

Whistleblowing Systems, Forensic Audit, and Perceived Fraud Prevention in Indonesian State-Owned Enterprises: the Moderating Role of Internal Audit Quality

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Abstract

Fraud in Indonesian State-Owned Enterprises (BUMN) threatens financial sustainability and public trust. Evidence on the direct and interactive associations of whistleblowing systems, forensic audits, and internal audit quality with perceived fraud prevention remains limited. This study examines whether whistleblowing system effectiveness (WSE), forensic audit implementation (FAI), and internal audit quality (IAQ) are associated with perceived fraud prevention (FP), and whether IAQ moderates these relationships. A cross-sectional survey of 212 internal auditors, supervisors, and managers from 41 BUMN (effective response rate 60.6%) was analyzed using PLS-SEM with SmartPLS 4.0. The model explained 61.7% of the variance in perceived FP ($R^2 = 0.617$). WSE ($\beta = 0.312$, $p < 0.001$), FAI ($\beta = 0.247$, $p < 0.001$), and IAQ ($\beta = 0.415$, $p < 0.001$) were positively associated with perceived FP, with IAQ showing the strongest direct association. IAQ significantly moderated the WSE–FP relationship (β interaction = 0.143, $p = 0.005$), indicating a stronger positive association when IAQ was perceived as high. However, IAQ did not moderate the FAI–FP relationship (β interaction = 0.048, $p = 0.385$); thus, the moderation hypothesis for forensic audit was not supported. These findings suggest that whistleblowing systems and internal audit quality operate synergistically, whereas forensic audit's perceived preventive contribution appears relatively consistent across IAQ levels. The study contributes to fraud governance literature by clarifying the contingent role of internal audit quality in Indonesian BUMN. Because data are cross-sectional and self-reported, results should be interpreted as conditional associations rather than evidence of fraud reduction or causal effects.

KEYWORDS

fraud prevention; whistleblowing system; forensic audit; internal audit quality; BUMN; PLS-SEM; governance.

Introduction

Fraud in state-owned enterprises (Badan Usaha Milik Negara, BUMN) poses serious threats to financial sustainability, public trust, and the credibility of government-led development agendas in Indonesia (Lutfiani et al., 2025). High-profile corruption and asset misappropriation cases involving BUMN have repeatedly highlighted structural weaknesses in governance, risk management, and control environments. These weaknesses undermine the ability of internal audit and related assurance functions to detect and deter fraud in a timely manner. At the same time, national reform agendas, the strengthening of state-owned enterprise governance codes, and global expectations around transparency and accountability place increasing pressure on BUMN to demonstrate effective fraud prevention mechanisms (Swandhani et al., 2024).

Within this context, internal audit has traditionally been positioned as a key line of

defence in the prevention and detection of fraud (Milojević, 2025). Internal auditors are expected to evaluate the adequacy of internal control systems, assess risk management processes, and provide recommendations to mitigate vulnerabilities that can be exploited by fraud perpetrators (Pitriani & Dewi, 2023; Yulfani et al., 2025).

Empirical studies in Indonesia consistently find that the quality and professionalism of internal audit functions are positively associated with fraud prevention outcomes, particularly when supported by robust internal control frameworks and management commitment (Zurika Lubis et al., 2024). However, internal audit is not the only mechanism relevant to fraud risk management (Hanifah & Alkautsar, 2024). The emergence of whistleblowing systems and the development of forensic accounting and forensic audit practices have expanded the toolkit available to organisations seeking to combat fraud (Nurlaela et al., 2021).

Whistleblowing systems provide formal channels through which employees and other stakeholders can report suspected wrongdoing, including financial fraud, corruption, and violations of ethical standards (Rahman & Rachma, 2025). Effective whistleblowing mechanisms are characterised by clear procedures, accessible reporting platforms, protection against retaliation, and credible follow-up by competent investigative units. Research in various contexts indicates that whistleblowing systems can significantly contribute to fraud prevention by increasing the probability that fraudulent behaviour is detected early, thus deterring potential perpetrators who perceive a higher risk of exposure (Kharbach & Zaam, 2025).

In Indonesia, regulators have actively encouraged the establishment of whistleblowing systems in both public and private sector entities, including BUMN, as part of broader anti-corruption and good governance initiatives (Zul et al., 2025). Parallel to the expansion of whistleblowing channels, forensic accounting and forensic audit have gained prominence as specialised investigative tools in fraud detection and prevention (Agyare, 2026). Forensic audit involves the application of advanced investigative procedures, detailed transaction analysis, and evidence gathering techniques designed to uncover and document fraud for both internal disciplinary processes and potential legal proceedings (Sudarmadi, 2023).

Studies in Indonesia and other emerging economies show that forensic accounting practices enhance the effectiveness of fraud detection, improve the quality of financial reporting, and strengthen the deterrent effect of anti-fraud programmes (K Ghani et al., 2024; Ninzi Maiviza & Rusmawan Kusumah, 2025).

Forensic auditors often work alongside internal auditors and external investigators, using data analytics, digital forensics, and interview techniques to identify red flags that may not be visible through routine audit procedures.

The interaction between whistleblowing systems, forensic audit, and internal audit is conceptually and practically significant (Nuryasin, 2025). Evidence from public sector and inspectorate settings in Indonesia suggests that whistleblowing mechanisms can increase the inflow of fraud-related information, which then triggers forensic and investigative audit activities (Priyadi et al., 2022; Sumanto & Zuhdi, 2026).

At the same time, the presence of capable forensic auditors can enhance the credibility of whistleblowing systems, as potential reporters perceive that their disclosures will be investigated professionally and lead to meaningful consequences. Quantitative studies using path analysis and structural equation modelling have documented that the effectiveness of whistleblowing systems has both direct and indirect effects on fraud prevention, with forensic audit and investigative audit acting as mediating variables that

translate information signals into concrete investigative and sanctioning actions (Putra et al., 2025).

Despite growing interest in these mechanisms, several gaps remain in the literature on fraud prevention in Indonesian BUMN. First, much of the existing research focuses either on internal audit and internal control systems, or on whistleblowing and forensic accounting in isolation, without jointly examining their combined influence within the specific governance environment of BUMN.

Fraud incidents in BUMN have broad fiscal and societal implications, including potential losses to the state budget, distortions in market competition, and erosion of public confidence in government-owned enterprises. Strengthening fraud prevention mechanisms in BUMN thus contributes not only to corporate performance but also to national development objectives and governance reforms (Shuliuk, 2021). Furthermore, BUMN often implement complex programmes, joint ventures, and public-private partnerships, which create intricate risk profiles and opportunities for collusion and corruption if not adequately monitored (Bouherour & Zebouchi, 2022).

From a theoretical perspective, the study draws on agency theory and the fraud triangle framework to position whistleblowing systems, forensic audit, and internal audit within organisational responses to fraud risk. Agency theory (Azhari & Afrijal, 2026) provides a foundational lens for understanding the governance challenges in BUMN. Under this framework, managers (agents) may pursue self-interested behaviour that diverges from the interests of the state (principal), particularly in the absence of effective monitoring mechanisms. Information asymmetry between managers and the state creates opportunities for fraud and misappropriation. Internal audit, whistleblowing systems, and forensic audits serve as monitoring mechanisms that reduce information asymmetry by providing the principal with credible information about agent behaviour. Internal audit quality is particularly critical in agency theory because it enhances the credibility and reliability of monitoring activities—high-quality internal audits reduce the information gap and increase the probability that fraudulent agent behaviour will be detected and sanctioned.

The fraud triangle identifies pressure, opportunity, and rationalisation as key elements that drive individuals to commit fraud, while the fraud diamond adds capability as a fourth dimension. Internal audit and internal control systems primarily target the opportunity element by reducing control weaknesses and improving supervision. Whistleblowing mechanisms influence both opportunity and rationalisation by signalling that unethical behaviour is likely to be exposed and sanctioned, thereby altering perceived costs and moral justifications. Forensic audit addresses capability and opportunity by increasing the likelihood that sophisticated fraud schemes will be uncovered and that perpetrators will face legal and organisational consequences. Together, agency theory and the fraud triangle provide complementary explanations: agency theory highlights the need for monitoring mechanisms to align agent-principal interests, while the fraud triangle explains the individual-level conditions that enable fraud to occur despite monitoring.

Based on these theoretical foundations and empirical gaps, the following hypotheses are proposed:

H1: Whistleblowing system effectiveness has a positive effect on fraud prevention in Indonesian BUMN.

H2: Forensic audit implementation has a positive effect on fraud prevention in Indonesian BUMN.

H3: Internal audit quality positively moderates the relationship between whistleblowing system effectiveness and fraud prevention, such that the effect of whistleblowing on fraud prevention is stronger when internal audit quality is high.

H4: Internal audit quality positively moderates the relationship between forensic audit implementation and fraud prevention,

such that the effect of forensic audit on fraud prevention is stronger when internal audit quality is high.

H5: Internal audit quality is positively associated with perceived fraud prevention capability in Indonesian BUMN.

Building on these theoretical foundations and empirical observations, this study aims to examine the associations of whistleblowing system effectiveness, forensic audit implementation, and internal audit quality with perceived fraud-prevention capability in Indonesian BUMN. It further examines whether internal audit quality conditions the associations between whistleblowing system effectiveness and perceived fraud-prevention capability and between forensic audit implementation and perceived fraud-prevention capability. Because the study uses cross-sectional, self-reported perceptual data, the analysis concerns conditional associations rather than demonstrated causal effects or reductions in actual fraud incidents (Osho, 2025).

The remainder of the article is structured as follows. The next section reviews relevant literature on internal audit, whistleblowing systems, forensic audit, and fraud prevention, highlighting key empirical findings and conceptual linkages. This is followed by a description of the research method, including population and sample, measurement of variables, data collection procedures, and data analysis techniques. The results section presents descriptive statistics, measurement model assessment, and structural model findings. The discussion section interprets these findings in light of prior research and theoretical frameworks, while the final section concludes with implications, limitations, and suggestions for future studies.

Methods

Research Design and Approach

This study adopts a quantitative, cross-sectional survey design to test the hypothesized relationships among latent variables. The choice of a survey method is appropriate because the constructs—whistleblowing system effectiveness, forensic audit implementation, internal audit quality, and fraud prevention—are perceptual in nature and best captured through the structured responses of informed participants. A cross-sectional approach enables the collection of data at a single point in time from a large number of BUMN entities, providing external validity and statistical power for hypothesis testing.

Population and Sample

The population consists of internal auditors, compliance officers, and governance professionals working in Indonesian BUMN and their subsidiaries. A purposive sampling technique was employed. Respondents were required to have at least three years of experience in internal audit, risk management, or compliance within a BUMN and to hold a position of Senior Auditor, Supervisor, or Manager/Above.

A total of 350 questionnaires were distributed through direct contact, email, and professional networks. Of the 227 responses received, 15 were excluded because of incomplete responses or straight-lining, resulting in 212 valid observations and an effective response rate of 60.6%.

Unit of Analysis and Nested Data Structure

The unit of analysis is the individual respondent. The final dataset comprised 212 individual respondents recruited from 41 BUMN. Because more than one respondent may have been recruited from the same BUMN, the observations may be statistically dependent.

The manuscript should report the number of respondents contributed by each BUMN, together with the minimum, maximum, median, and mean number of respondents per

enterprise. These details are necessary to assess the extent of within-BUMN dependence. The organizational-size, sector, and respondent-position variables were included as substantive control variables, but they do not correct standard errors for clustering.

Ideally, the structural model should be re-estimated using BUMN-clustered standard errors or a multilevel model, provided that a BUMN identifier is available and the number of observations per enterprise is sufficient. If such an adjustment is infeasible, the reported coefficients should be interpreted under an unverified independence assumption. In that case, the hypothesis tests may be affected by within-BUMN error dependence, and generalizability should be limited to the participating respondents and enterprises.

Sample Size Determination

A power analysis using G*Power for a multiple regression model with three predictors and moderation terms, assuming a medium effect size ($f^2 = 0.15$), $\alpha = 0.05$, and power = 0.80, indicated a minimum sample size of 85 respondents. A target of 200 respondents was established before data collection. The final sample consisted of 212 valid responses.

The power analysis was based on individual-level observations and did not account for a possible design effect caused by respondents being nested within BUMN. Therefore, the achieved sample size should not be interpreted as guaranteeing equivalent statistical power under a clustered-data structure.

Measurement and Instrumentation

The questionnaire consisted of four reflective constructs: whistleblowing system effectiveness (WSE), forensic audit implementation (FAI), internal audit quality (IAQ), and perceived fraud-prevention capability (FP). All items were measured using a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree.

Whistleblowing System Effectiveness

Whistleblowing system effectiveness was measured using five items adapted from [insert the exact original source, authors, year, title, publication, and DOI or URL]. The items assessed the availability and accessibility of reporting channels, confidentiality protection, protection against retaliation, follow-up of reports, and perceived effectiveness of the system.

The items were adapted to the Indonesian BUMN context by replacing references to the original organizational setting with references to the respondent's organization. Any additional wording changes should be documented item by item in Appendix A.

Forensic Audit Implementation

Forensic audit implementation was measured using four items adapted from [insert the exact original source, authors, year, title, publication, and DOI or URL]. The items assessed the use of forensic audit techniques, investigative procedures, transaction analysis, and the implementation of forensic audit in fraud-related investigations.

Internal Audit Quality

Internal audit quality was measured using five items adapted from [insert the exact original source, authors, year, title, publication, and DOI or URL]. The items assessed internal-audit competence, independence, objectivity, professional conduct, and adherence to professional standards.

Perceived Fraud-Prevention Capability

Perceived fraud-prevention capability was measured using five items adapted from [insert the exact original source, authors, year, title, publication, and DOI or URL]. The items

assessed respondents' perceptions of the organization's fraud-prevention capability, perceived reduction of fraud opportunities, and the effectiveness of anti-fraud mechanisms.

The dependent construct does not measure verified fraud incidents, detected cases, financial losses, prosecution outcomes, or changes in fraud incidence over time.

Translation and Adaptation Procedure

The original items were translated into Indonesian by a bilingual researcher and independently back-translated into English. Three academics with expertise in auditing and fraud research reviewed the translated items for semantic clarity, content relevance, and contextual suitability. A pilot test involving 30 respondents who were not included in the final sample was conducted to assess item clarity and preliminary reliability.

The authors should report all substantive modifications made during translation, expert review, and pilot testing. Specifically, the manuscript should identify whether any items were deleted, added, combined, or rephrased. Translation and pilot testing do not replace the identification of the original source and item provenance.

The complete Indonesian questionnaire, including instructions, response options, all measurement items, and demographic questions, is provided in Appendix A.

Control Variables

Organizational size was measured as the natural logarithm of total assets. Sector was represented using dummy variables, with Financial Services as the omitted reference category. Respondent position was represented using dummy variables, with Senior Auditor as the omitted reference category.

The sector categories were Financial Services, Energy & Mining, Infrastructure, Manufacturing, and Others. The respondent-position categories were Senior Auditor, Supervisor, and Manager/Above. These definitions must correspond exactly to the categories reported in the respondent profile and the variables used in the statistical dataset.

Data Analysis Technique

Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0 software. PLS-SEM was chosen over Covariance-Based SEM (CB-SEM) for several reasons. First, the study is prediction-oriented, aiming to explain variance in perceived fraud prevention and identify key drivers, which aligns with PLS-SEM's emphasis on prediction. Second, the model includes moderation effects, which are more readily estimated in PLS-SEM using the product indicator approach. Third, PLS-SEM imposes fewer distributional assumptions and is more robust to non-normality, which is relevant given the perceptual nature of the data.

Measurement Model Assessment. The measurement model was assessed by examining indicator loadings, composite reliability (CR), Cronbach's alpha, and average variance extracted (AVE) to establish convergent validity. Discriminant validity was evaluated using the Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT). Loadings above 0.708, CR and alpha above 0.70, AVE above 0.50, and HTMT values below 0.90 were considered acceptable (Hair & Alamer, 2022).

Structural Model Assessment. The structural model was evaluated through collinearity diagnostics ($VIF < 5$), path coefficients, t-statistics obtained via bootstrapping with 5,000 subsamples, coefficient of determination (R^2), predictive relevance (Q^2), and effect sizes (f^2). The interaction terms $WSE \times IAQ$ and $FAI \times IAQ$ were created using the product

indicator approach, and the significance of moderation was judged by the p-value of the interaction path coefficient. Simple slope analysis was conducted to visualize the nature of significant moderation.

Common Method Bias. Common method bias was addressed through procedural remedies (anonymity, clear instructions) and statistical checks via the full collinearity VIF test (all VIFs < 3.3).

Ethical Considerations

The study adhered to academic ethical standards. The research protocol was reviewed and approved by the Ethics Committee of Universitas Dharmawangsa (Approval No. 045/UDW/EC/2025, dated 15 January 2025). Anonymity of respondents and BUMN entities was guaranteed. Participation was voluntary, and informed consent was obtained through a statement at the beginning of the questionnaire, which respondents acknowledged by completing the survey. Potentially sensitive fraud-related survey data were stored in password-protected files accessible only to the researchers and will be retained for five years following publication before secure deletion.

Result and Discussion

Respondent Profile

Table 1 presents the demographic characteristics of the 212 respondents. The majority were male (63.7%), reflecting the gender composition of internal audit units in Indonesian BUMN. The largest age group was 31–40 years (45.3%), indicating a relatively experienced cohort. Educational background was predominantly bachelor's degree (52.8%), with a significant proportion holding master's degrees (38.2%). Regarding work experience, 41.5% had 6–10 years in audit, and 28.3% had over 10 years. Most respondents held supervisor-level positions (44.8%), followed by senior auditors (32.1%), ensuring an informed perspective on organizational anti-fraud mechanisms. The sample represented BUMN from financial services (28%), energy and mining (21%), infrastructure (19%), manufacturing (17%), and others (15%), providing sectoral diversity.

Descriptive Statistics of Constructs

Table 2 summarizes the mean, standard deviation, and normality indicators for each latent construct. All constructs registered mean scores above the mid-point (3.0), indicating a moderately positive perception. Forensic audit implementation recorded the lowest mean (3.51), suggesting room for strengthening in BUMN. Skewness and kurtosis values remained within acceptable bounds of ± 2 , supporting the use of PLS-SEM, which is robust to minor non-normality.

Measurement Model Assessment

The measurement model was evaluated for indicator reliability, internal consistency, and convergent and discriminant validity. Table 3 shows that all indicator loadings exceeded the threshold of 0.708, ranging from 0.759 (FAI3) to 0.903 (IAQ5), confirming indicator reliability. Composite reliability (CR) values for all constructs were above 0.90, and Cronbach's alpha values were above 0.85, demonstrating strong internal consistency. The average variance extracted (AVE) for each construct surpassed the 0.50 benchmark, with the lowest being 0.659 for FAI, confirming convergent validity.

Discriminant validity was assessed using the Fornell-Larcker criterion and HTMT ratios. Table 4 displays the square roots of AVE (diagonal) and inter-construct correlations. All square roots of AVE exceed the respective off-diagonal correlations, satisfying the Fornell-Larcker criterion. Table 5 presents the HTMT values, all of which are well below the

Table 1. Respondent Demographics (n=212)

Characteristic	Category	Frequency	Percentage
Gender	Male	135	63.7%
	Female	77	36.3%
Age	25–30 years	52	24.5%
	31–40 years	96	45.3%
	41–50 years	48	22.6%
	>50 years	16	7.6%
	Bachelor	112	52.8%
Education	Master	81	38.2%
	Doctorate	19	9.0%
Work Experience	3–5 years	64	30.2%
	6–10 years	88	41.5%
	>10 years	60	28.3%
Position	Senior Auditor	68	32.1%
	Supervisor	95	44.8%
	Manager/Above	49	23.1%
BUMN Sector	Financial Services	59	27.8%
	Energy & Mining	45	21.2%
	Infrastructure	40	18.9%
	Manufacturing	36	17.0%
	Others	32	15.1%

Table 2. Descriptive Statistics of Latent Constructs

Construct	Mean	Std. Dev.	Skewness	Kurtosis
Whistleblowing System Effectiveness (WSE)	3.72	0.84	-0.47	-0.31
Forensic Audit Implementation (FAI)	3.51	0.91	-0.22	-0.67
Internal Audit Quality (IAQ)	3.89	0.76	-0.61	0.12
Fraud Prevention (FP)	3.83	0.79	-0.53	-0.09

conservative threshold of 0.85 (maximum HTMT = 0.781), indicating distinct constructs.

Structural Model and Hypothesis Testing

Before examining the structural paths, collinearity was assessed; all VIF values for predictors were below 3.0, indicating no harmful multicollinearity. The structural model explains 61.7% of the variance in fraud prevention ($R^2 = 0.617$), indicating substantial explanatory power. The predictive relevance Q^2 value was 0.428, well above zero, confirming the model's predictive capability.

Table 6 presents the hypothesized direct associations. Whistleblowing system effectiveness was positively associated with perceived fraud-prevention capability ($\beta = 0.312$, $t = 5.247$, $p < 0.001$), supporting H1. Forensic audit implementation was also positively associated with perceived fraud-prevention capability ($\beta = 0.247$, $t = 4.106$, $p < 0.001$), supporting H2. Internal audit quality showed a positive association with perceived fraud-prevention capability ($\beta = 0.415$, $t = 6.892$, $p < 0.001$), supporting H5. These results should be interpreted as associations in a cross-sectional perceptual model rather than as causal effects.

Table 7 presents the moderation results. The interaction between whistleblowing system effectiveness and internal audit quality was positive and statistically significant ($\beta = 0.143$, $t = 2.813$, $p = 0.005$), supporting H3. This finding indicates that the positive conditional association between whistleblowing system effectiveness and perceived fraud-prevention capability was stronger at higher levels of perceived internal audit quality.

The interaction between forensic audit implementation and internal audit quality was not statistically significant ($\beta = 0.048$, $t = 0.869$, $p = 0.385$).

Therefore, H4 was not supported. The non-significant interaction does not demonstrate that forensic audit operates independently of internal audit quality in all contexts; it indicates only that this sample did not provide sufficient evidence of a statistically detectable interaction.

Robustness Checks

Variance Inflation Factor (VIF) analysis was conducted to assess collinearity among the constructs. As shown in Table 8, all VIF values were well below the recommended threshold of 5.0 (ranging from 1.423 to 3.187), indicating no serious multicollinearity issues.

The Stone-Geisser Q^2 statistic was computed through blindfolding to assess the model's predictive relevance. The Q^2 value for perceived fraud prevention was 0.342, exceeding the threshold of zero and indicating the model has moderate predictive relevance (Table 9).

The control variables were coded as follows (see Table 10). Organizational size was measured as the natural logarithm of total assets. Sector was represented by four dummy variables, with Financial Services as the omitted reference category: Energy & Mining, Infrastructure, Manufacturing, and Others. Respondent position was represented by two dummy variables, with Senior Auditor as the omitted reference category: Supervisor and Manager/Above.

The coefficients for sector therefore represent differences relative to Financial Services, whereas the coefficients for respondent position represent differences relative to Senior Auditor. The control-variable table must use these labels consistently with Table 1 and the underlying dataset.

This study set out to investigate the effectiveness of whistleblowing systems and forensic audit implementation on fraud prevention in Indonesian BUMN, while examining the moderating role of internal audit quality. The empirical results largely support the proposed theoretical model and offer nuanced insights with significant practical and policy implications.

The findings of this study provide support for the positive

Table 3. Indicator Loadings, Construct Reliability, and Convergent Validity

Construct	Indicator	Loading	Cronbach's α	CR	AVE
WSE	WSE1	0.825	0.891	0.920	0.698
	WSE2	0.852			
	WSE3	0.814			
	WSE4	0.847			
	WSE5	0.838			
FAI	FAI1	0.831	0.886	0.917	0.659
	FAI2	0.801			
	FAI3	0.759			
	FAI4	0.852			
IAQ	IAQ1	0.847	0.906	0.930	0.727
	IAQ2	0.877			
	IAQ3	0.861			
	IAQ4	0.820			
	IAQ5	0.903			
FP	FP1	0.843	0.895	0.923	0.706
	FP2	0.856			
	FP3	0.817			
	FP4	0.825			
	FP5	0.859			

Table 4. Fornell-Larcker Criterion for Discriminant Validity

Construct	WSE	FAI	IAQ	FP
WSE	0.835			
FAI	0.568	0.812		
IAQ	0.612	0.544	0.853	
FP	0.674	0.591	0.702	0.840

Note: Diagonal values (bold) are square roots of AVE.*

Table 5. Heterotrait-Monotrait Ratio (HTMT)

Construct	WSE	FAI	IAQ	FP
WSE				
FAI	0.642			
IAQ	0.687	0.614		
FP	0.748	0.663	0.781	

associations between whistleblowing systems and perceived fraud prevention (H1), and between forensic audits and perceived fraud prevention (H2). These results are consistent with prior research by [Melisa & Bela, \(2025\)](#), who similarly found that these mechanisms contribute to fraud prevention in various organizational contexts ([Melisa & Bela, 2025](#)). It is important to note that these findings should be interpreted as associations based on respondents' perceptions, rather than evidence of actual fraud reduction or definitive causal prevention. Given the cross-sectional and self-reported nature of the data, the results indicate that respondents who perceive their organizations' whistleblowing systems and forensic audit practices as more effective also tend to perceive stronger fraud prevention capabilities. This perceived effectiveness may be associated with lower perceived fraud opportunity, but causality cannot be inferred ([Bani & Siregar, 2025](#)).

The significant direct association for internal audit quality (H3) is consistent with agency theory predictions that high-quality monitoring mechanisms reduce information asymmetry and align agent-principal interests. Internal audit quality, measured through competence, independence, objectivity, and professional standards, appears to be the strongest direct predictor of perceived fraud prevention capability among the three mechanisms examined ($\beta = 0.415$, $f^2 = 0.245$). This finding reinforces the foundational role of internal audit in fraud governance and aligns with prior empirical work in the Indonesian public sector ([Lubis et al., 2026](#); [Yulfani et al., 2025](#)).

The positive association between internal audit quality

and perceived fraud-prevention capability supported H5 ($\beta=0.415$, $\beta = 0.415$, $f^2=0.245$, $f^2 = 0.245$). This result is consistent with the agency-theory expectation that more credible monitoring may be associated with stronger perceived anti-fraud capability. However, because the data were collected at one point in time using self-reported measures, the result should not be interpreted as evidence that improving internal audit quality causes actual fraud reductions. It indicates that respondents who rated internal audit quality more positively also tended to rate their organization's perceived fraud-prevention capability more positively.

The significant WSE $\times$ IAQ interaction indicates a conditional association. The positive association between whistleblowing system effectiveness and perceived fraud-prevention capability was stronger at higher levels of perceived internal audit quality. The simple-slope analysis therefore describes differences in the strength of the observed association across levels of IAQ; it does not demonstrate that internal audit quality causes whistleblowing reports to produce preventive outcomes.

One possible organizational explanation is that high-quality internal-audit functions may be more capable of reviewing reports, coordinating follow-up, and communicating control-related recommendations. This explanation is consistent with the theoretical literature, but it was not directly tested in the present study. The survey did not measure report-processing time, investigation quality, remediation activities, control changes, or actual fraud incidents. Accordingly, the empirical evidence supports a moderation pattern, while the proposed investigative and remedial processes remain theoretical interpretations requiring longitudinal or process-level evidence.

For BUMN management, the result may justify assessing whistleblowing-system quality and internal-audit quality together. However, it should not be interpreted as proof that implementing a hotline or upgrading internal audit will necessarily reduce actual fraud incidents. This finding resonates with the "whistleblowing action sequence" proposed by [Mappisabbi et al. \(2025\)](#) and extends it by demonstrating that internal audit quality is a critical organizational factor that determines whether whistleblowing leads to substantive governance improvement or languishes as an unresolved complaint. For BUMN management, this implies that implementing a hotline without simultaneously upgrading internal audit competence and independence is a half-measure; the true anti-fraud power is unleashed only

Table 6. Direct Effects – Path Coefficients and Hypothesis Testing

Hypothesis	Path	β	t-value	p-value	f ²	Decision
H1	WSE → FP	0.312	5.247	<0.001	0.137	Supported
H2	FAI → FP	0.247	4.106	<0.001	0.085	Supported
H5	IAQ → FP	0.415	6.892	<0.001	0.245	Supported

Table 7. Moderation Effects

Hypothesis	Interaction Path	β	t-value	p-value	f ²	Decision
H3	WSE × IAQ → FP	0.143	2.813	0.005	0.052	Supported
H4	FAI × IAQ → FP	0.048	0.869	0.385	0.008	Not Supported

Table 8. Collinearity Assessment (VIF Values)

Construct	VIF	Status
Whistleblowing System (WS)	1.876	Acceptable
Forensic Audit (FA)	1.723	Acceptable
Internal Audit Quality (IAQ)	2.014	Acceptable
WS × IAQ Interaction	3.187	Acceptable
FA × IAQ Interaction	2.945	Acceptable

Table 9. Predictive Relevance Assessment (Q²)

Endogenous Construct	Q ² Value	Predictive Relevance
Perceived Fraud Prevention (PFP)	0.342	Moderate

when the two are aligned (Mappisabbi et al., 2025)

In contrast, H4 is not supported: internal audit quality does not moderate the relationship between forensic audit implementation and fraud prevention. While unexpected, this null moderation is interpretable and instructive. Forensic audit is often a specialized activity with distinct methodologies, tools, and sometimes separate reporting lines. In many Indonesian BUMN, forensic audits are outsourced to external bodies such as BPKP or external forensic firms, or conducted by a dedicated forensic unit that operates semi-autonomously from the general internal audit department (Aditama et al., 2026). Consequently, the quality of the routine internal audit function may not directly enhance or inhibit the preventive effect of forensic audit—its effectiveness is already built into its investigative rigor and the perceived certainty of severe consequences. The non-significant interaction ($\beta = 0.048$, $p = 0.385$) suggests that forensic audit's contribution to fraud prevention is robust and does not depend on the overall internal audit quality. From a practical standpoint, this implies that even BUMN with moderately weak internal audit can still derive preventive benefits from investing in forensic audit capabilities, because forensic audit functions as a standalone deterrent. However, caution is warranted; the potential for synergy exists if forensic audit findings are systematically fed back into internal audit's preventive control recommendations. The non-significance may also reflect measurement limitations or a context where such integration is rare (Najih, 2025).

The findings contribute to fraud governance literature in several ways. First, they demonstrate the applicability of agency theory to understanding fraud prevention in the Indonesian BUMN context. The significant associations between whistleblowing, forensic audit, and internal audit quality with perceived fraud prevention suggest that these monitoring mechanisms—from different theoretical perspectives—are perceived as effective in reducing information asymmetry and aligning agent behavior with principal interests. Second, the findings extend the fraud triangle framework by showing that perceived anti-fraud mechanisms address different elements of the triangle: whistleblowing addresses rationalization and opportunity, forensic audit addresses capability and opportunity, and internal audit quality addresses opportunity through

enhanced monitoring (Melinda et al., 2026).

Third, the differential moderation effect contributes to understanding the contingent role of internal audit quality. The significant moderation of the whistleblowing–prevention relationship suggests that the effectiveness of whistleblowing as a monitoring mechanism depends critically on the credibility and responsiveness of the internal audit function. This aligns with agency theory's emphasis on monitoring quality—the principal's confidence in monitoring outcomes depends not only on the existence of monitoring channels but also on the perceived competence and independence of those performing the monitoring (Sitompul et al., 2025).

Practical and Policy Implications

The findings yield several actionable implications. First, BUMN boards and Ministry of SOEs should mandate and invest in the quality, not merely the presence, of whistleblowing systems. This includes anonymized digital platforms, independent ombudspersons, and swift investigation protocols. Second, forensic audit capabilities should be institutionalized beyond ad-hoc investigative engagements. Establishing in-house forensic units with continuous data monitoring and surprise forensic reviews can serve as a powerful preventive signal. Third, and most critically, internal audit quality must be elevated to a strategic priority. This entails enforcing professional certification requirements, ensuring functional reporting to the Board of Commissioners, ring-fencing internal audit budgets, and implementing performance metrics tied to control improvements and fraud reduction. Regulators such as BPKP and the Financial Services Authority (OJK) could incorporate these dimensions into their assessment frameworks for BUMN governance. The synergistic insight—that high internal audit quality magnifies the value of whistleblowing—suggests an integrated reform package rather than piecemeal interventions.

Limitations and Future Research

Despite its contributions, the study has limitations. The cross-sectional design precludes causal inference; longitudinal studies tracking fraud incidents before and after governance changes would be valuable. The use of self-reported perceptual measures may introduce social desirability bias, although procedural and statistical remedies were applied. Future research could incorporate actual fraud occurrence data or audit report metrics. The sample, while diverse, was confined to BUMN internal auditors; expanding to other public sector entities or private companies would enhance generalizability. The non-significant moderation of forensic audit calls for deeper qualitative investigation—perhaps case studies exploring how forensic audit findings are utilized by internal

Table 10. Control Variable Effects

Control Variable	Coding	β	t-value	p-value	Significance
Organizational Size	Log of total assets; Continuous	0.067	1.234	0.217	Not significant
Sector: Banking/Financial	Financial Services Reference	0.053	0.987	0.324	Not significant
Sector: Energy	Financial Services Reference	0.041	0.765	0.444	Not significant
Sector: Transportation	Financial Services Reference	0.048	0.892	0.372	Not significant
Respondent Position: Internal Auditor	Senior Auditor Reference	-0.038	-0.723	0.469	Not significant
Respondent Position: Compliance Officer	Senior Auditor Reference	-0.022	-0.418	0.676	Not significant

audit. Finally, exploring additional moderators such as organizational culture, IT governance, or board oversight could further enrich the model.

Conclusion

This study examined the associations between whistleblowing system effectiveness, forensic audit implementation, and perceived fraud prevention within Indonesian State-Owned Enterprises, with a focus on the moderating role of internal audit quality. Using PLS-SEM analysis of survey data from 212 respondents, the study found significant positive associations between whistleblowing systems and perceived fraud prevention ($\beta = 0.312$, $p < 0.001$), and between forensic audits and perceived fraud prevention ($\beta = 0.247$, $p < 0.001$). More importantly, the findings revealed that internal audit quality significantly moderates the whistleblowing–fraud prevention relationship, strengthening the positive association when internal audit quality is high (WSE $\times$ IAQ: $\beta = 0.143$, $p = 0.005$). However, internal audit quality does not moderate the forensic audit–fraud prevention relationship (FAI $\times$ IAQ: $\beta = 0.048$, $p = 0.385$), leading to the rejection of H4. These associations were based on perceptual data and should be interpreted with appropriate caution regarding causality. The study contributes to fraud governance literature by illuminating the synergistic interplay among internal audit, whistleblowing, and forensic audit in the Indonesian BUMN context, and offers evidence-based recommendations for regulators, boards, and management to integrate and upgrade these anti-fraud pillars. Future longitudinal and mixed-methods research is encouraged to capture the dynamic causal mechanisms over time.

Author contributions

I.R.N and M.I.D developed the initial research idea, formulated the research questions, and established the theoretical framework. I.R.N designed the research methodology, including the selection of research design,

sampling approach, and statistical analysis techniques, and contributed to the development of measurement instruments and validation of the questionnaire, while M.I.D coordinated the data collection process, including distribution of questionnaires, follow-up with respondents, and management of response data. I.R.N performed the PLS-SEM analysis using SmartPLS software and assisted with robustness checks, including VIF analysis, Q^2 assessment, and control variable analysis. I.R.N and M.I.D prepared the initial manuscript draft and contributed to the literature review and theoretical framework sections; I.R.N subsequently participated in reviewing and editing the manuscript and led the revision process based on reviewer feedback, while M.I.D managed the overall project coordination, including correspondence with organizations and oversight of the research timeline. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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