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The implication of information technology on the audit profession in developing country

Extent of use and perceived importance

Menna Tarek and Ehab K.A. Mohamed
Faculty of Management Technology, German University in Cairo, Cairo, Egypt

Mostaq M. Hussain
Faculty of Business, University of New Brunswick-Saint John, Saint John, Canada, and College of Business and Economics, Qatar University, Doha, Qatar, and

Mohamed A.K. Basuony
Department of Accounting, The American University in Cairo, New Cairo, Egypt

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Abstract

Purpose – Information technology (IT) largely affected contemporary businesses, and accordingly, it imposes challenges on the auditing profession. Several studies investigated the impact of IT, in terms of the extent of use of IT audit techniques, but very studies are available on the perceived importance of the said issue in developing countries. This study aims to explore the impact of implementing IT on the auditing profession in a developing country, namely, Egypt.

Design/methodology/approach – This study uses both quantitative and qualitative data. A survey of 112 auditors, representing three of the Big 4 audit firms as well as ten local audit firms in Egypt, is used to gather preliminary data, and semi-structured interviews are conducted to gather details/qualitative-pertained information. A field-based questionnaire developed by Bierstaker and Lowe (2008) is used in this study. This questionnaire is used first in conducting a pre-test, and then, the questionnaire for testing the final results is developed based on the feedback received from the test sample.

Findings – The findings of this study reveal that auditors' perception regarding client's IT complexity is significantly affected by the use of IT specialists and the IT expertise of the auditors. Besides, they perceive that the new audit applications' importance and the extent of their usage are significantly affected by the IT expertise of the auditors. The results also reveal that the auditors' perception regarding the client's IT is not affected by the control risk assessment. However, the auditors perceive that the client's IT is significantly affected by electronic data retention policies. The results also indicated that the auditors' perception regarding the importance of the new audit applications is not affected by the client's type of industry. The auditors find that the uses of audit applications as well as their IT expertise are not significantly affected by the audit firm size. However, they perceive that the client's IT complexity as well as the extent of using IT specialists are significantly affected by the audit firm size.

Research limitations/implications – This study is subject to certain limitations. First, the sample size of this research is somehow small because it is based on the convenience sampling technique, and some of the respondents were not helpful in answering the surveys distributed for this research's purpose. This can be attributed to the fear of the competitors that their opponent may want to gather information regarding their work to be able to succeed in the competition in the market so they become reluctant to provide any information about their firm. Even some people who were interested to participate were not having enough time because the surveys were distributed during the high season of their audit work and there was limited time for the research to be accomplished. Hence, it is difficult to generalize the results among all the audit firms

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in Egypt because this limits the scope of the analysis, and it can be a significant obstacle in finding a trend. However, this can be an opportunity for future research. Second, the questionnaire is long and people do not have enough time to complete it. This also affected the response rate. In addition to this, the language of the questionnaire was English, so some respondents from the local audit firms were finding difficulty in understanding some sophisticated IT terms.

Practical implications – This study makes some recommends/suggestions that can well be used to solve some practical problems regarding the issues concerned. This study focuses on accounting information system (AIS) training during the initial years of the auditors' careers to help staff auditors when they become seniors to be more skilled with AIS expertise needed in today's audit environment. Clear policy statements are important to direct employees so that IT auditors evaluate the adequacy of standards and comply with them. This study suggests increasing the use of AIS to enhance individual technical and analytical skill sets and to develop specialized teams capable of evaluating the effectiveness of computer systems during audit engagements. This study further recommends establishing Egyptian auditing standards in this electronic environment to guide the auditors while conducting their audit work.

Social implications – Auditors should prioritize causes of risks and manage them with clear understanding of who receives them, how they are communicated and what action should be taken in a given community/society. So, they have to determine and evaluate all risks according to the client's type of industry (manufacturing, non-financial services and financial). Auditors also have to continually receive feedback on the utility of continuous auditing (CA) in assessing risk. In particular, it is better for the auditor to determine how the audit results will be used in the enterprise risk management activity performed by the management. In addition, privacy has several implications to auditing, and so, it has to be reflected in the audit program and planning as well as the handling of assignment files and reports. Alike, retention of electronic evidence for a limited period of time may require the auditor to select samples several times during the audit period rather than just at year end.

Originality/value – As mentioned, this study is conducted within a developing country's context. The use and importance of IT is reality of time. However, very few studies are devoted to explore the use/importance of IT in auditing in developing countries, and thus, this study carries a significance to have better understanding about it. Moreover, knowledge of how IT is used, the related risks and the ability to use IT as a resource in the performance of audit work is essential for auditor effectiveness at all levels including developing countries.

Keywords Information technology (IT), Audit, Procedures, Developing country, Firm size, Application

Paper type Research paper

1. Introduction

Accounting provides information, whereas auditing confirms the degree of compliance of the information to accounting principles and standards. However, the auditing profession is exposed to major challenges because the procedures of conducting the audit is different from those applied to the traditional audit of accounting systems (Reynolds, 1989). It has been becoming increasingly important to address the challenges facing auditing because of the rapid advancement in information technology (IT). Firms are relying heavily on IT in conducting their day-to-day operations, resulting in changes in the nature of the work and the business relationships. This is coupled by the widespread of internet, real-time accounting systems, electronic commerce (e-commerce) and using websites and social media to disclose financial information. Consequently, this leads to an increasing need for new IT audit techniques (Kotb and Roberts, 2011; Wanger, 2001).

Many firms make huge investments in IT resources because of the major benefits gained from these IT resources. For example, in the 2012 report of the top 500 information systems (IS) innovators by *InformationWeek* magazine, IT investments in the banking and financial industries accounted for 8.7 and 9.0 per cent of firms' annual revenues in 2011 and 2012, respectively (InformationWeek, 2012). In more IT-intensive industries, these investments could reach 40 per cent of the firms' total capital expenditures. However, many firms are still

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unable to fully realize the economic benefits coming from these investments because business strategies are not matching with IT. This could be attributed to poor planning and lack of motivation and support (Karanja and Zaveri, 2014).

Nowadays, no accounting process takes place without the use of computer and an accounting software. Thus, accounting technology and software are becoming very sophisticated. It is believed that changes in the accounting profession are the main reason behind the sophistication of accounting software to increase security and protection. Moreover, the size of companies is accelerating the need for more advanced software to support all the aspects of the company's operations (Enofe *et al.*, 2012).

IT has transformed the audit process from traditional audit to IT audit[1]. Large audit firms have made major investments in IT and developed computerized tools to help them during the audit process. However, smaller audit firms may not be able to compete with these large firms on IT investments (Janvrin *et al.*, 2008). Technological advances are one of the significant factors affecting the accounting and auditing profession. It has significantly affected the ways companies conduct their business worldwide. Hence, in the world of technology, it is impossible for accountants and auditors to depend only on information gathered from traditional papers to have the evidence needed to assist them in forming the appropriate opinion on financial statements (Enofe *et al.*, 2012).

There is a lack in the literature that examines the impact of IT on audit practices, particularly in developing countries. Therefore, the objective of this paper is to examine the extent of use and perceived importance of IT in auditing practices in a developing country, namely, Egypt. The rest of this paper is structured as follows. A review of relevant literature and hypotheses development are provided in the next section. The research methodology is discussed in Section 3. Section 4 provides analyses and discussions on the perceptions of auditors toward the impact of continuous auditing (CA) on the quality of internet-reported financial information. Summary and conclusions are presented in the final section.

2. Theoretical background and hypotheses development

2.1 Background

IT highly affects contemporary businesses because it increases the ability to store, capture, analyze and process large amounts of information. Consequently, IT affects the auditing profession in various perspectives such as the planning process, evidence collection, the skills required to conduct an audit, the knowledge necessary to perform the audit work, the risks encountered by the auditors as well as the adopted auditing techniques (Wanger, 2001).

The widespread of IT resulted in many companies moving toward the automation of accounting information systems (AIS) to gain competitive advantage. Thus, auditors do not need to depend on samples to evaluate controls, instead they can analyze their pertained data using a data analysis software (Zaho *et al.*, 2004). When the auditors start the planning of their audit work and analyze the business process after understanding the internal control (IC) environment, this analysis can be done using an enterprise computing platform such as Systems, Applications and Products in Data Processing (SAP R/3) (Bierstaker *et al.*, 2001). When auditors plan for the work, they also need to consider several audit factors such as the data transmission errors and intentional data manipulation (Rezaee and Reinstein, 1998). Auditors need to consider financial statement risk as well as IT business risk (Canada *et al.*, 2009; Vilsanoiu and Serban, 2010).

Moreover, auditors can use new audit techniques to easily gather evidence that exists electronically (Al-Laith, 2012). Large amount of data can be collected from large databases through data mining[2], text mining[3] and continuous monitoring[4] (Hunton and Rose, 2010). Auditors should also take into consideration that certain electronic evidences are

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available at a certain time but might not be accessible later (Moreno, 2012). It is easier to change information in electronic evidence than traditional paper evidence. Because evidence is available now electronically, auditors may not be able to detect the intended manipulation of the data and so, they should conduct a test of controls (Rezaee and Reinstein, 1998). Auditors should also take into consideration that electronic business (e-business) transactions can be manipulated intentionally or unintentionally either during the recording process or during the final step of preparing the financial statements (Majdalawieh and Zaghloul, 2008).

Though IT has brought several benefits for organizations such as reducing costs, accelerating sales and improving organizational efficiency and effectiveness, various kinds of risks result from IT implementation. Risks may be caused by virus attacks, hacking and having easy access to data by unauthorized people. Repudiation[5] can also be caused in electronic transactions. Fraud is one of the well-known risks in an electronic environment. All these risks are related to information integrity; thus, it is important to ensure that the necessary security tools are in place (Abu-Musa, 2004; Pathak, 2004). Auditors expect that the results generated are accurate without checking its accuracy so IT gives auditors a false sense of security because of this over reliance. Information security is the most important criticism to IT. Also, the latest trend of Virtual Private Network (VPN) brings people at different locations together via a single network; so, this extremely threatens computer security because this increases the possibility for a potential attack by hackers and consequently creates additional burdens for the auditor in developing a test of control and security control for the company. Thus, information security will continue to be a major risk that acts as an obstacle to the successful implementation of IT (Hayale and Abu-Khadra, 2006; Enofe *et al.*, 2012).

Software security and physical security measures should be taken to make sure that only authorized users are the ones who have access to the data. Software security measures include encryption, which helps in discovering any unauthorized trials to access the systems, and the use of firewalls that helps in giving access only to authorized users. Physical security measures include things such as locking the doors and having restricted access to computer equipment rooms to only authorized users. Also, the growth of the internet and the new ways of conducting business electronically are driving the demand for other assurance services such as WebTrust[6] and SysTrust[7] (Arens *et al.*, 2013). Thus, to reduce some risks related to applying IT, the AICPA created a program called certified public accountant (CPA)/(CA) WebTrust in which auditors examine three areas of a website every 90 days. These areas are information protection, disclosure of the business and transactions integrity. WebTrust provides the trust in the websites containing the information, and the SysTrust service provides the trust in the systems producing the information (Pathak and Lind, 2002; Amin and Mohamed, 2016).

Furthermore, in light of the risks the system is exposed to in the IT environment which affects the information security and safety especially in the e-commerce through the internet, the objective of the internal control system is to provide confidence among the customers who are involved in the e-commerce transactions and also to give confidence in the site through which e-commerce transaction occurs. Another internal control objective in the IT environment is to obtain financial statements of high reliability and to provide adequate and appropriate evidence to attain the goals of the organization (Al-Laith, 2012). Moreover, risk management is now considered a crucial task of internal control systems. Effective risk management aims to help enterprises ensure that risks are discovered automatically and dealt with in a real-time basis. Auditors play a vital role in monitoring and evaluating the entities' risk management systems. However, traditional auditing does not respond to risks

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on real time basis because they perform risk assessments on a periodic basis. Thus, to achieve the purpose of coordinating with electronic accounting processes and fulfilling the needs of the shareholders and regulators for nearly real-time audit procedures, the auditing profession needs to be updated (Abu-Khadra *et al.*, 2009; Sun *et al.*, 2015).

Internal controls that help in reducing risks are sometimes costly so auditors should consider the organization's objectives and compare the costs of developing IC systems with the expected benefits of this system. There should be a high level of security on the amount of information exchanged to determine which kind of information can be shared so as to not put the client at risk (Pathak, 2004). Thus, understanding the client's IC system is an essential step in the audit work. Elements of IC that should be evaluated are risk estimation, information, communication systems, control activities and follow up. There are internal control frameworks developed in USA such as the Information systems Audit Control Foundation's Control Objectives for Information and Related Technology. This framework helps in assuring that the policies and practices are formulated to provide reasonable assurance that the objectives of the company are attained and any unfavorable event is detected and controlled. Moreover, the Institute of Internal Auditors Research Foundation's Systems Audit ability and Control helps in managing and protecting IT resources (Noorvee, 2006). Similarly, the enterprise risk management-(ERM) integrated framework is developed to make sure organizations apply the strategies in accordance to law. ERM stresses on internal environment, goal setting, event identification, risk assessment, risk response, control activities, communication and monitoring (Lin *et al.*, 2011).

Therefore, auditors should have adequate IT knowledge that enables them to complete the audit work. Understanding IT is important for auditors as they are exposed to accounting transactions recorded in an electronic form without documented papers. Auditors must keep pace with certain issues such as information security, electronic document management, data integration, spam, disaster recovery, wireless technology and authentication technologies (Petterson, 2005). They also need to be aware of the risks that may occur as a result of IT implementation. (Pathak and Lind, 2002). It is for the auditors to gain an understanding of technical requirements to improve their role in the implementation and proper use of audit software. Auditors may help IT experts to develop a reliable system, which can produce reliable information rapidly (Razi and Madani, 2013). Standard setters and audit practitioners emphasize the role of auditors in understanding clients' IT (PCAOB, 2010; COSO, 2013). Auditors have to work in an automated IT environment and accordingly modify their audit processes to cope with the new updated technologies (Han *et al.*, 2015; Janvrin and Wood, 2016).

Nonetheless, auditing firms should be aware of the consequences before shifting to electronic systems to make sure that the resistance of auditors will not lead to failure in implementation (Bedard *et al.*, 2006). According to the technology acceptable model, there are external factors such as the task, user characteristics, organizational factors and the development process that may affect technology acceptance behavior indirectly through affecting beliefs, attitudes or intentions (Davis, 1980; Szajna, 1996). This is also explained by the auditing behavior theory that views three perspectives that can lead to the success or failure of IT implementations: the socio perspective, the technical perspective and the socio-technical perspective (Adebayo *et al.*, 2008).

2.2 Hypotheses development

It is argued that the Big 4 audit firms can cope quickly with technology as they are defined as firms possessing deep pockets so they are capable of providing their employees with excessive training sessions and they do not hesitate to pay more to remain competitive in the

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market because they care about their reputation (Lennox, 1999; Janvrin *et al.*, 2008). Furthermore, because IT dominates most of the organizations, auditors do not have to only audit around the system without assessing the reliability of the system. Auditors should acquire auditing capabilities matching the complexity of the system. That is why the auditors may need a computer audit specialist (CAS) to help them in conducting their audit work. The CAS will be an important member in the audit team as he will be responsible for understanding and evaluating internal controls of audit clients who apply IT systems in their business (Brazel, 2005). It is found that large audit firms (Big 4) have large amount of resources so they are willing to pay more to provide higher quality audit reports by assigning a CAS (Lennox, 1999; Janvrin *et al.*, 2008).

Big 4 audit firms may be able to adapt their audit procedures to changes in clients' IT by integrating more computer-related procedures such as the use of IT specialists. This is because the Big 4 firms mostly have more resources so they will be more willing to develop and support the new technologies than smaller local audit firms (Janvrin *et al.*, 2009). International audit firms are more likely to facilitate the diffusion of innovative practices. Large international audit firms are likely to demand high-quality disclosure. This could be explained by the signaling theory because managers that hire large auditing firms signal to the market that they are willing to provide quality disclosures (Healy and Palepu, 2001; Hail, 2002; Xiao *et al.*, 2004, Samaha and Hegazy, 2010; Amin and Mohamed, 2016). Hence, the first two hypotheses are as follows:

H1. Using technology in auditing varies significantly according to the audit firm type.

H2. The level of importance of IT in auditing varies significantly according to the audit firm type.

Companies are moving toward automation to add value; automation saves time because the workload is spread throughout the year rather than at the end of a financial cycle or during an audit. Moreover, automation assists management to have a clear view of the possible risks (Dzuranin and Malaescu, 2016). Automation enhances auditors' confidence in reports provided by the client's internal audit department and consequently increases the reliance on these outputs (Malaescu and Sutton, 2015). Technology and Big Data help provide more evidence than that provided in a traditional audit; this may be particularly beneficial in fraud investigation cases (Yoon *et al.*, 2015).

Auditors should be aware of the different clients' risks that are due to the variance of in the adoption of advanced accounting information systems among clients. Accordingly, the auditor may need to increase the inherent and control risk evaluations because most organizations implement ERP systems, and the evaluation of the inherent and control risks will differ when examining clients with complex IT. These ERP systems integrate all business functions such as accounting, sales, production and marketing to decrease operating costs, shorter cycle time and provide updated data. In spite of these advantages accompanied by the implementation of ERP systems, the company implementing these ERP systems is exposed to major risks caused by untrained personnel, inappropriate access and insufficient internal controls. This may lead to financial misstatements (Brazel, 2005; Janvrin *et al.*, 2009).

Auditors should evaluate if the protective actions taken are adequate to avoid possible risks for clients who adopt complex information systems. They should assess the security architecture of the applications used, virus protection mechanism, firewall implementations and detection mechanisms. Using the internet widely though helps maximizing access to stakeholders, it also incur risks such as the risk of unauthorized access to data and its manipulation. The risk affecting financial statements depends on factors such as whether IT

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systems are separate or related to accounting systems. Exchanging data can be risky because errors in data transfer can occur; thus, auditors should be aware of IT security and the necessary software applications (Zaho *et al.*, 2004). Therefore, auditors have to understand the nature of the business of the client such as the intensity of the competition, its market share and the extent of using technology to identify the possible sources of risks. These risks arise because of the dependency of the organization on IT; however, these risks differ according to the level of IT adopted by the client. Thus, the third and fourth hypotheses are as follows:

H3. Using technology in auditing varies significantly with the client's level of technology adoption.

H4. The level of importance of IT in auditing varies significantly with the client's level of technology adoption.

3. Research methodology

The methodology used in this research is described in terms of the sample of the study, the instrument used and the variables of the research.

3.1 Population frame and sampling

The population frame for this study consists of the auditors who are registered in the Egyptian Financial Supervisory Authority (EFSA). We chose our sample from the list of the auditors in the EFSA. We sent the questionnaire to 260 auditors who represent the total number of sampling units where the total number of respondents were 129. From these respondents, there were 112 eligible respondents with a completed questionnaire and 17 ineligible respondents (uncompleted questionnaire). By adopting the Council of American Survey Research Organizations response rate standard for this survey, Table I illustrates the method of calculation. Furthermore, the table reveals that the survey yielded a response rate of 42.6 per cent.

The sample studied consisted of 112 auditors from Big 4 and local audit firms in Egypt: 51 (45.5 per cent) auditors from three of the Big 4 firms and 61 (54.5 per cent) auditors from ten local firms, that is, nearly half of the sample is from the Big 4 and the other half is from the local firms. Actually, the respondents are composed of more men (78.60 per cent) than women (21.40). Moreover, most of the respondents (59.80 per cent) possess a professional certificate such as CPA, certified management accountant (CMA), certified financial executive (CFE), certified internal auditor (CIA), certified financial planner (CFP) and certified information systems auditor (CISA) […]. The majority of the sample holds a bachelor degree (86.60 per

Total number of sampling units	260
Total number of respondents	129
Total number of eligible respondents (completed questionnaires)	112**
Total number of ineligible respondents (uncompleted questionnaires)	17
Percentage of eligible firms (112/129)	86.8%
Total number of non-respondents (260 − 129)	131
Expected percentage of eligible firms in non-respondents [131 × (112/129)]	150.92
Response rate [112 × 100]/[112 + 150.92]	42.6%

Notes: *Method for response rate calculation advised by the Council of American Survey Research Organizations (1982); For an extensive discussion, see Wiseman and Billington (1984); **Moreover, 51 of the respondents are from Big 4 audit firms and 61 of the respondents are from local audit firms (non-Big 4) in Egypt

Table I.
Survey response rate statistics*

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cent); however, only 13.40 per cent holds a Master degree or beyond it. Finally, as for the IT expertise of the respondents, it is found that most of them are intermediate (65.20 per cent) (Table II).

3.2 Data collection

There are two types of data used in this research: quantitative and qualitative. Semi-structured interviews are used to get qualitative data. However, surveys are used to collect the quantitative data. A field-based questionnaire developed by Janvrin *et al.* (2008) is adopted in this study. This questionnaire is used first in conducting a pre-test. Then, the final questionnaire for testing the final results is developed based on the feedback received from the test sample. Moreover, to examine the reliability of the questionnaire, Cronbach's alpha was calculated and was found to be above 0.7. In this instance, Nunnally's (1978) threshold level of acceptable reliability, an alpha coefficient of around the 0.70, was adopted. The result of Cronbach's alpha indicates a strong internal consistency for the questionnaire because the criteria for the Cronbach's alpha is 0.7 or above.

3.3 Questionnaire design

This step is to determine the forms of response. A number of methods of measurement were available, and the decision was taken to adopt a self-report type of approach where respondents were asked about their attitudes and opinions toward certain objects. This approach is one of the most appropriate techniques for attitude measurement. All the questions were closed in type, thus encouraging direct response on a pre-determined measurement scale. The questions scored responses at interval or ratio levels of measurement. The reason for this was that such response formats can facilitate the adoption of powerful statistical approaches for data analysis (Field, 2005).

The type of measurement adopted varies from using semantic differential scales and summated rating scales to itemized rating scales (Bell, 2005; Blumberg *et al.*, 2005). The data were collected using the questionnaire developed by Janvrin *et al.* (2008). The questionnaire

Demographic	Frequencies	(%)
Highest education level		
Bachelor's degree	97	86.60
Master' degree or beyond Master' degree	15	13.40
Certification		
With professional certification	67	59.80
Without professional certification	45	40.20
Gender		
M	88	78.60
F	24	21.40
Firm size		
Big 4	51	45.50
Local	61	54.50
IT Expertise		
Novice	14	12.50
Intermediate	73	65.20
Expert	25	22.30

Table II. Participant demographics

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is divided into six parts plus the demographic data. Part 1 includes use of technology, Part 2 includes technology tools, Part 3 includes technology questions, Part 4 includes client's use of technology, Part 5 includes the importance of technology and, finally, the last part includes IT expertise. For the purpose and scope of this paper, only Parts 1, 2, 3, 6 and demographic data were included. Most of the scales for the variables were articulated around five and seven points. The reason for using these types of scale were because they effectively measured the operationalized variables in questions; they were relatively easy to construct and administer; and respondents found them easy to answer because the response categories allowed sufficient expression of the intensity of attitude (Malhotra, 1993).

3.4 Measurement of variables

This section explains how the variables are measured to address the research hypotheses previously mentioned. The aim of this research is to test the effect of IT on the auditing profession, and the variables of this research are mentioned in Table III. Table III elicits the different research variables and how they are measured.

4. Findings and analysis

Different analytical techniques are used to analyze the data collected in this study. These techniques include basic descriptive statistics, frequencies, Mann–Whitney and Kruskal–Wallis tests.

4.1 Descriptive and frequency statistics

Mean, standard deviation and frequencies are the descriptive statistics used for the four parts of the main theme of this study. The four parts are the use and importance of audit applications, use and importance of productivity tools, work paper review method used and the format used for documenting internal control.

4.1.1 Use and importance of audit applications. Table IV shows the descriptive analysis for the extent of use and perceived importance. The analysis indicates that the use of audit application and the level of importance varies significantly. For the extent of using audit applications and its perceived importance, the respondents highly rated the extent of use where the means ranged from 5.74 to 5.00 for most of the applications in the four panels as shown in Table IV. These applications are classified under the four panels as follows: panel A includes financial ratio tools, audit planning software, risk assessment and client acceptance; panel B includes sampling, internal control, continuous transaction monitoring,

Variables	Measurement
IT usage	Extent of usage by using a seven- point scale
IT perceived importance	Level of importance by using a seven-point scale
Audit applications	Extent of usage and level of importance
Audit procedures	Level of importance (seven-point scale)
Audit firm type	A dummy variable in which 1 represents Big 4 and 2 represents local firm
Industry type	A dummy variable, where 1 represents a manufacturing company, whereas 2 represents a non-financial company and 3 represents a financial company
Client's level of technology	A dummy variable where Automate refers to information technology (IT) replacing human labor by automating business processes, Informate up/down indicates IT provides data/information to empower management and employees and Transform refers to IT fundamentally altering traditional ways of doing business by redefining business processes and relationships

Table III. Summary of the research variables

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Audit application	Extent of use Mean (SD)[a]	Level of importance Mean (SD)[b]
Panel A: Client acceptance and audit planning		
Financial ratio tools	5.73 (1.215)	6.04 (1.082)
Internet search tools	4.97 (1.748)	5.17 (1.670)
Audit planning software	5.38 (1.863)	5.83 (1.261)
Risk assessment	5.54 (1.342)	6.04 (1.134)
Client acceptance	5.49 (1.601)	5.87 (1.150)
Panel B: Evidence collection and audit testing		
Sampling	5.62 (1.453)	5.62 (1.484)
Internal control	5.54 (1.314)	5.90 (1.157)
Data mining	4.83 (1.892)	5.19 (1.683)
Continuous transaction monitoring	5.53 (1.451)	5.60 (1.384)
Test on-line transactions	5.43 (1.655)	5.68 (1.446)
Database modeling	4.81 (1.802)	5.23 (1.518)
Digital analysis	5.20 (1.555)	5.59 (1.473)
Panel C: Audit completion and report writing		
Audit report writing	5.74 (1.609)	5.88 (1.478)
Fraud review	5.21 (1.654)	5.65 (1.317)
Review of client's financial disclosures on websites	5.00 (1.991)	5.40 (1.604)
Panel D: Administrative work		
Electronic workpapers	5.21 (1.921)	5.37 (1.791)
Client relationship management	5.65 (1.475)	5.85 (1.281)
Expert systems	4.40 (1.932)	4.90 (1.697)
Graphs	4.79 (1.810)	5.27 (1.550)

Table IV.
Use and importance of information technology audit applications

Notes: [a]Participants rated "the extent of use of each audit application on a typical audit" using a seven-point scale where 1 = none and 7 = extensive; [b]Participants rated "the importance of each audit application on a typical audit" using a seven-point scale where 1= not important and 7 = very important

test on line transactions and digital analysis; all three applications of panel C are included; panel D includes electronic work papers and client relationship management. The relatively low-rated applications for the extent of use with a mean of less than 5.00 are internet search tools, data mining, database modeling, expert systems and graphs.

For the level of importance, respondents assigned the highest importance rating only for two applications in panel A (ranged above the mean 6.00). Those two applications are financial ratio tools and risk assessment. On the other hand, the only low-rated application with a mean of less than 5.00 is expert systems in panel D, whereas the rest of the applications are rated as moderate as shown in Table IV.

4.1.2 Use and importance of productivity tools. The descriptive analysis for the use and perceived importance of productivity tool use and perceived importance varies significantly. Table V shows that the email, cell phone and wireless network have the highest mean of the extent of use, whereas remote network access, personal digital assistants and instant messaging have the lowest mean. Similarly, respondents highly rated the importance of email, cell phones and wireless networks. However, lower importance is assigned to remote network access, personal digital assistants and instant messaging.

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4.1.3 Work paper review method used. By using the descriptive statistics for the work paper review, we found that the email and face-to face meeting are the most common methods used for work paper review as shown in Table VI. The telephone and other methods could be considered less in use than the email and face-to-face method. So, it can be said that face-to-face and email are still used by the majority of auditors.

4.1.4 The format used for documenting internal control. The most common formats used for documenting internal control are the narrative and questionnaire, where the mean is 2.81 and 1.37, respectively. The use of flow chart, matrix, mapping and other format are rarely used by the majority of the auditors as shown in Table VII.

Productivity tool	Extent of use Mean (SD)[a]	Level of importance Mean (SD)[b]
Email	6.36 (1.077)	6.28 (1.142)
Cell phones	6.02 (1.478)	5.97 (1.540)
Remote network access	4.93 (2.068)	5.41 (1.680)
Personal digital assistants (PDAs)	4.22 (2.195)	4.38 (2.140)
Wireless networks	5.93 (1.575)	6.15 (1.337)
Instant messaging	4.55 (2.160)	4.51 (2.182)

Notes: [a]Respondents rated "the extent of use for each audit application on a typical audit" using a seven-point scale where 1 = none and 7 = extensive; [b]Respondents rated "the importance of each audit application for a typical audit" using a seven-point scale where 1 = not important and 7 = very important

Table V.
Use and importance of information technology productivity tools

Work paper review method	Mean (SD)
Face-to-Face[a]	2.15 (1.317)
Email[b]	2.32 (1.317)
Telephone[c]	1.31 (1.369)
Other[d]	0.07 (0.418)

Notes: [a]Respondents estimated how frequently (0 to 100 per cent) each method was used when conducting a typical audit work paper review (e.g. between staff and senior or between senior and manager); [b]Email refers to "preparer forwards work papers electronically to the reviewer; the reviewer examines the file online, and sends his or her comments back electronically"; [c]Telephone refers to "feedback provided via phone conversion and voice mail messages"; [d]Other such as hard copy review

Table VI.
Frequency of work paper review methods use

Format	Mean (SD)[a]
Narrative	2.81 (1.534)
Questionnaire	1.37 (1.228)
Flow chart	0.81 (0.935)
Matrix	0.37 (0.774)
Mapping	0.33 (0.728)
Other format	0.04 (0.186)

Note: [a]Respondents estimated how frequently (0 to 100%) each format was used to document internal controls on a typical audit engagement

Table VII.
Frequency of the format used for documenting internal control

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4.2 Hypotheses testing

The first part of this section deals with testing the first two hypotheses by using the Mann–Whitney test. These two hypotheses examine whether IT audit use and level of importance differ by the type of audit firm. GAO (2003) stated that small audit firms may not be able to compete with large audit firms in the level of investment in IT. For the extent of use, Table VIII shows that there is a difference between Big 4 and non-Big 4 audit firms in only one application in panel A which is audit planning software ($Z = -2.324, p < 0.05$). For panel B, the sampling ($Z = -2.587, p < 0.01$) and digital analysis ($Z = -1.648, p < 0.10$) are the only two applications that vary in using IT between the Big 4 and non-Big 4 audit firms. Panel C indicates that there is no application that varies between the audit firm types in the use of audit IT. Finally, panel D has two applications that vary in the use of audit IT between Big 4 and non-Big4 audit firms where electronic work papers and expert systems are significant at 5 and 1 per cent, respectively. Thus, it can be said that only five applications differ between the Big 4 and non-Big 4 firms in the extent of use of audit IT, and there is no difference in the rest of the applications, which are financial ratio tools, internet search tools, risk assessment, client acceptance, internet control, data mining, continuous transaction monitoring, test on-line transactions, database modeling, audit report writing, fraud review, client relationship management and graphs. The results go in line with the findings of prior literature (Janvrin *et al.*, 2008; Razi and Madani, 2013; Amin and Mohamed, 2016)

Table VIII. The association between using technology in auditing and its level of importance with the audit firm type

Panels	Extent of use Big 4	Extent of use Non-Big 4 (local)	Extent of use *Z*-value	Importance Big 4	Importance Non-Big 4 (local)	Importance *Z*-value
Panel A: Client acceptance and audit planning						
Financial ratio tools	60.09	53.50	−1.113	52.72	59.66	−1.205
Internet search tools	59.35	52.41	−1.157	60.54	50.48	−1.692*
Audit planning software	61.62	48.13	−2.324**	56.41	53.76	−0.460
Risk assessment	54.96	57.79	−0.473	51.72	60.50	−1.525
Client acceptance	58.11	53.25	−0.825	55.61	52.54	−0.536
Panel B: Evidence collection and audit testing						
Sampling	64.38	49.13	−2.587***	60.46	53.19	−1.234
Internal control	52.60	59.76	−1.200	50.84	59.53	−1.496
Data mining	54.69	54.34	−0.060	54.91	54.16	−0.126
Continuous transaction monitoring	54.28	57.41	−0.527	52.18	59.13	−1.175
Test on-line transactions	50.97	60.12	−1.538	47.95	61.57	−2.330**
Database modeling	60.07	52.66	−1.229	56.56	55.54	−1.170
Digital analysis	50.06	59.87	−1.648*	50.43	60.57	−1.711*
Panel C: Audit completion and report writing						
Audit report writing	59.63	54.72	−0.670	57.06	56.03	−0.178
Fraud review	54.39	56.46	−0.347	52.87	57.77	−0.833
Review of client's financial disclosures on websites	49.42	59.04	−1.630	45.83	58.21	−2.151**
Panel D: Administrative work						
Electronic workpapers	63.88	48.77	−2.543**	61.55	52.28	−1.552
Client relationship management	53.68	58.86	−0.875	55.94	56.05	−0.019
Expert systems	66.44	47.77	−3.140***	63.16	49.34	−2.305**
Graphs	60.20	52.43	−1.287	54.87	56.01	−0.191

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$

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For perceived importance, Table VIII shows that there is a difference between Big 4 and non-Big 4 audit firms in only one application in panel A which is internet search tools, where $Z = -1.692$ and $p < 0.10$. For panel B, the test on-line transactions ($Z = -2.330$, $p < 0.05$) and digital analysis ($Z = -1.711$, $p < 0.10$) are the only two applications that vary in perceived importance between the Big 4 and non-Big 4 audit firms. For panel C, review of client's financial disclosures on websites ($Z = -2.151$, $p < 0.05$) is the only application that differs between the two types of audit firms. Panel D has only one application which is expert systems that varies in perceived importance of audit IT between Big 4 and non-Big 4 audit firms, where $Z = -2.305$ and $p < 0.05$. The rest of the applications have no difference in perceived importance between the Big 4 and non-Big 4 audit firms as shown in Table VIII.

Table IX shows the use and importance of IT productivity tools. For the extent of use, only the remote network access and instant messaging used as productivity tools vary significantly between Big 4 and non-Big 4 audit firms at 1 and 10 per cent level, respectively. The other productivity tools (email, cell phone, personal digital assistants and wireless network) are not varying between Big 4 and non-Big 4 when they are used in audit in the IT environment. For the level of importance, the only productivity tool that differs in perceived importance between Big 4 and non-Big 4 firms is the remote network access ($Z = -1.867$, $p < 0.10$). This result means that most of the productivity tools are similar for both Big 4 and non-Big 4 firms as an extent of use and perceived importance.

The second part of this section deals with testing the third and fourth hypotheses by using the Kruskal–Wallis test. These two hypotheses examine whether IT audit use and level of importance differ with the client's level of technology. For the extent of use, Table X shows that there is no difference between the client's level of technology and the applications in panel A. For panel B, the sampling ($\chi^2 = 5.342$, $p < 0.10$), digital analysis ($\chi^2 = 22.150$, $p < 0.01$) and test on-line transactions ($\chi^2 = 6.086$, $p < 0.05$) are the only three applications that vary in using IT between the client's level of technology. For panels C and D, the review of client's financial disclosures on websites and client relationship management vary significantly with the client's level of technology at 1 and 10 per cent level, respectively. These results are consistent with those of previous studies (Janvrin *et al.*, 2009; Amin and Mohamed, 2016).

For perceived importance, Table X shows that there is a difference in three applications of panel A (audit planning software, risk assessment and client acceptance) with client's level of technology at 1, 1 and 10 per cent, respectively. For panel B, sampling, continuous transactions monitoring, the test on-line transactions and digital analysis are the applications that vary in perceived importance with client's level of technology at 10, 10, 1 and 10 per cent, respectively. For panel C, fraud review and review of client's financial disclosures on websites are the applications that vary in perceived importance with the

Table IX. The association between using information technology productivity tools and its level of importance with the audit firm type

Panels	Extent of use			Importance		
	Big 4	Non-Big 4 (local)	*Z*-value	Big 4	Non-Big 4 (local)	*Z*-value
Email	55.57	56.37	−1.53	53.18	57.51	−0.805
Cell phones	57.24	54	−0.580	55.74	56.23	−0.088
Remote network access	66.46	43.07	−3.982***	60.24	49.37	−1.867*
Personal digital assistants	56.38	50.83	−0.945	57	50.25	−1.146
Wireless network	56.90	52.35	−0.821	55.98	52.20	−0.714
Instant messaging	59.95	49.34	−1.785*	57.46	51.29	−1.037

Notes: ***$p < 0.01$; *$p < 0.10$

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Table X.
The association between using technology in auditing and auditors perception of its importance with the client's level of technology

Panels	Extent of use				Importance			
	Automate	Informate up/down	Transform	Chi-square	Automate	Informate up/down	Transform	Chi-square
Panel A: Client acceptance and audit planning								
Financial ratio tools	54.20	50.18	45.25	0.607	57.90	46.82	42.25	4.271
Internet search tools	54.08	47.83	54.75	1.209	52.52	49.29	30.75	1.309
Audit planning software	53.36	46.26	68	2.468	62.87	39.51	51.75	17.682***
Risk assessment	57.02	46.95	60.25	3.223	62.11	42.23	58.25	13.261***
Client acceptance	56.23	46.32	49.75	3.037	55.55	44.34	33.75	4.801*
Panel B: Evidence collection and audit testing								
Sampling	58.38	45.40	45	5.342*	58.13	47.08	29.75	5.050*
Internal control	56.29	48.29	43.50	2.113	56.17	45.69	62.50	3.895
Data mining	52.61	48.72	46.50	0.497	53.52	48.15	39.50	1.185
Continuous transaction monitoring	57.95	46.97	37	4.173	58.44	46.19	45.25	4.687*
Test on-line transactions	59.24	45.08	54.50	6.086**	58.62	44.10	65.75	7.196**
Database modeling	55.03	48.77	61.75	1.371	55.86	48.28	54.25	1.716
Digital Analysis	65.54	38.42	54.50	22.150***	64.72	40.40	41.72	18.318***
Panel C: Audit completion and report writing								
Audit report writing	55.36	48.79	53.25	1.383	56	48.96	33	2.586
Fraud review	54.12	47.01	74.25	2.877	56.92	44.51	68.25	5.540*
Review of client's financial disclosures on websites	60.91	39.72	50.50	13.855***	58.53	37.51	41.75	14.613***
Panel D: Administrative work								
Electronic work papers	54.57	47.56	53	1.517	58.03	46.88	37.25	4.292
Client relationship management	57.94	45.86	66.25	5.021*	50.30	52.19	63.50	0.486
Expert systems	47.80	54.98	77.50	3.030	51.55	51.13	60	0.180
Graphs	50.93	52.38	43	0.236	55.34	47.54	31.25	2.822

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.10$

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client's level of technology at 10 and 1 per cent, respectively. Panel D has no difference in any of its applications that vary in perceived importance with the client's level of technology as shown in Table X.

5. Summary and conclusions

The rapid advances in IT that have occurred in the past two decades have totally changed the business environment. Similarly, IT has greatly affected the auditing profession in many ways, thus transforming the traditional audit process to a more technology-based audit. IT has also impacted the client acceptance and the planning phase, evidence collection, audit testing and report writing. Consequently, this affected the skills and knowledge required in auditors to conduct the audit. Nonetheless, there are risks that accompany the adoption of technology such as virus attacks, hacking, repudiation, fraud, manipulation and unauthorized access to data. Hence, software security should be implemented to make sure that only authorized users can have access to IT resources. Auditors should be aware of such risks, and therefore, new audit techniques to overcome these risks are needed.

This paper further enriches the growing literature on the impact of technology in auditing by offering new insights into different contexts. The paper examines auditors' perception on the extent of use and perceived importance of using technology in auditing in the different economic and cultural setting of Egypt. The paper surveys the perception of 112 auditors working in large international audit firms as well as local firms in Egypt. Data collected are analyzed using Mann–Whitney and Kruskal–Wallis tests to answer the four research questions. The results reveal that only five applications of the extent of use of IT audit differ between the Big 4 and non-Big 4 audit firms. Those applications are audit planning software, sampling, digital analysis, electronic work papers and expert systems. Furthermore, for perceived importance, there is a difference between Big 4 and non-Big 4 audit firms in only six applications. These applications are internet search tools, the test on-line transactions, digital analysis, review of client's financial disclosures on websites and expert systems.

It is found that only five applications of the extent of use of IT audit differ with the client's level of technology. These applications are sampling, digital analysis, test on-line transactions, the review of client's financial disclosures on websites and client relationship management. Moreover, for perceived importance, audit planning software, risk assessment, client acceptance, sampling, continuous transactions monitoring, the test on-line transactions, digital analysis, fraud review and review of client's financial disclosures on websites are the applications that vary in perceived importance with client's level of technology.

For productivity tools, only the remote network access and instant messaging used as productivity tools are varying significantly between Big 4 and non-Big 4 audit firms. The other productivity tools (email, cell phone, personal digital assistants and wireless network) are not varying between Big 4 and non-Big 4 firms when they are used in IT audit. The only productivity tool that differs in perceived importance between Big 4 and non-Big 4 firms is the remote network access.

The findings illustrate some important implications: first, the need for auditors to prioritize and manage the various risks caused by the widespread use of IT; these risks might vary according to the nature and complexity of the client's IT system. Second, knowledge of how IT is used, the related risks and the ability to use IT as a resource in the performance of audit work is essential for auditors' effectiveness at all levels. Third, privacy has several implications to auditing in the IT environment; this has to be reflected in the audit program and planning as well as the handling of assignment files and reports. Fourth, retention of electronic evidence for a limited period of time may require the auditor to select samples

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several times during the audit period rather than just at the year end. Fifth, auditors need to determine how the audit results are used in the ERM activity performed by the management.

The widespread use of technology by both auditing firms as well as clients emphasizes the importance of focusing on IT training during initial years of auditors' careers to help auditors to be more skilled with IT expertise needed in today's audit environment. It is necessary to enhance auditors' technical and analytical skills and to develop specialized teams capable of evaluating the effectiveness of computer systems during audit engagements. Clear policy statements are needed so that auditors are able to evaluate the adequacy of standards and comply with them. It is recommended that some auditing standards need to be enacted to provide guidelines that help define auditors' role and responsibility in this electronic environment and to guide the auditors while conducting their audit work.

Notes

1. IT audit encompasses all things that help in improving auditor's capacity to conduct an audit engagement.
2. Data mining is applied using many different techniques such as neural networks, genetic algorithms and Bayesian belief networks to find large volumes of data.
3. Text mining is a form of data mining that helps in discovering patterns from text.
4. Continuous monitoring does not essentially entail assurance, although it could involve some form of assurance over the design and operation of internal controls.
5. Repudiation happens when transactions occur but one of the parties denies this.
6. WebTrust is an assurance service that is related to the trust in the websites containing the financial information.
7. SysTrust is an assurance service related to the trust in the systems producing the financial statements.

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About the authors

Menna Tarek is a Lecturer Assistant at the Faculty of Management Technology, the German University in Cairo. She graduated from the Faculty of Management Technology, the German University in Cairo, and received her Master's Degree from the same university.

Ehab K.A. Mohamed is a Professor of Accounting and Dean of the Faculty of Management Technology, the German University in Cairo. Prior to joining GUC, he worked for ten years at the College of Commerce & Economics, Sultan Qaboos University, Oman, where he served as the Assistant Dean for Undergraduate Studies and the Head of the Department of Accounting. He graduated from Cairo University and received his Masters and PhD degrees from Cass Business School, London. He is a Fellow of the Chartered Institute of Internal Auditors, UK and Ireland, and a member of the American, British and European Accounting Associations. His areas of research include auditing, fraud, performance measurement, business education, financial reporting, banking regulations and corporate governance. He has published a number of papers in international refereed journals and presented papers at numerous international conferences. He published two books on financial accounting and auditing.

Mostaq M. Hussain is a Professor of Accounting at the University of New Brunswick-Saint John, Canada. He received his PhD in Accounting from the University of Vaasa, Finland, and has been working for the past 20 years at different academic institutions in Japan, Sweden, Finland, Kuwait, Oman as well as Canada. He has published a number of articles on performance management, IFRS and GCC Accounting Standards in several international refereed journals including *Accounting, Auditing and Accountability Journal*, *Technovation* and so on. He received more than two dozens of scholarships, awards/rewards on his academic achievements from different prestigious institutions in Finland, Sweden, Japan, Norway, UK, Oman and Canada, including Literati Club's "Awards for Excellence" and Sultan Qaboos University's "Distinguished Research Award". He is the launching editor of a few international refereed journals, and currently serving as the Editor-in-Chief on the "International Journal of Accounting and Finance (IJAF)". Mostaq M. Hussain is the corresponding author and can be contacted at: mhussain@unb.ca

Mohamed A.K. Basuony is an Associate Professor of Accounting Faculty of Management Technology, the German University in Cairo, and Faculty of Commerce, Ain Shams University. He graduated with honors from the Faculty of Commerce, Ain Shams University, and received his Master' Degree from the same university. He obtained his PhD degree from Brunel University in the UK. His work experience includes 20 years teaching undergraduates as well as post-graduates in Egypt and the UK. He is also an expert trainer and consultant for many organizations in Egypt and the Gulf area. His areas of research include performance measurement and management, balanced scorecard, management and strategic control, corporate governance and corporate social responsibility.

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