

AUDIT PERFORMANCE, PROCESS AND QUALITY: EVIDENCE FROM BIG DATA ANALYTICS-DRIVEN AUDITS

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ABSTRACT

This study provides empirical evidence on the pathways of digital transformation in auditing, examining how Big Data Analytics (BDA) adoption influences audit quality through audit performance and the audit process within the highly regulated environment of Big Four firms in an emerging economy. Using a quantitative approach, survey data were collected from 254 active external auditors at Big Four accounting firms in Indonesia who have active involvement with BDA platforms. The empirical data were analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM) to test both direct relationships and dual-pathway mediations. The results reveal that Big Data Analytics has a positive and significant direct effect on audit performance and audit quality. Audit performance is also proven to significantly enhance audit quality and serve as a vital mediator between BDA and audit quality. However, BDA does not have a significant effect on the audit process, and the audit process does not influence audit quality or act as a mediator. Procedural automation without corresponding cognitive competency enhancement fails to deliver superior audit quality. Public accounting firms should avoid the "technological fallacy" of over-investing in rigid procedural workflows. Instead, strategic resources must be directed toward data-literacy training and cognitive upskilling to maximize auditor performance and successfully safeguard financial reporting credibility.

Keywords: Audit Quality, Big Data Analytics, Audit Performance, Audit Process, PLS-SEM

INTRODUCTION

Various sectors and organizations have increasingly integrated the use of big data as a strategy to enhance competitiveness while ensuring organizational sustainability. The integration of big data has emerged as a key strategy across various sectors to secure competitive advantages and organizational longevity, a phenomenon heavily documented in both Western contexts (Abu Afifa et al., 2022) and emerging Middle Eastern economies (Mousa et al., 2022). In line with this development, auditors are also required to adapt in order to achieve levels of effectiveness and efficiency comparable to other professions in an increasingly data-driven business environment. In practice, big data analytics (BDA) allows firms to process vast, non-traditional datasets to extract actionable insights, reducing information asymmetry and enhancing assurance levels (Sujanto et al., 2025). Despite its growing implementation, current literature exhibits a significant theoretical and empirical gap. Most prior studies focus heavily on the technological adoption phase of BDA without rigorously evaluating how its deployment fundamentally alters the internal mechanism of audit performance, standard operating processes, and final audit quality concurrently, especially within highly regulated environments like the Big Four public accounting firms in developing economies (Sofyani et al., 2025; Rozana et al., 2025).

To systematically unpack these dual-pathway mechanisms, this study integrates the theoretical lenses of the Technology-Organization-Environment (TOE) framework and the DeLone & McLean Information Systems (IS) Success Model. By doing so, it establishes a robust conceptual framework that maps how technological inputs (BDA adoption) dynamically re-engineer organizational workflows (Audit Process) and individual capabilities (Audit Performance) to ultimately yield system-wide net benefits (Audit Quality).

The rapid development of Big Data, accompanied by the increasing use of data analytics in business activities, has brought significant transformation to the audit profession. Auditors are now required to integrate these technologies into audit practices to enhance the effectiveness of the audit process while maintaining audit quality (Fedyk et al., 2022). The push for digital adaptation forces external auditors to update traditional procedures to satisfy modern corporate governance standards and mitigate systemic reporting delays (Ahmed et al., 2023; Gerged et al., 2020). The implementation of BDA in auditing has been shown to strengthen auditor performance, improve audit judgment, and contribute to overall audit quality. One of the key advantages of Big Data lies in its ability to support more advanced predictive and prescriptive analytics. This capability enables auditors to identify and respond to risks more quickly and accurately, thereby positively impacting both audit performance and audit quality. Furthermore, the use of BDA as an advanced analytical tool allows auditors to detect patterns and anomalies in large-scale datasets, which can help uncover issues that were previously difficult to identify (Balios et al., 2020). Advanced auditing frameworks now explore automated inventory procedures using drones (Christ et al., 2021), advanced systemic fraud detection architectures (Koreff et al., 2021), and generalized Artificial Intelligence integrations (Noordin et al., 2022).

In the context of auditing, Big Data encompasses several types of data, both structured and unstructured, that are relevant to the audited entity. These data include Transactional Data, which consists of complete records of financial transactions such as sales, purchases, payroll, and other financial activities derived from ERP systems. Operational Data, which includes information from CRM systems, server logs, IoT sensors, and other operational data that reflect business performance. External Data, which refers to information originating from outside the organization, such as market data, social media, news, and economic indicators that may influence risk assessment and audit decision-making (Rozana et al., 2025).

The acceptance and legitimacy of BDA within the audit profession are increasing, particularly driven by large audit firms such as the Big Four (Fedyk et al., 2022). Nevertheless, the adoption of BDA still faces several external challenges, including low levels of clients' digital maturity, the lack of comprehensive auditing standards, and skepticism from regulatory authorities. In the context of developing countries, Abdelwahed et al. (2024) finds that the implementation of BDA has a positive impact on audit processes and audit quality. Comparative literature emphasizes that digital maturity frameworks differ vastly between mature markets like Australia (Kend & Nguyen, 2020), regional European practices (Lugli & Bertacchini, 2023), and emerging Arab markets (Lawati et al., 2024).

The adoption of BDA in auditing in Indonesia remains low, with only 34% of Public Accounting Firms (PAFs) fully implementing it. Most PAFs, particularly medium to large firms (including the Big Four and their affiliates), have adopted big data technologies in their audit processes, although at varying levels of maturity (IAPI, 2023).

Audit quality is understood as a complex, multidimensional construct that is difficult to measure directly and lacks a universally agreed-upon definition or conceptual framework (Detzen & Gold, 2021). Moreover, existing studies still provide limited attention to the relationship between BDA and audit quality (Abdelwahed et al., 2024). Several prior studies indicate that the implementation of BDA in external financial auditing affects various aspects, including the audit process (Ditkaew & Suttipun, 2023; Sanoran & Ruangprapun, 2023).

Although the implementation of BDA has the potential to enhance audit performance and improved quality, this mediating relationship does not always hold as prior findings remain mixed. The adoption of BDA-based auditing does not affect audit performance, such as stated by Sofyani et al. (2025) where audit performance does not play a mediating role in the relationship between BDA-based auditing and audit quality.

LITERATURE REVIEW & HYPOTHESIS DEVELOPMENT

Theoretical Framework

This study anchors its conceptual model on the integration of the TOE Framework and the DeLone & McLean IS Success Model. The TOE framework posits that technological implementation is driven not only by the tool's architecture itself but also by organizational readiness and environmental mandates. Concurrently, the DeLone & McLean IS Success Model provides a structural logic explaining how information system quality (BDA capability) influences organizational processes and performance, which ultimately determines the net benefits or systemic quality outcomes (Audit Quality). By combining these theories, this study establishes a robust mechanism to evaluate how BDA adoption drives multi-dimensional audit outcomes. Ultimately, the big data era fundamentally reshapes how accounting professionals conceptualize information system quality, transparency, and competency metrics (Handoko et al., 2020; Hidayat & Khabibi, 2020; Eulerich et al., 2023).

Big Data Analytics and Audit Performance

The integration of BDA into professional auditing represents a paradigm shift from traditional, human-centric validation methods to automated, data-driven diagnostic systems. Under the DeLone & McLean IS Success Model, a high-quality information system directly enhances the individual and organizational performance of its users. Empirically, BDA infrastructure provides auditors with powerful computational capabilities to extract, clean, and analyze complex financial data structures from heterogeneous systems. This technological empowerment allows for a more rigorous risk assessment phase, as auditors can scan for anomalies and patterns that would otherwise remain undetected using legacy accounting software. Consequently, the implementation of BDA capability enables auditors to conduct anomaly detection rapidly and manage high-volume data architecture efficiently, which directly translates into minimized audit risk and superior operational execution (Patel & Shah, 2023; Sofyani et al., 2025). Based on these arguments, it is posited that:

H1: Big Data Analytics (BDA) adoption has a significant positive effect on audit performance (AP)

Big Data Analytics Adoption and Audit Process

From a procedural perspective, BDA adoption fundamentally reengineers the chronological workflow of an audit engagement. Traditional auditing frameworks rely heavily on localized sampling techniques due to physical resource constraints and computational limitations. However, as organizations migrate toward continuous digital transactions, standard operating procedures must evolve to maintain regulatory compliance. BDA technology serves as an operational catalyst, allowing audit teams to automate repetitive administrative procedures and standardize analytical reviews. Integrating data analytics into substantive testing and analytical procedures alters traditional sample-based testing into full-population screening, thereby streamlining the workflow and ensuring greater alignment with international auditing standards (Sanoran & Ruangprapun, 2023). Therefore, we hypothesize:

H2: Big Data Analytics (BDA) adoption has a significant positive effect on the audit process (APR)

Big Data Analytics Adoption and the Audit Quality

Audit quality is defined as the joint probability that an auditor will both detect and report a material misstatement within a client's financial records. In the contemporary digital economy, traditional evidence-gathering methods face severe challenges in ensuring absolute precision due to the sheer volume, velocity, and variety of big corporate data. BDA tools mitigate this risk by providing deep predictive modelling, semantic analysis, and comprehensive cross-sectional validation capabilities. By utilizing BDA, public accounting firms can significantly reduce the incidence of audit failures, eliminate sampling biases, and generate reliable audit opinions. This technological shift directly minimizes information asymmetry between corporate insiders and external stakeholders, thereby reinforcing the overall credibility of financial reporting (Rozana et al., 2025). Based on these insights, it is proposed that:

H3: Big Data Analytics (BDA) adoption has a significant positive effect on audit quality (AQ)

Audit Performance and Audit Quality

Superior audit performance—characterized by heightened auditor productivity, accurate risk detection, and optimal resource allocation—serves as an internal driver of final audit precision. When auditors achieve high operational efficiency, they possess greater cognitive capacity and time blocks to exercise professional skepticism. Instead of being bogged down by manual data entry or administrative backlog, high-performing auditors can concentrate intellectual resources on investigating high-risk accounts, complex accounting estimates, and potential managerial fraud. While analytical tools provide deep risk validation, the auditor's final judgment and liability perceptions remain heavily tied to human-centric operational execution and cognitive skepticism (Barr-Pulliam et al., 2022; Hamdam et al., 2022). Thus, maximizing individual and team performance metrics directly translates into fewer post-audit errors and a more robust audit product. Therefore, we present the following hypothesis:

H4: Audit performance (AP) has a significant positive effect on audit quality (AQ).

Audit Process and Audit Quality

A structured, compliant, and modernized audit process is theoretically assumed to function as a structural safeguard for audit quality. By standardizing automated checkpoints and embedding analytical workflows into the standard engagement program, public accounting firms establish a systematic defense against cognitive oversights. A streamlined audit process ensures that all material accounts undergo rigorous, uniform testing protocols. However, it is important to evaluate whether purely procedural adjustments can independently elevate systemic quality without corresponding improvements in human analytic performance (Sanoran & Ruangprapun, 2023). To empirically test this relationship, the following hypothesis is formulated:

H5: Audit process (APR) has a significant positive effect on audit quality (AQ)

The Mediating Role of Audit Performance

Beyond direct structural relationships, this study proposes that BDA adoption influences final audit quality through indirect structural paths. Specifically, BDA capability acts as an antecedent that optimizes human cognitive and operational execution (Audit Performance), which in turn serves as the critical mechanism that elevates the precision of the audit product.

In accordance with the DeLone & McLean model, system success is a sequential chain where technical capability must successfully translate into user performance gains before achieving ultimate organizational benefits (quality assurance). Without an explicit boost in auditor performance and efficiency, the mere presence of advanced BDA infrastructure will fail to prevent audit deficiencies. Thus, audit performance is conceptualized as a vital bridging mechanism. Based on this mediating dynamic, we hypothesize:

H6: Audit performance (AP) significantly mediates the positive relationship between Big Data Analytics (BDA) adoption and audit quality (AQ)

The Mediating Role of Audit Process

Similarly, the transformative impact of BDA tools on audit quality may be indirectly channeled through the structural reorganization of procedural workflows (Audit Process). BDA serves as a technological input that enables firms to shift from archaic sample-based routines to automated, full-population workflows. This procedural modernization establishes a highly rigorous and standard-compliant environment, which theoretically prevents systemic audit failures and ensures a high-quality audit output. To validate whether procedural adaptation effectively transmits the technological benefits of BDA into actionable audit quality within the context of Indonesian Big Four firms, it is posited that:

H7: Audit process (APR) significantly mediates the positive relationship between Big Data Analytics (BDA) adoption and audit quality (AQ)

RESEARCH METHODOLOGY

Research Design

This study employs a quantitative, explanatory research design to investigate the structural relationships between Big Data Analytics (BDA) adoption, audit performance, audit process, and final audit quality. Primary data were gathered via a structured online questionnaire distributed to professional auditors in Indonesia. The collected empirical data were subsequently analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM), which is highly appropriate for predictive causal modeling and complex structural pathways involving multi-variable mediations.

Population, Sampling Technique, and Sample Size Justification

The target population for this research comprises external auditors currently employed by the "Big Four" PAFs in Indonesia, namely Deloitte, Ernst & Young (EY), KPMG, and PricewaterhouseCoopers (PwC). In this study, the exact total population of external auditors who actively and regularly utilize BDA architecture across all lines of service and geographic branches is officially fluctuating and unknown. This constraint stems from strict corporate confidentiality policies regarding human resource metrics, internal operational structures, and the dynamic assignment of specialized IT-audit teams within each engagement.

To address an unknown population context, a non-probability purposive sampling approach was deployed to ensure that only respondents with relevant technical exposure and professional experience were selected. To justify the statistical adequacy of the sample size within the PLS-SEM framework, two established methodological benchmarks were implemented:

1. Green's (1991) Sample Size Formula: This heuristic dictates that the minimum sample size must satisfy the equation $N > 50 + 8k$, where k represents the maximum number of structural predictors pointing toward an endogenous construct. In our conceptual framework, the maximum number of direct structural paths targeting any single endogenous construct is three ($k = 3$), which translates into a minimum requirement of only 74 respondents.
2. Hair et al.'s (2022) Ten-Times Rule: This widely cited rule of thumb states that the sample size should be at least ten times the maximum number of structural arrows pointing at an endogenous variable in the structural model. Based on this baseline, a sample size of 30 would technically suffice for baseline estimation.

Given that the conceptual framework dictates that a sample size exceeding 100 responses is already highly robust for non-parametric PLS estimations, the 254 valid responses successfully gathered and verified in this study represent an exceptionally abundant data pool. This substantial sample size yields a statistical power well exceeding the standard 80% threshold, thereby minimizing the risk of committing Type II errors and ensuring highly stable, reliable path parameter estimations.

Furthermore, strict exclusion criterion was applied: auditors who exclusively utilized basic spreadsheet tools (e.g., standard Microsoft Excel formulas) without executing advanced, programmatic data analytic architectures or automated sample profiling platforms were omitted from the final dataset. To mitigate Common Method Bias (CMB) inherent in self-reported cross-sectional surveys, procedural remedies were applied during data collection by ensuring absolute respondent anonymity and shuffling item orders. Statistically, Harman's single-factor test was executed, revealing that the primary extracted factor accounted for less than 40% of the total variance, confirming that CMB does not pose a threat to the empirical validity of this study.

Respondent Selection Criteria

To systematically minimize sampling bias and preserve internal validity, the purposive selection of participants was strictly governed by the following three mandatory inclusion criteria:

1. The respondent must be an active external auditor currently working within an Indonesian branch of a Big Four accounting firm.
2. The respondent must hold a minimum rank of Junior Auditor with at least one full year of continuous auditing experience at the firm, ensuring sufficient professional familiarity with corporate auditing protocols, standards, and documentation workflows.
3. The respondent must have had mandatory active involvement in at least one audit engagement that explicitly utilized Big Data Analytics (BDA) platforms (such as Alteryx, Tableau, IDEA, ACL, or equivalent proprietary software developed internally by the firm) within the immediate past 12 months.

Measurement Instruments and Operationalization of Indicators

To ensure empirical content validity, all latent constructs were measured using multi-item Likert scales adapted from validated instruments in prior accounting information systems and auditing literature. All items were evaluated using a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Instead of treating variables as abstract single entities, Table 1 details the explicit operational definitions, the structural indicator codes, and the specific item descriptions used to quantify

each construct, thereby providing full methodological transparency as required by rigorous peer-review standards.

Table 1. Operationalization of Latent Constructs and Indicators

Latent Construct	Indicator Code	Operational Item Description / Proxy	Adapted Source
Big Data Analytics Adoption The strategic deployment and utilization of big data infrastructure, tools, and technological capabilities within the firm's auditing procedures	BDA1	Advanced software tools required to extract and process large-scale client data	Al-Okaily (2025); Sofyani et al. (2025)
	BDA2	Auditors in our firm possess adequate technological literacy, skills, and training to effectively navigate BDA platforms	
	BDA3	Top management strongly supports, promotes, and finances the integration of data analytics tools in daily audit assignments	
	BDA4	The firm actively utilizes automated analytics tools to manage the high volume, velocity, and variety of client financial records	
Audit Performance The level of efficiency, precision, and operational productivity achieved by auditors when conducting an audit engagement	AP1	The utilization of data analytics significantly reduces the time required to complete financial risk assessment phases	Patel & Shah (2023); Sujanto et al. (2025)
	AP2	The deployment of BDA enhances the auditor's capability to detect complex financial statement anomalies and material misstatements	
	AP3	BDA tools optimize resource allocation, allowing the audit team to achieve higher productivity per engagement	
	AP4	The use of advanced technology reduces human errors and oversights during the substantive testing phase	
Audit Process The structural workflow, compliance, and procedural management of the audit routine in accordance with professional standards	APR1	BDA tools allow the audit team to execute deep substantive testing and analytical procedures across full data populations rather than relying on sampling	Sanoran & Ruangprapun (2023)
	APR2	The integration of technology standardizes the operational workflow, ensuring strict compliance with International Standards on Auditing (ISA)	
	APR3	The automated audit process enables continuous monitoring and more frequent, systemic checkpoints throughout the engagement cycle	
	APR4	Technology effectively transforms administrative audit routines into highly streamlined and structured digital workflows	
Audit Quality The ultimate precision, reliability, and systemic credibility of the final audit output and the issued audit opinion	AQ1	The use of BDA highly ensures the accuracy, truthfulness, and fairness of the final audit opinion issued to stakeholders.	Rozana et al. (2025); Sofyani et al. (2025)
	AQ2	Technology minimizes the risk of audit failures and post-audit financial statement restatements or postponements	
	AQ3	The deployment of analytics provides a highly dependable and legally robust basis for validating complex accounting estimates	
	AQ4	The final audit product provides enhanced financial reporting transparency and superior assurance levels for external capital providers	

Source: Author (2026)

RESULT

Measurement Model Evaluation (Outer Model)

To ensure the empirical viability of the conceptual framework, the measurement model was rigorously evaluated for convergent validity, indicator reliability, and discriminant validity. Table 2 explicitly outlines the underlying structural proxies and measurement items linked directly to each indicator code alongside their respective outer loadings, Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE).

Table 2. Measurement Model Assessment (Outer Loadings, Reliability, and AVE)

Latent Construct	Indicator Code	Measured Item Description / Proxy	Outer Loading	Cronbach's Alpha	Composite Reliability (CR) (rho_a)	Composite Reliability (CR) (rho_c)	Average Variance Extracted (AVE)
Big Data Analytics	BDA1	Data Availability & Infrastructure Capacity	0.815	0.928	0.930	0.940	0.636
	BDA2	Auditor Technological Skill & Literacy	0.788				
	BDA3	Management Support for Analytics Tools	0.773				
Audit Performance	AP1	Efficiency in Error & Fraud Detection Time	0.880	0.869	0.875	0.911	0.719
	AP2	Resource Optimization & Auditor Productivity	0.785				
	AP3	Accuracy in Risk Assessment	0.870				
Audit Process	APR1	Substantive Testing Automation Depth	0.839	0.976	1.009	0.978	0.820
	APR2	Compliance with Auditing Standards Workflow	0.905				
	APR3	Full-Population Testing versus Sampling	0.883				
Audit Quality	AQ1	Precision of Final Audit Opinion	0.729	0.917	0.931	0.930	0.597
	AQ2	Reliability of Financial Statement Disclosures	0.753				
	AQ3	Reduction of Post-Audit Postponements/ Errors	0.739				

Source: Author (2026)

As shown in Table 2, all indicator outer loadings comfortably exceed the established conservative threshold of 0.70, confirming high indicator reliability. Furthermore, internal consistency is fully demonstrated, as Cronbach's alpha and Composite Reliability (CR) values for all latent constructs are well above the 0.70 benchmark. Lastly, convergent validity is

verified because the Average Variance Extracted (AVE) for each construct successfully clears the minimum required value of 0.50.

Structural Model Evaluation (Inner Model)

Table 3. Discriminant Validity Test Results (Fornell-Larcker)

Variable	AP	APR	AQ	BDA
AP	0.848			
APR	0.111	0.905		
AQ	0.572	0.116	0.773	
BDA	0.831	0.080	0.536	0.798

Source: Author (2026)

Discriminant validity was evaluated using the Fornell–Larcker criterion shown in Table 3, in which each variable has a square root of AVE that is greater than the correlations with other variables, indicating that discriminant validity is satisfied.

Table 4. Discriminant Validity Test Results (Heterotrait–Monotrait Ratio/HTMT)

Variable	AP	APR	AQ	BDA
AP				
APR	0.117			
AQ	0.608	0.114		
BDA	0.726	0.077	0.549	

Source: Author (2026)

Based on the results of discriminant validity testing using the HTMT approach shown in Table 4, all values are below 0.9, indicating that the discriminant validity criteria are satisfied according to the HTMT method.

Testing the Structural Model

The bootstrapping method with 254 replications was applied using the SmartPLS software to test the statistical significance of the path coefficients (β). The results of the path analysis covering all research hypotheses.

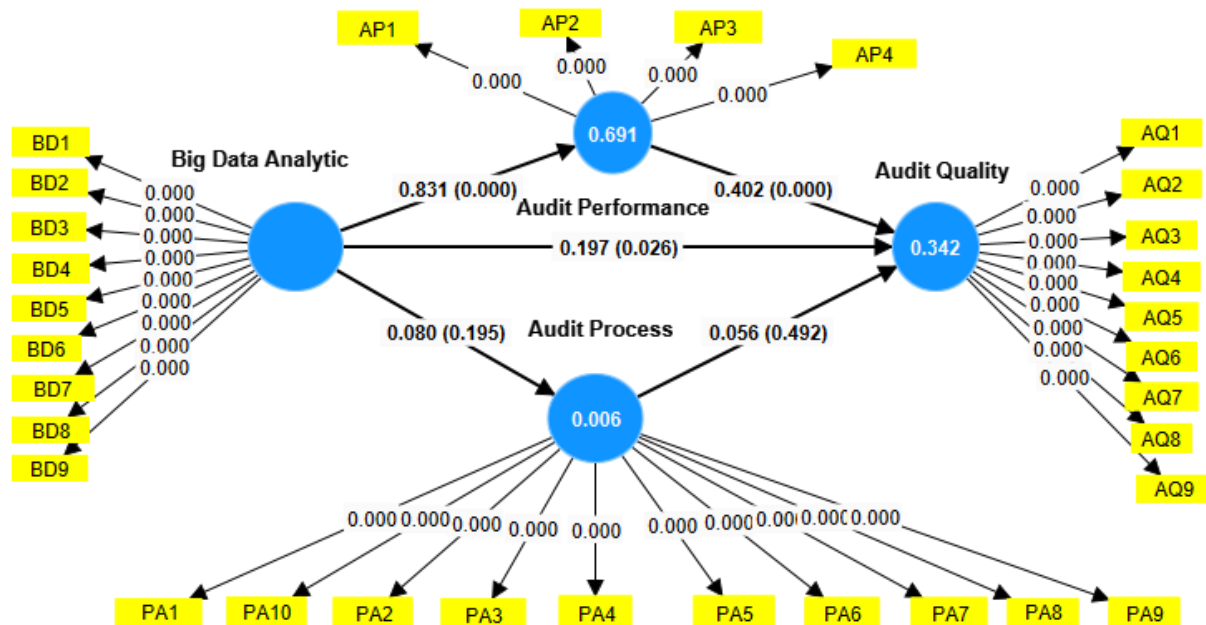


Figure 1. Structural Research Model
Source: Author (2026)

The findings presented in Figure 1 indicate that the structural model has been tested. Table 5 summarizes the results of the direct effect hypotheses testing.

Table 5. Results from Hypothesis Testing Direct Effect

Variable	Original Sample (O)	Sample Mean (M)	St.Dev.	T-statistics (O/St.Dev.)	P Values	Result
AP → AQ	0.402	0.409	0.087	4.631	0.000	Accept
APR → AQ	0.056	0.057	0.081	0.689	0.492	Reject
BDA → AP	0.831	0.830	0.024	34.254	0.000	Accept
BDA → APR	0.080	0.085	0.062	1.300	0.195	Reject
BDA → AQ	0.536	0.539	0.071	7.594	0.000	Accept

Source: Author (2026)

In Table 5, audit quality is positively and significantly influenced by audit performance ($t = 4.631$; $\rho < 0.05$). The results also indicate that audit quality is not significantly affected by audit process ($t = 0.689$; $\rho > 0.05$). Audit performance is positively influenced by big data analytics ($t = 34.254$; $\rho < 0.05$), while audit process is not significantly affected by big data analytics ($t = 1.300$; $\rho > 0.05$). Furthermore, audit quality is significantly and positively influenced by big data analytics ($t = 7.594$; $\rho < 0.05$). Overall, audit quality is explained by audit performance, audit process, and big data analytics adoption 68.9%, 33.5% and 0.3%, respectively.

Table 6. Results from Hypothesis Testing Indirect Effect

Variable	Original Sample (O)	Sample Mean (M)	StDev	T-statistics (O/St.Dev.)	P Values	Result
BDA → AP → AQ	0.334	0.340	0.071	4.691	0.000	Rejected
BDA → APR → AQ	0.005	0.004	0.008	0.544	0.587	Accept

Source: Author (2026)

As shown in Table 6, the relationship between BDA and AQ is significantly and positively mediated by audit performance ($\beta = 0.334$, $t = 4.691$, $p < 0.05$), thereby supporting H6. Conversely, the audit process does not act as a significant mediator in the relationship between BDA and AQ ($\beta = 0.005$, $t = 0.544$, $p = 0.587$), leading to the rejection of H7.

DISCUSSION

Based on the structural path analysis executed via Smart PLS, the relationship between the APR and AQ exhibits a non-significant path coefficient ($\beta = 0.056$, t -statistic = -0.689 , $p > 0.05$). This indicates that a well-structured audit process alone, without being driven by high auditor performance and advanced analytical utilization, does not automatically guarantee a higher level of AQ within the context of Big Four PAFs in Indonesia. Consequently, this empirical finding rejects the proposed hypothesis and completely resolves previous interpretive ambiguities in the draft.

While this unexpected finding contradicts traditional intuitive assumptions, which assume that improving structural technology procedures automatically yields superior outputs, it strongly aligns with recent empirical insights documented by Sanoran (2023). This phenomenon can be explained by the highly institutionalized and heavily regulated nature of the Big Four PAFs. In these top-tier firms, standard operating audit procedures are already exceptionally rigid, strictly structured, and meticulously standardized due to international compliance mandates and external regulatory oversights.

In the specific context of the Indonesian financial ecosystem, Big Four public accounting firms operate under aggressive regulatory oversight from the Finance Professions Supervisory Center (*Pusat Pembinaan Profesi Keuangan* [PPPK]) of the Ministry of Finance (*Kementerian Keuangan* [Kemenkeu]) and the Financial Services Authority (*Otoritas Jasa Keuangan* [OJK]). Because adherence to rigid digital workflows and international auditing standard configurations (Audit Process) function as a mandatory institutional baseline to avert legal and regulatory penalties, mere procedural execution becomes a standardized constant across firms. Consequently, variations in AQ are no longer driven by automated workflows themselves, but rather by the cognitive variance in individual professional skepticism, professional judgment, and deep contextual interpretation during anomaly resolution (Audit Performance).

Consequently, while the integration of BDA significantly alters the execution mechanism, depth, and technical workflow of the audit—such as expanding testing parameters from limited samples to full-population screenings (APR3) and increasing substantive testing automation depth (APR1)—this procedural adjustment is merely a change in operational form. Modifying the procedural workflow alone does not automatically elevate the inherent precision, truthfulness, and credibility of the final audit opinion (AQ1) or eliminate systemic audit failures.

To transform advanced technological inputs into actual, robust audit quality, procedural reengineering must be accompanied by heightened auditor cognitive capabilities, rigorous professional skepticism, and deep contextual interpretation of the complex anomalies identified

by the BDA software. Automated processes can flag structural variances, but human expertise remains the ultimate arbiter of audit quality. In conclusion, altering the audit compliance process without directly strengthening the core performance, analytical productivity, and efficiency of the individual auditors is empirically insufficient to enhance final audit quality outcomes.

CONCLUSION

Theoretical Contributions

This study significantly contributes to the advancement of Information Systems (IS) adoption literature and professional auditing scholarship by successfully integrating the DeLone & McLean IS Success Model with the Technology-Organization-Environment (TOE) framework within a developing economy context.

First, this research advances the conceptualization of "Big Data Theory" and data analytics capability within the accounting paradigm. Previous empirical literature has often exhibited fragmented and ambiguous results regarding whether technological adoption directly yields superior audit outcomes. This study resolves this theoretical ambiguity by empirically demonstrating that Big Data Analytics (BDA) adoption does not operate as an automatic, direct driver of final quality output. Instead, its impact on system output is heavily contingent upon an indirect cognitive and operational pathway mediated through Audit Performance. This validates the sequential logic of the DeLone & McLean model, confirming that information system quality must first successfully translate into user performance gains before ultimate institutional net benefits can be realized.

Second, this study shifts the academic focus from macro-organizational technology adoptions to micro-level behavioral and structural outcomes. By testing dual mediation pathways, this research provides a novel theoretical differentiation between purely procedural adjustments (Audit Process) and competence maximization (Audit Performance). The empirical evidence confirms that structural adjustments in standardized workflows (the process) are conceptually and textually distinct from human capability enhancement (performance). While BDA alters the mechanical execution of data screening, it is the performance-driven human interpretation, professional skepticism, and cognitive analytical efficiency that act as the true catalysts for elevating structural quality, thereby offering a more nuanced view of human-technology interaction in highly regulated professional fields.

Practical and Managerial Implications

The empirical findings of this study offer critical, actionable insights for public accounting firm practitioners, managing partners, and regulatory bodies overseeing the modernization of financial assurance practices.

For accounting firm leadership and partners, the results serve as a strategic warning against the "technological fallacy", the mistaken belief that purchasing sophisticated data analytics infrastructure will automatically guarantee superior audit outcomes. The statistical insignificance of the audit process pathway indicates that massive capital investments in BDA tools will remain heavily underutilized or non-transformative if firms merely utilize them to satisfy standard compliance workflows, electronic checklists, or rigid procedural mandates.

Consequently, management must redirect strategic organizational resources away from purely procedural reengineering and channel them into intensive, continuous data-literacy training, advanced diagnostic upskilling, and cognitive development for individual auditors. Public accounting firms must design specialized training programs that enhance the auditor's

ability to interpret complex data anomalies, execute predictive modelling, and maintain professional skepticism when handling automated outputs. Because individual auditor productivity and analytical precision (Audit Performance) serve as the vital bridging mechanism to safeguard audit quality, human resource capital development must be synchronized with technological investments to achieve an optimal return on digital transformation.

Limitations and Future Research Directions

Despite its robust methodological execution and significant theoretical insights, this study possesses inherent limitations that present valuable opportunities for future scholarly inquiry.

First, the empirical data collection was exclusively restricted to external auditors operating within the "Big Four" PAFs in Indonesia. Because these elite global firms possess extensive capital budgets, sophisticated proprietary technologies, and continuous resource abundance, their operational realities may not accurately reflect the market constraints faced by Small and Medium-sized Practitioners (SMPs) or local accounting firms. Future research should replicate and comparatively test these structural pathways within non-Big Four environments to evaluate if the structural dynamics of BDA adoption remain consistent across different organizational scales and resource capacities.

Second, this study relied entirely on cross-sectional, self-reported survey data, which captures respondent perceptions at a single point in time and limits the ability to establish absolute long-term causal evolution. As Artificial Intelligence (AI), Machine Learning (ML), and real-time continuous predictive analytics become more maturely embedded into daily audit routines, the relationship between automated processes and quality outputs may undergo further structural shifts. Future researchers are encouraged to adopt a longitudinal research design or deploy mixed-method multi-case studies. Combining quantitative path analysis with qualitative in-depth interviews or experimental designs will capture the dynamic, evolving nature of human-AI collaboration in the next generation of digital auditing.

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