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Big data analytics in enhancing public sector auditing: drivers, benefits and the moderating role of auditor certification

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Abstract

Purpose – This study examines the adoption of big data analytics (BDA) in public sector auditing through a modified technology acceptance model (TAM) framework, focusing on system quality, complexity, self-efficacy, ease of use and usefulness. It also analyzes the impact of BDA usage on audit performance and quality, with auditor certification assessed as a moderating factor.

Design/methodology/approach – This study employs a survey questionnaire method and involves government auditors at Indonesia's Supreme Audit Agency as samples. The data are analyzed using partial least squares techniques.

Findings – The findings show that system quality positively influences both perceived ease of use and usefulness, while complexity has no significant effect. Self-efficacy enhances ease of use but not usefulness. Both perceived ease of use and usefulness significantly drive the intention to adopt BDA, which in turn leads to actual usage. BDA usage improves audit performance and quality; however, auditor certification only moderates the relationship between BDA usage and audit performance, not audit quality. Certification also does not moderate the effect of perceived ease of use or usefulness on adoption intention.

Originality/value – This study offers a significant contribution by extending the TAM framework to the context of public sector auditing in developing countries, a setting often overlooked in existing literature. Uniquely, it introduces auditor certification as a moderating variable, providing fresh insights into how professional credentials shape the relationship between BDA adoption and audit outcomes.

Keywords Big data analytics, Audit performance, Audit quality, Modified TAM framework, Auditor certification, Public sector

Paper type Research article

Introduction

The rapid advancement of technology has significantly transformed the auditing landscape, including in the public sector, in recent years. Big Data Analytics (BDA) is one of the current innovations that has changed the game. BDA transforms auditing in settings where accountability, transparency, and resource efficiency are critical (Sofyani, 2024). Specifically, it enables auditors to leverage vast quantities of structured and unstructured data to enhance decision-making, uncover patterns, and detect anomalies, significantly improving the audit process (Al-Ateeq *et al.*, 2022; Sun *et al.*, 2024). As data volumes grow exponentially from

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sources such as the Internet of Things (IoT), social media, and financial transactions, traditional auditing methods — relying on sample testing and manual analysis — are increasingly insufficient to address the complexities of modern governance and financial reporting (Al-Ateeq *et al.*, 2022).

The potential benefits of integrating BDA into auditing are highlighted in recent literature. Pan and Zhang (2020) suggested that by employing advanced analytical techniques, auditors can gain deeper insights into financial data, identify patterns that indicate fraud or inefficiency, and enhance the reliability of financial reporting. Additionally, Sun *et al.* (2024) found that BDA can improve audit quality by enabling auditors to conduct more comprehensive analyses, assess risks more effectively, and provide reliable stakeholder recommendations. However, transitioning to BDA in auditing is challenging, especially in the public sector. Barriers such as limited access to appropriate analytical tools, skills gaps, system complexity, and heightened concerns over data privacy continue to impede widespread adoption (Brown-Liburd and Joe, 2020). Moreover, factors such as system quality, system complexity, auditor self-efficacy, and digital competency and skills have emerged as critical determinants that influence the successful implementation of BDA in the public sector (Pan and Zhang, 2020). These barriers and the non-mandatory nature of BDA adoption in public sector auditing have contributed to slow and uneven implementation across public sector audit agencies.

Although research on BDA in public sector auditing has begun to emerge (as discussed in the Literature Review section), limited attention has been paid to implementing and utilizing these technologies in developing countries. In such contexts, financial, human, and intellectual resource constraints often hinder the adoption of BDA. Emerging economies frequently lack the infrastructure and institutional support needed to fully realize the benefits of digital transformation in public audit processes (Syed *et al.*, 2023). However, the improved oversight, transparency, and resource optimization BDA promises can be especially beneficial in these contexts. To address these gaps, this study investigates the adoption of BDA in public sector auditing in Indonesia, where BDA has been incrementally introduced since 2020 (Saud *et al.*, 2025). The study adopts a modified Technology Acceptance Model (TAM) framework, incorporating critical variables such as system quality, system complexity, auditor self-efficacy, and auditor-specific competency (certification) alongside traditional TAM constructs—perceived usefulness and ease of use. Accordingly, this study expands the model to reflect these complexities. To do so, this study investigates the determinants and impacts of BDA utilization on audit performance and quality, with auditor certification examined as a moderating factor. This dual focus offers a comprehensive view of both the drivers of adoption and the resulting audit outcomes.

The contributions of this study are threefold. Theoretically, it extends the TAM framework to better suit public sector contexts in emerging economies, which remain underrepresented in the literature. Empirically, it provides much-needed evidence on the relationship between BDA adoption and audit quality in a developing country setting. Practically, the study provides valuable information for institutional leaders, policymakers, and public sector auditors, especially in settings with limited resources. It offers actionable insights that can support other developing countries facing similar constraints in financial, human, and technological capacities. By identifying emerging economy-specific enablers and barriers, this research informs strategies for overcoming adoption challenges and optimizing the transformative potential of BDA in public auditing across diverse developing contexts.

Literature Review

Several recent studies contribute to our understanding of BDA in auditing. Appelbaum *et al.* (2017) highlight the fundamental changes in audit practice as firms increasingly use Big Data and advanced analytics. This condition has prompted the audit profession to respond with a more sophisticated data-driven audit approach. They emphasize that traditional audit standards, especially those governing audit evidence and analytical procedures, are not fully prepared to face the challenges of the complex Big Data environment. Thus, there is a need for

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the audit profession to develop new approaches that enable the use of predictive and prescriptive analytics in the audit process. Overall, their study contributes to the literature by expanding the understanding of the challenges and opportunities of using Big Data in auditing and offering directions for further research and innovation in digital auditing. Building on this, our study extends the discourse by examining how adopting BDA in the public sector—an area often constrained by rigid institutional structures and audit bureaucracy—presents unique opportunities and challenges that differ from those identified in private sector settings.

Moreover, using the TAM framework, Al-Ateeq *et al.* (2022) examine how auditors' acceptance of BDA affects audit quality. This study is based on two central constructs in TAM, namely perceived usefulness (PU) and perceived ease of use (PEOU), to explain how auditors are willing to adopt BDA in their audit practices. Involving 130 external auditors in Jordan, their study suggests that auditors are more likely to improve audit quality when they perceive that BDA is useful, not just easy to use. This study contributes to the auditing literature by filling the gap regarding technology acceptance in audit practice and emphasizing the importance of utilizing BDA to improve audit quality in the digital era. While Al-Ateeq *et al.* (2022) provide valuable insights into behavioral acceptance of BDA among auditors in Jordan, our research advances this line of inquiry by contextualizing the technology acceptance framework within the public sector and examining additional factors such as auditor certification and organizational readiness. This approach allows us to identify how institutional and individual characteristics interact with BDA adoption to influence audit outcomes, thus offering a more granular and jurisdiction-specific contribution to the literature. Moreover, Al Rob *et al.* (2025), using TAM, find that competition and client size drive BDA adoption among auditors, yet their focus remains on private firms. Our study brings TAM into the underexplored terrain of government audit offices, enriching its relevance.

Furthermore, Salijeni *et al.* (2019) emphasize BDA's ability to improve risk assessment by identifying patterns, anomalies, and hidden relationships within large datasets, allowing auditors to target their procedures better and allocate resources more efficiently. In addition, Balios *et al.* (2020) and Salijeni *et al.* (2019) suggest that BDA enables the collection of more comprehensive and reliable audit evidence. Auditors can obtain a more accurate and holistic view of the audited entity by analyzing entire data populations rather than relying on sampling techniques. Further, Dagilienė and Klovienė (2019) underline the potential of BDA to uncover fraudulent activities and provide deeper insights into complex transactions and organizational processes, which is particularly vital in the public sector, where fraud can severely erode public trust. Finally, a study by Merhi and Bregu (2020) stresses the efficiency gains of BDA in the public sector. While these studies provide valuable insights into the technical benefits of BDA for audit risk assessment, evidence collection, and fraud detection, they tend to focus predominantly on the capabilities and outcomes of BDA itself and do not address what key factors trigger successful adoption. The studies are also often in a conceptual or general context. Our study differentiates itself by empirically examining the organizational and individual factors that influence BDA's successful adoption and integration in public sector audits.

Kend and Nguyen (2020) demonstrate that BDA and emerging technologies significantly impact the Australian audit profession by reshaping auditors' competencies and workflows. While their study is centered on a developed country with mature audit systems, our study adds value by exploring similar dynamics in a developing country with distinct governance and technological infrastructures. Our study also complements prior studies by investigating whether public sector auditors' professional certifications moderate the relationship between BDA use and audit outcomes, particularly audit quality.

Importantly, our work also builds on more regionally relevant research. Nasrudin and Firmansyah (2024) investigate the mediating role of BDA implementation in public audit quality but do not address moderating effects or organizational context. Our study addresses this by considering moderating variables such as auditor certification and institutional constraints. Moreover, Saud *et al.* (2025) explore the determinants of BDA adoption in the

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Indonesian public sector and identify institutional and technological readiness as key drivers. This study distinguishes itself by not only exploring these determinants but also empirically assessing their effects on audit performance and quality, thereby advancing prior work from a primarily descriptive emphasis on adoption towards a more comprehensive consideration of performance implications. In addition, their study applied the original UTAUT framework without adapting or contextualizing it to the specific characteristics of the Indonesian public sector environment. To cover this weakness, our study includes variables more relevant to Indonesian public sector auditing, such as technology readiness and auditor certification.

Theoretical underpinning

The TAM theory has been widely used to understand the factors influencing technology adoption in various domains (Davis, 1989). While this theory has provided valuable insights into technology adoption in private sector contexts, its application in public sector auditing—particularly for technologies such as BDA—raises important questions about its sufficiency in capturing the complexities of this environment. The TAM's focus on individual-level perceptions, such as perceived usefulness and ease of use, may not fully account for broader organizational and institutional factors that shape technology adoption in public audit contexts. The public sector fundamentally differs from the private sector regarding objectives and regulatory environments due to heightened risk factors and governance complexities. For instance, public sector entities face unique risks related to procurement malpractices, resource misallocation, and accountability failures, which are intensified by the complexity of government operations (Myeza *et al.*, 2021). Moreover, the increasing emphasis on integrated thinking in public sector governance highlights the need for a holistic approach to risk management and IT corporate governance, where multiple stakeholders and cross-functional processes must be coordinated to enhance transparency and performance (Myeza *et al.*, 2023). Such governance dynamics underscore why technology adoption, including BDA, cannot be fully understood without considering the integrated, multi-dimensional environment of public sector auditing.

Therefore, in the public sector, technology adoption is often influenced by individual perceptions and institutional factors such as government policies, budgetary constraints, and organizational readiness (Sun *et al.*, 2024). Additionally, auditors in the public sector face stricter scrutiny, with increased demands for accountability and transparency, making the adoption process more complex and politically sensitive (Cordery and Hay, 2022). Given these public sector complexities, this paper argues that TAM alone is insufficient for capturing the multi-layered influences on BDA adoption in public sector auditing. Consequently, we propose an extended conceptual framework integrating TAM with the Technology-Organization-Environment (TOE) framework and Institutional Theory. The inclusion of TOE and Institutional Theory contextualizes individual perceptions within broader organizational and institutional environments. For example, perceived system quality and complexity are not merely technical issues but also reflect organizational readiness and infrastructure, which are core components of the TOE framework. Similarly, self-efficacy may be influenced by training opportunities and institutional support, linking it to organizational capacity-building efforts. Perceived usefulness and ease of use are further shaped by institutional mandates, regulatory expectations, and normative pressures—all key to Institutional Theory's explanatory power in the public sector context.

Furthermore, the moderating role of auditor certification provides a means to assess professional legitimacy and competence, aligning with Institutional Theory's emphasis on normative and cognitive legitimacy within public organizations. By bridging individual, organizational, and institutional factors, this extended framework offers a comprehensive and contextually grounded lens for understanding BDA adoption in public sector audit settings, particularly within developing countries where institutional environments are evolving rapidly.

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Hypotheses development

Perceived System Quality, Perceived Ease of Use, and Usefulness.

Perceived system quality refers to the subjective evaluation of a system's overall performance, including its reliability, accuracy, stability, and technical capabilities (Shin, 2017). Several studies have shown that high-quality systems enhance user satisfaction, positively impacting their perceptions of a system's ease of use and usefulness (Wilson *et al.*, 2021). Thus, the more reliable and efficient the system, the easier users find it to adopt and incorporate into their tasks, and the more they believe it will improve their performance (Nguyen *et al.*, 2023). Based on that, if the BDA system has fast processing speeds, minimal downtime, and accurate outputs, auditors will likely perceive it as easier to use and more helpful in improving audit performance. Marinagi *et al.* (2023) found that system quality positively influences ease of use and perceived usefulness, increasing technology adoption. Therefore, we hypothesize that:

H1a. Perceived system quality positively impacts the perceived ease of use of BDA-based auditing in the public sector.

H1b. Perceived system quality positively impacts the perceived usefulness of BDA-based auditing in the public sector.

Perceived complexity, perceived ease of use, and usefulness

Perceived complexity refers to the degree to which an individual perceives a technology as complex or requiring substantial effort to learn and operate (Albayati, 2024). According to the TAM, complexity negatively influences adoption, as users are less likely to adopt a system they perceive as difficult to learn or integrate into their workflows (Seymour and Koopman, 2022). Research has consistently demonstrated that perceived complexity negatively affects perceived ease of use and usefulness (Rahmi *et al.*, 2018). Auditors may view implementing BDA systems as challenging, especially if they lack familiarity with data analytics tools. This is particularly relevant in the public sector, where auditors may have limited technical expertise, and traditional auditing methods have been deeply ingrained in their practices (Rana *et al.*, 2022). The perception of complexity may thus lead to reluctance to adopt BDA tools, as auditors may doubt the system's ease of use and question its value in improving their audit processes. This aligns with findings by Perera and Abeygunasekera (2021). Therefore, we hypothesize that:

H2a. Perceived complexity harms perceived ease of use of BDA-based auditing in the public sector.

H2b. Perceived complexity harms the perceived usefulness of BDA-based auditing in the public sector.

Self-efficacy and perceived ease of use and usefulness

Self-efficacy refers to an individual's belief in their ability to successfully perform specific tasks or use particular tools (Bandura, 2023). When individuals believe they can effectively use a technology, they are more likely to perceive it as easier and more beneficial (Gaskin *et al.*, 2018). For public sector auditors, high self-efficacy makes it possible to foster positive perceptions of BDA tools. Auditors confident in their ability to learn and use BDA systems are more likely to view them as easy to use and helpful in improving audit performance. Previous studies have shown that self-efficacy influences users' confidence in using technology, which, in turn, enhances their perceptions of ease of use and usefulness (Gaskin *et al.*, 2018). Zhang *et al.* (2017) demonstrate that self-efficacy significantly influences users' perceptions of ease of use and usefulness, ultimately affecting technology adoption. Therefore, we hypothesize that:

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H3a. Self-efficacy positively impacts the perceived ease of use of BDA-based auditing in the public sector.

H3b. Self-efficacy positively impacts the perceived usefulness of BDA-based auditing in the public sector.

Perceived ease of use and BDA adoption

Perceived ease of use is the degree to which a user believes that using a particular technology will be free of effort (Chen and Aklikokou, 2020; Davis, 1989). Public sector auditors are more likely to adopt BDA if they believe it is easy to use and does not require excessive effort or additional training to incorporate into their existing work processes. The relationship between ease of use and adoption has been widely supported in previous research, particularly in the context of the TAM (Abdullah *et al.*, 2016; Davis, 1989). Technologies that are perceived to be user-friendly reduce the perceived cognitive load on the users and make the adoption process smoother. Given that BDA systems can often seem overwhelming, tools that are intuitive and easy to learn will likely foster greater adoption among public sector auditors. Therefore, we hypothesize that:

H4. Perceived ease of use positively impacts the intention to adopt BDA-based auditing in the public sector.

Perceived usefulness and BDA adoption

Perceived usefulness is the degree to which a user believes technology will enhance their job performance (Omar *et al.*, 2019). In the context of BDA adoption in the public sector, auditors are more likely to adopt BDA systems if they perceive these tools to be valuable for improving the quality, accuracy, and efficiency of their audit tasks. The perceived usefulness of BDA is significant for public sector auditors, who must justify the adoption of new technologies to their organizations, often in a constrained budget environment. The positive relationship between perceived usefulness and technology adoption has been extensively documented in the literature (Chen and Aklikokou, 2020; Tahar *et al.*, 2020). Auditors will be more likely to embrace BDA if they believe the system will enhance their audit capabilities, such as improving decision-making, uncovering new insights, and reducing manual effort. Therefore, we hypothesize that:

H5. Perceived usefulness positively impacts the intention to adopt BDA-based auditing in the public sector.

Behavioural intention is key in identifying an individual's intention to perform a specific task or engage in voluntary behaviour. According to Cristea and Gheorghiu (2016), behavioural intention refers to an individual's willingness to perform a particular task driven by the intention to take action. In earlier studies, behavioural intention has been examined as a dependent variable within the TAM framework, directly influencing the actual usage of technology (Shin, 2009). Research has consistently found a positive and significant relationship between behavioural intention and the use of new technologies (Barry and Jan, 2018). Additionally, Kurniasih *et al.* (2020) and Ahmad *et al.* (2020) demonstrated a significant positive effect of behavioural intention on actual usage. According to the extended TAM model by Venkatesh *et al.* (2003), which incorporates four variables, behavioural intention to use has been found to significantly and positively influence users' actual usage behaviour. Therefore, we hypothesize that:

H6. Adoption intention positively impacts the actual usage of BDA-based auditing in the public sector.

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BDA usage and audit performance

Audit performance is an essential measure of how effectively auditors can identify, assess, and report on risks and issues within the scope of an audit. The adoption of BDA in auditing is expected to significantly enhance audit performance by enabling auditors to analyze larger datasets, identify trends, and detect anomalies more effectively than traditional methods (Knechel *et al.*, 2013b). Using BDA in audit processes allows auditors to move beyond the limitations of manual data analysis, leading to better-informed audit decisions and faster identification of potential issues (Partanen, 2023). Research has shown that adopting advanced analytical tools leads to improved performance in audit processes (Krieger *et al.*, 2021). By leveraging BDA tools, auditors can make more accurate assessments of financial data, enhance fraud detection, and increase the efficiency of the audit process (Shalhoob *et al.*, 2024). As such, BDA adoption is expected to impact audit performance in the public sector positively. Therefore, we hypothesize that:

H7. The adoption of BDA-based auditing positively impacts audit performance in the public sector.

BDA usage and audit quality

Audit quality refers to the effectiveness of the audit process in producing reliable, accurate, and valuable audit outcomes (Xiao *et al.*, 2020). BDA can improve audit quality by giving auditors more precise and deeper insights into the data they are analyzing (Abu Afifa *et al.*, 2022). BDA tools, which can handle large volumes of data and perform advanced analytics, can increase the accuracy and reliability of audit results by identifying inconsistencies and risks that may not be apparent using traditional audit methods (Gepp *et al.*, 2018). Previous studies have demonstrated that using advanced technologies like BDA can improve the quality of audit outcomes (Knechel *et al.*, 2013a). The ability to analyze big data more effectively and uncover deeper insights leads to higher-quality audits, particularly regarding the accuracy of findings and the depth of risk assessments (Alles and Gray, 2016). Therefore, BDA adoption is expected to improve the overall quality of audits performed in the public sector. Thus, we hypothesize that:

H8. The adoption of BDA-based auditing positively impacts audit quality in the public sector.

Moderating role of auditor certification

Auditor certification (e.g. CPA, CIA) represents auditors' formal qualifications and expertise. Certified auditors are expected to possess higher professional knowledge, skills, and self-confidence in using advanced tools such as BDA (Athota *et al.*, 2023). In the context of technology adoption, certified auditors may be more likely to trust and adopt BDA, as they are typically more proficient at assessing the potential benefits of the technology and less likely to be intimidated by the perceived complexity of new tools. Moreover, certified auditors are likely to experience more significant improvements in audit performance and quality due to BDA adoption (Abdelwahed *et al.*, 2024). Their advanced knowledge and experience enable them to understand better and apply the insights provided by BDA tools, leading to enhanced audit outcomes. In line with this, auditor certification is expected to moderate the relationships between key TAM factors (ease of use and usefulness) and BDA adoption. Therefore, we hypothesize that:

H9. Auditor certification moderates the relationship between perceived ease of use (H8a) and usefulness (H8b) and the intention to adopt BDA-based auditing in the public sector.

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H10. Auditor certification moderates the relationship between BDA-based auditing usage and audit performance in the public sector.

H11. Auditor certification moderates the relationship between BDA-based auditing usage and audit quality in the public sector.

Based on the hypotheses formulated, this study developed the research conceptual framework model, as shown in Figure 1.

Methodology

Research design

This study employs a survey method. The sample of this study was auditors from the SAA of the Republic of Indonesia. Indonesia is selected for this study as it represents a relevant and timely case of an emerging economy introducing BDA into public sector auditing. Since 2020, Indonesian audit institutions have taken steps toward digital transformation, despite challenges such as limited resources, digital infrastructure gaps, and skills shortages. These conditions are common across many developing countries, making Indonesia an appropriate setting for exploring the barriers and potential of BDA adoption. Therefore, the insights gained apply to a broader international audience, particularly in similar emerging economy contexts.

Respondents were selected using a purposive sampling method based on specific criteria. The selection focused on auditors with BDA-based auditing experience, specifically with the BIDICS software. This criterion was applied to ensure that all respondents had the knowledge and expertise to answer the questionnaire accurately, as the questions primarily pertained to using BDA-driven audit software (Sekaran, 2016). The questionnaire was distributed from April to June 2024.

As recommended by some scholars, research utilizing non-probability sampling methods should incorporate power analysis to determine the appropriate minimum sample size (Memon *et al.*, 2024). Based on power analysis with a confidence level of 0.80 and three predictors for any endogenous variable, the minimum sample size required was 77. This study received 137 completed responses, which exceeded the minimum required sample size. However, the total number of auditors at Indonesia's SAA is approximately 4,000. Thus, the response rate to the survey was relatively low. This is because not all auditors met the sample criteria, specifically those who had used BDA in their auditing practices. Additionally, some

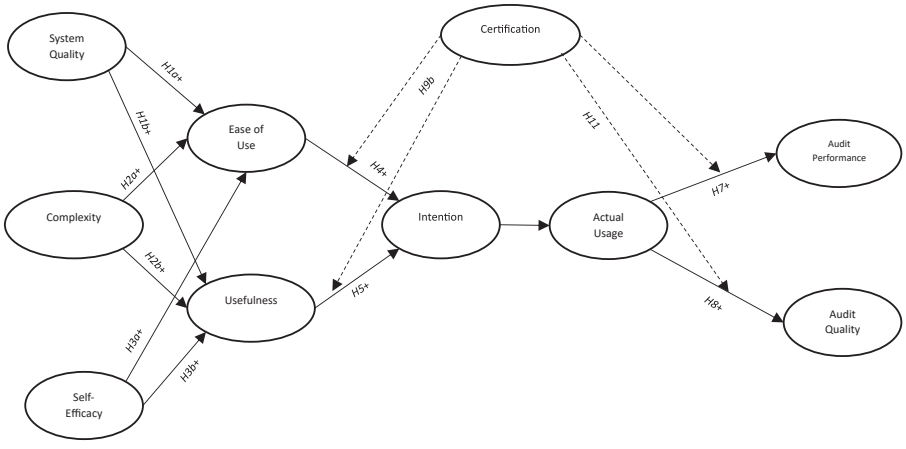

Figure 1. Conceptual framework model of the research. Source: Authors' own work

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SAA offices in some provinces did not permit the distribution of the questionnaire, citing timing issues, as they were engaged in extensive auditing activities across various local governments. Therefore, the sample size mentioned above should be considered as one of the limitations of this study. The demographic details of the respondents are provided in Table 1.

Variable measurement

The variables in this study were measured using established scales adapted for the research context. The measurement of self-efficacy, system quality, and system complexity was adapted from Al-Hashimy *et al.* (2022), respectively. While ease of use, usefulness, intention to use, and actual usage were adapted from Cimbaljević *et al.* (2023), and Al-Mamary and Al-Shammari (2023), respectively. Lastly, audit performance and quality were adapted from Louis *et al.* (2022) and Le *et al.* (2022). To ensure the validity and relevance of the questionnaire, it was first reviewed by nine experts in the accounting field, whose feedback was used to revise and finalize the instrument.

Ethical considerations

Before data collection, the research received ethical clearance from the University's Research Ethics Committee following revisions based on their feedback. Key ethical principles were upheld, including informed consent, participant anonymity, and voluntary participation. Participants received an information sheet explaining the study's purpose, rights, and the option to withdraw without penalty. Consent was obtained in advance, and responses were anonymized and kept confidential. Questionnaires were distributed by designated SAA staff, not the researchers, to minimize coercion. All data were securely stored in encrypted files and will be retained for up to two years, following the university's data protection policies.

Table 1. Demographics of respondents

Criteria	Frequency	Percentage
Gender		
Male	85	62.04
Female	52	37.96
Age		
20–35	72	52.55
36–50	11	8.03
>50	9	6.57
Education Level		
Degree	85	62.04
Master	51	37.23
Doctoral	1	0.73
Educational Background		
Non-IT and Accounting	39	28.47
Accounting	87	63.50
IT	11	8.03
Certification		
Yes	87	63.50
Not yet	50	36.50
Total	137	100.00

Source(s): Authors' own work

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Data analysis method

The hypothesis testing in this study was conducted using Partial Least Squares (PLS), a method that allows for both testing the validity and reliability of the measurement instruments and evaluating the structural relationships between variables (Chin *et al.*, 2003). PLS is particularly suitable for this study due to the non-parametric nature of the Likert scale used in the survey and the potential for multicollinearity among the model's constructs (Hair *et al.*, 2021). Several additional analyses were performed to ensure the robustness and accuracy of the results, including Common Method Variance (CMV) and Confirmatory Tetrad Analysis (CTA).

Results

Descriptive statistics test

Table 2 shows the descriptive statistics test results. The results of the measurement model assessment (reliability and validity tests) are presented in the Appendix.

Since the measurement model has been confirmed reliable and valid, hypothesis testing can proceed with the results presented in Table 3. The adjusted R^2 for the study model ranges between 24.2% and 51.1%, suggesting that the model's ability to explain the phenomenon is moderate (Chin *et al.*, 2003).

Discussions and conclusions

This study provides empirical evidence that using BDA-based auditing significantly improves audit performance and quality in the public sector. These results are consistent with prior studies, which suggest that integrating advanced analytics technologies into auditing processes enhances effectiveness and efficiency by enabling auditors to process high volumes of data, identify anomalies, and extract meaningful insights (Salijeni *et al.*, 2019; Handoko *et al.*, 2020). Within the Indonesian public sector, where transparency and accountability are fundamental goals, these findings highlight the strategic value of BDA tools in supporting evidence-based decision-making and optimizing resource allocation. Further, the significant effects of perceived ease of use and perceived usefulness on the intention to adopt BDA reinforce the applicability of the TAM in this context. As TAM suggests (Davis, 1989), users are more likely to adopt technologies when they are easy to use and perceived as beneficial—an argument that remains valid even in highly regulated, hierarchical institutions like public audit bodies (Aseeri, 2023).

Moreover, this study finds that system quality has a strong positive relationship with perceived ease of use and usefulness. This supports the idea that technical characteristics—

Table 2. Descriptive statistics

Variables	Minimum	Maximum	Mean	Std. deviation
Self-Efficacy	1.00	5.00	3.82	0.67
System Quality	2.00	5.00	3.78	0.54
System Complexity	1.00	5.00	2.52	0.90
Ease of Use	2.00	5.00	3.80	0.68
Usefulness	2.00	5.00	4.21	0.59
Intention	2.00	5.00	4.17	0.59
Actual Usage	2.00	5.00	3.88	0.61
Audit Performance	3.00	5.00	4.26	0.52
Audit Quality	2.00	5.00	3.97	0.60

Source(s): Authors' own work

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Table 3. Hypothesis test results

BDA-based auditing drivers	Coefficient	Conclusion
System Quality → Ease of Use (H1a)	0.444**	Supported
System Quality → Usefulness (H1b)	0.434**	Supported
Complexity → Ease of Use (H2a)	−0.062	Not supported
Complexity → Usefulness (H2b)	−0.101	Not supported
Self-Efficacy → Ease of Use (H3a)	0.443**	Supported
Self-Efficacy → Usefulness (H3b)	0.077	Not supported
Ease → Intention to Adopt (H4)	0.321*	Supported
Usefulness → Intention to Adopt (H5)	0.594**	Supported
Intention To Adopt → Actual Usage (H6)	0.692**	Supported
BDA-based auditing Impacts		
Actual Usage → Audit Performance (H7)	0.309*	Supported
Actual Usage → Audit Quality (H8)	0.679**	Supported
Moderating Effect of Certification		
Certification*Usefulness→ Intention to Adopt (H9a)	−0.029	Not supported
Certification*Ease of Use → Intention to Adopt (H9b)	0.052	Not supported
Certification*Actual Usage → Audit Performance (H10)	0.295*	Supported
Certification*Actual Usage → Audit Quality (H11)	−0.117	Not supported

Note(s): Adj. R2: BDA actual usage = 0.475; Audit performance = 0.242; Audit quality = 0.511; *$p < 0.05$; **$p < 0.02$

Source(s): Authors' own work

such as reliability, user interface, and system responsiveness—are central to auditors evaluating BDA tools' potential. These findings also complement the TOE framework by showing that system quality can be interpreted as part of an organization's technological readiness. In the Indonesian public sector, where infrastructure and system design vary widely across regions (Sofyani *et al.*, 2020), ensuring robust and reliable audit technology is essential for successful implementation. Thus, attention to system quality should be seen not merely as a technical concern but also as a reflection of broader organizational preparedness.

However, several unexpected findings emerged and merit deeper theoretical exploration. Notably, the hypotheses relating to system complexity (H2a, H2b) were not supported, as complexity did not significantly influence either perceived ease of use or usefulness. This contradicts previous studies, which commonly identify complexity as a barrier to technology adoption (Kouhizadeh *et al.*, 2021). A possible explanation is that the auditors involved in this study had already received adequate training, which helped them overcome initial perceptions of difficulty. From the perspective of Cognitive Load Theory (Paas *et al.*, 2003), this may indicate that structured training programs can reduce mental effort and make complex systems appear more manageable (Camp *et al.*, 2001). Nonetheless, this explanation requires further empirical support. Future research may explore how individual learning trajectories and training intensity influence perceived system complexity, particularly in environments with varying digital literacy levels.

A similar pattern is observed in the findings related to self-efficacy. While self-efficacy positively affects perceived ease of use (H3a), it does not directly impact perceived usefulness (H3b). This partial support for TAM suggests that although confidence in using technology increases users' comfort, it does not automatically translate into their belief in the technology's strategic value. This may be due to a disconnect between personal confidence and organizational incentives or expectations. In the public sector context, perceived usefulness may be shaped more by task alignment, managerial endorsement, or policy directives than by individual beliefs alone. This highlights the importance of combining personal-level constructs from TAM with organizational-level variables from TOE and Institutional Theory to capture the full complexity of adoption dynamics.

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Findings on auditor certification as moderator

Furthermore, the findings on auditor certification as a moderating variable provide nuanced insights. Certification significantly moderates the relationship between BDA usage and audit performance (H10), indicating that certified auditors can better translate technological tools into measurable performance outcomes. However, certification does not moderate the link between BDA usage and audit quality (H11), nor does it influence the relationship between perceived ease of use or usefulness and the intention to adopt. This result challenges the assumption that professional certification enhances technology acceptance (Qu *et al.*, 2023). Instead, it suggests that certification may reflect formal compliance or technical capacity, but not necessarily deeper engagement with the values and goals of audit quality, such as public accountability or ethical standards. From the perspective of Institutional Theory, this may reflect the symbolic rather than functional role of certification in public institutions (Sofyani *et al.*, 2018).

Furthermore, the absence of a moderating effect on adoption intention suggests that technology uptake in public sector auditing, particularly within emerging economies such as Indonesia, may be shaped more by organizational directives, infrastructural readiness, and prevailing collective norms than by individual professional credentials. This observation resonates with the broader reality in many emerging economies, where certification frameworks, although formally established, do not necessarily translate into greater technological innovation or sustained adoption. Strengthening the functional dimension of certification—by integrating continuous professional development, reinforcing ethical commitment, and enhancing competencies in data-driven decision-making—could extend its influence beyond mere compliance. Such an approach would support improvements in audit performance and foster a more sustainable culture of public accountability. In doing so, these findings contribute to the ongoing discourse on how professional development mechanisms in emerging economies can be recalibrated to harness better the potential of technological advancements in the public sector.

Theoretical implications

This study offers several theoretical insights into BDA adoption in public sector auditing. First, the findings support the original TAM framework, confirming that perceived ease of use and usefulness are key drivers of BDA adoption, especially in the Indonesian public sector with its infrastructure and training limitations (Pramono *et al.*, 2023). However, as the extended framework suggests, these perceptions are shaped not only by individual views but also by organizational readiness (TOE Theory) and institutional pressures (Institutional Theory). Second, system quality is found to significantly influence ease of use and usefulness, extending TAM and aligning with the technological component of the TOE framework. Unlike prior studies linking system quality to satisfaction (Gunesekera *et al.*, 2019), this research directly affects adoption perceptions. Interestingly, system complexity does not significantly affect adoption, suggesting that organizational support, training, and familiarity may reduce its impact. This challenges conventional TAM assumptions and reinforces the need to consider organizational readiness when evaluating perceived complexity (Arroyo and Carrete, 2019). Third, the study also adds nuance to TAM by showing that self-efficacy affects perceived ease of use but not usefulness. This may reflect the role of institutional norms and professional expectations, which are consistent with institutional theory.

Finally, auditor certification moderates the relationship between BDA use and audit performance, not adoption intention or audit quality. This implies that while certification signals competence, its effect is more evident in performance outcomes. From an institutional lens, certification represents both normative and cognitive legitimacy, while from a TOE perspective, external pressures may influence how certifications translate into results. This raises an important research question: Does certification truly enhance technology-driven audit outcomes, or is it simply symbolic? Future studies should investigate how institutional legitimacy and organizational capacity interact to enable innovation in public auditing.

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Practical implications

This study provides practical insights for policymakers, audit practitioners, and public sector institutions in adopting BDA tools, particularly within the Indonesian context, and potentially offers more valuable lessons for other developing countries. The findings underscore system quality as a key factor influencing auditors' perceptions of ease of use and usefulness. Public sector entities should therefore invest in technically sound BDA platforms aligned with audit needs, leading to broader audit coverage, faster anomaly detection, and reduced manual effort—critical for improving audit efficiency and effectiveness.

Self-efficacy also significantly affects BDA adoption. Auditors confident in their digital abilities are more likely to use these tools; thus, tailored training addressing challenges such as limited infrastructure and uneven digital literacy is essential. Peer mentoring, modular workshops, and responsive support can build long-term capacity. Beyond operational gains, BDA adoption supports governance objectives, enabling ESG data analysis under emerging standards such as IFRS S1/S2 and ISSA 5000, enhancing transparency, fraud detection, and public trust.

A notable contribution is that auditor certification strengthens the link between BDA usage and audit performance. While certification does not influence adoption intent, it improves auditors' capacity to deliver better outcomes. This highlights the need to institutionalize professional analytics and audit technology certification, tied to performance incentives and career growth. Certified auditors appear better equipped for complex BDA-related tasks, aligning with global trends from bodies such as ACCA, CIMA, and SAICA that stress digital competencies. This study reinforces that effective BDA adoption depends on robust systems and a digitally skilled workforce, requiring collaboration between professional bodies, training institutions, and public audit agencies.

Limitations and future suggestions

This study has several limitations. First, the cross-sectional design restricts the ability to observe changes over time or establish causality. Future studies are encouraged to adopt longitudinal approaches to better understand how BDA adoption impacts audit performance and quality over extended periods. For example, following audit teams before and after BDA implementation could reveal shifts in efficiency, error detection, or audit adaptability. Second, the study's focus on auditors from the Indonesian SAA may limit generalizability. Although Indonesia provides a relevant public sector context, institutional and technological conditions vary across countries. Comparative studies involving other Southeast Asian public audit institutions—such as Malaysia or the Philippines—could offer broader insights into how contextual differences influence BDA adoption.

Moreover, while validated instruments were used, they may not fully reflect Indonesia's public audit environment. Future research should consider adapting measurement tools to local conditions and employing mixed-method approaches—such as combining surveys with interviews or focus groups—to enrich findings and reduce the risk of non-response bias. Future studies could explore BDA's role in emerging audit areas such as sustainability assurance, particularly in line with the ISSA 5000 framework. There is also scope to examine how training, certification, and practical experience influence BDA adoption, especially when linked to government audit policies. Further exploration of BDA's contribution to fraud detection, policy evaluation, and alignment with broader digital governance and public accountability reforms in developing countries is also needed.

Use of AI tools

The authors acknowledge the use of generative AI tools, specifically ChatGPT, Quillbot, and Grammarly, in the preparation of this manuscript. These tools were employed to assist with paraphrasing, translation, and idea development. All AI-assisted outputs were carefully reviewed, edited, and validated by the authors, who assume full responsibility for the accuracy, originality, and integrity of the final manuscript.

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Appendix

Bias Test

This study underwent an assessment for Common Method Variance (CMV), a potential source of bias that arises when survey data are influenced by the measurement method rather than the underlying constructs. The CMV test using single-factor analysis resulted in a score of 42.99%, which is below the commonly accepted threshold of 50% for indicating significant bias. This suggests that while some degree of method variance is present, this bias does not substantially affect the data (Podsakoff *et al.*, 2003).

Measurement Model Assessment

Confirmatory Tetrad Analysis (CTA) is recommended for empirically validating measurement model specifications, whether reflective or formative (Hair *et al.*, 2019). In this study, the CTA results provided empirical support for the reflective measurement model of the construct. Additionally, the findings from the CTA indicated that zero was included within the confidence intervals.

Table A1 demonstrates reliability and convergent validity test results. Reliability testing evaluates the stability and consistency of the measurement tool, ensuring that results remain consistent across repeated measurements. This typically involves assessing Cronbach's alpha and composite reliability, with a minimum threshold of 0.60 for both (Hair *et al.*, 2019). The results show that Cronbach's alpha and composite reliability values surpass the minimum threshold of 0.60. Furthermore, the construct is deemed valid, as the outer loading value surpasses the 0.60 threshold (Hair *et al.*, 2021). Additionally, the average variance extracted (AVE) values confirm that each variable adheres to the established standards, thereby supporting the study's validity (Hair *et al.*, 2019). This established validity ensures that the research results accurately represent the examined phenomena.

Table A1. Reliability and convergent validity test results

Indicators	Loadings	AVE	CA	CR
System Quality				
BDA has a comprehensive design	0.675	0.547	0.794	0.856
BDA is reliable for audit work	0.835			
BDA is accessible anytime	0.569			
BDA functions are relevant to auditors' tasks	0.821			
BDA helps maintain error-free audits	0.767			
Perceived Complexity				
BDA is conceptually difficult to understand	0.842	0.783	0.874	0.915
Using BDA is not easy	0.902			
BDA complicates audit work	0.909			
Self-Efficacy				
Possess necessary skills to use BDA	0.912	0.853	0.914	0.946
Technological and informational proficiency supports BDA usage	0.919			
Have sufficient knowledge to operate BDA	0.938			
Perceived Ease of Use				
BDA is easy to use	0.889	0.732	0.819	0.891
No significant difficulty in using BDA	0.849			
BDA makes auditing easier than conventional methods	0.829			
Perceived Usefulness				
BDA enables fast collection of audit data	0.814	0.830	0.931	0.951
BDA increases auditor productivity	0.941			
BDA enhances auditor effectiveness	0.950			
BDA improves auditor efficiency	0.934			

(*continued*)

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Table A1. Continued

Indicators	Loadings	AVE	CA	CR
Intention to Adopt BDA				
Intention to use BDA in audit work	0.877	0.787	0.865	0.917
Consistent intention to adopt BDA	0.885			
Expectation of continued comfort in using BDA	0.900			
Actual Usage of BDA				
Preference for using BDA	0.816	0.747	0.830	0.899
Satisfaction from using BDA	0.915			
Positive experience and satisfaction with BDA usage	0.859			
Audit Performance				
Reporting of audit findings in accordance with standards	0.639	0.826	0.878	0.593
Compliance with applicable audit procedures	0.823			
Verification and review of auditee documents	0.858			
Evaluation of controversial accounting treatments	0.731			
Provision of recommendations to enhance auditee accountability	0.779			
Audit Quality				
BDA provides better audit results than conventional methods	0.814	0.778	0.904	0.933
Satisfaction with audit outcomes when using BDA	0.889			
Greater confidence in audit results when using BDA	0.918			
BDA enhances audit implementation quality	0.904			

Note(s): AVE: Average Variance Extracted; CA: Cronbach's Alpha; CR: Composite Reliability

Source(s): Authors' own work

Table A2 presents the results of the discriminant validity test result, which evaluates the degree to which items can distinguish between constructs or measure separate concepts (Hair *et al.*, 2014). Based on the Fornell-Larcker criterion, the square root of the Average Variance Extracted (AVE) for each construct should exceed its correlations with other latent constructs (Fornell and Larcker, 1981). The assessment of discriminant validity indicates that all required criteria have been satisfied.

Table A2. Discriminant validity test results (Fornell-Larcker)

Construct	1	2	3	4	5	6	7	8	9	10
Actusage	0.865									
Auditperf	0.489	0.770								
Auditqual	0.704	0.487	0.882							
Certified	0.010	0.006	0.043	1.000						
Complexity	−0.215	−0.128	−0.280	−0.028	0.885					
Ease	0.656	0.497	0.613	−0.019	−0.234	0.856				
Intention	0.692	0.519	0.657	−0.087	−0.230	0.688	0.887			
Selfeffic	0.565	0.489	0.435	0.075	−0.177	0.656	0.634	0.923		
Systqual	0.789	0.506	0.699	−0.098	−0.211	0.656	0.670	0.454	0.740	
Useful	0.602	0.435	0.696	−0.131	−0.258	0.581	0.782	0.439	0.638	0.911

Source(s): Authors' own work

Given that the measurement model has been confirmed as reliable and valid, hypothesis testing can proceed.

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