AN EMPIRICAL STUDY ON THE ANTECEDENTS AND PERCEIVED OUTCOMES OF COMPUTER-ASSISTED AUDIT TOOLS AND TECHNIQUES (CAATTS) USAGE IN SUDAN

Diaeldin Osman [*], Ibrahim Magboul [**], Fadi Herzallah [***], Alhashmi Aboubaker Lasyoud [****], Alnour Nadir Alnour Osman [*****]

* Department of Accounting and Finance, AACSB Business School, Clark Atlanta University, Southwest Atlanta, USA
** Department of Management Information Systems, Ahfad University for Women Sudan, Omdurman, Sudan
*** Department of Marketing and E-Commerce, Palestine Technical University – Kadoorie, Tulkarm, Palestine
**** *Corresponding author,* School of Business Administration, University of South Carolina Aiken, Aiken, USA
Contact details: School of Business Administration, University of South Carolina Aiken, 471 University Pkwy, Aiken, SC 29801, USA
***** Department of Business, Mississippi Valley State University, Itta Bena, USA

How to cite this paper: Osman, D., Magboul, I., Herzallah, F., Lasyoud, A. A., & Osman, A. N. A. (2026). An empirical study on the antecedents and perceived outcomes of computer-assisted audit tools and techniques (CAATTs) usage in Sudan. *Corporate Ownership & Control*, *23*(1), 17–28. https://doi.org/10.22495/cocv23i1art2

ISSN Online: 1810-3057
ISSN Print: 1727-9232

Received: 31.10.2025
Revised: 04.12.2025; 07.01.2026
Accepted: 14.01.2026

JEL Classification: M40, M41, M48
DOI: 10.22495/cocv23i1art2

Abstract

Empirical research related to computer-assisted audit tools and techniques (CAATTs) has been limited as the developing information technology (IT) audit environment in Sudan expands. To address this limitation, this study examines the relationship between user-based drivers of CAATTs usage and perceived CAATTs usage outcomes in Sudanese auditing firms. By testing a conceptual framework with survey data collected from 234 auditors, we find that six of ten hypothesized variables are statistically significant and relate to CAATTs usage; notably, however, perceived ease of use, client pressure, industry pressure, and user trust were not. Furthermore, CAATTs usage was associated with higher levels of three of the four CAATTs outcomes: audit services, task effectiveness, and auditor performance. We conclude that our study provides a starting point for understanding CAATTs enabling and CAATTs benefiting factors in developing environments, but provides evidence that further investigation is warranted to encourage wider CAATTs usage and therefore enhance overall audit efficacy.

Keywords: CAATTs Usage, Technology Adoption, Drivers, Perceived Outcomes, Developing Country

Authors' individual contribution: Conceptualization — D.O. and I.M.; Methodology — D.O., I.M., and F.H.; Formal Analysis — F.H., A.A.L., and A.N.A.O.; Investigation — D.O. and I.M.; Writing — Original Draft — D.O. and I.M.; Writing — Review & Editing — D.O., I.M., F.H., A.A.L., and A.N.A.O.; Supervision — D.O., I.M., and A.A.L.

Declaration of conflicting interests: The Authors declare that there is no conflict of interest.

1. INTRODUCTION

In today's technology-focused environment, it is not possible for auditors and accountants to be technically mute (Dermarkar et al., 2024; Lala et al., 2021). Information technology (IT) should never be treated as anything less than a tool for effectively conducting audits (Atta et al., 2024; Rana et al., 2022). The use of technology to make the audit process easier is in computer-assisted audit tools and techniques (CAATTs). CAATTs use both the complete application of technology to perform the audit (Pedrosa & Costa, 2010). This can include automated working papers, word processing, or customized software programs designed to assist auditors in addressing the audit issue (Rus &

Tolley, 2015). Software in the CAATTs category is more or less classified in the following four areas of software: data analysis software, network security assessment software, projects assessing security in operating system/database evaluation projects, and source code assessment software (Axelsen et al., 2017).

CAATTs represent the different technology applications to facilitate the auditor's work to detect trends that isolate and identify the outliers. CAATTs can be used in all types of audits, internal and external. With CAATTs, the auditor has the ability to analyze countless elements during the audit work, all the way from assessing the internal controls to obtaining certain direct evidence. However, while it is typically believed that CAATTs apply only to large size audit, there is certainly some value to small-scale audits (Siew et al., 2017).

CAATTs have significant applicability to the audit process in all phases of the audit, but even more will sampling and inventory evaluations. In fact, CAATTs give the auditors the ability to enhance complex evaluations that would give results in the audit process more efficiency and productivity. The auditors spend a majority of their time manipulating data, while auditors utilizing CAATTs can concentrate more on the substantive areas of the audit (Eulerich et al., 2023). Not only are CAATTs a highly productive system for the assessment and detection of fraud. The quality of the audit is greatly enhanced as CAATTs more easily identify suspect transactions and verify total ledgers. CAATTs also provide the auditor with the ability to go beyond sampling to inspect the data landscape of the entire company (Assiri & Humayun, 2023).

The benefits of CAATTs would include rapid and precise testing of a significant volume of data, which saves costs. Many factors affect the adoption of CAATTs by audit firms, as discussed in the existing literature. Pizzi et al. (2021) note that convenience of access online, expected performance, and social influence were influential variables of behavioral intentions toward the adoption of electronic remote audit. Bierstaker et al. (2014) noted that perceived outcome, organizational pressures, and facilitating technical infrastructure leverage the use of CAATTs. In a Saudi Arabian study, performance expectancy and facilitating conditions were determining factors (Almagrashi et al., 2023).

While numerous studies have explored CAATTs' adoption in developed nations, there is a significant research gap concerning developing countries, where economic, technological, and cultural factors may present unique challenges. To the best of our knowledge, no prior empirical study has investigated the drivers and outcomes of CAATTs usage within Sudan's auditing context. Therefore, this study investigates the antecedents and perceived outcomes of CAATTs usage among auditors based on a modified technology-organization-environment (TOE) framework.

This study seeks to answer the following research questions:

RQ1: What are the key antecedents that influence CAATTs usage among auditors in Sudan?

RQ2: What is the relationship between CAATTs usage and perceived audit service quality?

RQ3: What is the relationship between CAATTs usage and perceived audit task effectiveness?

RQ4: How are CAATTs used in relation to perceived auditor performance?

2. LITERATURE REVIEW

CAATTs have transformed the landscape of traditional auditing, offering tools such as database applications, electronic working papers, and cutting-edge business intelligence software. But the many capabilities of CAATTs offer flexibility in terms of audit requirements, including data analysis, improving audit quality, and evaluating large quantities of data (Mousa et al., 2024). The tools of CAATTs may even include basic spreadsheets to specialized software (Generalized Audit Software [GAS]), integrated test facilities (Wassie & Lakatos, 2024).

IT skills are integral to effective audit performance (Stoel & Havelka, 2021). The importance of IT was enhanced when integrated with the assurance process (Iwuanyanwu et al., 2023). An auditor's knowledge of an organization's information systems and audit support systems has now become necessary for modern practice (Afsay et al., 2023; Raudeliūnienė et al., 2020). Standards, like AICPA SAS No. 80, have emphasized how IT can be beneficial in obtaining evidence related to electronic transactions, to improve auditors' efficiency (Atta et al., 2024). It is important for IT auditing to become a core part of specific audits within today's computerized accounting systems, as it is very important in assessing the quality of the information (Leong & Sung, 2024; Al Wahid et al., 2024).

The increase in electronic information systems has prompted research into their impact on auditing (Lawal et al., 2022). While some studies adopt a theoretical stance on the implications of IT advancements (Atayah & Alshater, 2021), others delve into auditors' perceptions of these tools' advantages (Afsay et al., 2023). This study falls into the latter category, using an empirical approach to evaluate how auditors view performance improvement and enhanced audit quality resulting from CAATTs.

Research into CAATTs adoption has presented factors influencing these variables, such as technical support, cost pressures, and budget constraints (Varma et al., 2023). Higher levels of cost pressures may sway the weight of effort and performance expectations (Aksoy & Gurol, 2021). Reports of interviews with auditors in Indonesia indicated that GAS could increase financial accountability and transparency, among other conditions that would exist within the context of auditor characteristics and firm (Nguyen et al., 2023). External factors identified as well, that reach beyond the firm, such as client characteristics, regulatory environment, and facilitating conditions (Al Omari et al., 2025).

Low internal demand and support have persistently explained the slow uptake of CAATTs. Meanwhile, traditional methods are still adopted and being used (Ahmad Ramli & Mohd Ali, 2024). Certain studies have highlighted the general use of CAATTs in audit samples and analytics (Nguyen et al., 2023). Risk-taking auditors adopt CAATTs more likely than low risk-taking auditors, who will care about the cost and are more averse to new technology (Almagrashi et al., 2023).

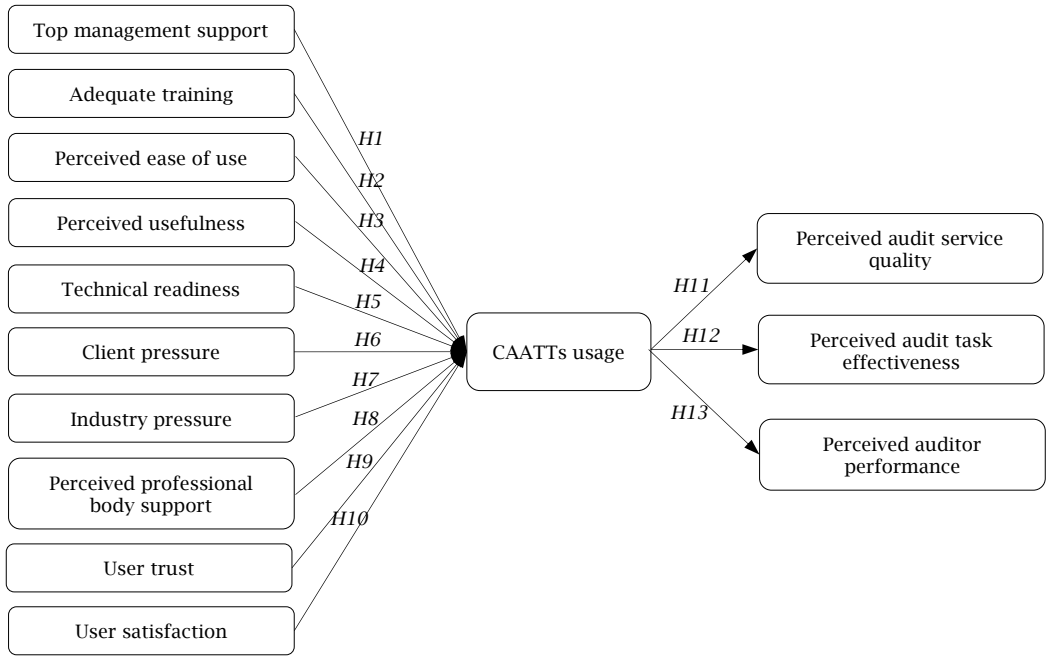
Although they offer significant benefits, uptake of GAS among smaller clients is limited due to perceived usability and expense issues (Sagar & Ramanathan, 2022). The collective framework suggests what is driving CAATTs adoption among audit public policy, especially, but not limited to, perception of outcome expectation, technological support, and organizational pressure caused by using them (Alnatour et al., 2024). Eventually, computer skills of auditors, client size, and regulatory support systems are potential drivers (Krieger et al., 2021; Daoud et al., 2021).

This study uses the prior research studies and applies them to CAATTs adoption by Sudanese auditors. The study will foreground user psychology and organizational context to provide a more comprehensive understanding of how technology would interact with user-related issues to provide service quality. This study is to fill a substantial gap in the literature.

3. CONCEPTUAL MODEL AND HYPOTHESES DEVELOPMENT

The persistent rise of information technology reliance on CAATTs is on the increase. The audit profession needs to know more untangle the forces of adoption of the technology, and how it relates to audit quality. Previous literature has considered the impact of the tool on IT quality, but there is insufficient clarity as to which key factors had the greatest impact on an auditor's desire to utilize CAATTs, especially in a developing country. The present study addresses the void by presenting and examining a model of adoption of CAATTs that includes individuals' decisions, organization, and technology to model CAATTs and to examine the effect on audit quality. The model is presented in Figure 1.

Figure 1. An integrated conceptual model of CAATTs usage



3.1. Top management support

Top management support (TMS) is an organizational attribute that has the potential to affect technology acceptance. When top management actually and publicly supports CAATTs' use by allocating resources, expressing expectations, and fostering a supportive culture, it demonstrates to auditors that CAATTs are a priority. Top management support can moderate other factors with CAATTs usage (Daoud, 2023). Studies have found management commitment to be an organizational element that leads most strongly to successful IT adoption in auditing (Daoud et al., 2021).

H1: There is a positive significant relationship between top management support and CAATTs usage.

3.2. Adequate training

Training provides auditors with the knowledge and skills needed to effectively use CAATTs. Adequate training (TRA) can help auditors learn what the tools can do, which subsequently increases their readiness and willingness to use these tools (Senan, 2024). Providing competence in CAATTs and utilization for data analysis and risk assessment makes for a greater level of auditor confidence and more trusting usage of the tools, which encourages them to use the CAATTs seamlessly (He et al., 2021).

H2: There is a positive significant relationship between adequate training and CAATTs usage.

3.3. Perceived ease of use

Perceived ease of use (PEoU) is defined as "the degree to which an auditor perceives that using CAATTs would be free of physical or mental effort"

(Davis, 1989, p. 321). When the CAATTs tools are perceived to be intuitive and user-friendly, the likelihood of acceptance and continued acceptance increases (Alshurafat et al., 2024). Research in the area of technology acceptance still indicates that perceived ease of use is a strong determinant of behavioral intention and actual use (Mustapha & Sheikh, 2014).

H3: There is a positive significant relationship between perceived ease of use and CAATTs usage.

3.4. Perceived usefulness

Perceived usefulness (PU) is the extent to which an auditor believes that using CAATTs will improve their job performance (Davis, 1989). Research suggests that workers will improve their use of technology when they believe it will improve their work (Godefroid et al., 2024). When the auditor believes CAATTs improve efficiency, accuracy, and effectiveness, this increases the general level of uptake for CAATTs (Ayinla et al., 2024; Omar, 2023).

H4: There is a positive significant relationship between perceived utility and CAATTs usage.

3.5. Technical readiness

Technical readiness (TER) signifies the degree of general attitude and preparedness that an auditor has towards new technology. Auditor's technology background and experience with technology systems heavily influence CAATT's use (Al-Shanti et al., 2024). Research supports a clear relationship between user experience and technology use in the audit (Rosli et al., 2012). An auditor who has a higher technical readiness would tend to see more efficiency and effectiveness rewards as a result of CAATTs.

H5: There is a positive significant relationship between technical readiness and CAATTs usage.

3.6. Client pressure

Client information systems and their expectations for a technology-oriented audit create pressure on auditors to use CAATTs. In jointly developed information systems, clients leverage technology for their operations, and for auditors, it means they must also follow the technology area to validate and appraise client data (Fülöp et al., 2024). The client pressure (CLP) represents external pressure to audit firm policies, and CAATTs' use is an audit process necessity to comply with audit quality (Daoud et al., 2021).

H6: There is a positive significant relationship between client pressure and CAATTs use.

3.7. Industry pressure

An industry environment with audit competition can put pressure on CAATTs' use. An audit firm may feel competitive pressure as market conditions demand, and they need to adopt new technology to remain competitive. Increased CAATT's use by preeminent firms can create annual normative pressure for subsequent audit firms. The motive for this trend is driven by efficient and cost-effective services, suited to a variety of services. Auditors may face industry pressure (INP) to adapt to CAATTs for professional quality and professionalism.

H7: There is a positive significant relationship between industry pressure and CAATTs usage.

3.8. Perceived professional body support

Assurances from professional bodies, such as accounting associations, often strengthen technology adoption. When professional associations support, instruct, and train auditors on CAATTs, auditors' anxiety is lowered, and the technology becomes socially approved. This professional body support (PBS) becomes a type of social influence, allowing auditors to be assured that CAATTs are an authenticated necessary aspect of modern auditing practice (Senan, 2024).

H8: There is a positive significant relationship between professional body support and CAATTs usage.

3.9. User trust

Trust is a key factor for the adoption of a new information system (Balakrishnan et al., 2024). User trust (TRT) in CAATTs means that an auditor can believe that the applications have reliability, security, and that the results produced are correct. Without trust, the auditor can be hesitant to depend on data and/or insights provided by these tools, limiting usage and resulting in less use. Trust is very important to technology adoption (Akinwunmi et al., 2015; Jaiswal et al., 2021).

H9: There is a positive significant relationship between user trust and CAATTs usage.

3.10. User satisfaction

Technology user satisfaction (USAT) is a strong predictor of future usage. When auditors are satisfied with the performance of CAATTs, they are likely to adopt them into their workflow. CAATTs can improve satisfaction as they improve efficiency and decrease manual effort in audit tasks (Feliciano & Quick, 2022). Satisfaction creates a behavioral intention to use the tools.

H10: There is a positive significant relationship between user satisfaction and CAATTs usage.

3.11. CAATTs usage and perceived audit service quality

It is expected that CAATTs will have a direct effect on audit service quality (PASQ). CAATTs enhance the speed and accuracy of data analysis, thereby allowing auditors to conduct more thorough and dependable audits (Dewi et al., 2023). In addition, the use of audit software improves the quality of their audits because it improves the financial and performance quality of the audit (Christensen et al., 2012).

H11: There is a positive significant relationship between CAATTs usage and perceived audit service quality.

3.12. CAATTs use and perceived audit task effectiveness

It is expected that CAATTs' use will correlate closely with the perceived audit task effectiveness (PATE). The automation of repetitive tasks and then using

sophisticated analysis, when CAATTs are employed, the auditor can make more intelligent decisions and carry out the work more efficaciously (Atta et al., 2024). It is then perceived by the auditor that their tasks performed with the use of technology were more effective than tasks without technology.

H12: There is a positive significant relationship between CAATTs usage and perceived audit task effectiveness.

3.13. CAATTs use and perceived audit performance

The most recent part of the research, strong positive connections exist between the use of CAATTs and perceived auditor performance (PAP). CAATTs enhance the auditor's performance in various areas, such as efficiency, accuracy, and productivity overall (Damer et al., 2021; Lutfi & Alqudah, 2023). The relationship between the use and the effective application of CAATTs should be positively related to the perceived overall performance of the auditor.

H13: There is a positive significant relationship between CAATTs usage and perceived auditor performance.

4. STUDY METHOD

The study empirically examined the antecedents and perceived performance measures of CAATTs in the audit industry in Sudan. To collect data, we used a normal sampling process with an appropriate population of select auditors from a sample of Sudan's eight major audit firms, all located in Khartoum. We sent out 400 questionnaires and received 234 valid responses, which were good for a 58.5% response rate. These specific respondents were selected because they had direct experience with and baseline knowledge of CAATTs and how CAATTs would be used in their current jobs. Rigor was built into the data collection process. The survey instrument was a four-part questionnaire with a 5-point Likert scale. The questionnaire items were derived from prior validated literature to ensure construct validity. Before the main data collection, a pilot test was conducted with a small group of auditors to refine the questions, ensuring clarity, consistency, and a proper contextual fit for the Sudanese environment. Feedback from experts and the pre-testing procedure led to minor adjustments to the final survey items. In testing the research model, we used structural equation modeling (SEM) methodology, particularly partial least squares (PLS), using Smart-PLS Version 4.0 software. PLS-SEM was selected because it is well-suited to an explanatory study with a non-normal data distribution, which is a typical characteristic of survey data (Hair et al., 2011). Additionally, this methodology is appropriate for small to medium-sized samples and does not require a strong assumption of multivariate normality (Chin et al., 2003), thus further supporting the methodological rigor of the analysis. The unit of analysis was the individual auditor employed in departments using or interacting with CAATTs, such as finance, internal audit, and IT.

5. DATA ANALYSIS AND FINDINGS

5.1. Demographic characteristics

After the administration of 400 questionnaires, there were 234 valid responses, resulting in a 58.5% response rate. In terms of demographics, in Table 1, the sample consisted primarily of males (80%), the age group of 36–45 years old (49%), and utilization of CAATTs for 6–10 years (48%). These statistics indicated that the sample was well-positioned to offer informed perspectives about what factors influenced CAATTs usage and associated outcomes. The sample was heavily populated with a bachelor's degree holder (81%), which helped to contribute to their role as an academic and professional resource.

Table 1. Demographic characteristics of auditors

Demographic variable	*Characteristics*	*Frequency*	*%*
Gender	Male	187	80
	Female	47	20
Age	24–25	31	13
	26–35	65	27.5
	36–45	115	49
	> 45	23	9.5
Years of experience	1–5	77	33
	6–10	112	48
	11–15	33	14
	> 16	12	5
Education	B.Sc.	191	81.5
	M.Sc.	7	3
	Ph.D.	6	2.5
	Professional certificate	30	15
CAATTs usage	< 1 year	21	9
	1–3 years	118	50.4
	> 3 years	95	40.5
	Total	234	100

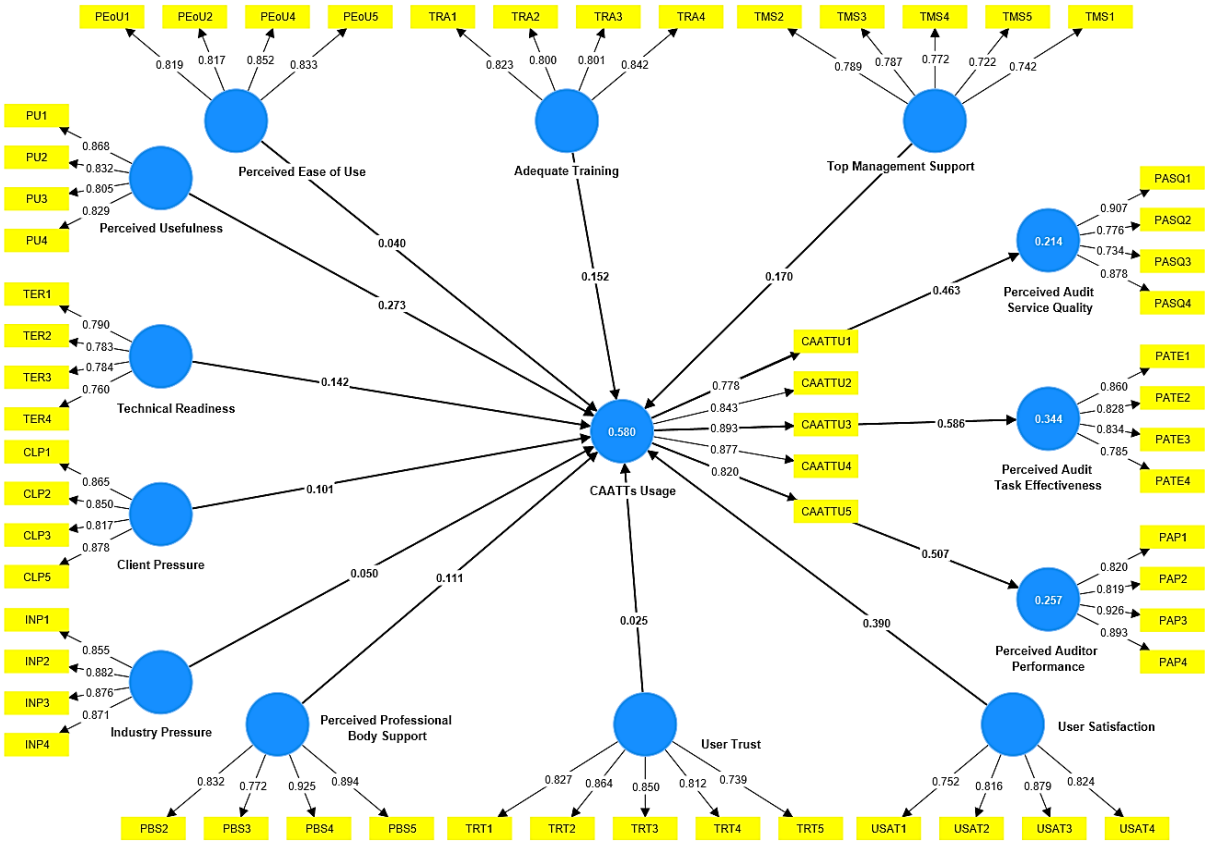
5.2. Structural equation modelling

The partial least squares (PLS) method of structural equation modelling, utilizing Smart-PLS Version 4.0, was used to test the research model. Given the explanatory nature of the study, this method is thought to be the most appropriate (Hair et al., 2011). Survey research often deviates from normal distribution, leading to a departure from assumptions regarding the multivariate normality of the data. The methodology advocated by Chin et al. (2003) does not presuppose such normality and facilitates the evaluation of both the measurement and structural models, even with smaller sample sizes.

5.3. Measurement model evaluation

As shown in Figure 2, the PLS measurement model was tested using 64 reflective indicators. Five items, TRA5, PEoU3, TER5, CLP4, and PBS1, had factor loadings of less than 0.708, respectively. According to Henseler et al. (2009), if the factor loading value is less than 0.708, the indicator should be removed, provided that its deletion will increase the composite reliability above the recommended threshold value.

Figure 2. Measurement model



Therefore, in this study, each indicator was deleted separately by performing the PLS algorithm test for each case. Thus, the revised model had 59 indicators, and PLS factor loadings fell between the range of 0.722 and 0.926; values greater than 0.708 are regarded as extremely good (Henseler et al., 2009). As shown in Table 2, the findings imply good reliability since Cronbach's alpha coefficients for 14 constructs are larger than 0.7 (Nunnally & Bernstein, 1994). The average variance extracted (AVE) values for all constructs are between 0.582 and 0.759, and the composite reliability (CR) values are between 0.786 and 0.898. These values are higher than the minimum requirements of 0.70 for CR and 0.50 for AVE (Hair et al., 2019). These results show that the constructs accounted for a high percentage of variance and that the constructs have sound internal reliability (Fornell & Larcker, 1981).

Table 2. Construct validity and reliability

Variable	*Code*	*Cronbach's alpha (CA)*	*Composite reliability (CR)*	*Average variance extracted (AVE)*
Adequate training	*TRA*	0.833	0.834	0.667
CAATTs usage	*CAATTU*	0.898	0.898	0.711
Client pressure	*CLP*	0.876	0.886	0.727
Industry pressure	*INP*	0.894	0.898	0.759
Perceived audit task effectiveness	*PATE*	0.846	0.849	0.684
Perceived audit service quality	*PASQ*	0.842	0.841	0.683
Perceived auditor performance	*PAP*	0.888	0.891	0.75
Perceived ease of use	*PEoU*	0.851	0.86	0.69
Perceived professional body support	*PBS*	0.878	0.882	0.735
Perceived usefulness	*PU*	0.855	0.868	0.695
Technical readiness	*TER*	0.785	0.786	0.607
Top management support	*TMS*	0.823	0.833	0.582
User satisfaction	*USAT*	0.839	0.865	0.671
User trust	*TRT*	0.877	0.879	0.671

After that, the analysis assessed discriminant validity. Utilizing the Heterotrait-Monotrait correlation ratio (HTMT), or how much the measures can differentiate between or measure different constructs, and here reported as reported by Franke and Sarstedt (2019), was used. The HTMT ratios in Table 3 were all under the HTMT 0.90 threshold, as recommended by Henseler et al. (2015), which demonstrates that they were discriminated against. The HTMT assessment indicates that the measures in this study were reliable and valid.

Table 3. Discriminant validity (Heterotrait-Monotrait correlation ratio)

Variable	*TRA*	*CAATTU*	*CLP*	*INP*	*PATE*	*PASQ*	*PAP*	*PEoU*	*PBS*	*PU*	*TER*	*TMS*	*USAS*	*TRT*
TRA	**1**													
CAATTU	0.655	**1**												
CLP	0.362	0.325	**1**											
INP	0.134	0.287	0.151	**1**										
PATE	0.597	0.669	0.262	0.307	**1**									
PASQ	0.641	0.527	0.387	0.245	0.699	**1**								
PAP	0.417	0.565	0.209	0.297	0.466	0.561	**1**							
PEoU	0.572	0.566	0.368	0.214	0.601	0.870	0.363	**1**						
PBS	0.432	0.424	0.067	0.078	0.389	0.353	0.219	0.381	**1**					
PU	0.720	0.664	0.253	0.153	0.688	0.780	0.466	0.723	0.387	**1**				
TER	0.603	0.578	0.338	0.201	0.578	0.632	0.325	0.586	0.332	0.600	**1**			
TMS	0.350	0.278	0.374	0.552	0.420	0.231	0.124	0.245	0.067	0.363	0.252	**1**		
USAS	0.417	0.605	0.211	0.626	0.370	0.292	0.479	0.329	0.195	0.365	0.275	0.635	**1**	
TRT	0.535	0.563	0.421	0.432	0.511	0.579	0.524	0.522	0.182	0.598	0.457	0.539	0.707	**1**

The analysis was also conducted using SPSS 27.0 to perform Harman's single-factor test to evaluate the possibility of common method bias. According to Podsakoff et al. (2003), the first component produced a variation percentage of less than 50%, corroborating the absence of common technique bias. Collinearity concerns between the components are not present in this study because the variance inflation factor (VIF) values for the constructs (which range from 1–2.351) are less than the suggested cut-off value of 5.0 by Hair et al. (2014).

5.4. Structural model assessment

The current investigation employs the bootstrapping technique, utilizing 234 cases and 5,000 resamples, to assess the statistical significance of the proposed model as per the methodology outlined by Hair et al. (2019). The outcomes of the PLS-SEM analysis are presented in Table 4 and Figure 3. The R-squared values for the four endogenous latent variables, CAATTs usage, perceived audit service quality, perceived audit task effectiveness, and perceived auditor performance are 0.580, 0.214, 0.344, and 0.257, respectively, surpassing the recommended threshold of 0.26 for model adequacy as stipulated by Cohen (1988). This implies that the ten antecedents explain 58% of the variance in CAATTs usage, while CAATTs usage explains 21.4%, 34.4%, and 25.7% of the variance in perceived audit service quality, perceived audit task effectiveness, and perceived auditor performance, respectively. Thirteen hypotheses outline the relationships between the variables in the current investigation. There is a bootstrapping mechanism in the Smart-PLS program used to determine a significant t-value. Analysis of the samples indicated a two-tailed significance threshold of 0.05, which affected the path coefficient evaluation, as in Table 4. This demonstrates that t-values greater than or equal to 1.96 are considered statistically significant at the 0.05 significance level.

Table 4. Results of the hypotheses testing

Structural paths	*Path coefficient*	*t-value*	*p-value*	*Decision*
H1: Top management support -> CAATTs usage	0.170	3.092	0.002	Supported
H2: Adequate training -> CAATTs usage	0.152	2.594	0.010	Supported
H3: Perceived ease of use -> CAATTs usage	0.040	0.681	0.496	Not supported
H4: Perceived usefulness -> CAATTs usage	0.273	3.937	0.000	Supported
H5: Technical readiness -> CAATTs usage	0.142	2.631	0.009	Supported
H6: Client pressure -> CAATTs usage	0.101	1.926	0.054	Not supported
H7: Industry pressure -> CAATTs Usage	0.050	0.877	0.381	Not supported
H8: Perceived professional body support -> CAATTs usage	0.111	2.504	0.012	Supported
H9: User trust -> CAATTs usage	0.025	0.355	0.722	Not supported
H10: User satisfaction -> CAATTs usage	0.390	5.554	0.000	Supported
H11: CAATTs usage -> Perceived audit service quality	0.463	9.296	0.000	Supported
H12: CAATTs usage -> Perceived audit task effectiveness	0.586	15.231	0.000	Supported
H13: CAATTs usage -> Perceived auditor performance	0.507	11.040	0.000	Supported

The results of the bootstrapping analysis, as shown in Table 4, demonstrate that six of the thirteen hypotheses were statistically significant. The positive relationships between CAATTs usage and top management support ($\beta = 0.170$, $p < 0.05$), adequate training ($\beta = 0.152$, $p < 0.05$), perceived usefulness ($\beta = 0.273$, $p < 0.05$), technical readiness ($\beta = 0.142$, $p < 0.05$), perceived professional body support ($\beta = 0.111$, $p < 0.05$), and user satisfaction ($\beta = 0.390$, $p < 0.05$) were all significant. Therefore, *H1*, *H2*, *H4*, *H5*, *H8*, and *H10* are supported.

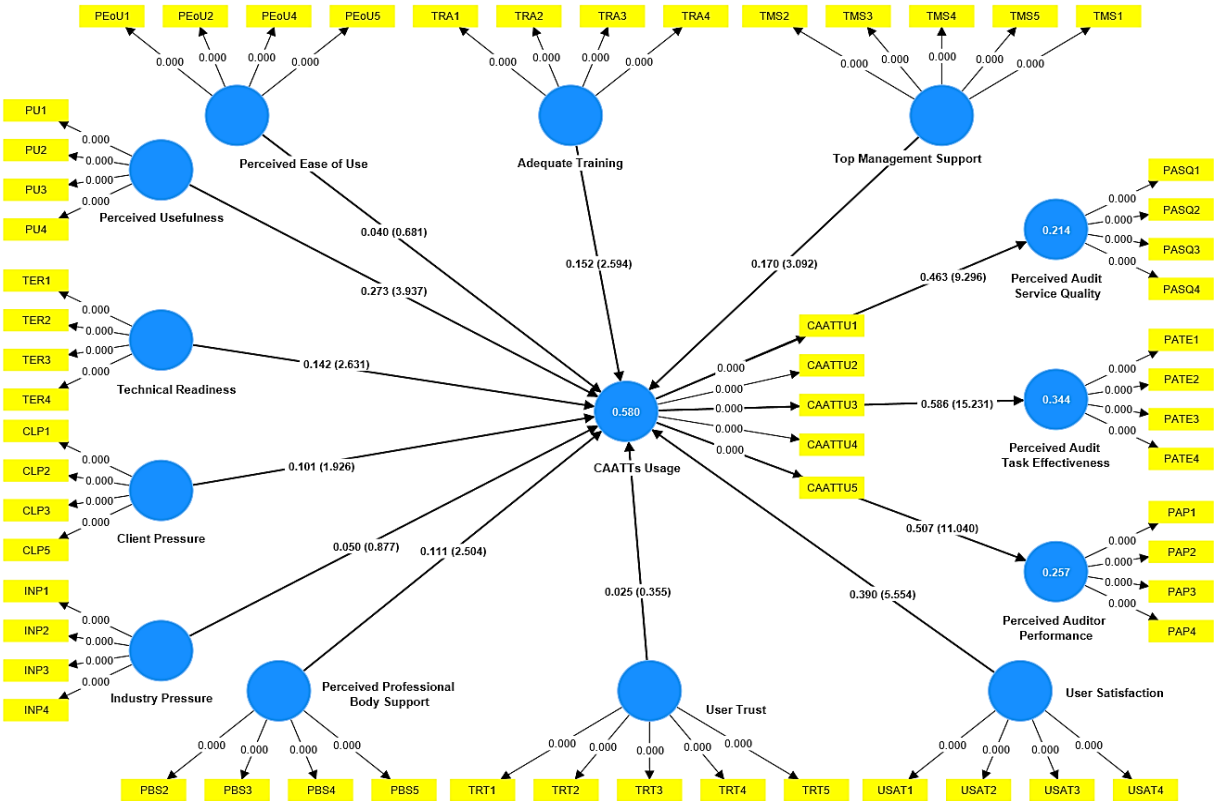
CAATTs usage also had a direct and positive impact on perceived audit service quality ($\beta = 0.463$, $p < 0.05$), perceived audit task effectiveness ($\beta = 0.586$, $p < 0.05$), and perceived auditor performance ($\beta = 0.507$, $p < 0.05$). Therefore, *H11*, *H12*, and *H13* are supported.

The lack of significant relationships for perceived ease of use (*H3*), client pressure (*H6*), industry pressure (*H7*), and user trust (*H9*) reveals a unique adoption context. In Sudan's audit sector, the decision to use CAATTs appears driven by internal strategic factors — such as management support, training, and perceived usefulness — rather than by external market pressures or initial usability concerns. This suggests that for complex professional tools, demonstrated utility and organizational backing outweigh ease of learning and external mandates. User trust, similarly, may

develop as a result of successful usage rather than act as a primary antecedent.

In contrast, the results showed no significant relationship for perceived ease of use (*H3*), client pressure (*H6*), industry pressure (*H7*), and user trust (*H9*), indicating that these hypotheses were not supported (see Table 3 and Figure 3)

Figure 3. Results of PLS-SEM analysis



6. DISCUSSION

This research provides a quantitative demonstration of the factors influencing CAATTs usage among auditors and the implications for audit quality, task efficiency, and auditor performance in Sudan. The findings show that factors such as top management support, training, perceived usefulness, technical readiness, perceived professional body support, and user satisfaction all positively affect CAATTs usage.

The analysis indicated that top management support had a significant positive influence on CAATTs usage ($\beta = 0.170$, $p < 0.05$). This confirms prior research that has identified top management as instrumental in promoting the use of CAATTs (Daoud, 2023; Pedrosa & Costa, 2010). Likewise, the result of adequate training has a significant positive effect ($\beta = 0.152$, $p < 0.05$), implying that adequate training gives auditors knowledge and confidence to use CAATTs, which is supported by He et al. (2021) and Senan (2024).

Perceived usefulness had a significant positive association with CAATTs usage ($\beta = 0.273$, $p < 0.05$), which supports the primary premise of the technology acceptance model (TAM) in that increased perceived usefulness results in increased technology acceptance (Davis, 1989). The result is corroborated by Zhao et al.'s (2025) and Omar's (2023) research, which shows perceived benefits, particularly around efficiency and effectiveness, are paramount for technologies to be accepted in auditing.

The study showed a positive association of technical readiness and CAATTs usage ($\beta = 0.142$, $p < 0.05$), contradicting the idea that auditors' technical competence emerges as a main influencing factor in using CAATTs, corresponding with Al-Shanti et al. (2024) and Magboul et al. (2024) revealed that auditors with greater levels of technical competence are more likely to implement new technologies. There was also a positive and significant association with perceived professional body support ($\beta = 0.111$, $p < 0.05$), confirming Wassie and Lakatos (2024) and Senan (2024), suggesting that professional bodies are an agent to promote adoption. As well, user satisfaction has a significant impact on CAATTs usage ($\beta = 0.390$, $p < 0.05$), confirming that users will continue to use their technology if they are satisfied with it, confirming other work which has identified user satisfaction as a barrier to continued adoption (Feliciano & Quick, 2022; Nguyen et al., 2023).

The analysis indicated, CAATTs usage has a significantly positive impact on perceived audit service quality ($\beta = 0.463$, $p < 0.05$), perceived effectiveness audit tasks ($\beta = 0.586$, $p < 0.05$) and perceived auditor performance ($\beta = 0.507$, $p < 0.05$) results are again consistent with previous work (Taghavi & Fakhari, 2024; Lutfi & Alqudah, 2023), which demonstrate that CAATTs provide auditors with improved abilities to perform audits effectively.

The findings of this study make several distinct contributions to the existing literature on technology adoption in auditing, particularly within an under-researched context. While prior studies, predominantly conducted in developed economies, have established broad frameworks like TAM and TOE, this research validates and refines these models within Sudan's unique professional environment. The strong support for *H1*, *H2*, *H4*, *H5*, *H8*, and *H10* confirms that core technology adoption drivers — such as top management support, training, and perceived usefulness — are universally critical, even in developing economies. However, the study's primary theoretical contribution lies in its nuanced findings regarding the unsupported hypotheses. By demonstrating that factors like perceived ease of use (*H3*) and external pressures (*H6*, *H7*) are not significant drivers in this context, the research challenges the assumed generalizability of some Western-derived constructs. It suggests that in environments with developing audit markets and different institutional pressures, the adoption calculus for specialized technologies like CAATTs may prioritize organizational support and internal competency development (e.g., technical readiness, professional body support) over external mandates or basic usability concerns. This contextualization enriches the theoretical discourse by highlighting boundary conditions for established adoption models.

Perceived ease of use (*H3*), client pressure (*H6*), industry pressure (*H7*), and user trust (*H9*) did not produce significant results, which went against some past research (Alshurafat et al., 2024; Mahmood et al., 2014). This could suggest that in the context of Sudan, these constructs are not primary or are not even relevant to CAATTs adoption. For example, possibly, clients and the industry are less mature and are therefore not exerting the same client and industry pressure to adopt technology, and therefore, did not surface in a developed country. Also, other constructions like training or useful could be so predominant that they obscure perceived ease of use and user trust.

7. STUDY IMPLICATIONS

These study outcomes have significant importance for auditors and public accounting firms, as they identify key factors for successful CAATTs adoption. The findings indicate that auditors are more likely to use CAATTs if they perceive the technology will improve their performance. This highlights the compelling need for firms to invest in technology to enhance efficiency, increase information access, and streamline audit tasks. The findings offer several excellent practical and pedagogical implications for the accounting and auditing profession.

The findings offer several excellent practical and pedagogical implications for the accounting and auditing profession:

1) Practical advice for firms: The findings, particularly the strong significance of top management support and adequate training, offer some practical advice for firms. Audit firms must view CAATTs adoption as more than an IT issue; it should be a corporate-driven direction from leadership. Firms should use resources towards obtaining the tools, and ensure that adequate and continuous hands-on training is provided so that auditors are both able and confident in the use of CAATTs. The non-significant findings for client pressure and industry pressure indicate that firms in Sudan cannot rely on external pressure for adoption; firms must develop an internal, self-motivated push.

2) Pedagogical advice for educators: The findings underscore the importance of Adequate Training and technical readiness for auditors. Auditing and accounting educators need to take their curriculum further than a very theoretical one and use student active learning, hands-on training to apply CAATTs. This means introducing the software, the tools, and case studies in real time, not just discussing how valuable the tools are to students. This is to cultivate a group of auditors who are not only aware of technology but are technologically prepared to use it with confidence.

3) Professional development: The findings also denote the importance of perceived professional body support. Professional bodies should support the broad show of CAATTs with guidance, certification programs, and training — this would lend legitimacy to the use of CAATs and alleviate perceived entry barriers.

8. STUDY LIMITATIONS AND FUTURE RESEARCH

Despite the insights offered by this study, it had several limitations. First, the sample was derived from a small group of firms in Khartoum. This reduced the ability to generalize the findings to auditors elsewhere or other firm types. Second, a core limitation is that it was based on self-reported, perceptual data. The perceived outcomes measured did not occur of their own accord, but the explained audit outcomes did not originate from objective data measures such as audit error rates, audit completion time, or specific key performance indicators (KPIs). As qualified by Pizzini et al. (2021), self-reported instruments may cause social desirability bias, where participants may answer in a socially acceptable way to avoid revealing their actual perspectives, rather than accurately reporting the outcome of the audit. Using perceived outcomes, rather than hard data, is invariably the weaknesses of survey research. Third, the study was cross-sectional; it presented a single moment-in-time. A longitudinal study could have given a more dynamic view of how the antecedents and outcomes of CAATTs play out.

Future research should address the limitations of this study by using a larger sample across different regions and firms of different sizes. A mixed-methods study would also be informative, integrating survey data that uses objective measurements (especially from audit management systems) or qualitative data from interviews, to develop a holistic understanding.

9. CONCLUSION

This paper explored the determinants of CAATTs usage in Sudan and can be valuable to both audit practitioners and researchers. This study built upon the basic TAM and TOE by suggesting more relevant antecedent factors and providing new perspectives

on the adoption of CAATTs from the perspective of improving audit quality. The results indicate that a positive perception of perceived usefulness, user satisfaction, and technical readiness is necessary to increase CAATTs usage to improve audit quality.

The strong positive associations between CAATTs usage and management support, training, perceived usefulness, technical readiness, and user satisfaction highlight the importance of individual preparedness and organizational support for successful CAATTs integration. Although a few independent variables, like perceived ease of use, client pressure, and user trust, yielded no statistically significant results, the research argues for a strategic approach to adopting new technology, accounting for both organizational and individual factors. This is particularly relevant for developing nations, where firms may need to rely on internal drivers rather than external market pressures.

Future research should explore these relationships further and investigate possible moderating or mediating factors that might account for some variation in CAATTs usage. It is also important to remember that as technology changes, so too will the auditing tools and techniques. The findings of this study should be viewed in light of the current technological landscape, opening the door for future research on how these relationships might change with the introduction of new technologies.

REFERENCES

Afsay, A., Tahriri, A., & Rezaee, Z. (2023). A meta-analysis of factors affecting acceptance of information technology in auditing. *International Journal of Accounting Information Systems, 49*, Article 100608. https://doi.org/10.1016/j.accinf.2022.100608

Ahmad Ramli, N. S., & Mohd Ali, N. A. (2024). Integrating technology in government internal audit: Catalysts and Challenges. *Information Management and Business Review, 16*(1), 124–136. https://doi.org/10.22610/imbr.v16i1(I).3668

Akinwunmi, A. O., Olajubu, E. A., & Aderounmu, G. A. (2015). Trust: A requirement for cloud technology adoption. *International Journal of Advanced Computer Science and Applications, 6*(8), 112–118. https://www.academia.edu/33619018/Trust_A_Requirement_for_Cloud_Technology_Adoption

Aksoy, T., & Gurol, B. (2021). Artificial intelligence in computer-aided auditing techniques and technologies (CAATTs) and an application proposal for auditors. In T. Aksoy & U. Hacioglu (Eds.), *Auditing ecosystem and strategic accounting in the digital era: Global approaches and new opportunities* (pp. 361-384). Springer International Publishing. https://link.springer.com/chapter/10.1007/978-3-030-72628-7_17

Al Omari, H. M. A., Kadir, M. R. A., Sapingi, R. B., & Al-Dalaien, A. (2025). The impact of top management support on Computer-Assisted Audit Tools (CAATs) Adoption: Mediating effects of auditor IT competency and innovativeness with a focus on perceived usefulness. *WSEAS Transactions on Business and Economics, 22*, 220–233. https://doi.org/10.37394/23207.2025.22.22

Al Wahid, S. A., Mohammad, N., Islam, R., Faisal, M. H., & Rana, M. S. (2024). Evaluation of information technology implementation for business goal improvement under process functionality in economic development. *Journal of Data Analysis and Information Processing, 12*(2), 304–317. https://doi.org/10.4236/jdaip.2024.122017

Almagrashi, A., Mujalli, A., Khan, T., & Attia, O. (2023). Factors determining internal auditors' behavioral intention to use computer-assisted auditing techniques: an extension of the UTAUT model and an empirical study. *Future Business Journal, 9*(1), Article 74. https://doi.org/10.1186/s43093-023-00231-2

Alnatour, A., Al-Mawali, H., Zaidan, H., Meqbel, R., & Kawuq, S. (2024). The readiness of Jordanian-listed firms toward CAATTs application in the post Covid-19 epidemic period. *Discover Sustainability, 5*(1), Article 118. https://doi.org/10.1007/s43621-024-00313-3

Al-Shanti, A., Jebreel, M., Qabajeh, M., Nassoura, A., & Airout, R. (2024). The role of organizational antecedents in fostering accounting intelligence adoption: The mediating influence of organizational culture. *Human Systems Management, 43*(4), 495–511. https://doi.org/10.3233/HSM-23019

Alshurafat, H., Al Shbail, M. O., & Almuiet, M. (2024). Factors affecting the intention to adopt IT forensic accounting tools to detect financial cybercrimes. *International Journal of Business Excellence, 33*(2), 169–190. https://doi.org/10.1504/IJBEX.2024.139917

Assiri, M., & Humayun, M. (2023). A blockchain-enabled framework for improving the software audit process. *Applied Sciences, 13*(6), Article 3437. https://doi.org/10.3390/app13063437

Atayah, O. F., & Alshater, M. M. (2021). Audit and tax in the context of emerging technologies: A retrospective analysis, current trends, and future opportunities. *The International Journal of Digital Accounting Research, 21,* 95–128. https://doi.org/10.4192/1577-8517-v21_4

Atta, A. A. B., Baniata, H. M., Othman, O. H., Ali, B. J. A., Abughaush, S. W., Aljundi, N. A., & Ahmad, A. Y. B. (2024). The impact of computer assisted auditing techniques in the audit process: An assessment of performance and effort expectancy. *International Journal of Data & Network Science, 8*(2), 977–988. https://doi.org/10.5267/j.ijdns.2023.12.009

Axelsen, M., Green, P., & Ridley, G. (2017). Explaining the information systems auditor role in the public sector financial audit. *International Journal of Accounting Information Systems, 24*, 15–31 https://doi.org/10.1016/j.accinf.2016.12.003

Ayinla, B. S., Atadoga, A., Ike, C. U., Ndubuisi, N. L., Asuzu, O. F., & Adeleye, R. A. (2024). The role of robotic process automation (RPA) in modern accounting: A review-investigating how automation tools are transforming traditional accounting practices. *Engineering Science & Technology Journal, 5*(2), 427–447. https://doi.org/10.51594/estj.v5i2.804

Balakrishnan, J., Dwivedi, Y. K., Hughes, L., & Boy, F. (2024). Enablers and inhibitors of AI-powered voice assistants: A dual-factor approach by integrating the status quo bias and technology acceptance model. *Information Systems Frontiers, 26*(3), 921–942. https://doi.org/10.1007/s10796-021-10203-y

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. https://doi.org/10.1016/j.adiac.2013.12.005

Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. *Information Systems Research, 14*(2), 189–217. https://doi.org/10.1287/isre.14.2.189.16018

Christensen, B. E., Glover, S. M., & Wood, D. A. (2012). Extreme estimation uncertainty in fair value estimates: Implications for audit assurance. *Auditing: A Journal of Practice & Theory, 31*(1), 127–146. https://doi.org/10.2308/ajpt-10191

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates. https://utstat.utoronto.ca/brunner/oldclass/378f16/readings/CohenPower.pdf

Damer, N., Al-Znaimat, A. H., Asad, M., & Almansou, Z. A. (2021). Analysis of motivational factors that influence usage of computer assisted audit techniques (CAATS) by external auditors in Jordan. *Academy of Strategic Management Journal, 20*(2), 1–13. https://www.researchgate.net/publication/357166406_Analysis_of_Motivational_Factors_That_Influence_Usage_of_Computer_Assisted_Audit_Techniques_CAATS_By_External_Auditors_in_Jordan

Daoud, L. (2023). Predictors of auditors' usage of CAATS: The role of top management support and trust. *Information Sciences Letters, 12*(5), 1841–1850. https://doi.org/10.18576/isl/120528

Daoud, L., Marei, A., Al-Jabaly, S. M., Aldaas, A. A. (2021). Moderating the role of top management commitment in usage of computer-assisted auditing techniques. *Accounting, 7*, 437–468. https://doi.org/10.5267/j.ac.2020.11.005

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Management Information Systems Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Dermarkar, S., Hazgui, M., & Baudot, L. (2024). A glimpse into the innovative landscape of the accounting profession from the perspective of prospective accountants. *Accounting Auditing Control, 30*(4), 15–48. https://doi.org/10.2139/ssrn.4713972

Dewi, N. S., Faiza, S. N., Tobing, D. L., Said, J., & Julian, L. (2023). Professional skepticism and self-efficacy on the detection of financial statements fraud. In *Proceedings of the International Conference in Technology, Humanities and Management (ICTHM 2023)* (pp. 357–368). https://scholar.ui.ac.id/en/publications/professional-skepticism-and-self-efficacy-on-the-detection-of-fin/

Eulerich, M., Masli, A., Pickerd, J., & Wood, D. A. (2023). The impact of audit technology on audit task outcomes: Evidence for technology-based audit techniques. *Contemporary Accounting Research, 40*(2), 981–1012. https://doi.org/10.1111/1911-3846.12847

Feliciano, C., & Quick, R. (2022). Innovative information technology in auditing: Auditors' perceptions of future importance and current auditor expertise. *Accounting in Europe, 19*(2), 311–331. https://doi.org/10.1080/17449480.2022.2046283

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50. https://doi.org/10.2307/3151312

Franke, G., & Sarstedt, M. (2019). Heuristics versus statistics in discriminant validity testing: A comparison of four procedures. *Internet Research, 29*(3), 430–447. https://doi.org/10.1108/IntR-12-2017-0515

Fülöp, M. T., Ionescu, C. A., Măgdaș, N., & Topor, D. I. (2024). Factors influencing the use of computer-assisted audit techniques in the digital era. *Journal of Business Economics & Management, 25*(6), 1140–1160. https://doi.org/10.3846/jbem.2024.22505

Godefroid, M. E., Plattfaut, R., & Niehaves, B. (2024). Identifying key barriers to nonprofit organizations' adoption of technology innovations. *Nonprofit Management and Leadership, 35*(1), 237–259. https://doi.org/10.1002/nml.21609

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed, a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139–152. https://doi.org/10.2753/MTP1069-6679190202

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and when not to use PLS-SEM. *European Business Review, 31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Hair, J. F., Jr., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A primer on partial least squares structural equation modeling (PLS-SEM).* Sage Publications.

He, C., Li, C. K., Monroe, G. S., & Si, Y. (2021). Diversity of signing auditors and audit quality. *Auditing: A Journal of Practice & Theory, 40*(3), 27–52. https://doi.org/10.2308/AJPT-19-068

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. In R. R. Sinkovics & P. N. Ghauri (Eds.), *Advances in international marketing: New challenges to international marketing* (Vol. 20, pp. 277–320). https://doi.org/10.1108/S1474-7979(2009)0000020014

Iwuanyanwu, U., Apeh, A. J., Adaramodu, O. R., Okeleke, E. C., & Fakeyede, O. G. (2023). Analyzing the role of artificial intelligence in it audit current practices and future prospects. *Computer Science & IT Research Journal, 4*(2), 54–68. https://doi.org/10.51594/csitrj.v4i2.606

Jaiswal, D., Kaushal, V., Kant, R., & Singh, P. K. (2021). Consumer adoption intention for electric vehicles: Insights and evidence from Indian sustainable transportation. *Technological Forecasting and Social Change, 173*, Article 121089. https://doi.org/10.1016/j.techfore.2021.121089

Krieger, F., Drews, P., & Velte, P. (2021). Explaining the (non-) adoption of advanced data analytics in auditing: A process theory. *International Journal of Accounting Information systems, 41*, Article 100511. https://doi.org/10.1016/j.accinf.2021.100511

Lala, Z., Poole, V. B., & Kimmel, S. B. (2021). Adapting to new technology in the accounting industry. *Business Education Innovation Journal, 13*(2), 37–42. http://beijournal.com/images/V13_N2_draft_4.pdf#page=37

Lawal, A., Mohamed, R., Abdalla, H., Elkelish, W., & Lasyoud, A. (2022). The role of accounting information systems in firms' performance during the COVID-19 pandemic. *Journal of Governance and Regulation, 11*(1), 45–54. https://doi.org/10.22495/jgrv11i1art5

Leong, K., & Sung, A. (2024). Gender stereotypes in artificial intelligence within the accounting profession using large language models. *Humanities and Social Sciences Communications, 11*(1), 1–11. https://doi.org/10.1057/s41599-024-03660-8

Lutfi, A., & Alqudah, H. (2023). The influence of technological factors on the computer-assisted audit tools and techniques usage during COVID-19. *Sustainability, 15*(9), Article 7704. https://doi.org/10.3390/su15097704

Magboul, I., Jebreel, M., Shawtri, F., Qabajeh, M., Shanti, A., Alqudah, M., & Abu Huson, Y. (2024). Factors influencing accounting information system usage by oil companies & performance outcomes. *Cogent Business & Management, 11*(1), Article 2369211. https://doi.org/10.1080/23311975.2024.2369211

Mahmood, K., Mahmood Ahmad Qureshi, I., & Nisar, A. (2014). An empirical study on measurement of performance through TQM in Pakistani aviation manufacturing industry. *International Journal of Quality & Reliability Management, 31*(6), 665–680. https://doi.org/10.1108/IJQRM-03-2012-0041

Moorthy, M. K., Mohamed, A. S. Z., Gopalan, M., & San, L. H. (2011). The impact of information technology on internal auditing. *African Journal of Business Management, 5*(9), 3523–3539. https://academicjournals.org/journal/AJBM/article-full-text-pdf/C93490637513

Mousa, M., Shahzad, F., & Shabana, M. M. (2024). Digital entrepreneurship among Egyptian women: Autonomy, experience and community. *Journal of Small Business and Enterprise Development, 31*(7), 1378–1399. https://doi.org/10.1108/JSBED-11-2023-0560

Mustapha, B., & Sheikh, S. N. B. (2014). The influence of technology characteristics towards an online tax system usage: The case of Nigerian self-employed taxpayer. *International Journal of Computer Applications, 105*(14), 30–36. https://www.researchgate.net/publication/268502470_The_Influence_of_Technology_Characteristics_towards_an_Online_Tax_System_Usage_The_Case_of_Nigerian_Self-_Employed_Taxpayer

Nguyen, T. T., Nguyen, L. A., Kend, M., & Pham, V. A. T. (2023). The challenges facing Vietnamese accountants and auditors with the adoption of emerging technologies. In T. Rana, J. Svanberg, P. Öhman, & A. Lowe (Eds.), *Handbook of big data and analytics in accounting and auditing* (pp. 41–63). Springer. https://doi.org/10.1007/978-981-19-4460-4_3

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.

Omar, N. A. (2023). Effect of technological innovations on the accounting practices efficiency in Kenya. *African Journal of Commercial Studies, 3*(2), 118–126. https://ijcsacademia.com/index.php/journal/article/view/172/version/172

Pedrosa, I., & Costa, C. (2010). Computer assisted audit tools in real world: Idea applications and approache's in real context. In *Proceedings of the IADIS International Conference Intelligent Systems and Agents 2010, ISA, IADIS European Conference on Data Mining 2010, Part of the MCCSIS 2010* (pp. 151–155). https://researchportal.ulisboa.pt/en/publications/computer-assisted-audit-tools-in-real-world-idea-applications-and/

Pizzi, S., Venturelli, A., Variale, M., & Macario, G. P. (2021). Assessing the impacts of digital transformation on internal auditing: A bibliometric analysis. *Technology in Society, 67*, Article 101738. https://doi.org/10.1016/j.techsoc.2021.101738

Pizzini, A., Bortolo Vieira, R., Deda Gomes, R., Santos, G., Malucelli, A., & Reinehr, S. (2021). Software quality practices in growing startups: A qualitative study. In *Proceedings of the XX Brazilian Symposium on Software Quality* (pp. 1–10). https://doi.org/10.1145/3493244.3493254

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Rana, M. S., Cavaliere, L. P. L., Mishra, A. B., Padhye, P., Singh, R. R., & Khanna, R. (2022). Internet of things (IOT) based assessment for effective monitoring data against malicious attacks on financial collectors. In *Proceedings of the 2022 2nd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)* (pp. 177–181). IEEE. https://doi.org/10.1109/ICACITE53722.2022.9823612

Raudeliūnienė, J., Tvaronavičienė, M., & Blažytė, M. (2020). Knowledge management practice in general education schools as a tool for sustainable development. *Sustainability, 12*(10), Article 4034. https://doi.org/10.3390/su12104034

Rosli, K., Yeow, P. H. P., & Siew, E.-G. (2012). Factors influencing audit technology acceptance by audit firms: A new I-TOE adoption framework. *Journal of Accounting and Auditing: Research & Practice, 2012*, Article 876814. https://doi.org/10.5171/2012.876814

Rus, D., & Tolley, M. T. (2015). Design, fabrication and control of soft robots. *Nature, 521*, 467–475. https://doi.org/10.1038/nature14543

Sagar, A., & Ramanathan, K. (2022). Factors that play a role in improving the efficiency of continuous audits using computer assisted audit techniques in enterprises including healthcare units. *Cardiometry,* (24), 385–392. https://doi.org/10.18137/cardiometry.2022.24.385392

Senan, N. A. M. (2024). *Influential factors shaping the adoption and utilization of audit technology (CAATS) in the audit practices in Saudi Arabia: Human capital expertise as a moderating factor*. https://doi.org/10.20944/preprints202402.0245.v1

Siew, E.-G., Yeow, P. H. P., Tan, C. L., & Grigoriou, N. (2017). Factors affecting IT audit quality: An exploratory study. *Communications of the IBIMA, 2017*, Article 802423. https://doi.org/10.5171/2017.802423

Stoel, M. D., & Havelka, D. (2021). Information technology audit quality: An investigation of the impact of individual and organizational factors. *Journal of Information Systems, 35*(1), 135–154. https://doi.org/10.2308/isys-18-043

Taghavi, S. R., & Fakhari, H. (2024). Futures study of emerging technologies in Iran's financial auditing profession: A Delphi-based scenario analysis. *Journal of Professional Auditing Research, 4*(16), 92–123. https://doi.org/10.22034/jpar.2024.2016148.1246

Thottoli, M. M. (2021). Knowledge and use of accounting software: evidence from Oman. *Journal of Industry-University Collaboration, 3*(1), 2–14. https://doi.org/10.1108/JIUC-04-2020-0005

Varma, A., Mancini, D., & Kaushik, S. (2023). Professional skepticism for green reputation clients: A mixed method study of technology enabled audits. *International Journal of Digital Accounting Research, 23*, 137–179. https://doi.org/10.4192/1577-8517-v23_6

Wassie, F. A., & Lakatos, L. P. (2024). Technology adoption in audit of information systems: Ethiopian audit firms' perspective. *Journal of Infrastructure, Policy and Development, 8*(13), Article 8819. https://doi.org/10.24294/jipd8819

Zhao, J., Yao, H., & Zhang, J. (2025). Investigating factors influencing Chinese teachers' intelligent technology application: extending TAM with NET and IDT. *Education and Information Technologies, 30*, 22649–22676. https://doi.org/10.1007/s10639-025-13661-y