found [with the old system], was some of our new grads would come in the doors and do one piece and they won't really know how their

> piece fits into the whole picture [of the audit engagement], but now at least they can visually see it.

The real-time connectivity increased the timeliness of interaction between preparers and reviewers by ensuring all audit team members have "the most up-to-date version of the file" (senior). The system facilitates timely and accurate resolution of issues. As illustrated by a manager: I can see "exactly the thing that they have a question about and … resolve their question over the phone … there's no guess work involved in what they're actually asking." Although the real-time connectivity could increase managers' surveillance of preparers and make preparers feel pressured and constrained, this did not emerge as a concern. The real-time connectivity was perceived as enabling effective communication between preparers and reviewers.

Although preparers and reviewers reported that the real-time connectivity improved reviewer efficiency and effectiveness, it raises a question about whether reviewer independence is reduced, and the consequences for review quality. Both preparers and reviewers reported that the real-time connectivity enabled a shared understanding of the engagement as it was being completed. The auditors reported that this improved audit efficiency by reducing the amount of rework. However, in so doing, the system is implicitly forcing managers to become co-preparers. While this may improve audit efficiency, it may negatively impact audit effectiveness by reducing reviewer independence. The increased opportunities for interaction facilitated by the system also increase the risk that preparers stylize their work to influence reviewers' evaluation of their performance (Rich et al. 1997). This should be a concern for audit firms because managers display little awareness of preparers' stylization (Gibbins and Trotman 2002). To some extent the structure imposed by the system reduces this risk by minimizing opportunities for stylization of workpapers. But, even if preparers do not purposefully stylize their work to gain the approval of reviewers, the real-time interaction enabled by the system increases the risk of predecisional distortion if preparers, exposed to their manager's conclusions, inadvertently adopt them as their own (Peytcheva and Gillett 2011; Wilks 2002).

Some managers were less positive about the system and they reported that their client load had increased. They also felt they were spending more time "sitting at their desk reviewing" instead of interacting with their clients, particularly for smaller clients. However, they felt that the new system enabled them to be fully informed as the engagement progressed, and when on site, they were more productive and spent their time interacting with the client.

The engagement file contains several mandatory sign-offs. These are an active control that achieves internal transparency by requiring an "experienced member of the audit team [to be] engaged throughout the audit" (ex-regulator). The system has been designed so that the allocated reviewer can only sign off from their computer and not another computer. This reduces the risk that reviewers may give their password to another person to log in and sign off. The sign-offs require reviewers to "be more involved" as the engagement progresses, and rather than "focusing just on the key issues [of their choice] … they're forced to sign off on certain things" (manager).

While sign-offs are an accountability control used in paper and electronic environments, all auditors expressed that the new system had too many sign-offs. For example, where the old system combined design and performance of substantive tests into a single sign-off, the new system requires separate sign-offs. The partners were adamant that the granularity of sign-offs in the new system did not improve audit quality. In the words of one partner: "I can get to the end of an engagement where I know I've looked at everything that I see as risky … but get an email from the manager saying that there's 22 screens that I haven't actually put my initials on yet." The more granular sign-offs were

intended to ensure timely reviewer involvement. However, this did not always occur because many sign-off fields are not completed until after the diagnostic report was run to archive the engagement.

Many of the features that enable internal transparency were included in the system to improve reviewer effectiveness. However, we found that they inadvertently also increased preparers' internal transparency of the engagement. Compared with the old system, the preparers reported that the new system changed the frequency and timeliness of their interaction with reviewers. The preparers expressed that this provided opportunities for them to learn and they felt they were now playing a more important part in decisions as the engagement progressed. Based on the auditors' positive response to the features instantiating internal transparency, we conclude that this system and the way the audit teams use it has enabled internal transparency to a high extent.

Global transparency

Global transparency "refers to the intelligibility for employees [to understand] the broader system within which they are working" (Adler and Borys 1996, 72–73). The scope of the broader system is defined by the boundary of the local process. In this study, the local process is the audit engagement. We define the broader system of interest as the firm's policies and methodologies that all engagements should follow. An enabling audit support system facilitates global transparency by promoting an auditor's knowledge of the firm's policies and methodology. A coercive system would force compliance with the policies without facilitating understanding. In Table 3, panel C, we identify one active control and one passive control that facilitate global transparency.

The passive control that facilitates global transparency is the methodology icon, which provides hyperlink access to the firm's methodology. As illustrated by a senior auditor: "if you don't know what something is you can just press the button and [the system] automatically uploads you into the methodology and it has all the guidance." Auditors reported that the icon has increased the likelihood that they would search for guidance, is improving their understanding of the methodology, and when they search for information they are more confident that they have complied with the firm's methodology.

The active control feature facilitating global transparency is "knowledge in context." This feature imports extensive industry-specific knowledge and prescribed substantive procedures into the engagement file to ensure compliance with the firm's methodology. Compared with the old system, which was not tightly integrated with the firm's methodology, managers reported that the new system improved "execution of the methodology" and "consistency in the way audits are approached." A senior auditor said it provided "a safety net [that] ensures that key members need to do this step and this step and this step, [which] gives you … comfort that the audit has been executed effectively and is consistent with the methodology." The use of words like "safety net" and "comfort" is concerning because they signify the potential for overreliance. In the short term, inappropriate reliance may negatively impact audit effectiveness and/or efficiency if auditors do not adequately tailor the engagement to address idiosyncratic client factors. In the long term, inappropriate overreliance can have detrimental effects on auditor knowledge development (Arnold and Sutton 1998).

By importing prescribed procedures into the engagement file that cannot be deleted, the system ensures the audit team documents how they have addressed these procedures. The auditors reported that the new system made the methodology more explicit. Because the prescribed procedures were located in Word documents in the old system, if a team deleted these from the engagement file, the auditors reported that it was unlikely that the deleted procedures would be detected when the engagement file was rolled forward the following year. The new system eliminates this risk by importing all prescribed procedures

into the engagement file each year. This reduces anchoring on the prior year's engagement and the ease of adopting the same approach as last year (Wright 1988). Compared with the old system, the new system promotes global transparency to a high extent. The passive control feature complements the active control feature by facilitating an auditor's understanding of the system's enforcement of the firm's methodology.

Flexibility

Flexibility is the extent to which the system provides actors with options in how they use the system. Flexibility provides choice for predictable issues that actors need to address. Flexibility can be constrained or unconstrained. Unconstrained flexibility puts no boundaries around how actors address issues that arise. In contrast, constrained flexibility establishes boundaries. We identified three system features that instantiate flexibility: the timing and extent of prescribed substantive procedures is not explicit, auditors can override the system's recommendations by documenting their reasons in rationale boxes, and the scalability of the system. As depicted in Table 3, panel D, with the exception of scalability, the other two features are active controls.

As discussed previously, one of the features that enable global transparency is the importation of prescribed substantive procedures. Although this feature forces compliance with the firm's methodology, audit teams have discretion in the extent and timing of the work. This discretion implicitly provides audit teams with constrained flexibility to determine the appropriate level of assurance for an engagement. However, in the early stages of the system's deployment, audit teams did not recognize that they had this discretion and overrelied on the system's recommendations. This is illustrated by one partner who said "people just assumed it's a prescribed substantive procedure … I have to do it. So they got the message they have to do it, but they didn't get the message that you have to determine time and extent." Following the deployment of the new system, the senior management of the firm identified that audit efficiency had reduced because audit teams "didn't really think about the [prescribed procedures] they just did them irrespective of the risk assessment … they did them as if they had the highest risk possible" (partner). Senior management intervened by conducting efficiency reviews that made teams "challenge their audit approach" to align with the client's risk assessment (partner). The efficiency reviews were effective because they were not linked to the firm's normal quality reviews and reviewed the audit team's application of the system "without being judgmental" (manager). The initial overreliance by auditors on the system is a typical response when a system that imposes control is initially deployed (e.g., Majchrzak, Rice, Malhorta, and King 2000). The efficiency reviews were vital for making the implicit flexibility provided by the system explicit to the auditors.

This incident, although focused on audit efficiency, has implications for audit effectiveness if an audit team does not challenge the system-recommended audit approach to ensure the procedures address a client's idiosyncratic requirements. Because the efficiency reviews focused on making auditors question the system's recommendations, the risk that auditors do not incorporate additional procedures not recommended by the system remains. This is a concern because prior research has found that auditors who overrely on decision aids do not identify additional risks or procedures to those the aid recommended (Asare and Wright 2004; Pincus 1989; Seow 2011).

The system enables auditors to reject a prescribed procedure by providing an explanation for the override in a rationale box. Requiring auditors to document their rationale can increase judgment accuracy (Ashton 1992). Staff auditors found the requirement to provide a rationale intimidating because they had to "to justify every step." In contrast, senior auditors reported that providing the rationale forced them to consider the audit approach and increased "confidence in our judgment." We asked preparers and reviewers

whether having to include a written justification increased acceptance of the system's default recommendation. Both groups thought that there was a high risk of this in the first year of deployment because auditors were not familiar with the system. However, following the efficiency reviews that empowered auditors to challenge and question the system's recommendations, more auditors reported providing explanations in the second year.

The flexibility provided by the system pushed the auditors into using and developing their knowledge because they were required to be responsible for how they applied the system on engagements. In so doing, these features discourage mechanistic use by leveraging the auditor's skills and intelligence (Adler and Borys 1996). The flexibility provided by the system helped auditors appreciate that the system "isn't our big wall that's going to stop us from doing something wrong … [it's] just a tool … you've still got to make the right calls" (manager). Our analysis identified that the flexibility provided by the system and the empowerment provided to auditors by the efficiency reviews are major reasons why auditors view the system as enabling rather than coercive.

5. Conclusion

This study provides evidence of how audit support systems are evolving and how this is changing auditor behavior and audit team interaction. We use internal documents and interviews with auditors at a Big 4 firm to analyze auditors' reactions to the firm's new audit support system. This firm developed the system as a process control to ensure auditors comply with the firm's methodology and auditing standards. Using Adler and Borys's (1996) enabling and coercive framework, we classify the system's features into one of four design principles: repair, internal transparency, global transparency, or flexibility.

Although many of the system's features could have been used as a coercive control, the auditors view the system as enabling. Internal transparency is enabled by the system features that inform preparers and reviewers of how the engagement is progressing (e.g., home page summary, graphical navigator, summary screens, structured information, and sign-offs). Global transparency is enabled by the features that ensure compliance with the firm's methodology and policies (i.e., the importation of prescribed procedures and the methodology icon). Flexibility is enabled by providing auditors with constrained choice in how they apply the system (i.e., choice of timing and extent of prescribed procedures, and the option to override a system recommendation by documenting a reason). Although we identify two features that instantiate repair (i.e., the diagnostic reports and context-specific help), the extent of repair facilitated by the system is low because these features do not actively enable auditors to identify or resolve contingencies.

Adler and Borys (1996) imply that each of the four principles of repair, global transparency, internal transparency and flexibility are important. Even though the extent of repair facilitated by the system is low, the auditors view the system as enabling. Two reasons explain the difference between our findings and Adler and Borys's (1996) framework. First, the system does not constrain auditors from identifying or resolving contingencies. We find that by not facilitating or constraining repair, the system is implicitly enabling because it requires auditors to apply and develop their knowledge to identify and resolve contingencies. Support for this is found in our observation that by not providing auditors with direction on how to resolve issues in the diagnostic reports, auditors developed their understanding of the system and the firm's audit process. Second, there is a difference in the expertise of the auditors we interviewed and the expertise required to complete the tasks discussed by Adler and Borys (1996). The auditors are educated knowledge workers, whereas Adler and Borys (1996) illustrate their framework using tasks that do not require the same level of expertise, such as repairing a photocopier and the "undo" command in computer software systems. These two reasons imply that for tasks undertaken by

knowledge workers, a system that enables internal transparency, global transparency and flexibility but does not constrain repair can be enabling because it leverages users' skills and knowledge (Adler and Borys 1996). This finding illustrates the type of system features that can ensure auditors apply their expertise when using the system. This is important because designing a system that works with a user's expertise can decrease the risk of overreliance and technology dominance (Arnold and Sutton 1998).

An important caveat of the conclusion above is that not only does the design of the system influence how it is used, but how the system is deployed is also important. This study identified that the use of training methods that ensure auditors understand "why" the system requires what it does, reinforcement of this by champions in business units, and nonthreatening interventions by senior management were important factors that influenced auditors viewing the system as enabling rather than coercive. In particular, the interventions by senior management ensured auditors leveraged the decision rights they were implicitly delegated. For example, the system enables auditors to not apply prescribed procedures on specific engagements if they document their reasons in a rationale box. However, it was only following the interventions that auditors felt empowered to question the applicability of the system's recommended prescribed procedures. This finding has important implications for audit practice because it highlights that when an audit support system is used to control the audit process there is a high risk that, at least initially, auditors will overrely on the system, but that effective management interventions that empower auditors to be responsible for how they use the system can reduce this risk.

An important contribution of this study is that it provides a detailed description of the features in an audit support system designed by a Big 4 firm and how these features are changing auditor behavior. For example, we found that the mandatory sign-offs and the real-time connectivity of the system increased the frequency and timeliness of preparer and reviewer interaction. The auditors reported that these changes were improving audit effectiveness and efficiency. However, they were unaware that these changes decreased reviewer independence and might compromise review quality (Rich et al. 1997). The potential impact of the behavioral changes documented in this study highlights the need for future research to investigate how these changes impact auditor judgment. For instance, this firm's system requires that auditors commence reviewing the file from the aggregated summary on the home page before they can access a detailed view. Because how information is presented impacts reviewer judgment (Boritz 1985), an important area for future research is to understand how the presentation of information in these systems affects auditor judgment. Understanding how these features impact reviewer effectiveness is important because contrary to prior studies that have concluded that reviews conducted electronically are not effective (e.g., Bible et al. 2005; Bedard et al. 2007; Rosman et al. 2007), the auditors reported that this system's design improved reviewer effectiveness. By documenting the system's features and auditors' reactions to these features, this study identifies several important avenues for future research to investigate how these systems impact auditor judgment.

When interpreting the findings reported in this study, the following limitations need to be considered. Evidence was obtained from auditors in a group setting, hence the responses are not independent (Minichiello et al. 1995). Because consistent patterns emerged across different groups and offices, it would appear that the group setting did not influence the responses. This study focused on understanding how auditors use the system when working on an audit engagement. We did not focus on individual factors that influence system use. The consistency in our responses across auditor rank and offices suggests that the individual factors identified in prior research (e.g., Dowling 2009) were unlikely to be a major determinant for the auditors we interviewed. Because we

found that auditors' reactions to the system's features are a joint function of the features and the way the system was deployed, it is possible that our findings may be different if senior management had used alternative interventions or the system had different features. For example, if the firm had used application training (Sharma and Yetton 2007) instead of contextual training (Kang and Santhanam 2003–04), auditors may have focused on becoming proficient at using the system's tools rather than understanding how the system enforces the firm's methodology. Despite these caveats, this study informs future research and audit practice by providing detailed evidence of how information technology, in the form of a new audit support system, is changing auditor behavior and audit team interaction.

Appendix

Description of the new system

Prior to an audit team setting up a new engagement, the team needs to request a workspace from the central audit support group. Not allowing teams to create a new engagement file means the firm has control over each workspace. There are two versions of the system: a "full" version and the "small" version for less complex engagements that require a predominately substantive audit approach. Typically the full version is used. The engagement is hosted on a central server, and all team members access the file from this server. Once a workspace is created, the audit team input the client's information through the engagement profile screen. The system uses this information and information it extracts from the firm's audit methodology and industry-sector knowledge banks to customize the workspace. Visually the engagement file replicates traditional "paper" workpapers through screens equivalent to lead-sheets. These screens contain mandatory fields and restrict where attachments can be added to the file. The worksheets are interlinked. The data is entered and stored in a central repository and all interlinked worksheets access the data from this source. By eliminating data redundancy, data integrity is enhanced. Prescribed substantive procedures are populated from the system's knowledge bank. Auditors cannot delete these procedures, but can reject them by providing a rationale in a justification box. The system contains hyperlinks to the firm's methodology. These context-sensitive links provide auditors with information explaining the firm's audit methodology. The system also contains several synchronous and asynchronous communication tools (e.g., chat and email facilities) for auditors to share information.

Auditors navigate through the system using the navigator page. This page is a graphical representation of the audit process and contains hyperlinks to the key audit activities grouped according to: (1) Planning and Risk Identification, (2) Strategy and Risk Assessment, (3) Execution, and (2) Conclusion and Reporting. The home page provides a snapshot summary of important items (e.g., review notes, management letter comments, and issues), significant risks, key documentation, team events and the status of key audit procedures. Summaries can be viewed by class of transactions/process, accounts/disclosures, or risks.

Audit teams can use the system to run several diagnostic program scripts. These scripts check that the documentation file is complete. There are numerous diagnostic checks, including checks to ensure all significant accounts are mapped to lead schedules, all mandatory fields contain data, all assertions are associated with risk assessments and significant accounts, all review notes are closed, all evidence is associated, and all sign-offs are complete. During the engagement, auditors can use the diagnostics at a screen level or across the engagement file. To ensure the engagement file is complete, a file can only be archived when a clean diagnostic report is produced.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:
Appendix S1. Example Interview Scripts.