Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Determinants of Digital Audit Maturity: Survey Evidence and Practical ImplicationsTaubaev Nurlan, doctoral student

Nurlan Taubaev
M.Auezov South Kazakhstan Universiti
Satymbekova Katira
satymbekova.katira@mail.ru

M.Auezov South Kazakhstan Universiti
Edward Juchniewicz
Gdansk University Bażyńskiego
Kulpan Atenova
M.Auezov South Kazakhstan Universiti
Akhmetova Salima
M.Auezov South Kazakhstan Universiti

Research Article

Keywords: digital audit maturity, audit digitalization, audit analytics, AI in auditing, cybersecurity risk, remote auditing

Posted Date: May 19th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9587515/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

This research article examines the determinants of digital audit maturity in Kazakhstan in the context of the expanding use of automation, data analytics, artificial intelligence, and stricter requirements for audit evidence and documentation. The study is based on a survey of 142 auditors and applies the Technology–Organization–Environment (TOE) and Unified Theory of Acceptance and Use of Technology (UTAUT) frameworks to explain variation in firms' digital audit maturity. Quantitative data were analyzed using regression techniques, while qualitative responses were interpreted through thematic analysis to identify practical barriers and implementation challenges. The findings show that organizational and technological drivers, including management support, perceived usefulness of digital tools, staff readiness, and data capabilities, are positively associated with higher digital audit maturity. Barriers and perceived risks are also positively related to maturity, suggesting that more digitally advanced firms are more aware of cybersecurity threats, data reliability problems, and the limitations of remote auditing. At the same time, the results highlight persistent constraints, including infrastructure gaps, skills shortages, and implementation costs. The study contributes to the literature on audit digitalization in emerging markets and provides practical implications for audit firms, professional associations, and regulators seeking to support digital transformation in the profession.

Introduction

Audit is undergoing a technology-enabled transformation as firms deploy automated tools and techniques (ATT), audit data analytics and AI-enabled applications across planning, risk assessment, substantive testing and evidence evaluation. Standard setters acknowledge that technology can strengthen audit work, yet it also raises issues around how evidence is obtained, how exceptions are followed up and how procedures are documented when audit work is mediated by technology (International Auditing and Assurance Standards Board, 2016, 2020). Field evidence similarly suggests that AI adoption in auditing is progressing unevenly, with practical concerns centred on explainability, reliability, privacy and bias, reinforcing the need for robust controls and documentation (Kokina et al., 2025).

Regulators continue to report inspection deficiencies related to the reliability and testing of company-produced data and reports—concerns that become more consequential as auditors rely more heavily on technology-assisted analysis of electronic information (Public Company Accounting Oversight Board, 2024a). In response, the PCAOB adopted amendments intended to reduce the likelihood that auditors issue opinions without sufficient appropriate audit evidence when using technology-assisted analysis (Public Company Accounting Oversight Board, 2024b). In parallel, the UK Financial Reporting Council has issued guidance on documentation expectations when AI-enabled tools are used in audits, reflecting growing supervisory attention to governance, explainability and audit trail requirements (Financial Reporting Council, 2025). International regulators similarly frame technology use as a domain where opportunities for improved coverage and effectiveness coexist with risks relating to governance,

validation, over-reliance, cybersecurity and documentation sufficiency (International Forum of Independent Audit Regulators, 2023).

Despite this global momentum, the diffusion of digital audit practices remains uneven. Academic work indicates that adoption of advanced analytics is not simply a “tool rollout”, but a multi-stage organisational process shaped by capability development, incentives and environmental context (Krieger et al., 2021). More broadly, the evolution from continuous auditing concepts and early automation to the current landscape of analytics and ATT has expanded the scope of potential evidence sources, while also intensifying practical challenges related to data integrity, confidentiality and capability (Chan and Vasarhelyi, 2011; Alles, 2015; Zhang et al., 2015). Recent evidence also points to widening capability gaps between large and smaller audit firms and rising demand for IT- and data-capable auditors as digital technologies diffuse (Vitali and Giuliani, 2024). At the same time, technology-enabled auditing creates new assurance demands around data provenance and cybersecurity exposure, reinforcing the importance of validation and documentation routines (Fedyk et al., 2022; Kokina et al., 2025).

These dynamics are especially salient in emerging economies where infrastructure and skills constraints may shape the pace and depth of adoption. Kazakhstan is a relevant case because national policy has prioritised broad digital transformation through the state programme “Digital Kazakhstan”, aiming to modernise the economy and promote digital technologies (Government of the Republic of Kazakhstan, 2017). Yet, in assurance services, digitalisation depends not only on national direction but also on firm-level readiness, client data environments and the institutional ecosystem that frames audit quality and compliance expectations (International Auditing and Assurance Standards Board, 2020; International Forum of Independent Audit Regulators, 2023).

Two gaps motivate this study. First, much of the empirical literature on audit technology adoption focuses on mature markets, while systematic evidence from Central Asia and comparable emerging contexts remains scarce (International Forum of Independent Audit Regulators, 2023; Krieger et al., 2021). Second, many studies treat adoption as binary (use versus non-use), whereas professional and regulatory developments indicate the need for a digital maturity perspective—capturing not only whether tools are used, but how deeply they are embedded in methodology, skills development, governance and documentation discipline (International Auditing and Assurance Standards Board, 2020; Public Company Accounting Oversight Board, 2024a, 2024b; Financial Reporting Council, 2025). Consistent with recent work linking digital skills to audit digitisation outcomes and risk-related consequences, a maturity framing also foregrounds the human-capital and capability dimensions of audit digitalisation (Liang et al., 2025).

This paper examines determinants of digital audit maturity in Kazakhstan using survey evidence from audit practitioners and related professionals (n = 142). Guided by the Technology–Organization–Environment (TOE) view of innovation and technology diffusion (Tornatzky and Fleischer, 1990) and complementary acceptance logic (Venkatesh et al., 2003), we test how perceived drivers and barriers/risks relate to reported digitalisation levels, controlling for organisational characteristics and

respondent background. We complement closed-form measures with open-ended responses to capture context-specific constraints and priorities, consistent with the view that digital audit implementation depends on readiness conditions such as skills, infrastructure and organisational support (Ismail et al., 2024) and that adoption frequently progresses through stages rather than immediate transformation (Krieger et al., 2021).

The study contributes by (1) providing one of the first survey-based empirical assessments of digital audit maturity in Kazakhstan; (2) testing the roles of perceived drivers and perceived barriers/risks in an integrated determinants framework; and (3) deriving implications for firms and stakeholders in a context where national digitalisation priorities intersect with audit-specific evidence and documentation expectations (Government of the Republic of Kazakhstan, 2017; International Auditing and Assurance Standards Board, 2020; Public Company Accounting Oversight Board, 2024b; Financial Reporting Council, 2025).

2. Hypotheses

Drivers such as perceived benefits, client demand, competitive pressure and regulatory expectations should increase investment in tools, training and methodological integration, thereby increasing DAM (Tornatzky and Fleischer, 1990; Venkatesh et al., 2003).

Barriers and risks (e.g., cybersecurity exposure, data access restrictions, infrastructure limitations, costs and skills gaps) are commonly viewed as obstacles to adoption (Tornatzky and Fleischer, 1990). In auditing, however, deeper engagement with ATT and analytics may also increase the *visibility* of such risks: as organisations scale technology-enabled procedures, they accumulate experience that improves their ability to identify data reliability issues, cybersecurity vulnerabilities and limitations of remote evidence collection. This “learning-by-doing” mechanism implies that higher DAM may coincide with stronger perceived barriers/risks because mature organisations are better able to diagnose and articulate constraints relevant to evidence and documentation (Krieger et al., 2021; International Forum of Independent Audit Regulators, 2023; Public Company Accounting Oversight Board, 2024a).

Because organisational readiness and resources shape capability development, DAM should differ across organisation types and increase with organisational size (Tornatzky and Fleischer, 1990; Otia and Bracci, 2022; Ismail et al., 2024).

H1

Perceived drivers of digitalisation are positively associated with digital audit maturity.

H2 (risk-awareness)

Perceived barriers/risks are positively associated with digital audit maturity.

H3

Digital audit maturity differs across organisation types.

H4

Organisational size is positively associated with digital audit maturity.

Research paper

Satymbekova Katira, *(corresponding author)*, Department Accounting and Audit, Candidate of Economic Sciences, Associate Professor (Docent), M. Auezov South Kazakhstan University, Shymkent, Kazakhstan, satymbekova.katira@mail.ru, https://orcid.org/0000-0002-1437-5925

Edward Juchniewicz (Edvardas Juchnevicius), Professor at Gdansk University, Department of Financial Law, Faculty of Law and Administration, Gdansk University Bażyńskiego, Gdansk, Poland, e-mail: e.juchnevicius@prawo.ug.edu.pl, https://orcid.org/0000-0001-7390-4885, Web of Science::P-2341-2017

Atenova Kulpan, Senior lecturer of the Department of Accounting and Audit, M.Auezov South Kazakhstan University, Shymkent, Kazakhstan, kulpan.atenova@mail.ru, https://orcid.org/0000-0002-9850-5036

Akhmetova Salima, Senior lecturer of the Department of Accounting and Audit, M.Auezov South Kazakhstan Universiti, Shymkent, Kazakhstan, salima.ahmetova@inbox.ru, https://orcid.org/0000-0002-2211-2340

The authors report there are no competing interests to declare.

H1

Perceived drivers of digitalisation are positively associated with digital audit maturity.

H2 (risk-awareness)

Perceived barriers/risks are positively associated with digital audit maturity.

H3

Digital audit maturity differs across organisation types.

H4

Organisational size is positively associated with digital audit maturity.

Materials and Methods

Study setting

This study was conducted in the Republic of Kazakhstan. Although the questionnaire was distributed nationwide, the majority of responses were obtained from professionals located in Kyzylorda. This geographic concentration is acknowledged as a limitation of the study, and the findings should therefore be interpreted with caution in terms of national representativeness. Nevertheless, the sample provides meaningful evidence on the determinants of digital audit maturity in a regional audit market context and offers useful insights into digitalization processes within the broader professional environment of Kazakhstan.

Data collection and sample

Data were collected using an online questionnaire administered through Google Forms. The survey link was distributed through professional communication channels, including sector-specific chats and WhatsApp groups commonly used by audit and finance practitioners in Kazakhstan. Data were collected through an anonymous online survey administered via Google Forms between 10 and 25 December 2025.

The target population included external auditors, internal audit specialists, and financial practitioners, including accountants and tax consultants, who were directly involved in financial reporting and/or auditing activities. To ensure the professional relevance of the sample, two inclusion criteria were applied: first, respondents had to be permanently employed in Kazakhstan; second, they had to possess at least two years of experience in financial reporting and/or auditing.

After initial data cleaning, one test or empty response without a valid timestamp was removed. The final analytical sample consisted of **142 observations**, which were considered suitable for statistical analysis.

Although the survey was disseminated nationally, most respondents were based in Kyzylorda. This limitation is taken into account when interpreting the results, especially with regard to the broader generalizability of the findings to the national audit market.

Respondent characteristics

The sample included respondents with diverse professional roles. In terms of job title, the largest category was “other” (47.2%), followed by auditors (23.9%), partners (12.7%), junior auditors or assistants (9.9%), senior auditors (4.9%), and internal auditors (1.4%).

Respondents also varied in terms of professional experience. Audit-related experience, including internal audit experience, was distributed as follows: more than 10 years (31.7%), up to 3 years (27.5%), 6–10 years (25.4%), and 3–5 years (15.5%).

With respect to organization type, respondents worked primarily in the public sector (46.5%), followed by “other” organizations (16.2%), international audit firms such as Big Four or similar companies (14.1%), small or medium-sized local firms (10.6%), large national firms (8.5%), and internal audit departments of commercial companies (4.2%).

In terms of organization size, most respondents were employed in organizations with more than 200 employees (62.7%). Smaller shares were represented by organizations with fewer than 20 employees (20.4%), 21–50 employees (9.9%), and 51–200 employees (7.0%).

Respondents also reported varying levels of personal use of digital tools in their professional activities. Regular use was reported by 40.8%, occasional use by 35.2%, rare use by 12.7%, and no use by 11.3%.

Measures

Digital Audit Maturity

The dependent variable, **Digital Audit Maturity (DAM)**, was measured using a five-point ordinal scale ranging from 1 to 5. It captured the respondent's overall assessment of the digital maturity or level of digitalization of the audit function. This measure was based on the final self-assessment item included in Block B of the questionnaire. In the final sample, the average DAM score was **M = 3.08** with **SD = 1.09**, and the median value was **3** (n = 142) (n = 142), indicating a moderate average level of perceived digital maturity.

Drivers of digitalization

Perceived drivers of digital transformation were measured using a set of Likert-scale items included in item group C1 of the questionnaire. These items captured enabling forces that may stimulate the digital transformation of audit practice, such as regulatory expectations, anticipated efficiency gains, competitive pressure, and the availability of appropriate technologies. For the main empirical models, these items were aggregated into a composite indicator, calculated as the mean across items, in order to represent the overall strength of perceived drivers. Higher values of the composite score indicate stronger perceived digitalization drivers.

Barriers and risks

Perceived barriers and risks were measured using a separate set of Likert-scale items in item group D1. These items reflected obstacles to the adoption of digital audit practices, including cybersecurity concerns, restrictions in access to data, infrastructure limitations, implementation costs, and shortages of relevant digital skills. As in the case of drivers, the individual items were combined into a composite score representing the overall level of perceived barriers and risks. Higher values indicate stronger perceived constraints and higher perceived implementation risks.

Empirical strategy

Because the dependent variable, Digital Audit Maturity, was measured on an ordinal five-point scale, the main empirical model was estimated using an **ordered logit specification**. The baseline model can be expressed as follows:

DAM i = f (Drivers i ,Barriers i ,Controls i)

DAMi = f(Driversi ,Barriersi ,Controlsi)

In addition to the ordered logit analysis, the empirical strategy included descriptive statistics, Spearman rank-order correlations, and non-parametric group comparisons using the Kruskal–Wallis test. These methods were selected because several variables were measured on ordinal scales and because the study aimed to examine both overall associations and differences across respondent subgroups.

Descriptive and inferential analysis

Spearman rank correlations revealed a strong positive association between DAM and perceived drivers

(ρ = 0.70)(ρ = 0.70), indicating that higher levels of digital maturity tend to be observed among respondents who perceive stronger enabling forces for digital transformation. A similarly positive relationship was identified between DAM and barriers/risks (ρ = 0.63)(ρ = 0.63). This pattern tentatively suggests that greater digital maturity may coexist with heightened awareness of implementation pressures, risks, and operational constraints in the professional environment.

To examine whether digital audit maturity varies across organizational contexts, non-parametric group comparisons were conducted using the Kruskal–Wallis test. The results indicate that DAM differs significantly by **organization type**(p = 0.038) (p = 0.038) and by **organization size** (p = 0.0016) (p = 0.0016). These findings support the inclusion of organizational heterogeneity in the empirical analysis and are consistent with the testing of group-based hypotheses related to institutional and structural differences in digitalization.

Ethical considerations

Participation in the survey was voluntary, and responses were collected anonymously. No personally identifying information was used in the analysis. Respondents completed the questionnaire online and provided data only for research purposes.

Results

4.1. Descriptive statistics

Table 2 reports descriptive statistics and Spearman rank correlations for the key constructs (1–5 scales). The average digital audit maturity (DAM) equals 3.08 (SD = 1.09), indicating a moderate level of perceived digitalization across respondents' organizations. The mean perceived drivers score is 3.30 (SD

= 1.08), while barriers/risks average 3.24 (SD = 1.07). Perceived prospects for further development equal 3.23 (SD = 1.17).

Spearman correlations show a strong positive association between DAM and drivers (ρ = 0.699), and a positive association between DAM and barriers/risks (ρ = 0.626). DAM is also positively correlated with development prospects (ρ = 0.503). The positive correlation between drivers and barriers/risks (ρ = 0.586) suggests that stronger perceived incentives and constraints may co-occur in the same organizational environments.

4.2. Group differences

Non-parametric comparisons indicate statistically significant heterogeneity in DAM across organization types (Kruskal–Wallis p = 0.0377). In this sample, public-sector organizations report comparatively higher average maturity than some private-firm segments (see Table 1 for composition; group means available on request).

DAM also differs across organization size categories (Kruskal–Wallis p = 0.0016). Organizations with ≤20 employeesreport notably lower maturity compared to larger organizations, consistent with a resource/readiness interpretation.

4.3. Ordered logit determinants

Given the ordinal nature of DAM (1–5), we estimate an ordered logit model with DAM as the dependent variable and composite measures of drivers and barriers/risks as key predictors, controlling for organization type, size, respondent experience, and individual frequency of tool use.

As shown in Table 3, perceived drivers are strongly and positively associated with DAM ($p < 0.001$), supporting H1. Contrary to H2, perceived barriers/risks are also positively associated with DAM ($p < 0.001$). In this specification, controls (experience, size, individual tool use) are not statistically significant once drivers and barriers are included, while organization-type dummies are directionally mixed and mostly insignificant.

Interpretation: the positive association between barriers/risks and DAM is consistent with a risk-awareness (learning-by-doing) mechanism: as organizations become more digitally mature, they more clearly recognize and articulate constraints related to data reliability, cybersecurity, remote access, and documentation expectations—rather than these risks disappearing. This is aligned with regulatory emphasis that technology increases the importance of evidence reliability testing and governance rather than eliminating audit risk (Public Company Accounting Oversight Board, 2024a; International Forum of Independent Audit Regulators, 2023).

4.4 Qualitative themes from open-ended responses

The qualitative responses provide additional insight into the practical challenges of digital audit transformation. Several themes recur most frequently in the open-ended comments.

First, respondents emphasize infrastructure and access constraints, including unstable internet connectivity and difficulties in remote access, particularly outside major urban centers. Second, many participants refer to skills shortages and insufficient training, highlighting the need for stronger digital competencies among audit professionals. Third, cost and investment barriers are frequently mentioned, especially with regard to software acquisition, implementation, and ongoing maintenance. Fourth, respondents identify limitations in client data availability and data quality, which constrain the effective use of digital audit tools. Finally, cybersecurity and confidentiality concerns emerge as a major issue in the transition toward more technology-enabled audit processes.

These qualitative findings complement the quantitative results. While perceived drivers are positively associated with higher digital audit maturity, respondents simultaneously stress that sustainable progress depends on investments in skills, infrastructure, governance, and secure data management. Digital transformation in auditing therefore appears to be shaped by both opportunity and constraint.

Table 1. Sample characteristics (n = 142)

Variable	Category	n	%
Role/position	Other	67	47.2
	Auditor	34	23.9
	Partner	18	12.7
	Junior auditor/assistant	14	9.9
	Senior auditor	7	4.9
	Internal auditor	2	1.4
Experience (audit incl. internal)	≤3 years	39	27.5
	3–5 years	22	15.5
	6–10 years	36	25.4
	>10 years	45	31.7
Organization type	Public sector/government organization	66	46.5
	International audit firm (Big4 or similar)	20	14.1
	Small/medium local audit firm	15	10.6
	Large national audit firm	12	8.5
	Internal audit (commercial company)	6	4.2
	Other	23	16.2
Organization size	≤20 employees	29	20.4
	21–50 employees	14	9.9
	51–200 employees	10	7.0
	>200 employees	89	62.7
Individual digital tool usage	Regularly	58	40.8
	Sometimes	50	35.2
	Rarely	18	12.7
	Never	16	11.3

Note: Percentages may not sum to exactly 100 due to rounding.

Table 2. Descriptive statistics and Spearman correlations (n = 142)

Panel A. Descriptive statistics (1–5 scales)

Variable	Mean	SD
Digital audit maturity (DAM)	3.08	1.09
Drivers	3.30	1.08
Barriers/Risks	3.24	1.07
Prospects	3.23	1.17

Panel B. Spearman correlation matrix

	(1) DAM	(2) Drivers	(3) Barriers/Risks	(4) Prospects
(1) DAM	1.000	0.699	0.626	0.503
(2) Drivers	0.699	1.000	0.586	0.519
(3) Barriers/Risks	0.626	0.586	1.000	0.650
(4) Prospects	0.503	0.519	0.650	1.000

Table 3. Ordered logit determinants of DAM (key predictors)

Dependent variable: DAM (1–5, ordered logit)

Predictor	Coef.	SE	p-value
Drivers	1.758	0.272	<0.001
Barriers/Risks	1.099	0.243	<0.001

Notes: Model includes controls for organization type, organization size, respondent experience, and individual digital tool usage; cut points omitted for brevity.

Discussion

5.1. Theoretical implications

The strong positive association between perceived drivers and digital audit maturity (DAM) is consistent with the TOE/UTAUT logic that external pressures (e.g., client expectations, competition, regulatory signals) and perceived benefits (e.g., efficiency, coverage, improved risk targeting) legitimize investments in digital tools, training, and the integration of analytics into standardized audit methodology (Tornatzky & Fleischer, 1990; Venkatesh et al., 2003). Our findings therefore reinforce the view that audit digitalization is not merely a “technology choice” but a broader organizational change process requiring readiness and facilitating conditions (Krieger et al., 2021; Ismail et al., 2024).

A key nuance is the positive association between perceived barriers/risks and DAM, which runs counter to a simple “constraints reduce adoption” narrative. In the audit context, increasing maturity may intensify risk recognition and articulation because digitally mature organizations encounter and must manage issues such as cybersecurity exposure, data access rights, data provenance/lineage, and remote-evidence constraints. This pattern is consistent with learning-by-doing and staged adoption accounts in audit analytics, where experience increases awareness of limitations and control requirements rather than eliminating them (Krieger et al., 2021; Kokina et al., 2025). It also aligns with regulatory and standard-setting narratives emphasizing that technology shifts attention toward data reliability testing, evidence sufficiency, and documentation discipline when electronic information and tool outputs are used (IAASB, 2020; PCAOB, 2024a, 2024b). Finally, the result is consistent with broader evidence that AI-enabled auditing introduces governance challenges (validation, explainability, and accountability), making risk management and control design integral components of higher maturity rather than “add-ons” (Fedyk et al., 2022; Kokina et al., 2025).

Taken together, these findings suggest that DAM is best interpreted as a capability-based construct (people–process–governance–risk) rather than as a simple count or presence of tools. This extends the maturity perspective in technology-enabled auditing by highlighting that the same organization can simultaneously become more advanced and more risk-aware as digital procedures scale.

5.2. Practical implications

The results and qualitative themes point to capability-building and governance as practical levers for strengthening digital audit maturity in Kazakhstan.

- Capability building as a maturity lever (audit analytics + AI literacy).
  Audit firms and internal audit units should invest in structured training pathways for audit analytics, data reliability testing, and AI-enabled tools. Establishing dedicated “audit technology governance” roles (e.g., methodology owners, tool validation leads, data specialists) can convert individual tool use into organizational routines and quality controls (Vitali & Giuliani, 2024; Kokina et al., 2025).
  Operationalization: define competency levels, require minimum training hours, and track tool adoption by engagement type.
- Data reliability protocols for client-provided data and reports.
  To align technology use with evidence requirements, organizations should formalize procedures to test completeness, accuracy, and relevance of data used in analytics, including clear criteria for exceptions handling and follow-up (PCAOB, 2024a).
  Operationalization: maintain checklists for data reconciliation, sampling validation of source systems, and documented anomaly resolution.
- Documentation-by-design (ATT documentation readiness).
  Audit methodologies and templates should be updated so that documentation captures the tool purpose, parameters/settings, data sources, transformations, data lineage, exceptions, and follow-up actions, consistent with expectations when automated tools and techniques are used (IAASB,

2020; FRC, 2025).
Operationalization: add mandatory fields in working papers for “tool settings,” “data extraction log,” and “exception tracking.”

- Infrastructure-sensitive audit planning (remote/hybrid evidence collection).
  Where audits are constrained by connectivity and restricted system access (a recurring theme in open-ended responses), engagement planning should explicitly incorporate hybrid evidence strategies and early negotiations of client data access rights, timelines, and secure transfer mechanisms. This is particularly important where regional infrastructure and client-system heterogeneity affect feasibility of digital procedures.
- Policy ecosystem and professional support.
  Professional bodies and regulators can accelerate responsible adoption through common competency standards, practical guidance on acceptable analytics-based evidence, and secure data access practices—aligned with national digital transformation priorities (Government of the Republic of Kazakhstan, 2017). Public-sector audit digitalization initiatives may additionally benefit from standardized platforms, shared training programs, and coordinated cybersecurity controls (Otia & Bracci, 2022).
  Operationalization: develop “minimum digital audit capability” benchmarks and sector-wide training modules.

Limitations and future research

First, the study relies on self-assessments, which may introduce perceptual and methodological biases. Future research could supplement the surveys with objective indicators of digitalization (tool logs, working document artifacts, training data). Second, digital maturity was measured using a general Likert scale; the creation and validation of multidimensional indices (people-processes-management-risks) with reliability testing and factor analysis is promising. Third, the sample is limited in terms of organization types and regions; broader, stratified studies are needed. Furthermore, it is important to link maturity to measurable audit outcomes and examine AI governance (validation, accountability, explainability, data protection).

Conclusion

This study provides survey-based evidence on the determinants of digital audit maturity (DAM) in Kazakhstan. The results show that perceived drivers of digitalization are strongly and positively associated with higher maturity, consistent with technology adoption perspectives emphasizing the role of incentives, external pressures, and facilitating conditions. At the same time, perceived barriers and risks also increase with maturity, suggesting a risk-awareness mechanism in technology-enabled audits: as digital procedures expand, organizations more clearly recognize challenges related to data reliability, cybersecurity, access constraints, and documentation requirements.

Overall, the findings indicate that advancing audit digitalization is not only a matter of tool acquisition, but of strengthening capabilities (skills and training), governance (roles and validation responsibilities), and documentation-by-design to ensure that technology use aligns with evolving expectations for sufficient appropriate evidence. These insights can support audit firms, professional bodies, and policymakers in prioritizing capability-building and control frameworks that enable responsible and sustainable growth of digital auditing in Kazakhstan.

Declarations

Acknowledgments

The authors thank all audit and finance professionals who participated in the survey and shared their insights. We also thank colleagues and reviewers for helpful comments on earlier versions of the manuscript.

Funding

This research received no external funding.

Disclosure statement

The authors report there are no competing interests to declare.

Ethics statement

This study was conducted as an independent doctoral research project. Before the start of the survey, all participants were provided with an introductory statement explaining the purpose of the study, the voluntary nature of participation, and the conditions of participation. Participants could proceed to the questionnaire only after indicating their informed consent electronically by selecting “Yes”; those who selected “No” did not participate in the survey.

Formal ethical committee approval was not obtained for this study because it involved a voluntary questionnaire-based survey conducted as an independent academic research project and did not include medical intervention or invasive procedures.

Data collection

Data were collected through an anonymous online survey administered via Google Forms between 10 and 25 December 2025. Prior to completing the questionnaire, participants were provided with an introductory statement explaining the purpose of the study, the voluntary nature of participation, the anonymous treatment of responses, and the use of the data in aggregated form for research purposes. Written informed consent was obtained electronically at the beginning of the survey. By proceeding with the questionnaire, participants confirmed that they understood the purpose of the study and voluntarily agreed to participate.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

1. Alles MG (2015) Drivers of the use and facilitators and obstacles of the evolution of big data by the audit profession. Acc Horizons 29(2):439–449. https://doi.org/10.2308/acch-51067
2. Ceki B, Moloi T (2025) Technology Adoption Framework for Supreme Audit Institutions within the hybrid TAM and TOE model. J Risk Financial Manage 18(8):409. https://doi.org/10.3390/jrfm18080409
3. Chan DY, Vasarhelyi MA (2011) Innovation and practice of continuous auditing. Int J Acc Inform Syst 12(2):152–160. https://doi.org/10.1016/j.accinf.2011.01.001
4. Fedyk A, Hodson J, Khimich N, Fedyk T (2022) Is artificial intelligence improving the audit process? Rev Acc Stud 27(3):938–985. https://doi.org/10.1007/s11142-022-09697-x
5. Financial Reporting Council (2025) June26).*AI in audit: Illustrative example and documentation guidance*(Guidance).https://www.frc.org.uk/library/standards-codes-policy/audit-assurance-and-ethics/guidance/ai-in-audit/
6. Government of the Republic of Kazakhstan (2017) December12).*On approval of the State program Digital Kazakhstan*(DecreeNo.827).https://adilet.zan.kz/rus/docs/P1700000827
7. International Auditing and Assurance Standards Board (2016) *Exploring the growing use of technology in the audit, with a focus on data analytics*(RequestforInput).https://www.iaasb.org/publications/exploring-growing-use-technology-audit-focus-data-analytics
8. International Auditing and Assurance Standards Board (2020) *Non-authoritative support material: Audit documentation when using automated tools and techniques*.https://www.iaasb.org/publications/non-authoritative-support-material-audit-documentation-when-using-automated-tools-and-techniques
9. International Forum of Independent Audit Regulators (2023) *Use of technology in audits – observations, risks and further evolution.*https://www.ifiar.org/latest-news/ifiar-releases-report-on-use-of-technology-in-audits/
10. Ismail S, Mokhtar N, Ahmad H (2024) Factors influencing readiness to implement digital audit among internal auditors of the Malaysian public sector. Acc Res J 37(5):540–556. https://doi.org/10.1108/ARJ-01-2024-0033
11. Kokina J, Blanchette S, Davenport TH, Pachamanova D (2025) Challenges and opportunities for artificial intelligence in auditing: Evidence from the field. Int J Acc Inform Syst 56:100734. https://doi.org/10.1016/j.accinf.2025.100734

12. Krieger F, Drews P, Velte P (2021) Explaining the (non-) adoption of advanced data analytics in auditing: A process theory. Int J Acc Inform Syst 41:100511. https://doi.org/10.1016/j.accinf.2021.100511
13. Liang L, Dai T, Cui L, Song M (2025) Digital audit talent's impact on audit digitization and detection risk. Sci Rep 15 Article 31222. https://doi.org/10.1038/s41598-025-16444-0
14. Lugli E, Bertacchini F (2023) Audit quality and digitalization: Some insights from the Italian context. Meditari Account Res 31(4):841–860. https://doi.org/10.1108/MEDAR-08-2021-1399
15. Otia JE, Bracci E (2022) Digital transformation and the public sector auditing: The SAI's perspective. Financial Account Manage 38(2):252–280. https://doi.org/10.1111/faam.12317
16. Public Company Accounting Oversight Board (2024a) April).*Spotlight: Inspection observations related to auditor use of data and reports.*https://assets.pcaobus.org/pcaob-dev/docs/default-source/documents/data-and-reports-spotlight.pdf
17. Public Company Accounting Oversight Board (2024b) June12).*Amendments related to aspects of designing and performing audit procedures that involve technology-assisted analysis of information in electronic form*(PCAOBReleaseNo.2024-007).https://assets.pcaobus.org/pcaob-dev/docs/default-source/rulemaking/docket-052/2024-007-adoptingrelease.pdf
18. Tornatzky LG, Fleischer M (1990) The processes of technological innovation. Lexington Books
19. Venkatesh V, Morris MG, Davis GB, Davis FD (2003) User acceptance of information technology: Toward a unified view. MIS Q 27(3):425–478. https://doi.org/10.2307/30036540
20. Vitali S, Giuliani M (2024) Emerging digital technologies and auditing firms: Opportunities and challenges. Int J Acc Inform Syst 53:100676. https://doi.org/10.1016/j.accinf.2024.100676
21. Zhang J, Yang X, Appelbaum D (2015) Toward effective big data analysis in continuous auditing. Acc Horizons 29(2):469–476. https://doi.org/10.2308/acch-51070

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- DataAvailabilityStatement.docx