

Moderating the role of top management commitment in usage of computer-assisted auditing techniques

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ABSTRACT

The importance of computer-assisted auditing techniques (CAATs) is widely acknowledged by auditors. However, the current usage of CAATs is not as broad as expected. In this work, the technology–organization–environment framework is used to establish and analyze the organizational factors affecting the post-adoption usage of CAATs. This study also determines whether or not the use of CAATs enhances the audit process. Top management commitment is introduced as a variable that moderates audit firms' use of CAATs and audit performance. The data used in this work were obtained from auditors of audit firms in Jordan. Analysis results reveal that CAAT usage is affected by the cost–benefit of technology, firm size, readiness and competitive pressure. By contrast, technology compatibility and the complexity of the accounting information systems of clients do not appear to influence CAAT usage. Top management directly influences audit performance and is thus crucial in dictating how auditors utilize CAATs. However, it does not exert a moderating effect (top management × audit firm's use of CAATs) between audit firms' use of CAATs and audit performance. Moreover, the use of CAATs improves the overall audit process of audit firms.

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1. Introduction

Information technology (IT) has deeply permeated business organisations and has become an important component of conducting business. At present, it is considered as a decisive factor that determines the success of business organisations. In this context, professional accountants face numerous challenges and risks brought about by the use of sophisticated and complex IT technologies in business organisations. Although such technologies facilitate the preparation of financial statements, their application to auditing is not as straightforward because of the complex and intricate characteristics of the process. Previous studies have reported the use of (CAATs) to aid auditors in their auditing tasks (Braun & Davis, 2003). CAATs include some processes, such as E-worksheets; and artificial intelligence tools and statistical analysis software that predict breaches or fail in financial statements (Braun & Davis, 2003; Hall, 2016; Jaksic, 2009). Auditors and audit firms benefit greatly from CAATs as these techniques decrease the cost of audit, enhance the quality of audit and productivity, help maintain audit reports and improve the overall audit effectiveness (Dowling & Leech, 2007). CAAT also enables auditors to perform complex tasks manually and to test the internal controls established by the Public Company Accounting Oversight Board (PCAOB) to enhance control effectiveness on the basis of the Sarbanes–Oxley Act (Section 404), as well as to improve fraud detection as mandated in SAS No. 99 (AICPA, 2001; AICPA, 2006; Curtis & Payne, 2008; PCAOB, 2010).

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However, other studies in the literature have indicated few uses of CAATs. For example, Mansour (2016), Okab (2013) and Oroud *et al.* (2011) reported that auditors show a laggard adoption of CAATs in the context of Jordan despite the availability of professional software to meet their auditing needs. Thus, the present study pays attention on providing insights into the factors preventing auditors' adoption of CAATs. This subject is rarely explored in the literature (Bierstaker, Janvrin & Lowe, 2014; Mansour, 2016; Okab, 2013; Shamsuddin, *et al.*, 2015; Solieri & Hodowanitz, 2016; Janvrin, Lowe & Bierstaker, 2009). In the current work, the use of CAATs is examined from the viewpoint of auditors that utilise information system (IS) audit. We attempt to minimise the literature gap by examining the adoption level of CAATs amongst auditors who use such system. Although CAATs have been generally examined in the literature, studies dedicated to explaining the low adoption of IS in auditing, particularly from the viewpoint of auditors from audit firms in Jordan, are still few and far between.

This study is aimed at investigating the organisational factors that affect audit firms' utilisation of CAATs and whether or not the application of CAATs improves audit performance. Several studies investigated factors influence to use of CAATs such as the use of technologies and general CAATs (Bierstaker *et al.*, 2014; Shamsuddin, *et al.*, 2015; Mansour, 2016) and continuous auditing (Vasarhelyi *et al.*, 2012). The demand for these tools arises because of the want to fully comprehend the audit plan so as to clarify internal monitoring and authentic financial reports to use accurate (Rosli *et al.*, 2012). However, the use and adoption of CAATs remains lacking amongst public accounting firms, with only a few leveraging the system (Curtis & Payne, 2008; Ahmi, 2012; Widuri, 2014; Eneizan *et al.*, 2020). The adoption of CAATs in big firms is undoubtedly promising, but small and medium-sized enterprises (SMEs) face challenges in the adoption of CAATs in order to several factors, which include the budget required for the adoption (Curtis & Payne, 2008). Other factors include the high costs of software licensing, training, hardware and management time and support; ease of use or lack thereof; and the technical knowledge required in the use of generalised audit software (Ahmi, 2012). In the Jordanian audit environment, information and knowledge regarding CAATs is lacking amongst auditors. Jordanian auditors generally believe that CAATs are not easy to use (Mansur, 2016); thus, despite professional bodies' efforts to expedite the adoption of CAATs, such adoption in the context of Jordan is still in its infancy (Mansur, 2016).

this study adopted Tornatzky *et al.*, (1990) framework which consist technology, organisation and environment (TOE) in evaluating the determinants and range of audit firms' use of CAATs and in determining whether or not the use of CAATs enhances audit performance. We also aim to explain the factors affecting CAAT usage and their impact on audit performance. The contingent effect of top management, particularly the top management's commitment that possibly moderates the relationship between CAAT usage and audit performance impact (Foss & Stieglitz, 2014), is likewise investigated. Top management commitment has been identified as one of the factors that support CAATs implementation and adoption (Mahzan & Lymers, 2008). In addition, Curtis and Payne (2008) suggested to decision making of auditors is affected by their supervisors and that the voluntary use of CAATs by subordinates may not be possible when they face pressure from the top management. The top management support is affected by auditors' utilisation of new technology in audit firms, (Curtis & Payne, 2008). We hypothesise that technological competence, technology cost-benefit, technology compatibility, size, readiness of client's complex accounting information system (AIS) and competitive pressure will affect an audit firm's use of CAATs. Furthermore, we posit that top management commitment likely moderates the relationship between CAAT usage and audit performance and that an audit firm's use of CAATs positive influences audit performance. We also evaluate whether or not the use of CAATs improves audit performance.

This study offers three important contributions. Firstly, this work is believed to be the first to focus on the determinants and scope use of CAATs and on if CAAT usage enhances audit performance. The results of this work are expected to serve as a reference for managers, regulators and vendors as they deal with the use of CAATs to boost audit performance. Secondly, new constructs for measuring CAAT usage are proposed herein. In the proposed model, top management commitment is identified as moderator of the relationship between CAAT usage and audit performance impact, and top management support is regarded as a crucial construct of management beliefs and participation related to CAAT use; such focus is rare in the literature (Foss & Stieglitz, 2014). In line with recent IS research, this work sheds light on the value of understanding the applications of audit performance (Li *et al.*, 2018). Thirdly, this work adopts an organisational approach in investigating the factors affecting CAAT usage. This method thus fills the research gap by exploring the rarely reported topic to acceptance and using technology by auditors at the organisational level (Ahmia *et al.*, 2016; Rosli *et al.*, 2013).

This paper rest is organised as follows. The Section 2 provided literature review. Hypothesis development is described in Section 3. Data collection and the techniques adopted are discussed in Section 4. In Section 5 the empirical results are summarised. In Section 6 the conclusions, limitations and future research are presented.

2. Literature Review

With IT undoubtedly changing the landscape of the audit profession, IT acceptance and usage levels amongst auditors and the perceived importance of IT usage have been examined broadly in previous studies (Eneizan *et al.*, 2019; Bierstaker *et al.*, 2014; Janvrin *et al.*, 2009; Mahzan and Lymer, 2008; Pedros and Costa, 2012; Vasarhelyi *et al.*, 2012). Janvrin *et al.* (2014), for example, reported that result expectation, technical infrastructure and organisational compression level affect the inclination of auditors toward CAAT use. The study extended the individual technology acceptance model by empirically explaining the working context of financial auditors when using CAATs. The organisational and individual factors influence to adopt audit software packages by internal auditors through perceived ease of use and perceived usefulness, respectively (Kim *et al.* 2009). The study of Mahzan and Lymer (2008) focused on the acceptance of CAATs by internal auditors in the United Kingdom. On the basis of a theoretical model of a successful accept of CAATs, the authors identified the primary factors that determine the successful implementation of CAATs; these factors include influencing motivation, performance measurement criteria, technical complexity and best implementation practices. Through a global survey on the use of continuous auditing (CA) by 210 internal auditors, Gonzalez *et al.* (2012) found that CA usage differs across regions and that it is greatly affected by the expected effort and social influences of internal auditors. Bierstaker *et al.* (2014) focused on the auditors of Big four firms, national, regional and local organisations and investigated the factors affecting their use of CAATs. The study revealed that the willingness of auditors CAATs usage is affected by result expectations, technical infrastructure support and organisational pressure. Janvrin *et al.* (2008) studied the IT usage of external auditors and reported that these auditors utilise different audit applications depending on firm size. Pedros and Costa (2012) mainly focused on defining the major tasks of financial auditors their use of CAATs and categorising the most important CAATs on the basis of population; they also aimed to shed light on the issues that Portuguese Statutory Auditors find important in individual intention toward CAATs use, to synthesise the challenges that can result in the avoidance of CAAT use and to establish definitions of individual IT dimensions. Although the acceptance and use of CAATs and CA have been broadly investigated, the factors affecting the usage of audit analytics and their role in improving the current audit process have yet to be explored fully.

In the literature, Janvrin *et al.*, (2008) focused on the audit information technology acceptance and usage are mainly examined at the individual level rather than at the organisational level in order to the interview process for the latter involves main personnel in audit sections and is thus particularly challenging. The ways in which audit firms adopt and use technology are rarely investigated. In internal audit departments in the public sector, Ahmia *et al.* (2016) studied the information technology adoption of internal auditors and the factors affecting the process. Rosli *et al.* (2012), studied the theoretical model was built to identify the factors affecting organisations' acceptance of CAATs; nevertheless, the proposed model was not adequately tested because of the lack of real data. Ahmi *et al.* (2014) aimed to identify the factors affecting auditors' IT adoption or the lack of it. The authors emphasised the importance of IT for auditors in terms of ensuring effective and efficient audit and enhancing audit productivity, which eventually influences the economy. To analyse the factors dictating external auditors' use of GAS, Ahmi and Kent (2012) added a number of organisational and external factors in the model, but their main model was restricted to individual auditors. In the work of Vasarhelyi *et al.* (2012) evaluation continue audit acceptance by individual internal auditors and established the level of CA acceptable by internal audit departments. On the basis of this discussion, this study employs an organisational approach to investigate the usage of CAATs and determine whether or not it boosts audit performance.

In our work, we direct our attention to use post-adoption instead of CAATs adoption. Several IT studies have investigated adoption opposite non-adoption. (Fichman, 2000) whilst others have focused on the post-adoption stage (Sun, 2012). In the IS literature, Zhu and Kraemer, (2005) studied the IT values are attributed to the skills of organisations in leveraging a benefiting from a certain technology instead of the technology itself. In their work on the application of IT to auditing, Janvrin *et al.* (2008) also contended that audit efficiency or effectiveness is enhanced by users and not by the tool itself. Therefore, we mainly shift our attention away from firms' intention to adopt CAATs and instead focus on post-adoption usage.

3. Development of Hypothesis

3.1. Technology, organisation and environment (TOE) framework

IT usage can be studied using TOE model, TOE framework is generally employed, TOE mode adopted for three reasons First, the TOE framework is useful in our focus on the post-adoption stage because according Zhu and Kraemer, (2005) it informs us of the aspects affecting the adoption, application and use of technological innovations. Second, the TOE framework is applicable to the study of technology usage in the context of enterprises and is thus beneficial in examining the factors affecting CAAT usage by audit firms instead of by auditors. Third, the TOE framework is fundamental to the study of all types of innovation. Generally, CAATs are innovation types 2 and 3, that is, they serve as an administrative task tool for fraud identification and as a strategic tool for inducing operational inefficiency and giving bits of knowledge to businesses, respectively (Swanson, 1994). Collectively, these characteristics of the TOE framework make it appropriate to use.

The TOE framework is employed in the contexts of technology, organisation and environment. Within the setting of technology, the framework deals with the use of existing technology and the technology available for use by firms. In the organisational context, the framework considers descriptive measures, such as organisational size or readiness (Zhu & Kraemer, 2005). In the context of the environment, the framework deals with firms' business environment, as well as the complexity of their clients' AISs and the competitive pressure they face (Tornatzky *et al.*, 1990). Although in line with the DOI model, Oliveira and Martins, (2011) studied the TOE framework has stronger explanatory power through its consideration of the environmental context, including the opportunities and constraints for technology adoption.

On the basis of the TOE framework, we build a conceptual model for evaluating CAAT usage (Fig. 1). As displayed in Fig. 1, the antecedents of an audit firm's CAAT usage, i.e. the factors affecting an audit firm's CAAT use, comprise the left portion of the model. The improvement of audit performance through CAATs is presented on the right side.

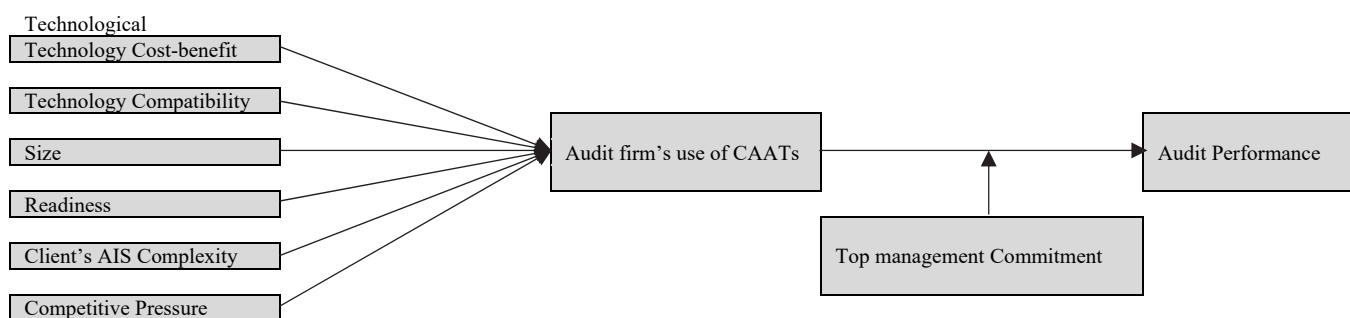


Fig. 1. Research framework

3.2. Cost–benefit of technology

In this work, the cost–benefit of technology refers to the advantages that CAATs could provide the organisation. These advantages include cost reduction, quick decision making, increased efficiency and so on (Rawwash, *et al.*, 2020; Ramen *et al.*, 2015; Temesgen, 2004; Widuri, 2014). According to the related theory, possible adopters perform as for an explicit or an implicit cost–benefit analysis. In this regard, possible adopters are expected to adopt an innovation with more prominent benefits than the past idea (Ahmad *et al.*, 2015; Cao, Jones, & Sheng, 2014; Rogers, 2003). As suggested by Rushinek and Rushinek (1995), the adoption of accounting software package entails the consideration of various factors, such as cost, ease of installation and use, on-disk tutorial and error recovery. Tan, Teo and Lai (2011) used cost-effectiveness to measure technology performance. Several studies have identified relative advantage as an important indicator of CAATs adoption (Ahmi *et al.*, 2014; Rosli *et al.*, 2013; Tijani, 2014). Similarly, we predict herein that audit firms are likely to use CAATs if they perceive these technologies as beneficial.

Hypothesis 1. *Technology cost–benefit positively influences audit firms' use of CAATs.*

3.3. Technology Compatibility

Herein, we use compatibility to describe the level of compatibility between CAATs and firms' values, requirements and experiences (Rogers, 2003). According to the existing research, a firm's use of CAATs is greatly affected by the compatibility factor (Rosli *et al.*, 2013; Widuri, 2014). Technology compatibility is the level at which audit technology use is aligned with the requirements of audit tasks that a firm need to perform. According to Mahzan and Lymer (2008), software compatibility refers with a client's data and is an important factor that affects external auditors' decision to use CAATs. Their work showed that the implementation of CAATs is typically hindered by technical issues during the preparation of data for examination and analysis. In the current study, we hypothesise that compatibility positively influences the adoption of audit technology. A high degree of compatibility is expected to enable CAAT adoption whilst minimally changing the current status (Widuri *et al.*, 2016; Yigitbasioglu, 2015;). Moreover, a high level of compatibility increases the perception of benefits (Ahmia *et al.*, 2016; Lins *et al.*, 2016).

Hypothesis 2. *Technology compatibility positively influences audit firms' use of CAATs.*

3.4. Size

The literature on innovation adoption has broadly considered the effect of firm size (Hannan & Mc Dowell, 1984; Cohen & Klepper, 1996). As prior studies indicate, the consensus is that a general positive relationship exists between the size of the

organisation and its adoption of IT innovation, with IT innovation type, organisational type, adoption stage and size of scope and measurement type moderating this relationship (Lee & Xia, 2006). In the present study, we expect that size exerts a positive effect on CAAT use because of two major factors. First, large firms have a great tendency to own a large amount of resources for the facilitation of the adoption process. According to an audit analytics survey (AuditNet, 2012), the limited use of CAATs tools is attributable to the costs of software and training. Large firms have enough budget to buy state-of-the-art software and facilitate training and maintenance, whereas small firms lack the same resources. Second, large firms generally conduct more auditing transactions and procedures than small firms and thus benefit more from CAATs.

Hypothesis 3. *Size positively influences audit firms' use of CAATs.*

3.5. Readiness

Organisational readiness refers to a firm's ability to achieve successful adoption, usage and leverage of IT (Fathian *et al.*, 2008). In this work, we regard readiness as a firm's technological and financial resources that are available for the adoption of audit technology. Financial resources can enable firms to secure sophisticated IT tools, facilities and an internal environment that reinforces the adoption of new technology (Venkatesh & Bala, 2012). Janvrin *et al.*, (2008) studied the research on CAAT adoption has shown that organisational environment and technological infrastructure affect the adoption of CAATs. Subsequently, we propose that readiness exerts a positive impact on the adoption of CAATs. That is, audit firms with excellent technological preparedness are in the best position to use CAATs. As a construct comprising as a financial resources and IT sophistication, organisational readiness is a key factor representing the potential resources required to use CAATs.

Hypothesis 4. *Readiness positively influences audit firms' use of CAATs.*

3.6. Complexity of client's accounting information system (AIS)

In the context of CAATs, complexity is the degree of difficulty encountered in applying these technologies and understanding. A client's business complexity is said to influence the intention of an audit firm to adopt CAATs. Complex businesses mean a high volume of accounting records for auditing. Hence, audit firms dealing with such clients are prompted to adopt CAATs. A client's business size, transaction process volume and industry type determine its business complexity. Janvrin *et al.* (2009) later reported that when dealing with clients with high IT complexity, external auditors tend to utilise computer-related audit procedures. This expectation stems from the fact that when faced with a complex AIS environment, auditors are driven to comprehend the business transaction issues stemming from such an environment in terms of the level of complication and firm specificity (Varsarhelyi & Alles, 2008; Enaizan *et al.*, 2019). Most audit clients utilise AISs to register, process and publicize accounting data to relevant stakeholders. Hence, AISs should be ensure that accurate business transactions are processed and reported. The greater the business transactions, the more complex the client's AIS becomes. Such a case calls for the adoption of CAATs. Hence, we propose that a client's business complexity influences the intention of an audit firm to adopt CAATs. Firms are apprehensive about using CAATs if these tools are difficult to comprehend, install, learn and use. Therefore, the more easily understandable the technology is, the faster its adoption will be, and vice versa.

Hypothesis 5. *Clients' AIS complexity positively influences audit firms' use of CAATs.*

3.7. Competitive pressure

Competitive pressure refers to the stress created by the threat of losing competitive advantage. Under such pressure, firms are urged to adopt CAATs (Rosli, 2013). The adoption of new technology can affect the business environment, modify the rules of competition and present new approaches to overtake rivals. It can also alter the competitive landscape (Zhu *et al.*, 2006). Such pressure refers to an audit firm's perceived level of pressure in the business environment. Competitive pressure has been found to affect AIS adoption amongst such firms (Cartman & Salazar, 2011). Prior studies have also shown that firms have a great tendency to accept IT when their industry rivals are doing the same (Enaizan *et al.*, 2020; Zhu *et al.*, 2003). As long as businesses operate in a competitive environment, they will invest in new technologies to gain competitive advantage over their rivals (Chan *et al.*, 2012).

Hypothesis 6. *Clients' AIS complexity positively influences audit firms' use of CAATs.*

3.8. Audit firms' use of CAATs and audit performance

IT has permeated audit work and has led to the development of sophisticated tools such as CAATs. Technology-based auditing undoubtedly gets better the effectiveness and capability of external audit processes. In such processes, IT reduces the time required for tasks, mitigates audit costs, improves the quality of audit, minimises the risks and increases the profitability and market shares (Okab, 2013).

Enhancing performance is important in closing the gap between an audit firm's use of CAATs and its audit performance. TOE models indicate a positive relationship between CAAT usage and audit performance. The fit between individuals and technology is expected to affect audit performance.

The utilisation of IT is vital because audit technologies are designed to improve audit performance (Bierstaker *et al.*, 2014). Audit firms that make good use of CAATs are those that utilise relevant technologies and ultimately increase their audit performance. Therefore, audit firms' use of CAATs is expected to exert a positive effect on audit performance through the synergy between their use of CAATs and audit performance. The following hypothesis is derived:

Hypothesis 7. *Audit firms' use of CAATs positively influences audit performance.*

3.9. Moderating role of top management commitment

Management commitment describes the level of investment made by Company management in technological innovation. The related literature highlights the major role of upper level management in the successful achievement of organisational initiatives (Cohen & Sayag, 2010). In business, top management has the power to communicate and coordinate with employees with regard to the planning for and adoption of technology (Rosli *et al.*, 2012). Hence, auditors become inclined to use audit technology when their management encourages such adoption and use (Curtis & Payne, 2008). This commitment from management encourages the use of new technology whilst facilitating IT adoption. Top management commitment back to the participation of top management in promoting the adoption of CAATs. In a public accounting firm's ICT project, the participation of top management enhanced the decision making related to the acquisition and implementation of technology (Salleh *et al.*, 2007). Similarly, Curtis & Payne, (2008) studied firms' partners are important in encouraging employees to adopt audit technology. By contrast, the lack of management support translates into a low adoption process. Therefore, support from top management is a crucial construct of management beliefs and participation related to CAAT use.

Hypothesis 8. *Top management commitment moderates the relationship between audit firms' use of CAATs and audit performance.*

4. Research Methodology

4.1. Population and sampling

In this study, the population comprised audit partners, audit managers and supervisors employed by audit firms in Jordan. A convenience sampling technique was adopted because of its ease of use in data collection (Fraenkel, Wallen & Hyun, 1993). The mail survey targeted the audit firms' audit partners, audit managers and supervisors because their knowledge and position in the firms make their perception of IT adoption valid and reliable (Trites, 2004).

4.2. Instrument

An online questionnaire was used in this study to collect data. The questionnaire items were gauged through a 1 to 7 point Likert scale. The measurement source, number of items and the Cronbach's alpha values from the pilot study are offered in Table 1.

Table 1
Results of Pilot Study and Source of Measurement

Constructs	Items	Cronbach's alpha of pilot study (N = 33)	Source
Technology Cost–Benefit	5	0.859	Rosli <i>et al.</i> (2013)
Technology Compatibility	3	0.898	Rosli <i>et al.</i> (2013)
Size	1	0.904	Li <i>et al.</i> (2018)
Readiness	5	0.901	Rosli <i>et al.</i> (2013)
Client's AIS Complexity	3	0.778	Rosli <i>et al.</i> (2013)
Competitive Pressure	4	0.877	Rosli <i>et al.</i> (2013)
Audit Firm's Use of CAATs	3	0.802	IFRS (2008); Janvrin <i>et al.</i> (2008)
Top Management Commitment	4	0.932	Rosli <i>et al.</i> (2013)
Audit Performance	5	0.802	Almaryani <i>et al.</i> (2012) and Li <i>et al.</i> (2018)

4.3. Data collection

In this field study, 462 questionnaires were mailed to the respondents through email referral. The questionnaires were distributed to the auditors to whom the criteria for this study are applied. Data were collected between June and October 2017. Of the 462 questionnaires, of these, 226 are returned usable. The sample size was deemed moderate, but it meets the standard criteria for structural equation modelling (SEM) nonetheless (Hair *et al.*, 2010).

4.4. Reliability and validity of instrument

Reliability refers to the degree at which an instrument is without bias and gives a reliable estimation over time and an assortment of items. In the current work, we adopted Cronbach's alpha, which is a commonly used consistency reliability test (Peter, 1979; Sekaran, 2000). Cronbach's alpha values ought to be more noteworthy than or rise to 0.7 (Straub, 1989). In the literature, Hair *et al.*, (2010) studies the reliability of a multi-item estimation scale is typically confirmed using Cronbach's alpha. In our work, Hair *et al.*, (2010) studies all factor loadings of the items for their corresponding constructs were higher than 0.40, which indicated convergent and discriminant validity. The validity of the variables was established through a comparison of the square roots of the (AVE). As shown in Table2, all CR and AVE values exceeded the cut-off values. Hence, the measurement model was deemed to have acceptable convergent validity. Table 2 presents the square root values of the AVEs on the diagonal line. These values were greater than the correlation coefficients between the constructs. This outcome established construct discriminant validity. Thus, the study proceeded with the examination of the structural model.

Table 2
Construct reliability and validity

Construct	Cronbach's Alpha (CA)	Composite Reliability (CR)	Average Variance Extracted (AVE)
Technology Cost–Benefit	0.921	0.951	0.867
Technology Compatibility	0.845	0.895	0.901
Size	0.811	0.865	0.912
Readiness	0.907	0.911	0.932
Client's AIS Complexity	0.789	0.878	0.923
Competitive Pressure	0.748	0.845	0.887
Audit Firm's Use of CAATs	0.898	0.921	0.941
Top Management Commitment	0.798	0.895	0.924
Audit Performance	0.859	0.915	0.930

Table 3
Discriminant validity

TCB	TC	S	RE	CAC	CP	AP	TMC
0.872							
0.152	0.790						
0.590	0.070	0.879					
0.492	0.090	0.356	0.771				
0.337	0.050	0.388	0.447	0.804			
0.442	0.118	0.457	0.478	0.396	0.858		
0.431	-0.033	0.428	0.324	0.415	0.459	0.852	
0.356	0.058	0.417	0.381	0.673	0.390	0.385	0.841

Note: AFU: Audit firm's use of CAATs, TCB: technology cost–benefit, TC: technology compatibility, S: size, RE: readiness, CAC: client's AIS complexity, CP: competitive pressure, AP: audit performance, TMC: top management commitment.

5. Data Analysis

5.1. Demographics and Descriptive Statistics

Table 4 shows the demographic information of the respondents. This study involved 226 respondents. Most of the respondents were males (90.7%), were younger than 35 years (68.58%) and had earned bachelor's degrees (95.1%). In terms of employment, 89.80% of the respondents had worked for more than 5 years with a professional JCPA qualification (56.19%). Most of them (60.62%) were working as supervisors (60.62%). Of the firms involved in this work, 95.90% were local audit firms, and 56.2% of them reported having more than 50 clients.

Table 4

Demographic information

Variable	Label	Frequency	Percent	Mean	Std. Deviation
Gender	Male	205	90.7	1.09	0.291
	Female	21	9.3		
Age	26–35	155	68.58	1.65	0.482
	36–45	59	26.10		
	Over 46	12	5.32		
Education	Bachelor's	215	95.1	2.08	0.351
	Master's	5	2.2		
	PhD	6	2.7		
Experience	Less than 5 years	23	10.20	2.04	0.595
	5–10 years	125	55.30		
	10–15 years	59	26.10		
	More than 15 years	19	8.40		
Professional qualification	JCPA	127	56.19	1.46	0.959
	ACPA	28	12.42		
	CPA	41	18.15		
	CMA	29	12.84		
	Others	1	0.4		
Position	Audit Partner	15	6.64	2.76	0.786
	Audit Manager	74	32.74		
	Supervisor	137	60.62		
Type Audit Firm	Big 4	4	1.90	2.86	0.691
	International Audit Firms (big size)	5	2.20		
	Local audit firms (Medium and Small)	217	95.90		
No. clients Firms	Under 25	43	19.0	2.71	1.128
	26–50	56	24.8		
	51–99	50	22.1		
	Over 100	77	34.1		

5.2. Hypotheses testing

5.2.1. Direct effect

Table 5 presents the output of the direct effect model. Of the seven direct effect hypotheses, five were accepted whilst two were rejected.

Table 5

Results of direct effect hypotheses

H	D.V	I.V	Estimate (β)	S.E.	C.R.	P	Label
H1	AFU	← TCB	.333	.058	5.700	.001	Supported
H2	AFU	← TC	.082	.063	1.300	.194	Rejected
H3	AFU	← S	.235	.065	3.545	.001	Supported
H4	AFU	← RE	.176	.082	2.132	.033	Supported
H5	AFU	← CAC	.087	.065	1.337	.181	Rejected
H6	AFU	← CP	.206	.057	3.631	.001	Supported
H7	AP	← AFU	.409	.067	6.066	.001	Supported

Note: AFU: Audit firm's use of CAATs, TCB: technology cost–benefit, TC: technology compatibility, S: size, RE: readiness, CAC: client's AIS complexity, CP: competitive pressure, AP: audit performance.

According to H1, the effect of technology cost–benefit is significant. The results indicated that technology cost–benefit indeed affected audit firms' use of CAATs ($\beta = 0.333$, $P = 0.01$). Consequently, H1 was supported. Meanwhile, technology compatibility did not show the same effect ($\beta = 0.082$; $P = 0.194$). Consequently, H2 was rejected. Size was positive and significant ($\beta = 0.235$; $P = 0.001$), Therefore, H3 was supported. As for H4, readiness was found to be positive and significant ($\beta = 0.176$; $P = 0.033$). Consequently, H4 was supported. Client's AIS complexity was not found to be significant ($\beta = 0.087$; $P = 0.181$). Consequently, H5 was rejected. Competitive pressure was found to be positive and significant ($\beta = 0.206$; $P = 0.001$). Consequently, H6 was supported. Audit performance was found to be positive and significant ($\beta = 0.409$; $P = 0.001$). Consequently, H7 was supported.

> 0.181). Thus, H5 was rejected. Competitive pressure exerted a positive and significant effect on audit firms' use of CAATs ($\beta = 0.206$, $P = 0.001$). Therefore, H6 was supported. An audit firm's use of CAATs was found to be positive and significant ($\beta = 0.409$, $P = 0.001$). Thus, H7 was supported.

5.2.2. Moderating effect

Top management commitment was proposed to moderate the relationship between audit firms' use of CAATs and audit performance. The results of hypothesis testing for the related path are shown in Table 6.

Table 6
Results of Moderating Effect Hypotheses

			Estimate	S.E.	C.R.	P	Label
P	←	Top Mgmt. × audit firm's use of CAATs	.078	048	1.649	.099	Rejected
P	←	TMC	.174	065	2.688	.007	Supported

Note: P: Performance, AFU: audit firm's use of CAATs, TMC: top management commitment.

H8 proposed that top management commitment moderates the relationship between audit firms' use of CAATs and audit performance. Our results (Table 4) indicated that top management did not exert a moderating effect (top management × audit firm's use of CAATs) between audit firms' use of CAATs and audit performance ($\beta = 0.078$, C.R. = 1.649, $P > 0.05$) given the P-value (0.099) of the moderating effect being greater than 0.05. Thus, H8 was rejected. nevertheless, the findings indicated that top management directly affected audit performance ($\beta = 0.174$, C.R. = 2.688, $P < 0.05$). Thus, an increase in top management commitment will directly boost audit performance.

6. Conclusions

Herein, we evaluated the variables influencing the post-adoption usage of CAATs and studied whether or not the use of CAATs enhances audit performance. To close the research gap, we chose to identify variables at the organisational level instead of at the individual level. On the basis of the TOE framework, we hypothesised a number of constructs that could technology cost–benefit, technology compatibility, size, readiness, client's AIS complexity, competitive pressure and top management commitment was proposed to moderate. In addition, we empirically examined whether or not utilising CAATs improves audit performance. CAAT usage by auditors was found to be motivated by their perceived level of significance of the technology and their technological ability. Technology cost–benefit, size, readiness, competitive pressure and audit firm's use of CAATs were identified as factors that improve audit performance. Moreover, top management was found to directly influence audit performance. These factors determine how auditors use CAATs. The factors of technology compatibility and clients' AIS complexity did not present a significant influence. In addition, top management did not demonstrate a moderating effect (top management × audit firm's use of CAATs) between audit firm's use of CAATs and audit performance.

6.1. Contributions

This study contributes to the studies in three ways. First, this work is a pioneering study that examines actual CAAT use amongst auditors at the organisational level. Previous studies have explored the adoption of audit technology on the basis of individual factors. One exception is the work of Rosli *et al.* (2012) who investigated GAS at the organisation level. The authors recommended further empirical studies. Second, we focus on actual CAAT use rather than on intention to use in seeking to enhance audit performance. According to Janvrin *et al.* (2008), enhancing efficiency/effectiveness depends on the users and not on the tool itself. Hence, our focus on actual use behaviours is relevant. Third, this study is amongst the pioneering studies that consider top management commitment as having a moderating role between audit firms' CAATs use and their performance.

6.2. Limitations and future research

Notwithstanding the contributions to practice and theory, several limitations are identified in this work. First, because of the limited sample size, we could not to test the interaction impact between firm size and public or private dual. Such tests would decrease our sample to a level that would prevent the generation of statistically robust results. Further research involving an adequate number of observations could address this issue. Second, this study concentrates on external auditors employed in audit firms in Jordan. These auditors primarily function as partners, audit managers, or supervisors. Internal auditors, information system auditors, or information technology auditors were not considered in our work. Third, the study was restricted to Jordanian firms. Hence, the findings may not be generalizable to auditing in other countries. Fourth, an online survey was adopted in this work. This method of data collection involves obtaining data at a certain point in time. Hence, future studies may achieve extended and highly accurate findings by adopting qualitative approaches, such as experiments, observations, case studies and longitudinal studies. Fifth, logistic regression analysis and exploratory factor analysis were used in the study. Hence, the use of confirmatory factor analysis could enrich our findings. Sixth, we did not collect data on the role of IT knowledge and

its influence on adoption behaviour. IT knowledge has been suggested to play a moderating role in motivational variables. One could argue that when an audit firm is motivated to use CAATs, the adoption of this technology would be contingent on the readiness of the firm's counterpart.

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References

- Ahmad, S. Z., Abu Bakar, A. R., Faziharudean, T. M., & Mohamad Zaki, K. A. (2015). An empirical study of factors affecting e-commerce adoption among small-and medium-sized enterprises in a developing country: Evidence from Malaysia. *Information Technology for Development, 21*(4), 555-572.
- Ahmi, A., & Kent, S. (2012). The utilisation of generalized audit software (GAS) by external auditors. *Managerial Auditing Journal, 28*(2), 88-113.
- Ahmi, A., Saidin, S. Z., & Abdullah, A. (2014). IT adoption by internal auditors in public sector: A conceptual study. *Procedia-Social and Behavioral Sciences, 164*, 591-599.
- Ahmia, A., Saidina, S. Z., Abdullaha, A., & Ahmada, A. C. (2016). IT Adoption by Internal Auditors in Malaysian Public Sector: A Preliminary Finding.
- AlMaryani, M. A. H., & Sadik, H. H. (2012). Strategic management accounting techniques in Romanian Companies: some survey evidence. *Procedia Economics and Finance, 3*, 387-396.
- American Institute of Certified Public Accountants (AICPA) (2006). Audit Risk Exposure Standards. Statements of Auditing Standards New York NY: AICPA.
- American Institute of Certified Public Accountants (AICPA) (2008). International Financial Accounting Standards (IFRS): An AICPA Backgrounder. New York.
- American Institute of Certified Public Accountants (AICPA). (2001). The Effect of Information Technology on the Auditor's Consideration of Internal Control in a Financial Statement Audit. Statement of Auditing Standards No. 94. New York NY: AICPA.
- AuditNet (2012). Survey of More Than 1,500 Auditors Concludes That Audit Professionals Are Not Maximizing Use of Available Audit Technology. [Available](#)
- Bierstaker, J., Janvrin, D., & Lowe, D. J. (2014). What factors influence auditors' use of computer-assisted audit techniques?. *Advances in Accounting, 30*(1), 67-74.
- Braun, R. L., & Davis, H. E. (2003). Computer-assisted audit tools and techniques: Analysis and perspectives. *Managerial Auditing Journal, 18*(9), 725-731.
- Cao, Q., Jones, D. R., & Sheng, H. (2014). Contained nomadic information environments: technology, organisation, and environment influences on adoption of hospital RFID patient tracking. *Information & management, 51*(2), 225-239.
- Cartman, C., & Salazar, A. (2011). The influence of organisational size, internal IT capabilities and competitive and vendor pressures on ERP adoption in SMEs. *International Journal of Enterprise Information Systems, 7*(3), 68-92.
- Chan, F. T. S., Chong, A. Y., & Zhou, L. (2012). An empirical investigation of factors affecting e-collaboration diffusion in SMEs. *International Journal of Production Economics, 138*(2), 329-344.
- Cohen, A., & Sayag, G. (2010). The effectiveness of internal auditing: an empirical examination of its determinants in Israeli organisations. *Australian Accounting Review, 20*(3), 296-307.
- Cohen, W. M., & Klepper, S. (1996). Firm size and the nature of innovation within industries: the case of process and product R&D. *The review of Economics and Statistics, 78*(2), 232-243.
- Curtis, M. B., & Payne, E. A. (2008). An examination of contextual factors and individual characteristics affecting technology implementation decisions in auditing. *International Journal of Accounting Information Systems, 9*(2), 104-121.
- Davis, F. D. (1985). *A technology acceptance model for empirically testing new end-user information systems: Theory and results* (Doctoral dissertation, Massachusetts Institute of Technology).
- Dowling, C., & Leech, S. (2007). Audit support systems and decision aids: Current practice and opportunities for future research. *International Journal of Accounting Information Systems, 8*(2), 92-116.
- Enaizan, O., Eneizan, B., Almaaitah, M., Al-Radaideh, A. T., & Saleh, A. M. (2020). Effects of privacy and security on the acceptance and usage of EMR: the mediating role of trust on the basis of multiple perspectives. *Informatics in Medicine Unlocked, 100450*.
- Enaizan, O., Zaidan, A. A., Alwi, N. M., Zaidan, B. B., Alsalem, M. A., Albahri, O. S., & Albahri, A. S. (2019). Electronic medical record systems: Decision support examination framework for individual, security and privacy concerns using multi-perspective analysis. *Health and Technology, 10*(3), 795-822.

- Eneizan, B., Alsaad, A., Abdelbaset Alkhalwaldeh, H. N., & Rawash, O. E. (2020). E-wom, trust, usefulness, ease of use, and online shopping via websites: the moderating role of online shopping experience. *Journal of Theoretical and Applied Information Technology*, 98(13).
- Eneizan, B., Mohammed, A. G., Alnoor, A., Alabboodi, A. S., & Enaizan, O. (2019). Customer acceptance of mobile marketing in Jordan: An extended UTAUT2 model with trust and risk factors. *International Journal of Engineering Business Management*, 11, 1847979019889484.
- Fathian, M., Akhavan, P., & Hoorali, M. (2008). E-readiness assessment of non-profit ICT SMEs in a developing country: The case of Iran. *Technovation*, 28(9), 578-590.
- Fichman, R. G. (2000). The diffusion and assimilation of information technology innovations. *Framing the domains of IT management: Projecting the future through the past*, 105127.
- Foss, N. J., & Stieglitz, N. (2014). Business model innovation: the role of leadership.
- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (1993). *How to design and evaluate research in education* (Vol. 7). New York: McGraw-Hill.
- Gonzalez, G. C., Sharma, P. N., & Galletta, D. F. (2012). The antecedents of the use of continuous auditing in the internal auditing context. *International Journal of Accounting Information Systems*, 13(3), 248-262.
- Grand, C. L. (2001). Use of Computer-Assisted Audit Tools and Technique (CAATs) Part 1. *IT Audit*, 4.
- Hair Jr, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2010). SEM: An introduction Multivariate data analysis: A global perspective (pp. 629-686).
- Hall, J. A. (2016). *Information Technology Auditing*. Mason, OH: Cengage Learning.
- Hannan, T. H., & McDowell, J. M. (1984). The determinants of technology adoption: The case of the banking firm. *The RAND Journal of Economics*, 15(3), 328-335.
- Jaksic, D., (2009). Implementation of computer assisted audit techniques in application controls testing. *Management Information Systems*, 4, 9-12.
- Janvrin, D., Bierstaker, J., & Lowe, D. J. (2008). An examination of audit information technology use and perceived importance. *Accounting Horizons*, 22(1), 1-21.
- Janvrin, D., Bierstaker, J., & Lowe, D. J. (2009). An investigation of factors influencing the use of computer-related audit procedures. *Journal of Information Systems*, 23(1), 97-118.
- Kim, H. J., Mannino, M., & Nieschwietz, R. J. (2009). Information technology acceptance in the internal audit profession: Impact of technology features and complexity. *International Journal of Accounting Information Systems*, 10(4), 214-228.
- Lee, G., & Xia, W. (2006). Organisational size and IT innovation adoption: A meta-analysis. *Information & Management*, 43(8), 975-985.
- Li, H., Dai, J., Gershberg, T., & Vasarhelyi, M. A. (2018). Understanding usage and value of audit analytics for internal auditors: An organisational approach. *International Journal of Accounting Information Systems*, 28, 59-76.
- Lins, S., Teigeler, & H. Sunyaev, A., (2016). TOWARDS A BRIGHT FUTURE: ENHANCING DIFFUSION OF CONTINUOUS CLOUD SERVICE AUDITING BY THIRD PARTIES.
- Mahzan, N., & Lymer, A. (2008). Adoption of computer assisted audit tools and techniques (CAATs) by internal auditors: current issues in the UK. In *BAA Annual Conference*(pp. 1-46).349.
- Mansour, E. M. (2016). Factors Affecting the Adoption of Computer Assisted Audit Techniques in Audit Process: Findings from Jordan. *Business and Economic Research*, 6(1), 248-271.
- Okab, R. (2013). Electronic Audit Role in Achieving Competitive Advantages and Support the Strategy of the External Audit in Auditing Offices in the Hashemite Kingdom of Jordan. *International Business Research*, 6(6), 181.
- Oliveira, T., & Martins, M. F. (2011). Literature review of information technology adoption models at firm level. *The electronic journal information systems evaluation*, 14(1), 110-121.
- Oroud, SH., Al khtath, W., Shorfa, A. (2011).The effect application of auditors utilisation IT techniques of finalizing electronic auditing process in Jordan. *Unpublished study, accounting, management, insurance magazine, Cairo University, No. (78)*.
- Pedrosa, I., & Costa, C. J. (2012). Computer Assisted Audit Tools and Techniques in Real World: CAATT's Applications and Approaches in Context. *International Journal of Computer Information Systems and Industrial Management Applications*, 4, 161-168.
- Public Company Accounting Oversight Board (PCAOB) (2010). The auditor's response to the risks of material misstatement. Auditing standard no. 13. Washington D.C: PCAOB.
- Ramen, M., Jugurnath, B., & Ramhit, P. (2015). UTR-CTOE: A New Paradigm Explaining CAATs Adoption. *Journal of Modern Accounting and Auditing*, 11(12), 615-631.
- Rawwash, H., Masad, F., Enaizan, O., Eneizan, B., Adaileh, M., Saleh, A., & Almestarihi, R. (2020). Factors affecting Jordanian electronic banking services. *Management Science Letters*, 10(4), 915-922.
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.
- Rosli, K., Yeow, P. H., & Siew, E. G. (2012). Factors influencing audit technology acceptance by audit firms: A new I-TOE adoption framework. *Journal of Accounting and Auditing*, 2012, 1.
- Rosli, K., Yeow, P., & Eu-Gene, S. (2013). Adoption of audit technology in audit firms. In *24th Australasian Conference on Information Systems (ACIS)* (pp. 1-12). RMIT University.

- Rushinek, A., & Rushinek, S. F. (1995). Accounting software evaluation: hardware, audit trails, backup, error recovery and security. *Managerial Auditing Journal*, 10(9), 29-37.
- Salleh, A., Rose, R. C., Kumar, N., & Peng, L. C. (2007). Readiness in meeting globalisation challenges: A case of accounting firms in Malaysia. *Journal of social Sciences*, 3(4), 176-184.
- SAYGILI, A. T. (2010). Taking Advantage of Computer Assisted Audit Tools and Techniques during Testing Phase in Financial Audits: An Empirical Study in a Food Processing Company in Turkey. *Global Journal of Management and Business Research*, 10(2).
- Shamsuddin, A., Logenthiran, A., Rajasharen, L., Dhinesh, A., Maran, L., Ameer, M. F. M., ... & Muthu, L. M. (2015). Factors influencing usage level of computer assisted audit techniques (CAATs) by internal auditors in Malaysia.
- Solieri, S. A., & Hodowanitz, J. (2016). Electronic Audit Confirmations: Leveraging Technology to Reduce the Risk of Fraud. *Journal of Forensic & Investigative Accounting*, 8(1).
- Sun, H. (2012). Understanding user revisions when using information system features: Adaptive system use and triggers. *MIS Quarterly*, 453-478.
- Swanson, E. B. (1994). Information systems innovation among organisations. *Management Science*, 40(9), 1069-1092.
- Tan, K. S., Teo, W. L., & Lai, K. P. (2011). The applicability of information technology governance in the Malaysian SMEs. *Journal of Innovation Management in Small and Medium Enterprises*, 2011, 1-10.
- Temesgen, Z. B. (2004). Determinants for Effective Application of Software in Computer Assisted Auditing Techniques (CAATs).
- Tijani, O. M. (2014). Built-In Functions and Features of Data Analysis Software: Predictors of Optimal Deployment for Continuous Audit Assurance. *Scholars Journal of Economics, Business and Management*, 1(1), 7-18.
- Tornatzky, L. G., & Fleischer, M. (1990). The Processes of Technological Innovation. *Lexington MA, Lexington Books*.
- Tornatzky, L. G., Fleischer, M., & Chakrabarti, A. K. (1990). *Processes of technological innovation*. Lexington books.
- Trites, G. (2004). Director responsibility for IT governance. *International Journal of Accounting Information Systems*, 5(2), 89-99.
- Vasarhelyi, M. A., & Alles, M. G. (2008). Reengineering business reporting creating a test bed for technology driven reporting.
- Vasarhelyi, M. A., Alles, M., Kuenkaikaew, S., & Littley, J. (2012). The acceptance and adoption of continuous auditing by internal auditors: A micro analysis. *International Journal of Accounting Information Systems*, 13(3), 267-281.
- Venkatesh, V., & Bala, H. (2012). Adoption and impacts of interorganisational business process standards: Role of partnering synergy. *Information Systems Research*, 23(4), 1131-1157.
- Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science*, 46(2), 186-204.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.
- Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS quarterly*, 157-178.
- Widuri, R. (2014). Adoption and use of generalized audit software by Indonesian audit firms.
- Widuri, R., Widuri, R., O'Connell, B., O'Connell, B., Yapa, P. W., & Yapa, P. W. (2016). Adopting generalized audit software: an Indonesian perspective. *Managerial Auditing Journal*, 31(8/9), 821-847.
- Yigitbasioglu, O. M. (2015). External auditors' perceptions of cloud computing adoption in Australia. *International Journal of Accounting Information Systems*, 18, 46-62.
- Zhu, K., & Kraemer, K. L. (2005). Post-adoption variations in usage and value of e-business by organisations: cross-country evidence from the retail industry. *Information systems research*, 16(1), 61-84.
- Zhu, K., Dong, S., Xu, S. X., & Kraemer, K. L. (2006). Innovation diffusion in global contexts: determinants of post-adoption digital transformation of European companies. *European journal of information systems*, 15(6), 601-616.
- Zhu, K., Kraemer, K., & Xu, S. (2003). Electronic business adoption by European firms: a cross-country assessment of the facilitators and inhibitors. *European Journal of Information Systems*, 12(4), 251-268.



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