



ENHANCING INTERNAL AUDIT QUALITY THROUGH DATA ANALYTICS AND TRANSFORMATIONAL LEADERSHIP

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Abstract

This study aims to examine the effects of data analytics and transformational leadership on internal audit report quality at the Financial and Development Supervisory Agency (BPKP) in Indonesia. The population consists of all auditors at BPKP, and a purposive sampling technique was employed to select 127 auditors as the sample. Data were collected using a structured questionnaire and analyzed with structural equation modeling using SmartPLS 4. The results show that data analytics and transformational leadership have a positive and significant effect on internal audit report quality. Therefore, organizations are encouraged to invest in both data analytics capabilities and transformational leadership development to maximize the quality of internal audit results.

Keywords: Data analytics; Internal audit; Public-sector accountability; Report quality; Transformational leadership

INTRODUCTION

Internal control plays a vital role in ensuring accountability, performance, and transparency in Indonesian government institutions. The Government Internal Control System (SPIP), regulated under PP No. 60/2008, mandates internal supervision through audits, reviews, evaluations, and monitoring by Government Internal Control Apparatus (APIP), including Financial and Development Supervisory Agency (BPKP), Inspectorates General, and local inspectorates. BPKP, directly responsible to the President, holds a strategic position as it conducts cross-sectoral internal supervision with significant impact. Thus, producing quality audit reports is crucial. According to AAIFI Regulation No. PER-01/AAIFI/DPN/2021, a high-quality audit report must be accurate, objective, concise, constructive, complete, and timely. However, recurring audit findings indicate challenges in audit quality and implementation of recommendations (Husni et al., 2022).

In the digital era, the government faces massive and diverse data flows. Hair and Wood (FEB UGM, 2019) highlight that only 5% of daily data generated can be transformed into useful information. Similarly, numerous government applications produce large volumes of data requiring careful analysis for decision-making. Within auditing, data analytics is increasingly essential to enhance audit quality, reduce audit delays (Listya et al., 2023), and meet growing public expectations (Irianto et al., 2024).

Beyond technology, leadership is another critical factor. Transformational leadership, characterized by vision, credibility, and the ability to motivate auditors (Burns, 2003), has been shown to improve audit quality (Wardana & Ariyanto, 2016; Marbun & Sitepu, 2018). This aligns with contingency theory (Fiedler, 1964), which posits that audit effectiveness depends on contextual factors, including leadership and technology. Empirical evidence supports this: Big Data Analytics improves efficiency and effectiveness (Ahmad & Aliyudin, 2020; Putra et al., 2023), while transformational leadership enhances auditor performance and audit quality (Safitri, 2014).

Based on these arguments, the study proposes the following hypotheses:

- H₁: Data analytics has a positive impact on internal audit quality.
- H₂: Transformational leadership positively influences internal audit quality.



This study contributes both scientifically and practically. Scientifically, it enriches the literature on internal government auditing by combining leadership and technology perspectives. Practically, it provides policy recommendations for enhancing audit quality and strengthening government accountability in Indonesia.

LITERATURE REVIEW

Internal Control and Audit Internal Quality

Internal control in the public sector can only function effectively if supported by high-quality internal audits. According to the Indonesian Government Internal Audit Standards (SAIPI) issued by AAIP in 2021, supervisory reports must be accurate, objective, clear, concise, constructive, complete, and timely. In practice, however, recurring findings remain a challenge due to limited auditor competence and weak follow-up mechanisms (Husni et al., 2022). Research shows that the effectiveness of APIP, including BPKP, in improving SPIP implementation and governance accountability depends on their ability to produce supervisory outputs that meet SAIPI standards (Irianto et al., 2024). Strengthening compliance with these standards is therefore essential to ensure internal audit quality and enhance public trust in government oversight (Christensen et al., 2019).

Data Analytics in Auditing

The rapid growth of digitalization requires auditors to apply Data Analytics (DA) to convert large volumes of government data into useful insights for decision-making. According to Hair et al. (2019), only a small fraction of daily data can be meaningfully utilized, emphasizing the importance of analytical tools. In auditing, DA helps reduce audit delays and increase efficiency (Listya et al., 2023; Ahmad & Aliyudin, 2020). Empirical studies also confirm its positive impact on Internal Audit Report Quality (IAQ), with findings from Hezam et al. (2023), Ditkaew and Suttipun (2023) in Thailand, and Sofyani et al. (2025) in Indonesia. Consistent with Albrecht et al. (2012), who stress that technology-driven audit techniques enhance audit effectiveness and reliability, these results indicate that adopting data analytics is essential for producing high-quality internal audit report that supports accountability.

Contingency Theory

Contingency theory explains that organizational effectiveness depends on the fit between leadership, technology, and situational factors (Fiedler, 1964; Donaldson, 2001). In auditing, this perspective suggests that audit quality improves when transformational leadership and the use of Data Analytics (DA) are aligned with institutional needs. Research in Indonesia shows that combining DA with adaptive leadership enhances efficiency and accountability in government audits (Putra et al., 2023; Ahmad & Aliyudin, 2020), while international studies emphasize that flexibility in applying audit approaches is critical for sustaining credibility in dynamic digital environments (Chenhall, 2003). These findings highlight the importance of adaptive strategies for strengthening internal audit quality in the public sector.

METHOD

This study applies a quantitative design to examine the influence of data analytics usage and transformational leadership on internal audit report quality. Table 1 below presents the detailed operationalization of each research variable.



Table 1. Operationalization of Research Variables

Variable	Definition	Measurement	References
Internal Audit Report Quality (IAQ)	The Internal Audit Report is considered to be of quality if it meets the minimum standart for communicating value-added internal audit findings. According to SAIPI (2021), communication of internal audit findings is required to be accurate, objective, clear, concise, constructive, complete, and timely.	• Accurate — fact-based, free from distortion and error; • Objective — fair, impartial, unbiased; • Clear — easy to understand, logical, avoids unnecessary technical terms, and represent all significant and relevant information; • Concise — straight to the point and avoids unnecessary elaboration, excessive detail, repetition, and length.; • Constructive — assist-like nature and aimed at making necessary improvements.; • Complete — not leaving out anything important, including significant and relevant information to support the conclusions and recommendatios; - and • Timely — the information is delivered according to the time and substance required, taking into account the level of significance that allows for appropriate corrective action.	Government Internal Audit Standards of Indonesia (SAIPI, 2021).
Use of Data Analytics (DA)	Data analytics is the systematic processing of data to generate insights (Perdana, 2020).	• Defining Appropriate Questions — identifying audit information needs, objectives, and business processes; • Data Collection — requesting relevant data, conducting surveys, and ensuring auditee cooperation;	Big Data Analytics: Concepts, Implementation, and Current Applications by Zen Munawar et al. (2023).



Variable	Definition	Measurement	References
		• Data Cleansing — verifying and validating data from auditees; • Data Analysis — applying descriptive, diagnostic, predictive, and prescriptive analyses; and • Data Visualization — presenting data visually and reporting results in the audit report.	
Transformational Leadership Style (TL)	Transformational leadership style is a leadership style that can inspire, motivate, and change employees in a positive way (Burns, 1978).	• Idealized Attributes — leader's ability to built trust, respect and pride on their followers; • Idealized Behaviors — leader's ability to acts with integrity, belief and value; • Inspirational Motivation — leader's ability to encourage their followers through meaning and motivation; • Intellectual Stimulation — leader's ability to stimulate their followers ability to innovative approach and thinking; and • Individual consideration — leader's ability to pay attention to their followers individualized need, growth, and achievement.	Moreno-Casado, H., Leo, F. M., López-Gajardo, M. A., García-Calvo, T., Cuevas, R., & Sánchez-Oliva, D. (2021).

Source: processed by the author

Data were collected using a structured questionnaire distributed online via Google Forms with a six-point Likert scale from strongly disagree (1) to strongly agree (6). The questionnaire consisted of four parts covering respondent profile, data analytics usage with 15 items, transformational leadership with 20 items, and internal audit report quality with 21 items.

The study population comprised all 4,697 auditors of the Financial and Development Supervisory Agency (BPKP) in Indonesia, as listed in the BPKP Personnel Management Application (MAP Mobile). This population included auditors from both the head office and regional representative offices. The sample was selected using purposive sampling, with the



criterion that respondents were BPKP auditors who had passed the auditor competency certification examination in accordance with the rank or position they held, as required by the Indonesian Government Internal Auditor Association (AAIPI). A total of 127 auditors participated in the study. The sample size was considered adequate since it fulfilled the requirement of the often-cited 10 times rule (Hair et al., 2022), which recommends that the number of respondents should be at least ten times the number of independent variables in the most complex regression within the PLS path model. In this study, the construct with the largest number of indicators was Internal Audit Report Quality (IAQ), which consisted of seven indicators, meaning that the minimum required sample size was 70, and the collected sample of 127 exceeded this threshold.

The data obtained using the questionnaire was processed using SmartPLS 4. This study used two analytical steps following Hair et. al. (2022). First, the measurement model was tested for reliability and validity using outer loading, Cronbach's Alpha, Composite Reliability, and AVE. Second, the structural model was evaluated through path coefficients, t-statistics, and p-values to test hypotheses, with R^2 and Q^2 used to assess model fit and predictive relevance.

RESULT AND DISCUSSION

Profile of Respondents

The study involved 127 auditors from Indonesia's Financial and Development Supervisory Agency (BPKP), covering both the head office and provincial representative offices. Respondents were spread across all seven echelon I units of BPKP and 35 echelon II units, including three units at the head office out of a total of five, and 32 provincial representative offices out of a total of 36.

Regarding work experience, the majority had 2–5 years of service (53.5%), followed by 11–30 years (23.6%), 6–10 years (12.6%), and over 30 years (9.4%), while only one respondent had less than two years of experience. In terms of position levels, most respondents were skilled auditors (55.1%), followed by young expert auditors (22.8%), first expert auditors (11.8%), intermediate expert auditors (7.9%), and proficient auditors (2.4%).

Regarding educational background, nearly half held a Bachelor's/Diploma IV degree (46.5%), Diploma III graduates made up 44.1%, and the remaining respondents held Master's degrees (9.4%). All respondents had prior audit experience, ensuring that the collected data reflects practical professional knowledge.

Descriptive Statistics Test Results

Descriptive statistical analysis (Table 2) was conducted to provide an overview of the data, including frequency distributions, as well as minimum, maximum, mean, and standard deviation scores for each variable measured on a 6-point likert scale.

Table 2. Descriptive Statistics

Constructs	N	Minimum	Maximum	Mean	Std. Deviation
Internal Audit Report Quality (IAQ)	127	3.62	6.00	5.10	0.51
Using of Data Analytics (DA)	127	3.87	6.00	5.00	0.52
Transformational Leadership (TL)	127	1.55	6.00	4.50	0.61

Source: processed by the author

The results indicate that internal audit report quality received the highest average score, suggesting a strong and uniform perception of audit effectiveness among respondents. The use of data analytics ranked closely behind, emphasizing its expanding role and relevance in internal audit processes. Conversely, transformational leadership exhibited both the lowest



mean score and the greatest dispersion, indicating a wide range of perceptions regarding leadership effectiveness among the participants.

Measurement Model Results

An initial data analysis was carried out to evaluate the validity and reliability of the research instrument, commonly known as the outer model test. The results are summarized in Table 3.

Table 3. Validity and Reliability Test Results

Constructs	Outer loading	Cronbach's alpha	Composite reliability (p_c)	AVE
Internal Audit Report Quality (IAQ)	0.520 – 0.784	0.955	0.960	0.535
Using of Data Analytics (DA)	0.506 – 0.836	0.915	0.928	0.500
Transformational Leadership (TL)	0.694 – 0.911	0.981	0.982	0.734

Source: processed using SmartPLS 4

Table 3 presents the results of the reliability and validity tests for all research constructs. All constructs show Cronbach's alpha and composite reliability values above 0.70, indicating strong internal consistency. AVE values also exceed 0.50, confirming that the instrument meets the required validity standards (Hair et al., 2022). Following Hair et al. (2022), outer loadings above 0.70 are acceptable, while values between 0.40 and 0.70 may be retained if they do not improve model consistency. Moreover, Hair et al. (2022) emphasize that outer loadings above 0.40 are still considered valid as long as the AVE value meets the minimum threshold of 0.50. In this study, one item (DA7: "Auditees are always cooperative in fulfilling data requests during the audit assignment") was removed because its loading was below 0.40, whereas all other items satisfied the criteria, confirming the adequacy of the measurement model.

Structural Model Results

After confirming that all variables have met the validity and reliability requirements, the next step is to conduct the structural model testing. The first test is the determination test, or R-square (R^2). According to Hair et al. (2017), generally, an R^2 value of 0.25 for an endogenous variable is considered weak, 0.50 is moderate, and 0.75 is substantial. The R^2 measurement results can be seen in Table 4 below.

Table 4. R^2 Test Results

Constructs	R-square	R-square adjusted
IAQ	0.528	0.520

Source: processed using SmartPLS 4

Based on Table 4, the R^2 value is 0.528 or 52.8%. Referring to Hair et al. (2017), this indicates that the model has a moderate level of explanatory power, as it falls within the 0.50–0.75 range. Furthermore, the results show that the Internal Audit Report Quality (IAQ) variable can be explained by the variables in this study, namely the use of data analytics and transformational leadership, by 52.8%, while the remaining 47.2% is explained by other factors not included in this study.

The next test is the predictive power of the model. The test was conducted using the PLSpredict/CVPAT menu to determine the Q-Square (Q^2) value. If the Q^2 value is above 0, the model is considered to have good predictive relevance (Hair et al., 2022).

Table 5. Q^2 Test Results

Constructs	Q^2 predict
IAQ	0.479

Source: processed using SmartPLS 4



Based on Table 5, the Q^2 predict value of 0.479 indicates that the model has good predictive relevance and can reliably predict variations in data not used during model development. Subsequently, hypothesis testing was performed through path analysis using the bootstrapping procedure. The results are summarized in Table 6.

Table 6. Hypotheses testing result

No	Hypothesis	Path Coefficient	t-statistic	p-value	Description
H1	Using of Data Analytics → Internal Audit Report Quality	0.521	7.189	0.000	Accepted
H2	Transformational Leadership → Internal Audit Report Quality	0.349	4.376	0.000	Accepted

Source: processed using SmartPLS 4

The Effect of Using Data Analytics on Internal Audit Report Quality

The hypothesis testing results indicate that the use of data analytics has a significant positive effect on Internal Audit Report Quality at BPKP. This is evidenced by a path coefficient of 0.521, a t-statistic of 7.189 (exceeding the critical value of 1.645), and a p-value of 0.000, well below the 0.05 significance level. These findings support Hypothesis 1 and suggest that greater utilization of data analytics leads to higher Internal Audit Report Quality.

The finding that data analytics enhances Internal Audit Report Quality (IAQ) at BPKP is supported by empirical research. Ahmad & Aliyudin (2020) and Putra et al. (2023) show that analytics improves audit efficiency, effectiveness, and anomaly detection in Indonesian government institutions. Recent studies (Hezam et al., 2023; Sofyani et al., 2025) highlight that data-driven approaches boost audit performance and report quality when system quality and auditor competence are sufficient. Regional evidence from Ditkaew & Suttipun (2023) in Thailand similarly confirms that audit analytics strengthens both audit quality and continuity, reinforcing the conclusion that data analytics substantially contributes to higher public sector audit quality. These findings contrast with studies by Haryanto & Setiawan (202), Putri et al. (2024), Shalhoob et al. (2024), and Junaidi (2024), which showed that Big Data Analytics reduces audit delays but does not directly improve overall audit quality or auditors' ability to detect fraud.

The outer loading analysis indicates that DA2 ("I understand the Tentative Audit Objective [TAO] when carrying out an audit assignment") achieved the highest value with a coefficient of 0.784, making it the most representative indicator of the construct. Using of Data Analytics. This suggests that auditors' ability to understand and align with audit objectives forms the strongest foundation for applying data analytics in audit processes. A high outer loading confirms convergent validity (Hair et al., 2019; Hair et al., 2022), meaning that DA2 best captures the underlying construct. This finding supports the argument that clarity of audit objectives not only enhances the effectiveness of audit procedures (AAIPI, 2021) but also strengthens the integration of data-driven approaches in improving audit efficiency and reliability (Hezam, Salem, & Al-Homaidi, 2023; Sofyani, Ratri, & Anwar, 2025).

By contrast, DA14 ("I visualize the processed data, such as through histograms, flowcharts, or Venn diagrams") recorded the lowest outer loading, with a coefficient of 0.520, indicating that data visualization is the least reliable indicator of the construct. While a loading above 0.50 is still considered minimally acceptable in exploratory research (Hair et al., 2019), this relatively weak value suggests that visualization practices are not yet strongly embedded in audit routines. This aligns with prior findings that data visualization remains underutilized in public sector audits, despite its potential to improve transparency, communication, and stakeholder trust (Listya et al., 2023; Putri, Santoso, & Rahmani, 2024; Junaidi, 2024). Therefore, while the construct of Use of Data Analytics is primarily driven by auditors'



technical alignment with objectives, strengthening visualization skills through training and the adoption of analytics tools will be critical to maximizing the benefits of data analytics in enhancing audit outcomes (Putra, Santoso, & Dewi, 2023; Haryanto & Setiawan, 2024).

The Effect of Transformational Leadership on Internal Audit Report Quality

The hypothesis testing results indicate that transformational leadership has a significant positive effect on Internal Audit Report Quality at BPKP. This is evidenced by a path coefficient of 0.349, a t-statistic of 4.376 (exceeding the critical value of 1.645), and a p-value of 0.000, well below the 0.05 significance level. These findings support Hypothesis 2 and suggest that greater utilization of transformational leadership leads to higher Internal Audit Report Quality.

This finding aligns with studies conducted in Vietnam by Doan et al. (2025), which examined audit teams and found that transformational leadership enhances team trust and audit quality. In Iran, Hassanzadeh Mohassel et al (2024) reported that transformational leadership improves knowledge sharing among auditors, thereby increasing audit quality. Afshar (2023), also in Iran, found that audit managers' transformational leadership positively affects internal audit effectiveness. In Indonesia, Marbun et al (2018) observed a positive impact of transformational leadership on audit quality at BPKP North Sumatra, while Pradipa (2016) found that transformational leadership enhances the quality of local government financial reports. Collectively, these studies support the conclusion that transformational leadership contributes to higher Internal Audit Report Quality. These findings contrast with the studies of Svanberg (2017), who investigated auditors in Sweden, and Noch (2024) who studied audit teams in Indonesia, all of which reported that transformational leadership does not necessarily enhance Internal Audit Report Quality. Svanberg (2017), for instance, showed in a Swedish context that transformational leadership exerted by a client can negatively impact an auditor's objectivity, undermining audit quality by fostering an unhealthy close relationship. Noch (2024), studying Indonesian audit teams, emphasized that leadership effectiveness is not inherent but is influenced by other variables like audit complexity, organizational culture, and the interplay with different leadership styles.

The outer loading results reveal that TL8 ("The leader explains strategic steps to achieve audit objectives") obtained the highest coefficient at 0.911, making it the strongest indicator of transformational leadership in the auditing context. This demonstrates that strategic communication is the most reliable measure of transformational leadership, as it provides clarity, direction, and shared purpose for audit teams. Leaders who articulate concrete strategies foster motivation and commitment, ultimately improving audit outcomes. This finding aligns with Bass and Riggio (2006), who highlight inspirational motivation and intellectual stimulation as key dimensions of transformational leadership, and is further supported by studies showing that effective strategic guidance from leaders significantly enhances auditors' performance and audit quality (Marbun & Sitepu, 2018; Putra, Santoso, & Dewi, 2023; Shafie, Ahmad, & Mohd, 2019).

In contrast, TL4 ("The leader appears confident in public, whether in front of auditees or audit teams") recorded the lowest outer loading at 0.694, indicating that public confidence is the least representative indicator of transformational leadership in this setting. While still above the 0.70 threshold commonly cited for acceptable reliability (Hair et al., 2019; Hair et al., 2022), its relatively weaker value suggests that leadership effectiveness in audits is perceived more through strategic direction and team empowerment than through outward displays of confidence. This finding is in line with prior studies which emphasize that transformational leadership in audit and public sector contexts is most strongly reflected through ethical orientation, vision, and motivational behavior, while personal charisma or outward confidence is a relatively less central dimension (Wardana, 2016; Hassanzadeh Mohassel et al.).



CONCLUSION

This study finds that both data analytics and transformational leadership significantly improve internal audit report quality at the Financial and Development Supervisory Agency in Indonesia. Data analytics enhances audit efficiency, effectiveness, and the detection of anomalies, while transformational leadership boosts auditor performance, trust, and overall audit quality. The findings highlight the importance of combining advanced technology and effective leadership to strengthen internal audit quality in government institutions.

Suggestions

To strengthen internal audit quality, BPKP is advised to enhance auditors' capacity to integrate data analytics with clearly defined audit objectives through structured training and continuous professional development. In addition, improving auditors' proficiency in data visualization is essential to ensure that audit findings are communicated with greater clarity and impact. On the leadership dimension, BPKP should focus on cultivating leaders who provide strategic direction, inspire team commitment, and uphold ethical values. Concentrating on these areas will enable BPKP to optimize the combined role of data analytics and transformational leadership in delivering higher quality internal audit reports. Future research is encouraged to incorporate intervening variables such as professional skepticism, organizational commitment, or technology readiness to provide deeper insights into how data analytics and transformational leadership influence internal audit quality.

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