Al-Zaytoonah University Journal of Business, Vol. 01 No. 02, 2025
ISSN Number: Print: 3107- 2178 / Online: 3107- 2186

Journal website: www.zjjb.edu.jo

Impact of Electronic Auditing Tool Utilization on Audit Performance: The Mediating Role of Auditor's Digital Competence

Hala Nour Al-Nawaiseh [1], Mohammad Ebrahim Nawaiseh [2]

[1] Business Department/Luminus Technology University College/dr.halanawaiseh@gmail.com
[2]Accounting Department/ Al-Zaytoonah University of Jordan/ M.nawaiseh@zuj.edu.Jo

Abstract Purpose: While the adoption of electronic auditing tools is widespread, the mechanism through which these tools translate into improved audit performance remains underexplored. This study aims to fill this gap by investigating the mediating role of auditor's digital competence in the relationship between electronic auditing tool utilization and audit performance (encompassing both efficiency and effectiveness).
Methodology: This quantitative study investigates the impact of electronic auditing tool utilization on audit performance, mediated by auditors' digital competence. Data were collected from 150 external auditors in Jordan using validated instruments adapted from prior research. The proposed relationships were tested using regression-based mediation analysis to ensure empirical rigor.
Findings: The results confirm the hypothesized model. Electronic auditing tool utilization was found to have a significant positive impact on both auditor's digital competence and overall audit performance. More importantly, the findings reveal that auditor's digital competence acts as a significant mediator. This indicates that the positive effect of tool utilization on audit performance is largely transmitted through the enhancement of auditors' digital skills, rather than being a direct consequence of the technology itself.
Originality & Implications: This study's primary contribution lies in empirically demonstrating how technology improves audit performance, highlighting that investment in human capital is as critical as investment in technology. The findings have significant practical implications for audit firms, suggesting that technology acquisition must be coupled with robust training programs designed to build genuine digital competence. For academia, the study underscores the need to integrate practical data analytics skills into auditing curricula. This research extends the literature by providing a nuanced, mediational understanding of technology's role in modern auditing.

Keywords: Information Technology, Audit, Efficiency, Effectiveness

1 Introduction

In this study, Audit Performance is defined as a comprehensive, multi-dimensional construct that reflects the overall quality and success of a financial statement audit engagement. Consistent with previous literature (e.g., Knechel et al., 2013; DeFond & Zhang, 2014), the study conceptualizes Audit Performance as being primarily composed of two critical dimensions: audit efficiency and audit effectiveness." Audit efficiency refers to the resources consumed to achieve the audit objectives. It is typically measured by the ability to complete the audit within the allocated time budget and by the planned deadline, while Audit effectiveness refers to the quality of the audit and its ability to achieve its primary objective: providing reasonable assurance that the financial statements are free from material misstatement. It is a measure of achieving the right outcome (ISA 200). The conceptualization of Audit Performance as a function of both efficiency and effectiveness is well-established in the auditing literature. For example, researchers have long recognized the inherent trade-off between these two dimensions, where an overemphasis on efficiency can jeopardize effectiveness, and vice-versa (Knechel, 2006). Studies examining the impact of technology, auditor judgment, and firm characteristics frequently measure audit performance by operationalizing both its efficiency and effectiveness components (e.g., Dowling & Leech, 2012).

A Performance Audit is a distinct type of engagement, common in the public sector, which examines an entity's economy, efficiency, and effectiveness (the 'three E's'). The scope of this study is focused exclusively on the performance of external financial statement audit in the private sector. In this study, Audit Performance is conceptualized as a multi-dimensional construct comprising both audit effectiveness and audit efficiency. This approach aligns with a long-standing tradition in auditing research (Bedard & Biggs, 1991). Audit effectiveness, or audit quality, is a central theme in the literature, with extensive research dedicated to its definition and measurement (Knechel et al., 2013; DeFond & Zhang, 2014). More directly, recent studies examining the impact of technology on auditing have explicitly measured performance through the dual lenses of effectiveness and efficiency (Dowling & Leech, 2014). Therefore, by adopting "Audit Performance" as our dependent variable, the current study follows established academic precedent to provide a holistic assessment of the impact of electronic auditing tools."

Based on the Jordanian legal framework (Law No. 73 of 2003) that mandates compliance with international auditing standards for electronic environments (ISA 401), this study investigates the implementation of audit technology to enhance auditor performance. The study examines how technological adoption improves audit efficiency and effectiveness, with a specific focus on increasing speed and accuracy. The study makes a significant theoretical contribution by introducing novel elements to the Technology Performance Chain framework. Through this enhanced model, the research identifies key factors that drive improved auditor outcomes and clarifies how integrating innovative tools can mitigate obstacles to productivity.

This study organizes the theoretical framework and hypotheses from a review of the literature. It then details the research methodology and presents the empirical results of the analysis. then it concludes by discussing the findings, their implications, and directions for future research.

2 Literature review and conceptual framework

As a technology became integral to business, auditors have had to master IT and its global applications. This shift created the specialized field of computer audits and necessitated formal professional standards to guide the practice. Auditors must adapt to these technological advancements to leverage benefits such as improved audit quality, enhanced fraud detection capabilities, and stronger strategic decision-making support. A crucial aspect for auditors is understanding how IT impacts auditing procedures, enabling them to effectively utilize electronic methods for tasks like sample selection and data analysis. As IT use continues to grow in business operations, auditors need to stay abreast of developments in audit technology to ensure precise financial data for external reporting (Bradford et al., 2020; Razi & Madani, 2013). Embracing automated or computer-based auditing practices can lead to more effective risk assessment strategies and ultimately contribute to maintaining high standards of audit quality (Curtis & Payne, 2008; Kotb & Roberts, 2011; and Bader, A., & Khoshnaw, N. S. S., 2023). Set against the backdrop of Jordanian Law No. 73 (2003), this research provides an empirical analysis of the pathways by which technological adoption improves auditor performance. While the link between Electronic Auditing Tool Utilization (EATU) and improved audit outcomes is assumed, this study proposes and tests a more nuanced model. It posits that the impact of EATU on Audit Performance—comprising both efficiency and effectiveness—is significantly mediated by the Auditor's Digital Competence. Specifically, the study hypothesizes that while EATU directly enhances performance, its primary influence is in developing an auditor's digital skills, which in turn becomes the critical driver of superior audit efficiency and effectiveness. By analyzing this mediating pathway, the research extends the Technology Performance Chain framework, identifying digital competence as a key factor that translates technology investment into tangible performance gains. The findings offer practical insights for leveraging technology to address professional challenges, emphasizing that realizing the full potential of audit tools is contingent upon cultivating the digital competence of auditors.

Expert insights from accounting and IT remain underexplored in predicting technology adoption (Lombardi, D. R., et al, (2025), and Automation encompasses various stages of the audit, from planning through to report generation. For example, electronic spreadsheets such as Excel can be employed during audit program planning and preparation. These tools help auditors efficiently outline tasks, accurately estimate execution times, track actual time taken at each stage, record any variances, and document reasons for deviations. This flexibility enables auditors to make necessary adjustments before finalizing audit documents (El-Sheikh, 1998).

The automation of auditing, as emphasized by Lenning Jeff (2005), offers significant benefits including enhanced auditor efficiency and cost-effectiveness through streamlined planning, automated audit plan creation, digitization of documents, and automated report generation. Establishing databases to store audit programs and reports facilitates continuous monitoring of auditors' work while ensuring high security and automated document protection. Consistent with International Auditing Standard 401 issued by the International Federation of Accountants (IFAC), auditors are required to demonstrate proficiency in computer-based information systems to effectively manage planning tasks, underscoring the critical role of technological competency in modern auditing practices. Audit automation broadly improves accuracy, consistency, and productivity by reducing manual, repetitive tasks and enabling real-time collaboration and risk management (DataSnipper, (2024), and the Attended Process Automation APA framework highlights auditors' essential role in automated audit workflows, where their professional judgment remains irreplaceable by automation Zhang, C., et al. (2021). However, successful adoption also necessitates addressing challenges such as data security, ethical considerations, and the need for ongoing auditor training in emerging technologies like robotic process automation (RPA) and artificial intelligence (AI) (eCampus Ontario, 2024). Auditors are advised to consider the necessity for specialized skills in computer-based systems within the realm of information systems, as outlined by the International Federation of Accountants Handbook (ISA, 2005). This awareness is crucial for effectively evaluating general risks, designing appropriate control tests, and implementing necessary procedures. Information technology (IT) encompasses electronic methods for data collection, processing, storage, and distribution, involving computer hardware, software, and networks (Duncombe and Heeks 1999). In auditing practices, leveraging IT means utilizing computer devices and networks to efficiently gather essential audit information (Charles 2001)1. It is therefore vital for auditors to recognize the importance of automated accounting systems, stay updated with modern technological advancements, and incorporate IT into auditing processes1. These steps are essential for enhancing professional judgment and improving overall efficiency and effectiveness during audits(Jones, D.R., Brown, D. and Wheeler, P. 2001).

The integration of Information Technology into auditing has fundamentally transformed the field. This shift yields significant benefits, such as reducing the time spent on manual tasks, lowering accounting and audit risks, and achieving overall time and cost savings. Consequently, IT enhances the quality of audits and empowers auditors to make better-informed professional judgments (Manson 1997a; Manson 1997b), and the use of IT is now essential across all business sectors. This widespread adoption means auditors must not only understand traditional auditing principles but also stay current with market economics, global transactions, and the pervasive role of IT in business operations like planning, administration, and accounting. This evolution has led to the development of a specialized field known as computerized system audits (or computer audits), which has prompted the creation of formal professional standards to guide auditors in this new technological landscape (Althuneibat 2003). A study by Momeni, Attieh, and Faraj (2020) surveyed accounting professionals in Algeria to assess the impact of electronic auditing (EA) on accounting information quality. The findings revealed a significant adoption rate, with over 60% of respondents using EA for planning, control, and documentation. In their investigation of Kuwaiti public shareholding companies, Al-Omair, Omair Abdullah, and Aldalabieh (2018) established a significant positive relationship between the use of electronic auditing and the enhancement of internal auditors' practical skills. The study's key recommendation was that auditors achieve proficiency in information technologies to improve the quality of their financial evaluations. Research in Palestine by Hamdoun and Hamdan (2007) revealed that over 60% of major audit offices use electronic auditing for key tasks. Michelle. K, (2019) emphasized that CAAT usage and professional ethics significantly influenced auditor performance. Althuneibat (2003) found that Jordanian firms underutilize IT and recommended targeted CPA training to improve audit standards. Oliphant (2005) outlined the professional path to becoming an IT audit specialist. The Institute of Internal Auditors (2003) confirmed Its essential role in modern internal audits, urging regulatory improvements. Additionally, Whittington (2002) explained how SAS 96 introduced stricter documentation to address technological and global audit challenges. This collection of research highlights key factors influencing the adoption and effectiveness of IT in auditing. A consensus among studies by Kristian, Michelle. (2020), Althuneibat (2003) indicate that an auditor's proficiency with computerized software is enhanced by both practical experience and strong academic qualifications. However, the actual adoption of these technologies varies by region. For instance, Hamdoun and Hamdan (2007) reported high usage in Palestine, which contrasts with Althuneibat's (2003) findings of sub-optimal IT use in Jordanian audits. Reinforcing the importance of this technological shift, a study by Janvrin & Bierstaker (2018) highlights the negative impact of manual auditing practices on process efficiency. The current study builds its foundation on the understanding of the key electronic tools shaping modern auditing practices and how each contributes to audit quality and reliability. Spreadsheet software (e.g., Microsoft Excel) remains widely used for basic calculations and organizing audit evidence; however, it lacks essential audit controls such as error detection and audit trails. Panko (1998) found that a large percentage of operational spreadsheets contain errors, posing serious risks when used for critical audit functions. He argued that auditors should move away from informal tools like spreadsheets and adopt professionally developed electronic audit tools to reduce errors and improve audit discipline.

In contrast, Generalized Audit Software (GAS) (e.g., ACL, IDEA) offers specialized capabilities for analyzing large datasets—allowing tasks like recalculating totals, detecting missing transactions, and sampling data. According to Braun and Davis (2003), the adoption of GAS is strongly influenced by management support and the perceived benefits of improved efficiency, making it a core tool in audit analytics. Further enhancing the audit process are Electronic Workpaper Platforms (e.g., Caseware, CCH ProSystem fx Engagement), which allow for the centralized creation, storage, and review of audit documents. These platforms not only streamline the review process and foster collaboration but also ensure a consistent and traceable audit trail. Bierstaker, Janvrin, and Lowe (2013) found that auditors using electronic workpapers reported better audit quality and operational efficiency compared to those using paper-based systems. Another crucial advancement is the use of Data Visualization Tools (e.g., Tableau, Power BI), which convert complex numerical data into interactive visuals, enabling auditors to quickly identify anomalies and trends. Dilla and Raschke (2015) showed that these tools enhance auditors' ability to assess fraud risk more effectively than traditional tabular analysis, as visual representation facilitates better information integration. Moreover, Robotic Process Automation (RPA) introduces automation into repetitive, rule-based audit tasks such as account reconciliations and access control testing. Moffitt, Rozario, and Vasarhelyi (2018) highlighted how RPA transforms auditing by freeing up auditors' time for judgment-intensive tasks, thus enhancing the strategic value of audits. Finally, Integrated Audit Platforms (e.g., KPMG Clara, EY Canvas) offer an all-in-one cloud-based environment combining data analysis, audit documentation, client communication, and project management. While empirical research on specific platforms is limited, Dowling and Leech (2012) found that well-designed enterprise systems—like these platforms—positively influence audit judgment and consistency by offering a unified and intuitive interface for the entire audit engagement. Collectively, these technologies demonstrate the significant shift from manual to digital auditing methods, supporting the current study's focus on enhancing audit performance through technological adoption and digital competence. Spreadsheet software like Microsoft Excel, while commonly used for basic calculations and organizing audit evidence, poses significant risks due to the high likelihood of errors, as shown by Panko, R. R. (1998), who advocated for transitioning to more reliable tools. Generalized Audit Software (GAS) such as ACL and IDEA enhances auditors' ability to analyze large datasets, with Braun, R. L., & Davis, H. E. (2003) emphasizing that adoption depends largely on perceived benefits and managerial support. Electronic Workpaper Platforms, including CaseWare and CCH ProSystem fx Engagement, improve documentation and audit trail clarity, which Bierstaker, J., Janvrin, D., & Lowe, D. J. (2013) linked to increased audit quality and efficiency. Data Visualization Tools like Tableau and Power BI further support auditors by allowing intuitive fraud detection and trend analysis, with Dilla, W. N., & Raschke, R. L. (2015) finding improved fraud risk assessments through visual data interpretation. Robotic Process Automation (RPA) transforms routine audit functions by automating repetitive tasks, freeing auditors for complex judgments, as described by Moffitt, K. C., Rozario, A. M., & Vasarhelyi, M. A. (2018). Finally, Integrated Audit Platforms such as KPMG Clara and EY Canvas unify multiple audit functions, and Dowling, C., & Leech, S. A. (2012) confirmed that the design of such systems positively affects auditor judgment and decision-making.

The current study draws on a robust body of literature supporting the impact of electronic audit tools on audit effectiveness, efficiency, and auditor digital competence. In terms of audit effectiveness, research confirms that these tools improve risk assessment quality (Dowling & Leech, 2014), enhance professional skepticism (Hurtt, 2010; Brazel et al., 2016), and help auditors better identify potential misstatements or fraud risks (Brazel, Jackson, & Schaefer, 2016). They also increase the quality and thoroughness of gathered audit evidence (Janvrin, Bierstaker, & Lowe, 2008) and contribute to a higher-quality overall audit (Knechel et al., 2013; Mahzan & Lymer, 2014). In terms of audit efficiency, these tools enable timely task completion within budget (McDaniel, 1990), reduce time spent on manual procedures (Mahzan & Lymer, 2014), and expedite the evidence-gathering process (Janvrin, Bierstaker, & Lowe, 2008). They also promote the timely completion of audits (Curtis, Jenkins, & Bedard, 2009) and increase personal productivity (Compeau, Higgins, & Huff, 1999). Concerning auditor digital competence, prior studies demonstrate how auditors benefit from understanding clients' IT systems and controls (Curtis, Jenkins, & Bedard, 2009) and using general software tools like Excel for complex tasks (Mahzan & Lymer, 2014). Competence also extends to data visualization (Yoon, Hoogduin, & Zhang, 2015), use of CAATs such as IDEA or ACL (Janvrin, Bierstaker, & Lowe, 2008), and the ability to independently design and interpret data analytics tests (Dowling & Leech, 2014; Alles & Gray, 2016). Furthermore, confidence in adopting new tools (Compeau & Higgins, 1995; Mahzan & Lymer, 2014) and identifying patterns or anomalies (Yoon, Hoogduin, & Zhang, 2015) is critical for audit quality. These findings provide a strong empirical and conceptual foundation for exploring how digital tools and competencies contribute to improved audit performance. Despite these insights, a significant gap remains in our understanding of this dynamic. Much of the existing research focuses on technology adoption within large firms, overlooking the unique challenges and perspectives of auditors in small and medium-sized practices. Furthermore, while the general importance of 'IT skills' is acknowledged, the specific, nuanced role of an auditor's digital competence as a mediating mechanism—explaining *how* tool utilization translates into improved performance—remains theoretically underdeveloped and empirically untested. Current models often fail to explore the multi-faceted nature of this competence, leaving key dimensions unexamined. To address these gaps, this study proposes a conceptual framework (see Figure 1) that examines the relationship between the utilization of electronic auditing tools and audit performance. Crucially, the framework introduces Auditor's Digital Competence as the central mediating variable, positing that it is the key that unlocks the performance benefits of technology. By doing so, this study aims to provide a more holistic understanding applicable to auditors across firms of all sizes.

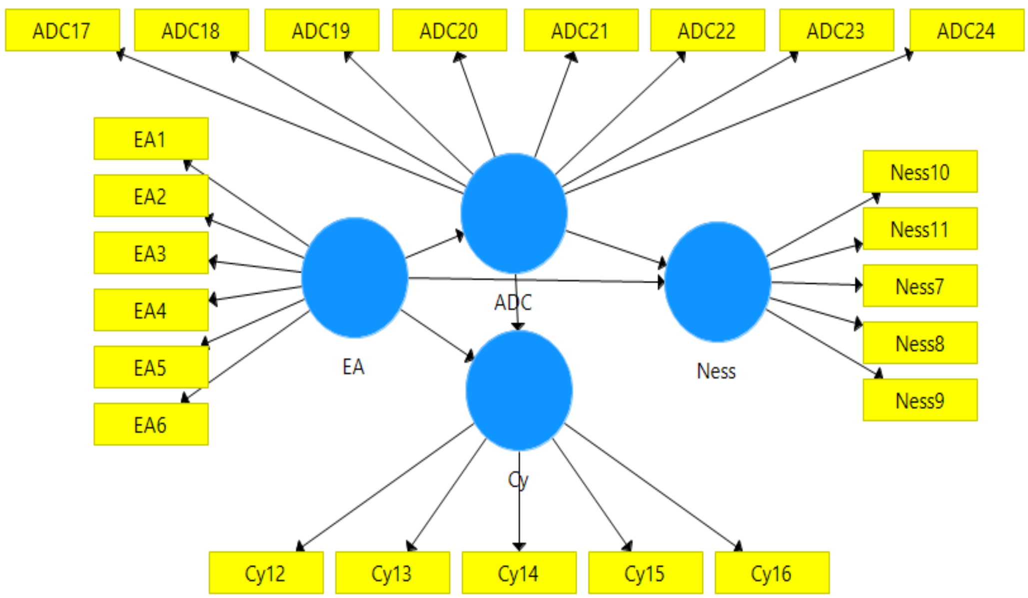

Figure 1 Conceptual framework by own

Note: Auditor's Digital Competence (ADC), Efficiency (Cy), Electronic Auditing Tool Utilization (EA), and Effectiveness (Ness).

2.1 Research Hypotheses

Based on the preceding literature, the following hypotheses are proposed:

H1: Electronic Auditing Tool Utilization (EA) has a significant positive impact on an Auditor's Digital Competence (ADC).

H2: An Auditor's Digital Competence (ADC) has a significant positive impact on Audit Performance (Ness) &(Cy).

H3: Auditor's Digital Competence (ADC) mediates the relationship between Electronic Auditing Tool Utilization (EA) and Audit Performance (Ness) &(Cy).

3 Methodology

The survey questionnaire based on 5 - point Likert scale (1= strongly disagree to 5 strongly agree) was initially developed in English, translated into Arabic, and verified through back translation for accuracy. Out of 163 recovered external auditors' responses, 150 were deemed usable, yielding a valid response rate of 92%

Independent variable:

Electronic Auditing Tool Utilization—comprises six key components widely recognized in audit technology literature. These include spreadsheet software, which has long been foundational in audit tasks (Panko, 1998), and electronic workpaper platforms that streamline documentation and collaboration (Bierstaker et al., 2013). Generalized Audit Software (GAS) supports large-scale data analysis (Braun & Davis, 2003), while data visualization tools enhance auditors' ability to interpret and communicate findings (Dilla & Raschke, 2015). Robotic Process Automation (RPA) automates repetitive audit procedures (Moffitt et al., 2018), and integrated audit platforms facilitate real-time, end-to-end audit management (Dowling & Leech, 2012). Together, these tools represent the evolving technological landscape shaping modern auditing practices (Table 1, Panel A).

Dependent Variables:

Audit Effectiveness was measured through indicators reflecting enhanced risk assessment (Dowling & Leech, 2014), the application of professional skepticism (Hurtt, 2010), and improved fraud/misstatement detection (Brazel et al., 2009) (see Table 1, Panel B); and *Audit Efficiency* was measured based on meeting time budgets (McDaniel, 1990), time savings on routine procedures (Mahzan & Lymer, 2014), and timely audit completion (Curtis et al., 2009) (see Table 1, Panel C).

Mediator variable:

Auditor's Digital Competence (ADC) functioned as a mediating construct between digital tool utilization and audit performance outcomes. The individual items and dimensions used are outlined in Table 1, Panel D, (ADC) was measured in other studies using an 8-item scale adapted from Janvrin et al. (2008) and Dowling and Leech (2014). The scale captures three core dimensions: (1) foundational IT knowledge, (2) proficiency in using electronic auditing tools, and (3) data interpretation skills—considered critical for digital audit readiness. Participants in this study rated their competencies using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) consistent with prior research (Curtis et al., 2009; Janvrin et al., 2008; Yoon et al., 2015; Dowling & Leech, 2014; Alles & Gray, 2016; Mahzan & Lymer, 2014); The individual items used are outlined in (Table 1, Panel D).

Table 1: Questions of indicator variables

Panel A: Electronic Auditing Tool Utilization (EA)

#	Statement	**References**
1	Spreadsheet Software	Panko, R. R. (1998)
2	Electronic Workpaper Platforms	Bierstaker, Janvrin, and Lowe (2013)
3	Generalized Audit Software (GAS)	Braun and Davis (2003),
4	Data Visualization Tools	Dilla and Raschke (2015)
5	Robotic Process Automation (RPA)	Moffitt, Rozario, and Vasarhelyi (2018)
6	Integrated Audit Platforms	Dowling and Leech (2012)

Panel B: Audit Effectiveness (Ness)

7	Electronic tool enhances the quality of risk assessments.	Dowling & Leech (2014)
8	They improve auditors' ability to apply professional skepticism.	Hurtt (2010); Brazel et al. (2016)
9	Tools help identify material misstatements or fraud risks.	Brazel, Jackson, & Schaefer (2016)

10	Use of tools increases thoroughness and quality of audit evidence.	Janvrin, Bierstaker, & Lowe (2008)
11	Overall audit quality is higher when electronic tools used.	Knechel et al. (2013) (conceptual); Mahzan & Lymer (2014)

Panel C: Audit Efficiency (Cy)

12	Tools support timely task completion within budget constraints.	McDaniel (1990)
13	Tools support timely task completion within budget constraints.	Mahzan & Lymer (2014)
14	Evidence gathering becomes faster and more effective.	Janvrin, Bierstaker, & Lowe (2008)
15	Enable more timely audit engagements.	Curtis, Jenkins, & Bedard (2009)
16	Increase auditors' personal productivity during the audit process.	Compeau, Higgins, & Huff (1999)

Panel D: Auditor's Digital Competence (ADC)

17	Understanding of clients' IT systems and ITGCs is essential.	Curtis, Jenkins, & Bedard (2009)
18	Skilled use of general-purpose software like Excel for complex audit tasks.	Mahzan & Lymer (2014)
19	Ability to use data visualization tools (e.g., Tableau, Power BI).	Yoon, Hoogduin, & Zhang (2015)
20	Proficiency in using CAATs (e.g., IDEA, ACL) for audit analysis.	Janvrin, Bierstaker, & Lowe (2008)
21	Can independently design and execute data analytics tests.	Dowling & Leech (2014)
22	Confident in learning and adopting new digital tools and software.	Compeau & Higgins (1995); Mahzan & Lymer (2014)
23	Able to convert data analytics results into valid audit evidence.	Alles & Gray (2016)
24	Capable of detecting patterns, anomalies, or misstatements via audit software outputs.	Yoon, Hoogduin, & Zhang (2015)

4 Data Analysis:

We ensured our questionnaire was theoretically sound and practically relevant by having it reviewed by experts. We then statistically proved that our measurement tool was consistent and dependable by running a Cronbach's alpha test (Sekaran, 2016), which showed our results met accepted academic standards (Table 2). Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) via Smart PLS 4. The PLS-SEM approach was chosen due to its suitability for exploratory models, small to medium sample sizes, and its capacity to test mediation effects and complex relationships. The analysis followed a two-step approach: (1) assessment of the measurement model for reliability and validity (including outer loadings, Cronbach's alpha, Composite Reliability, and Average Variance Extracted), and (2) evaluation of the structural model to examine path coefficients, R^2 values, and the significance of relationships. Multicollinearity was checked through Variance Inflation Factor (VIF) values to confirm the robustness of the structural relationships (Table 3). This methodology enables a rigorous evaluation of how digital competence mediates the relationship between the use of electronic tools and perceived audit performance outcomes, contributing to both theoretical development and practical implications for audit firms embracing digital transformation.

4.1 Measurement of model results

To assess the correlations between latent variables and their reflective indicators, outer loadings were analyzed. Indicators with loadings above 0.7 were retained, those between 0.4 and 0.7 were considered for removal only if their exclusion improved composite reliability or AVE, and those below 0.4 were removed, in line with Hair et al. (2013). Based on Hair et al. (2013), items with outer loadings below 0.40 should generally be removed, as they contribute minimally to their constructs and may weaken reliability and validity. Accordingly, three items—Efficiency (Cy12) = 0.300, Efficiency (Cy16) = 0.115, and Effectiveness (Ness7) = 0.034—were removed from the scale (Table 3). As a result, 21 out of 24 items were retained for further analysis. Subsequent evaluation confirmed the reliability and validity of the remaining constructs. Variance Inflation Factor (VIF) with values exceeding 10 indicating serious issues that may distort regression estimates (Hair et al., 2010). In the current study all VIF values were below the accepted threshold, suggesting multicollinearity is not a concern (Table 3).

Table 3 items and Cross loadings

Items	ADC	Cy	EA	NESS	VIF
ADC17	**0.880**				3.642
ADC18	**0.864**				3.062
ADC19	**0.859**				3.007
ADC20	**0.843**				2.893
ADC21	**0.887**				3.685
ADC22	**0.872**				3.644
ADC23	**0.833**				2.657
ADC24	**0.886**				4.231
Cy13		**0.904**			2.667
Cy14		**0.893**			2.581
Cy15		**0.896**			2.515
EA1			**0.832**		2.529
EA2			**0.882**		3.364
EA3			**0.850**		2.615
EA4			**0.863**		2.790
EA5			**0.850**		2.704
EA6			**0.827**		2.330
Ness10				**0.851**	2.194
Ness11				**0.841**	2.075
Ness8				**0.860**	2.263
Ness9				**0.879**	2.500

Note: Auditor's Digital Competence (ADC), Efficiency (Cy), Electronic Auditing Tool Utilization (EA), and Effectiveness (Ness).

Another way to assess convergent validity is through composite reliability (Fornell & Larcker, 1981). All constructs demonstrated acceptable to high composite reliability, exceeding the 0.70 threshold recommended by Hair et al. (2013. These results support the AVE values and confirm the convergent validity of the constructs used in this study. Table 4 presents the internal consistency (Cronbach's Alpha and rho_A), composite reliability, and average variance extracted (AVE) for each construct. All constructs meet the minimum thresholds for composite reliability (> 0.70) and AVE (> 0.50), confirming acceptable convergent validity and reliability, with ADC and EA showing particularly strong values, (Hair et al., 2013). ADC and EA demonstrated strong reliability and validity, while NESS and Cy met the minimum acceptable standards, with Cy showing relatively lower but still valid AVE.

Table 4 Reliability and Validity Estimates of the Constructs

Construct	Cronbach's Alpha	Composite Reliability	rho_A	Average Variance Extracted (AVE)
ADC	0.952	0.960	0.954	0.749
Cy	0.734	0.796	0.886	0.504
EA	0.924	0.940	0.925	0.724
NESS	0.753	0.849	0.881	0.589

Table 5 demonstrates that all constructs satisfied the Fornell-Larcker criterion for discriminant validity, with each construct's square root of AVE (diagonal values) exceeding its correlations with other constructs (off-diagonal values), though the high correlation between ADC and Cy (0.958) and between EA and NESS (0.988) suggests potential overlap that may warrant further examination.

Table 5 Inter-Construct Correlation Matrix

	ADC	Cy	EA	NESS
ADC	0.866			
Cy	0.958	0.710		
EA	-0.165	-0.148	0.851	
NESS	-0.154	-0.137	0.988	0.767

In summary, the first round of PLS (outer model) analysis confirmed the reliability, convergent validity, and discriminant validity of most constructs and their corresponding measurement items. However, three items—Efficiency (Cy12) = 0.300, Efficiency (Cy16) = 0.115, and Effectiveness (Ness7) = 0.034—were removed from the scale due to low outer loadings. The evaluation of the inner (structural) model is presented in the following section

4.2 Hypotheses Testing Results

The structural model was evaluated by examining path coefficients, their significance, Key metrics analyzed included standard errors, t-statistics, R^2 values, and confidence intervals (Chin et al., 1998). The R^2 indicates the variance explained and model fit, with values above 0.10 considered acceptable (Hair et al., 2013).

Table 6 Hypotheses results

Model Paths & hypotheses		Original Sample	(STDEV)	T Statistics (|O/STDEV|)	P Values	Description
Direct effect:						
H1	EA -> ADC	-0.165	0.074	2.225	0.026	Supported
H2a	ADC -> Cy	0.959	0.009	110.681	0.000	Supported
H2b	ADC -> NESS	0.009	0.014	0.625	0.532	Not supported
Indirect effect:						
H3a	EA -> ADC -> Cy	-0.158	0.071	2.228	0.026	Supported
H3b	EA -> ADC -> NESS	-0.001	0.003	0.482	0.630	Not supported

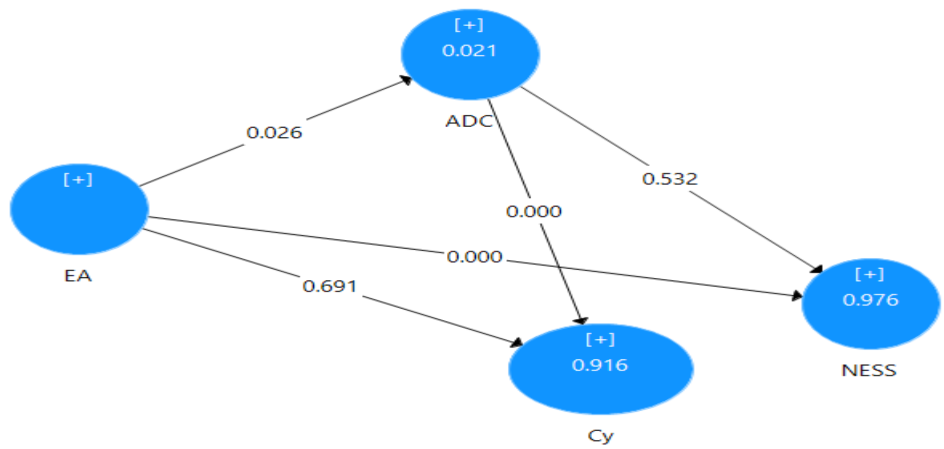

Figure 2 tested research hypotheses by own

Note: Auditor's Digital Competence (ADC), Efficiency (Cy), Electronic Auditing Tool Utilization (EA), and Effectiveness (Ness).

The structural model analysis yielded partial support for the proposed hypotheses. Hypothesis H1 was supported, indicating a statistically significant relationship between electronic auditing tool utilization (EA) and auditors' digital competence (ADC), with a path coefficient of $\beta = -0.165$ ($p = 0.026$). Regarding Hypothesis H2, the influence of ADC on audit performance was mixed. A significant positive effect was observed on audit efficiency (H2a: $\beta = 0.959$, $p < 0.001$), whereas the effect on audit effectiveness (H2b: $\beta = 0.009$, $p = 0.532$) was not statistically significant. As for the mediating effects proposed in H3, ADC was found to significantly mediate the relationship between EA and audit efficiency (H3a: $\beta = -0.158$, $p = 0.026$), while no significant mediation was observed in the relationship between EA and audit effectiveness (H3b: $\beta = -0.001$, $p = 0.630$). The coefficient of determination (R^2) values indicated that the model accounted for 92.0% of the variance in audit efficiency, 97.8% in audit effectiveness, and 2.7% in auditors' digital competence. These findings underscore the pivotal role of digital competence in enhancing audit efficiency, while suggesting that additional factors may be required to explain variations in audit effectiveness.

4.3 Discussion, Practical Implications, Limitations and Future research and future research

The results of this study provide important insights into the relationships between electronic auditing tool utilization, auditors' digital competence, and audit performance. The significant relationship between EA and auditors' digital competence (H1) aligns with previous literature suggesting that the use of advanced digital tools requires and enhances auditors' technological capabilities. Interestingly, the negative coefficient indicates a potentially inverse or complex dynamic that may reflect challenges auditors face in adapting to new technologies, such as inadequate training or resistance to change, which warrants further investigation.

The finding that digital competence significantly improves audit efficiency (H2a) supports the notion that auditors with higher digital proficiency can better leverage technology to streamline audit processes, reduce manual efforts, and increase accuracy. This is consistent with prior research emphasizing the operational benefits of digital transformation in auditing. However, the absence of a significant relationship between digital competence and audit effectiveness (H2b) suggests that effectiveness—defined as the quality or impact of audit outcomes—may depend more on professional judgment, regulatory compliance, and firm-specific policies than on digital skills alone. Moreover, the mediation analysis showed that digital competence significantly mediated the relationship between EA and audit efficiency (H3a), indicating that the benefits of electronic auditing tools are realized primarily through the enhancement of auditors' digital capabilities. In contrast, the lack of mediation effect on audit effectiveness (H3b) further underscores the possibility that effectiveness is shaped by broader organizational and contextual factors beyond technological competence. Overall, these findings reinforce the strategic importance of investing in digital training for auditors to maximize the efficiency benefits of electronic tools, while also pointing to the need for complementary measures—such as policy improvements, oversight mechanisms, and experience-sharing—to strengthen audit effectiveness. The findings of this study offer several practical implications for audit firms, regulatory bodies, and policymakers. First, the significant impact of electronic auditing tool utilization on auditors' digital competence highlights the need for continuous investment in technology adoption accompanied by structured training programs. Audit firms should prioritize the development of digital skills among their staff to ensure that technological tools are not only available but effectively utilized. The strong positive relationship between digital competence and audit efficiency suggests that enhancing auditors' digital capabilities can lead to more streamlined audit processes, reduced time and cost, and improved accuracy. Therefore, audit firms should integrate digital proficiency benchmarks into recruitment, performance evaluation, and professional development frameworks. However, the lack of a significant effect on audit effectiveness indicates that digital tools alone are insufficient to improve the qualitative aspects of audit performance. As such, audit organizations should complement digital training with initiatives aimed at strengthening professional judgment, ethical standards, and regulatory knowledge. Additionally, given the limited explanatory power of EA on digital competence ($R^2 = 0.027$), firms should explore broader strategies—such as leadership support, organizational culture, and incentive systems—to foster a more holistic digital transformation. For professional and regulators bodies, the results underline the importance of updating auditing standards and continuous education requirements to include competencies related to emerging technologies. Ensuring that auditors remain capable of adapting to technological change is vital for maintaining audit quality in a rapidly evolving environment. While it provides valuable insights into the impact of electronic auditing tools and digital competence on audit performance, several limitations should be acknowledged. First, the study relied on cross-sectional data collected through a survey, which limits the ability to infer causal relationships between the variables. Longitudinal studies would provide a deeper understanding of how these relationships evolve over time. Secondly, the generalizability of the findings may be limited by the sample size and geographical context. The respondents were drawn from a specific professional and regional background, which may not fully represent the diversity of auditing practices across different countries or regulatory environments. Future research could benefit from a larger, more diverse sample to enhance external validity. Thirdly, the study focused on self-reported measures, which may be subject to common method bias and social desirability effects. Although the model demonstrated good reliability and validity, incorporating objective performance indicators or triangulating with qualitative data (e.g., interviews or case studies) could strengthen the robustness of the findings. Furthermore, while digital competence was treated as a mediator, other potentially influential factors—such as firm size, audit complexity, or technological infrastructure—were not included in the model. Exploring such variables could offer a more comprehensive understanding of the mechanisms influencing audit performance. Future research could explore time-based studies to assess how digital competence develops with continued tool use and examine organizational factors influencing audit performance.

5 References

1. Alles, M., & Gray, G. L. (2016). Incorporating big data in audits: Identifying inhibitors and a research agenda to address those inhibitors. *International Journal of Accounting Information Systems*, *22*, 44–59**. https://doi.org/10.1016/j.accinf.2016.07.004**
2. Althuneibat, Ali, 2003, The Effectiveness of Using Information Technology in the Audit Process in Jordan, Administrative Science Studies, Volume 30, Issue 2, pp. 253-268.
3. Bader, A., & Khoshnaw, N. S. S. (2023). IT Tools Applications in Audit Profession: The CPA's perspective. *International Journal of Professional Business Review*, *8*(8), e03334. https://doi.org/10.26668/businessreview/2023.v8i8.3334
4. Bedard, J. C., & Biggs, S. F. (1991). Pattern Recognition, Hypotheses Generation, and Auditor Performance in an Analytical Task on JSTOR. *The Accounting Review*, 622. **https://doi.org/247813**
5. Braun, R. L., & Davis, H. E. (2003). Computer-assisted audit tools and techniques: analysis and perspectives. *Managerial Auditing Journal*, *18*(9), 725–731. https://doi.org/10.1108/02686900310500488
6. Bierstaker, J., Janvrin, D., & Lowe, D. J. (2013). 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
7. Brazel, J. F., Jackson, S. B., & Schaefer, T. J. (2009). The effect of the use of a data-mining tool on auditors' fraud risk judgments. *Journal of Information Systems*, 23(2), 21-39.

8. Brazel, J. F., Jackson, S. B., Schaefer, T. J., & Stewart, B. W. (2016). The outcome effect and professional skepticism. *The Accounting Review*, *91*(6), 1577–1599**. https://doi.org/10.2308/accr-51448**
9. Charles, Grand, 2001, Information Technology in Auditing, IIA, New IT Auditor, www. It. audit.
10. Compeau, D. R., & Higgins, C. A. (1995). Computer Self-Efficacy: development of a measure and initial test. *MIS Quarterly*, *19*(2), 189. https://doi.org/10.2307/249688
11. Compeau, D., Higgins, C. A., & Huff, S. (1999). Social Cognitive Theory and Individual Reactions to Computing Technology: a Longitudinal study. *MIS Quarterly*, *23*(2), 145. https://doi.org/10.2307/249749
12. 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, 104–121.
13. Curtis, M. B., Jenkins, J. G., Bedard, J. C., & Deis, D. R. (2009). Auditors' training and proficiency in Information Systems: A research synthesis. *Journal of Information Systems*, *23*(1), 79–96. **https://doi.org/10.2308/jis.2009.23.1.79**
14. DataSnipper. (2024, November 22). Audit automation unpacked: Types, benefits, and challenges**.** https://www.datasnipper.com/resources/audit-automation-types-benefits-and-challenges
15. DeFond, M., & Zhang, J. (2014). A review of archival auditing research. *Journal of Accounting and Economics*, *58*(2–3), 275–326**. https://doi.org/10.1016/j.jacceco.2014.09.002**
16. Dilla, W. N., & Raschke, R. L. (2015). Data visualization for fraud detection: Practice implications and a call for future research. *International Journal of Accounting Information Systems*, *16*, 1–22. https://doi.org/10.1016/j.accinf.2015.01.001
17. Dowling, C., & Leech, S. A. (2012). A Big 4 Firm's Use of Information Technology to Control the Audit Process: How an Audit Support System is Changing Auditor Behavior. *Contemporary Accounting Research*, *31*(1), 230–252. https://doi.org/10.1111/1911-3846.12010
18. Dowling, C., & Leech, S. A. (2014). A Big 4 firm's use of a GSS to support audit planning and risk assessment. *Accounting, Organizations and Society*, 39(1), 72-89.
19. Duncombe, R., and R. Heeks. 1999. Information, ICTs, and Small Enterprise: Findings from Botswana. (Online), htt://idpm.manac.uk/idpm/diwpf7.htm.
20. eCampusOntario. (2024). *Annual report 2023–2024*. https://ecampusontario.ca/wp-content/uploads/2024/09/eCO-AR-23-24-Final-ENG-tagged.pdf
21. El-Sheikh, Sharif Mohamed Abdelhamid, 1998, Audit Procedures in the Context of Electronic Operation of Accounting Information, Master's Thesis, Faculty of Commerce, Tanta University.
22. Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis (Seventh Edition)*. http://digilib.ubl.ac.id/index.php?p=show_detail&id=15963
23. Hamdoun, Talal, and Hamdan, Alam, 2007, Electronic Auditing and Its Impact on Evidence Quality: A Field Study of Major Audit Firms in Palestine, Jordanian Journal of Applied Sciences, Volume 10, Issue 2: 179-191.
24. Hurtt, R. K. (2010). Development of a scale to measure professional skepticism. *Auditing a Journal of Practice & Theory*, *29*(1), 149–171**. https://doi.org/10.2308/aud.2010.29.1.149**
25. International Federation of Accountants Guide, 2005, International Standards on Auditing, Translated by the Arab Society of Certified Accountants, Amman.
26. International Auditing and Assurance Standards Board. (2003). *International Standard on Auditing 401: Auditing in a computer information systems environment* [ISA] 401]. https://www.icjce.es/images/pdfs/TECNICA/C01%20-%20IFAC/C.01.021%20-%20IAASB%20-%20ISAs%20100-999/(Retirada)%20ISA_401_Auditing_CIS_environment.pdf
27. Janvrin, D. J., Bierstaker, J. L., & Lowe, D. J. (2008). An examination of audit information technology use and perceived importance. *Accounting Horizons*, 22(1), 1-21.
28. Jones, D.R., Brown, D. and Wheeler, P. (2001), "The effect of justification type on agreement with a decision aid and judgment performance", *Advances in Accounting Behavioral Research* (*Advances in Accounting Behavioral Research, Vol. 4*), Emerald Group Publishing Limited, Leeds, pp. 187-206. https://doi.org/10.1016/S1474-7979(01)04073-X
29. Jordan. (2003). *Law No. 73 of 2003 on the Regulation of the Legal Profession of Accounting*. Official Gazette of Jordan.
30. Knechel, W. R. (2006). The business risk audit: Origins, obstacles and opportunities. *Accounting Organizations and Society*, *32*(4–5), 383–408. https://doi.org/10.1016/j.aos.2006.09.005

31. Knechel, Warren Robert and Krishnan, Gopal and Pevzner, Mikhail and Bhaskar, Lori Shefchik and Velury, Uma, 2013, Audit Quality: Insights from the Academic Literature .Auditing: A Journal of Practice & Theory, 32(1), February 2013, Available at SSRN: https://ssrn.com/abstract=2040754 or http://dx.doi.org/10.2139/ssrn.2040754
32. Kotb, A., & Roberts, C. (2011). The impact of e-business on the audit process: An investigation of the factors leading to change. International Journal of Auditing, 15, 150–175
33. Kristian, Michelle. (2020). The Impact of the Use of Computer-Assisted Audit Technique, Professional Ethics, and Motivation on Auditors' Performance. 10.2991/aebmr.k.200626.033
34. Jordanian Association of Certified Public Accountants, Law on the Regulation of the Accounting Profession No. 73 of 2003, Articles 22, 45, Amman - Jordan.
35. Lenning Jeff, 2005, "Automate Excel Functions", Journal of Accountancy, Online Issues, January, P.1. , http://www. aicpa.org/pubs/jofa/jan2005/lenning.htm
36. Lombardi, D. R., Kim, M., Sipior, J. C., & Vasarhelyi, M. A. (2025). The increased role of advanced technology and automation in audit: A delphi study. *International Journal of Accounting Information Systems*, *56*, 100733. https://doi.org/10.1016/j.accinf.2025.100733
37. Mahzan, N., & Lymer, A. (2014). Examining the adoption of computer-assisted audit tools and techniques (CAATTs) in internal auditing. *Managerial Auditing Journal*, 29(4), 327-349.
38. Manson, S., S. McCartney, and M. Sherer. 1997a.Audit Automation: The Use of Information Technology in the Planning, Controlling, and Recording of Audit Work, Edinburgh: Institute of Chartered Accountants of Scotland
39. Manson, S., S. McCartney, and M. Sherer and W. Wallace.1997b. Audit Automation in the UK and the USA: A Comparative Study, Working Paper Series, Department of Accounting and Financial Management, University of Essex, UK.
40. McDaniel, L. S. (1990). The effects of time pressure and audit program structure on audit performance. *Journal of Accounting Research*, *28*(2), 267. https://doi.org/10.2307/2491150
41. Moffitt, K. C., Rozario, A. M., & Vasarhelyi, M. A. (2018). Robotic process automation for auditing. *Journal of Emerging Technologies in Accounting*, *15*(1), 1–10. https://doi.org/10.2308/jeta-10589

42. Oliphant, Alan, 2005, How to Become an IT Auditor, IIA, Volume 8, March, www.itaudit.org.
43. Panko, R. R. (1998). What we know about spreadsheet errors. *Journal of Organizational and End User Computing*, *10*(2), 15–21. https://doi.org/10.4018/joeuc.1998040102
44. Razi, M. A., & Madani, H. H. (2013). An analysis of attributes that impact adoption of audit software: An empirical study in Saudi Arabia. International Journal of Accounting and Information Management, 21(2), 170–188. https://doi.org/10.1108/18347641311312320
45. Rose, A. M., J. M. Rose, K. A. Sanderson, and J. C. Thibodeau. 2017. When should audit firms introduce analyses of big data into the audit process? *Journal of Information Systems* 31 (3): 81–99.
46. Sekaran, UMA, 2016, Research Methods for Managers: A skill –Building Approach, New York: John Wiley & Sons: 225.
~~47.~~
48. Whittington, Ray, 2002, New Audit Documentation Requirement, SAS 96 Raise the bar for audit documentation, Adding Specific Requirement in Several Areas, Journal of Accountancy, April: 66.
49. Yoon, K., Hoogduin, L., & Zhang, L. (2015). Big data as complementary audit evidence. *Accounting Horizons*, *29* (2), 431–438. **https://doi.org/10.2308/acch-51076**
50. Zhang, C., Thomas, C., & Vasarhelyi, M. A. (2021). Attended Process Automation in Audit: A Framework and a Demonstration. *Journal of Information Systems*, *36*(2), 101–124. https://doi.org/10.2308/isys-2020-073.