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The Evolution of Audit Procedures: From Manual Processes to Artificial Intelligence

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Abstract

This paper provides an examination of the evolution of audit procedures and techniques. It traces the progression from manual methods performed on columnar paper, including the use of handwritten tick marks on printed working papers, through the adoption of computer-assisted audit tools and techniques (CAATs), spreadsheet-based analytics, and enterprise resource planning (ERP) systems. The analysis extends to contemporary developments, focusing on the integration and use of Artificial Intelligence (AI) in audit processes. And the impact of these technologies on audit efficiency, coverage, quality, and the role of professional judgment exercised by auditors. As a final step the paper explores ethical, governance, and data protection considerations associated with the introduction of emerging technologies in auditing.

Keywords: audit procedures, CAATs, artificial intelligence, audit analytics, professional judgment, Responsible AI.

Introduction

Before the adoption of digital systems, much like the work performed by accountants at the time, the work of auditors was conducted almost entirely on paper. Auditors prepared columnar working papers, organized them in binders alongside physical evidence available, and used handwritten tick marks to indicate procedures performed and conclusions reached. Evidence was gathered manually from invoices, contracts, ledgers, bank statements, and other available supporting documents. These procedures were highly time-consuming, more susceptible to human error, and limited in scope due to their dependence on small, judgmental samples (Mesquita et al., 2024).

Mesquita et al. (2024) describe this phase clearly: “Tradicionalmente, as técnicas de auditoria baseavam-se em processos manuais, análise de amostras e controle físico de documentos” [Traditionally, auditing techniques relied on manual processes, sample analysis, and physical control of documents; *author’s translation*] (Mesquita et al., 2024, p. 5).

Despite their limitations, manual audits reinforced a deep understanding of underlying documentation. Auditors reconstructed audit trails manually and used judgment-based sample selection to identify relevant transactions. These approaches shaped the foundations of evidence evaluation and professional skepticism. Historical perspectives also help contextualize the profession's early development. Cossa (2010) explains that the term "auditor" originates from the Latin audire, which means "to hear," reflecting a practice where auditors listened to explanations about accounts in environments with limited documentation. This phase represents the baseline from which later technological improvements, coverage, automation, and standardization would be evaluated.

Digital and Analytics Auditing

The modification from manual auditing to digital auditing began during the extensive adoption of computerized information systems in the 1990s and early 2000s. As financial data moved into ERP systems, auditors needed new ways to evaluate digital records, assess system integrity, and validate electronic audit trails.

Cossa (2010) presents one of the earliest descriptions of a system-based audit methodology grounded in COBIT. In a case study applied to the Mozambique Inspectorate General of Finance, he highlights how reviewing automated controls, inspecting electronic logs, and testing the integrity of system-generated information became central to modern audit procedures.

When discussing the foundations of IT governance within early audit methodologies, Cossa (2010) describes the role of COBIT in shaping the evaluation of automated environments. As stated:

"O COBIT é um conjunto de directrizes baseadas em auditoria para processos, práticas e controlos de TI. Foi publicado em sua primeira edição em 1996 pela ISACA e IT Governance Institute. Está voltado para a redução de risco com enfoque na integridade, confiabilidade e segurança." [COBIT is a set of audit-based guidelines for IT processes, practices, and controls. It was first published in 1996 by ISACA and the IT Governance Institute. It is oriented toward risk reduction, focusing on integrity, reliability, and security; author's translation] (Cossa, 2010, p.

26).

In line with technological innovations and the implementation of ERPs, ComputerAssisted Audit Tools and Techniques (CAATs) operationalized these concepts. ACL (Audit Command Language) and IDEA (Interactive Data Extraction and Analysis) were among the first widely adopted tools, allowing auditors to extract, filter, and analyze large datasets directly from client systems. As stated: "Computer Assisted Audit Techniques and Tools (CAATTs) are a form of innovation in the field of technology in the world of accounting, CAATTs have become fundamental in many audit methodologies." (Nasrah et al., 2023, p. 630).

Will (1983) anticipated this transformation decades earlier:

"Within this decade, almost all accounting and many office procedures will be computerized. The design variety of accounting and management information systems (MIS) will be enormous. To

perform audit functions in this environment, interactive communication with computers will inevitably and increasingly be required. In the past, it was sufficient for auditors to be expert accountants. Today, it is also necessary for them to be proficient in the information systems technology used to design, implement, and operate accounting systems. Auditors can no longer rely solely on inspection of accounting records. They must read and interpret the records using machines. Thus, the interface between auditors and their clients (observation, conversation, and examination of records) is being replaced by a human-machine communication system. This new interface is strange to many auditors, but they will have to depend increasingly on it". (Will, 1983, p. 356)

At the same time, Microsoft Excel became a widely adopted tool for reconciliations, calculations, pivot tables, and macros. Mesquita et al. (2024) highlights that Excel enabled the automation of repetitive tasks and made documentation more transparent and auditable. The transition to CAATs brought new benefits, such as the possibility of expanding sampling, analysis, and extraction of digital documentation, more precise analytical procedures, but also new challenges. Adoption varied between different types of companies and individuals due to differences in training, familiarity, and organizational investment (Eulerich, 2022).

Over time, and as ERP environments became more complex, auditing evolved beyond basic CAATs to more advanced analytics. Tools like Power BI, Alteryx, and other visualization platforms emerged, allowing auditors to integrate more data sources, create automated workflows, and dynamically visualize anomalies (Mesquita et al., 2024; Shaikh et al., 2018).

Audit analytics expanded the scope from small samples to broad or entire population testing. As Shaikh et al. (2018) state, "Technology has completely modified the accounting cycle and the internal controls over financial reporting and thereby the auditing processes and methods that the auditor adopts to obtain audit evidence to acquire reasonable assurance and accomplish the overall objective in compliance with International Standards on Auditing."

Practical studies (Eulerich, 2022) show that automation and analytics improve the effectiveness of tasks such as recalculations, duplicate detection, and exception testing. However, these tools require clean and well-structured data, analytical skills, and an understanding of the underlying business processes. Audit teams with lower digital maturity often struggle to implement these technologies effectively. This phase established the necessary technical and cultural foundations for the emergence of AI in auditing.

Artificial Intelligence in Auditing

The most current and recent stage of technological evolution in auditing involves the adoption of AI tools that enable the analysis of structured and unstructured data, document classification, anomaly detection, and predictive modeling. "Several studies […] pointed out various upsides of AI implementation in accounting and auditing. These benefits include but are not limited to—efficiency and effectiveness, consistency, structure for audit tasks, improved decision making and communication, enhanced staff training, expertise development for novices, and shorter decision time." (as cited in Hasan et al., 2022, p. 9).

These capabilities deepen the analytical scope of audit work and support more targeted substantive procedures. Recent professional publications further reinforce these themes. One of the key statements on PwC's page is:

"AI agents are no longer experimental. They're beginning to fundamentally change how work gets done. These intelligent systems can interpret context, automate complex workflows, make recommendations and continuously learn and improve. They're informing and accelerating decisions, increasing precision and enabling new ways of working that blend human expertise with digital capabilities." (PwC, 2025a)

However, despite so many benefits, AI also introduces significant risks. Many models function as "black boxes," with limited explainability, challenging professional standards that require auditors to understand and document the basis for their conclusions. Recent cases in the media, such as that of the giant Deloitte, exemplify these risks concretely.

According to Krishani Dhanji (2025), Deloitte delivered a report that contained several

AI-generated inaccuracies, including fabricated references, flawed citations, and inconsistently modified information. These issues raised concerns among regulators about whether the firm had relied too heavily on AI tools that were not fully understood or properly validated.

Experts explain that generative models can "fill in gaps" or hallucinate content when data inputs are ambiguous, accenting the need for human oversight even in the face of intelligent automation. "AI […] is a tool that is only valuable if people know how to use it […]. Accountants and auditors cannot be replaced by artificial intelligence when it comes to exercising human creativity and judgment." (Hasan et al., 2022, p. 15).

As technology advances, ethical and regulatory concerns become increasingly important. Modern data privacy requirements impose strict expectations regarding the protection of sensitive information, including financial records, health data, and federally regulated personal identifiers. In this context, automated procedures and AI models must incorporate robust security controls, such as encryption, access restrictions, data-minimization practices, and clear governance mechanisms to ensure responsible use and prevent misuse of sensitive information.

PwC (2025b) presents the Responsible AI framework as an organizational approach designed to enable organizations to adopt artificial intelligence in a reliable and responsible manner by embedding governance, monitoring, and risk management practices throughout the AI lifecycle. Rather than focusing solely on technical development, the framework emphasizes trust, oversight, and responsible decision-making as essential conditions for moving AI initiatives from experimentation to enterprise-level adoption and long-term value creation. In this context, the firm highlights the importance of "balance speed and trust with transformation" when scaling AI solutions, positioning governance as an enabler of innovation rather than a constraint (PricewaterhouseCoopers, 2025b, para. 3).

Additionally, PwC (2025b) highlights that Responsible AI is not only a compliance matter but a strategic imperative. As stated in its privacy guidance, "Organizations should have holistic policies

that address data minimization, consent and user autonomy. They also should find ways to demonstrate that AI-driven decisions are explainable to key stakeholders, including customers.This transparency and accountability is crucial for maintaining user trust."

(PricewaterhouseCoopers, 2025c, para. 9). PwC also reinforces the importance of cybersecurity within Responsible AI, noting that "AI has democratized the threat landscape. Threat actors are leveraging AI tools to scale and automate their attacks, offering powerful capabilities on dark markets in exchange for fees." (PricewaterhouseCoopers, 2025d, para. 12). Taken together, these considerations demonstrate that the future of auditing will require not only advanced tools but also increasingly robust governance and ethical safeguards.

The reviewed literature demonstrates a clear and structured progression in the evolution of audit procedures, from manual processes to digital systems, advanced analytics, and, more recently, AI approaches. Each step introduced new tools and capabilities that expanded the scope of testing, increased efficiency, and enhanced the analytical depth of audit evidence, as well as optimizing field time. At the same time, these developments redefined expectations for auditors, demanding new technical and interpretive skills.

Manual auditing relied heavily on physical documentation, selective sampling, and direct professional judgment. As organizations migrated to the use of systems, the adoption of computerized environments and data extraction tools allowed auditors to extract and standardize documentation, automate calculations, and analyze larger datasets more systematically and quickly. The incorporation of these more advanced analytics expanded auditors' ability to detect patterns, automate workflows, and perform more comprehensive testing. The most recent stage includes the use of artificial intelligence to support predictive modeling and automated document review. This move also introduces new forms of risk assessment and governance challenges.

While these tools strengthen analytical capabilities, they also raise concerns about transparency, ethical standards and professional judgment, data protection, and the need for consistent and effective human oversight. These considerations highlight that technological progress in auditing is not only a matter of efficiency, but also of governance, ethics, and responsible use.

Overall, the literature suggests a coherent technological trajectory, but also reveals a gap:

few studies present these developments in an integrated and chronological way, including academic and professional perspectives. This study synthesizes the existing evidence and analyzes how these phases, together, influence the role of the auditor in a constantly evolving technological environment.

Research Purpose and Research Design

The objective of this study is to examine, in a chronological and practitioner-oriented manner, the evolution of audit procedures from manual, paper-based methods to digital analytics and Artificial Intelligence. This analysis connects three main technological trends: manual, digital and analytics, and AI auditing. It seeks to explore how each phase has reshaped audit procedures, evidence generation and analysis, and the evolving role of the auditor. Through a structured literature review

and exploratory contributions from professionals, the study evaluates both the benefits associated with technological expansion, such as efficiency gains and broader testing capabilities, and the emerging risks, including overreliance on technology, lack of transparency in automated decisions, data protection concerns, and potential impacts on professional judgment, independence, and ethical principles.

Research Questions

1. How have auditing procedures evolved from manual processes to analytical analysis and, more recently, AI?
2. What benefits and risks have emerged at each stage of technological evolution?
3. How do audit professionals perceive the current and future role of AI in auditing?
4. How can automation be balanced with human judgment?

Research Method

This project employs a qualitative and exploratory research design consisting of two components:

- Structured Literature Review: A systematic review of academic articles, papers, monographs, and professional publications related to: manual auditing practices, CAATs and early computerization, audit analytics and ERP systems, AI in auditing, and responsible AI and data protection frameworks. Sources were selected based on relevance to the chronological framework and their contributions to empirical, conceptual, or regulatory discussions.
- Exploratory Practitioner Evidence: A short structured questionnaire was distributed to current and former audit professionals to gather insights on: experience with audit technologies, perceived benefits and challenges, adoption of analytics and AI tools, and concerns regarding judgment, independence, and data privacy. The participation was voluntary and anonymous.

Data Collection Methods

The literature was collected using a structured search strategy on Google Scholar, institutional repositories, and publications from specialized companies. The inclusion criteria were established as follows:

- Relevance to at least one of the three target phases (manual > digital > AI). The presence of conceptual or empirical evidence, availability of the full text, and coverage of different auditing contexts were the established criteria that guided the structure and analytical approach of the literature review.

Questionnaire data was collected using Google Forms, with no personal identifiers required. The 50 respondents provided information considering:

- Years of auditing experience, audit type (external, internal, IT audit), use of Excel, CAATs, analytics, AI, perceived risks and benefits of technology, and views on AI and professional judgment.

The questionnaire includes multiple-choice and brief open-ended questions. The instrument was originally developed in Portuguese to facilitate participation from the select practitioners and was later translated into English for reporting and Appendix presentation.

Data Analysis

The literature was analyzed using a chronological and thematic framework aligned with the three technological phases. Findings will be synthesized narratively. Each source was reviewed for:

- tools and techniques described
- impacts on efficiency, documentation, and audit coverage
- implications for judgment, independence, ethics, and governance
- specific contributions to manual, digital, or AI auditing

The questionnaire responses will be analyzed using descriptive statistics (frequencies, percentages, and simple cross-tabulations such as experience level versus use of analytics tools). The analysis will later serve as a basis for comparing practitioner perceptions with insights identified in the literature. Open-ended responses will be examined using thematic coding to identify recurring themes, including:

- enthusiasm or skepticism toward automation
- concerns about data protection
- expectations about the future role of auditors

Data Analysis

Fifty audit practitioners participated in the questionnaire. Most respondents reported between 2 and 10 years of experience, and the majority had backgrounds in Big Four, mid-size, or internal audit environments, indicating familiarity with both traditional and technology supported audit procedures. When asked which technological phase had the greatest impact on the evolution of auditing, responses were distributed across the three stages. The most frequent response was that all phases are equally important, followed by analytics (Excel, CAATs, ERP/BI tools) and AI auditing (see Table 1 and Figures 1 and 2).

The most frequently cited benefits of technological adoption were efficiency and time savings, expanded test coverage, improved anomaly detection, reduced human error, and clearer documentation. These findings align with the shift toward broader and more automated evidence-gathering approaches described in the literature (see Table 2 and Figures 2).

The main challenges identified were data quality issues, lack of training, and the risk of overreliance on technology. Concerns related to data privacy and AI explainability also emerged, mirroring current debates surrounding responsible AI and governance in auditing (see Table 3 and Figures 3).

Regarding the impact of AI on judgment, most respondents stated that AI may influence decision-making but does not replace professional judgment. Overall, participants perceived technology's

impact on auditing as positive, while highlighting the need for continuous training, strong data governance, and maintaining human oversight (see Figure 4 and 5).

Conclusion

The results obtained through the questionnaire reinforce the chronological evolution mapped to the available literature. Respondents acknowledged the limitations of manual auditing, the efficiency gains brought about by automation through computer-assisted audit tools

(CAATs) and ERP's analyses, as well as the transformative potential of artificial intelligence

(AI) tools. In line with academic and professional publications, professionals observed that technology has broadened coverage, improved document analysis, and supported more accurate risk assessments. At the same time, the results highlight some persistent concerns regarding data quality, professional training, and ethical implications, notably the risk of excessive reliance on automated results and the need for transparency in AI-based procedures. These concerns reveal the governance issues identified in the Responsible AI frameworks of large audit firms.

In summary, perceptions suggest that the future of auditing will depend on a balanced integration between automation and human judgment, where technology helps enhance analytical work, while auditors remain responsible for interpretation, decision-making, and ethical considerations. This study examined the technological evolution of auditing procedures, from manual processes to advanced analytics and artificial intelligence. The literature and evidence from professionals together demonstrate a clear chronological progression, highlighting improvements such as greater efficiency, expanded coverage, enhanced documentation, and deeper analytical insights. However, technological advancements also introduce new risks related to adoption, training, governance, explainability, and AI hallucinations, as well as data protection.

The contribution of this project is a consolidated narrative, based on the perspective of professionals, on the evolution of auditing. The results helped clarify how automation can support, rather than replace, professional judgment and independence. Ultimately, the future of auditing will depend not only on the adoption of new tools but also on how professionals and organizations responsibly manage and apply them.

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Appendix A

Practitioner Questionnaire (English Translation)

Q1. How long have you worked (or did you work) in the audit field?

( ) Less than 2 years
( ) 2 to 5 years
( ) 6 to 10 years
( ) More than 10 years

Q2. What type of organization have you worked for (or do you currently work for)? (Select all that apply)

[ ] Big Four (PwC, EY, Deloitte, KPMG)
[ ] Mid-size firm
[ ] Small firm / local office
[ ] Corporate sector (internal audit)
[ ] Other: _____

Q3. In your experience, which phase had the greatest impact on the evolution of auditing?

( ) Manual processes (columnar paper, audit tick marks)
( ) Data analysis phase (Excel, IDEA, CAATs)
( ) AI implementation and automation
( ) All equally important

Q4. Which benefits stood out with the use of technology in auditing? (Select up to 2)

[ ] Increased efficiency and speed of testing
[ ] Reduction of human errors
[ ] Greater sample coverage
[ ] Improved quality and transparency of reports
[ ] Other: _____

Q5. Which challenges do you consider most relevant when using analytical tools and AI? (Select up to 2)

[ ] Implementation costs
[ ] Lack of training or technical knowledge
[ ] Excessive dependence on technology
[ ] Lack of regulatory acceptance

[ ] Risk of loss of professional judgment
Q6. In your opinion, can the use of AI compromise the auditor's judgment or independence?

( ) Yes, it can partially compromise
( ) Yes, significantly
( ) No, if there is adequate supervision
( ) No, AI only complements human work

Q7. Regarding LGPD (Brazil's data protection law) and data protection, what is your perception of the use of technology in auditing?

( ) Increases the risk of data breaches
( ) Requires more control and accountability from auditors
( ) Improves traceability and information security
( ) I do not see a major impact

Q8. Do you believe automation and AI will replace part of auditors' activities in the future?

( ) Yes, significantly
( ) Partially, especially in repetitive tasks
( ) No, human judgment will remain essential
( ) It is still too early to say

Q9. Overall, how do you assess the impact of technology on the auditing profession?

( ) Very positive
( ) Moderately positive
( ) Neutral
( ) Negative

Q10. In your opinion, what should be the focus of audit firms in the coming years?

( ) Invest more in technology and automation
( ) Train auditors to interpret AI-generated results
( ) Strengthen ethics and professional independence
( ) Increase data protection and data governance
( ) Other: _____

Table 1

Respondent Characteristics by Years of Experience and Organization Type

Type of organization	0 to 2 years	2 to 5 years	6 to 10 years	More than 10 years	Total
Big Four (PwC, EY, Deloitte, KPMG)	2	18	5	7	32
Corporate sector (internal audit)	1	1	1		3
Mid-size firm	6	9	3	5	23
Small firm / local office		3	1		4
Total	9	24	8	9	50

Note. Frequencies represent respondent counts.

Table 2

Perceived Benefits of Technology Adoption in Auditing

Benefits	Respondents	%
Increased efficiency and speed	46	92
Greater coverage	19	38
Improved quality and transparency	19	38
Reduced human error	18	36
Other	2	4
Total	**50**	**100**

Note. Respondents could select more than one option.

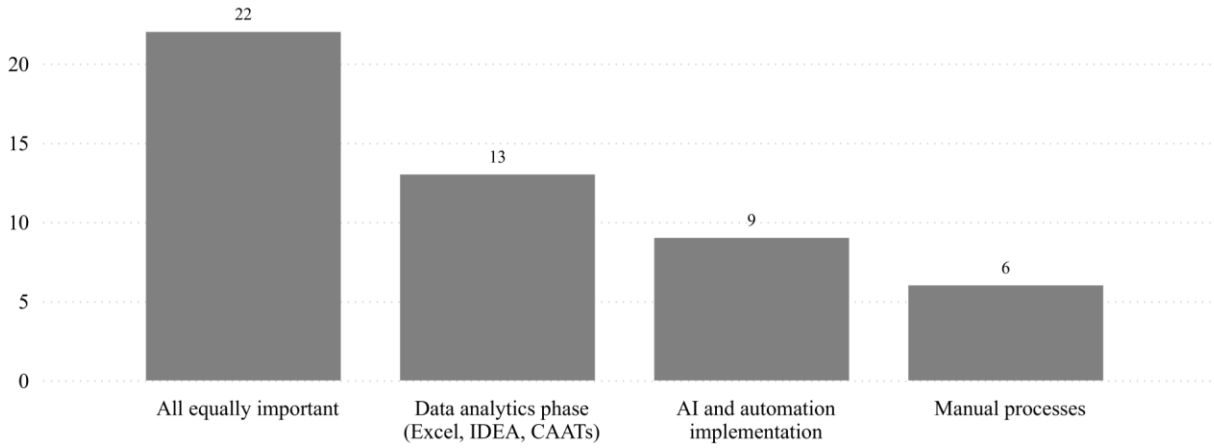
Table 3

Perceived Challenges of Technology Adoption in Auditing

Challenges	Respondents	%
Risk of loss of professional judgment	35	70
Lack of training / technical knowledge	31	62
Excessive dependence on technology	27	54
Implementation costs	7	14
Lack of regulatory acceptance	7	14
Total	**50**	**100**

Figure 1

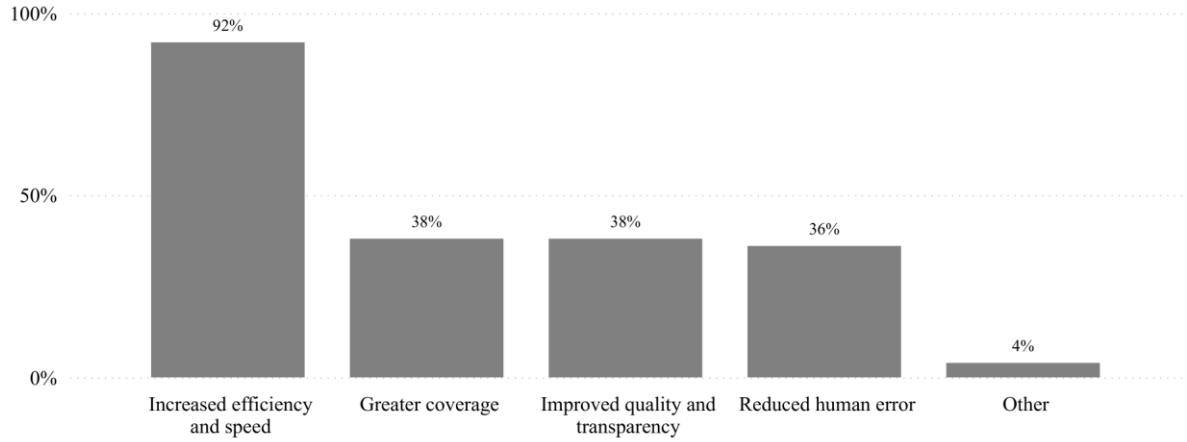
Technological Phase Perceived as Most Influential



Note. Frequencies reflect practitioner perceptions of phase impact.

Figure 2

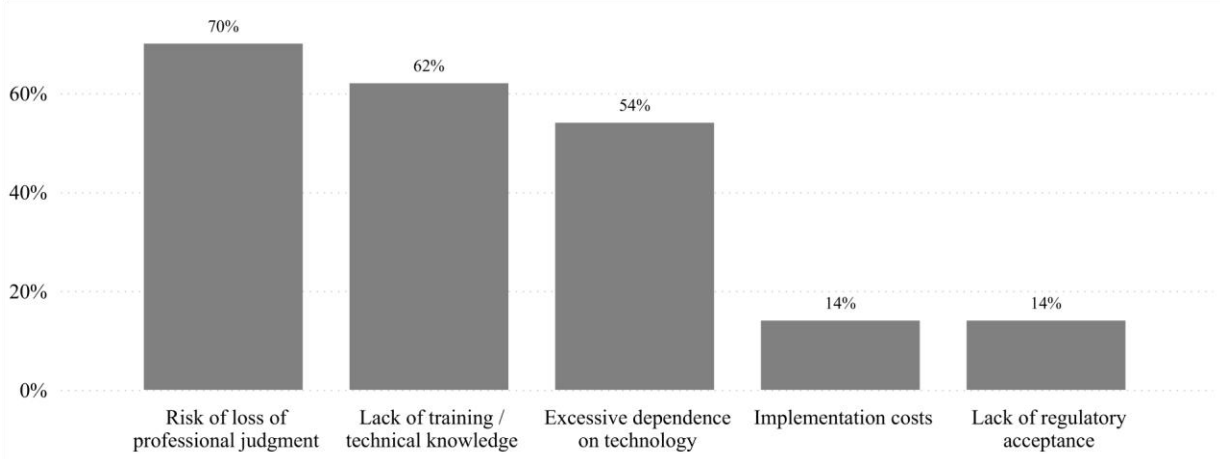
Reported Benefits of Technology in Auditing



Note. Multiple selections allowed..

Figure 3

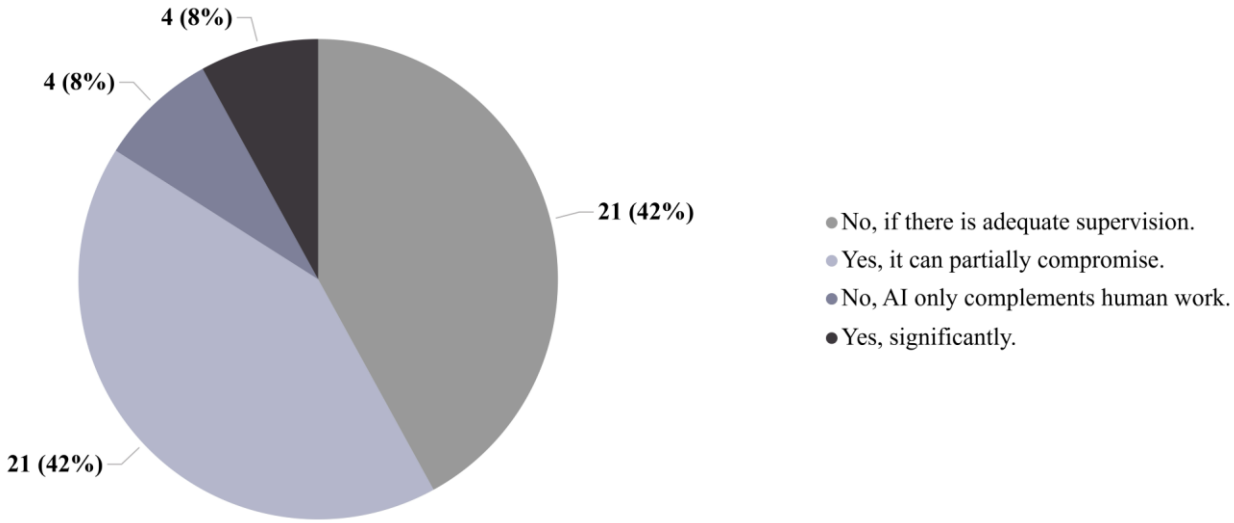
Reported Challenges Related to Technology and AI



Note. Multiple selections allowed.

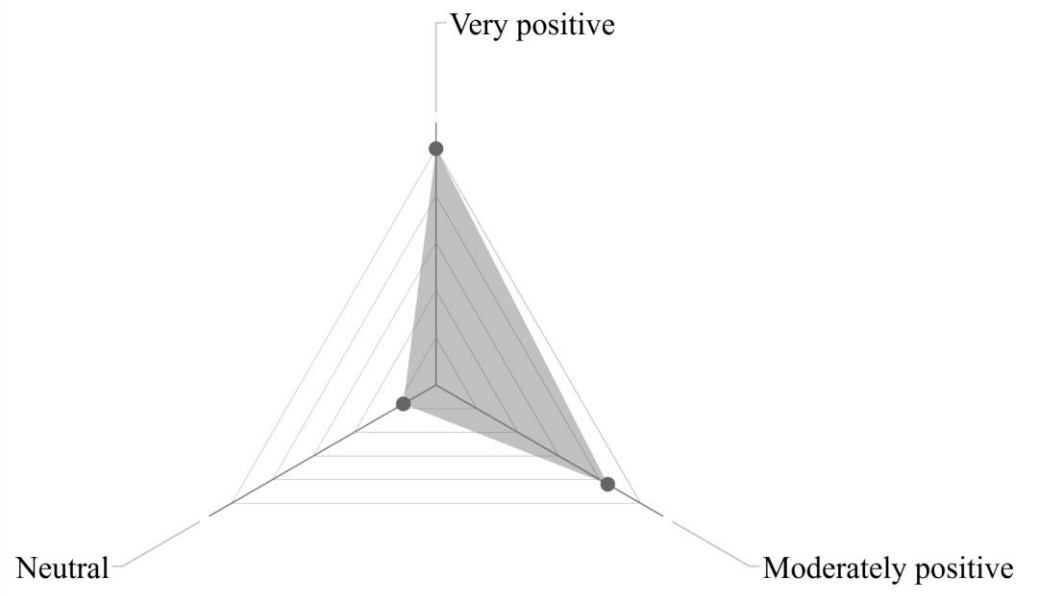
Figure 4

Perception of AI's Influence on Professional Judgment



Note. Categories summarize respondents' views on AI impact.

Overall Perception of Technology's Future Role in Auditing



Note. Higher frequencies indicate a more positive perception.