

## FORENSIC ACCOUNTING, DATA ANALYTICS, AND WHISTLEBLOWING SYSTEMS ON FRAUD DISCLOSURE IN BPKP RIAU

Jihan Azrinaziha<sup>1\*</sup>, Rita Anugerah<sup>2</sup>, Supriono<sup>3</sup>

<sup>1,2,3</sup>Program Studi Akuntansi, Universitas Riau, Kota Pekanbaru, Indonesia

\*Corresponding author; [jihan.azrinaziha0744@student.unri.ac.id](mailto:jihan.azrinaziha0744@student.unri.ac.id)

### Abstract

Previous studies had reported inconsistent findings regarding the influence of forensic accounting, data analytics, and whistleblowing systems on fraud disclosure, particularly within the context of government internal audit institutions in Indonesia. This study aimed to examine the influence of these three variables on fraud disclosure at the BPKP Representative Office of Riau Province. A quantitative approach was employed. The population comprised 83 auditors at the BPKP Representative Office of Riau Province; a purposive sampling technique was applied, which resulted in 63 usable responses from questionnaires. The data were analyzed using multiple linear regression with SPSS version 31. The findings indicated that forensic accounting had a positive and significant effect on fraud disclosure. Furthermore, the whistleblowing system had a positive and significant effect. All three hypotheses were accepted. Forensic accounting, data analytics, and the whistleblowing system each had a positive and significant partial effect on fraud disclosure. Enhancing these three mechanisms collectively could improve the effectiveness of fraud detection. BPKP and other government internal audit institutions need to strengthen forensic training, to expand the use of data analytics technology, and to improve the credibility of their whistleblowing systems. Future research should expand the population scope and include additional variables such as auditor independence and organizational culture.

Keywords: Forensic accounting, data analytics, whistleblowing system, fraud disclosure.

### Abstrak

*Studi-studi sebelumnya melaporkan temuan yang tidak konsisten mengenai pengaruh akuntansi forensik, analitik data, dan sistem pelaporan pelanggaran pada pengungkapan kecurangan, khususnya dalam konteks lembaga audit internal pemerintah di Indonesia. Studi ini bertujuan untuk menguji pengaruh ketiga variabel tersebut pada pengungkapan kecurangan di Kantor Perwakilan BPKP Provinsi Riau. Pendekatan kuantitatif digunakan. Populasi terdiri dari 83 auditor di Kantor Perwakilan BPKP Provinsi Riau; teknik pengambilan sampel bertujuan diterapkan, yang menghasilkan 63 tanggapan yang dapat digunakan dari kuesioner. Data dianalisis menggunakan regresi linier berganda dengan SPSS versi 31. Temuan menunjukkan bahwa akuntansi forensik memiliki pengaruh positif dan signifikan pada pengungkapan kecurangan. Selanjutnya, sistem pelaporan pelanggaran memiliki pengaruh positif dan signifikan. Ketiga hipotesis diterima. Akuntansi forensik, analitik data, dan sistem pelaporan pelanggaran masing-masing memiliki pengaruh yang positif dan signifikan pada pengungkapan kecurangan. Peningkatan ketiga mekanisme ini secara kolektif dapat meningkatkan efektivitas deteksi kecurangan. BPKP dan lembaga audit internal pemerintah lainnya perlu memperkuat pelatihan forensik, memperluas penggunaan teknologi analitik data, dan meningkatkan kredibilitas sistem pelaporan pelanggaran mereka. Penelitian di masa mendatang harus memperluas cakupan populasi dan mencakup variabel tambahan seperti independensi auditor dan budaya organisasi.*

*Kata Kunci: Akuntansi forensik, data analisis, sistem pelaporan pelanggaran, pengungkapan kecurangan.*

### Introduction

Fraud remains a major governance problem in both public and private organizations because it harms financial accountability, distorts reporting, and weakens public trust. The Association of Certified Fraud Examiners classifies fraud into corruption, asset misappropriation, and fraudulent statements, and its global survey shows that tips remain the most common detection method in occupational fraud cases (ACFE, 2020). In practice, fraud is difficult to disclose because many schemes are hidden in routine transactions, supported by

weak controls, and protected by information asymmetry between managers and control functions (Siregar & Surbakti, 2019; Vousinas, 2019).

The main issue with fraud lies not only in its frequency but also in the difficulty of fully uncovering it. This phenomenon can be understood through the concept of the fraud iceberg, which refers to a situation where the fraud that is visible and successfully detected represents only a small fraction of the actual fraudulent activity taking place (Dyck et al., 2020). The ACFE report also confirms that many fraud cases are only detected after they have been ongoing for quite some time, so that audit findings often do not yet reflect the full reality of the situation (ACFE, 2022). Therefore, organizations need stronger detection tools so that hidden fraud can be identified earlier and proven more accurately.

In practice, fraud detection often faces numerous challenges. Internal auditors, including those from the BPKP and inspectorates, frequently encounter limitations in evidence, pressure from management, and increasingly complex fraud schemes, meaning that not all indications of fraud can be fully uncovered (Achmad & Galib, 2022; ACFE, 2022). In internal government supervision, fraud disclosure depends not only on formal audit procedures but also on the quality of investigative capability, the use of technology, and the credibility of reporting channels.

Prior studies show that forensic accounting and investigative is relevant to fraud disclosure because it focuses on identifying, tracing, and documenting financial evidence for legal purposes (Singleton & Singleton, 2010). In this study, forensic accounting is understood as an investigative approach that combines accounting, auditing, and investigation to prove the existence of fraud. However, the results of previous studies remain inconsistent. Khatimah (2024) found a positive and significant effect, whereas Pamungkas & Jaeni (2022) found non-significant results. Ardianysah (2023) also noted that forensic accounting is not always effective in detecting fraud because it is often applied only after initial indications have emerged.

In addition to forensic accounting, technological advancements are driving auditors to utilize data analytics in fraud detection, particularly as manual approaches become increasingly inadequate when dealing with large datasets, diverse transactions, and complex patterns of irregularities (Dewi & Dewayanto, 2024). Data analytics helps auditors process and analyze data to uncover critical information, draw conclusions, and support more accurate fraud detection (Ghavami, 2020). The ACFE (2022) also emphasizes that modern forensic auditing now encompasses the use of data analytics, computer forensics, and digital traces. However, findings from previous research remain inconsistent. Prasetyo et al. (2023) and Sidauruk (2024) found that data analytics has a positive effect on the identification, prevention, and detection of fraud, whereas Claudiastuti (2023) showed that the integration of big data has not yet had a significant effect on the detection of internal fraud.

Another important mechanism is the whistleblowing system. A whistleblowing system is a critical reporting mechanism in fraud detection because it provides a secure channel for individuals to report suspected misconduct to both internal and external parties within an organization (Srikandhi & Suryandari, 2020). In good governance, this system forms part of anti-fraud controls that support fraud prevention and detection; indeed, the ACFE (2020) notes that whistleblower reports are the most effective method for detecting fraud. However, its effectiveness is not always consistent across organizations, as it can still be hindered by bureaucracy, resource constraints, and inadequate protection for whistleblowers (Pramudyastuti et al., 2021; Muhyidin et al., 2025). Previous research findings have also been inconsistent. Hanie (2024) and Damayanty (2023) demonstrated a positive and significant effect on fraud disclosure, whereas Pramudyastuti et al. (2021) found that this effect may weaken when just in the system and whistleblower protection remains low.

This study was conducted because a research gap remains in the study of fraud detection. Previous research findings regarding the influence of forensic accounting, data analytics, and whistleblowing systems on fraud detection still show inconsistent results. Furthermore, previous studies such as Putri et al. (2024) employed general variables related to information technology utilization and relied on secondary data, thus limiting direct empirical evidence from auditors in the field. Therefore, this study aims to address this gap by refining the information technology variable to focus on data analytics, incorporating a forensic accounting variable, and conducting an empirical test on auditors at the Riau Provincial BPKP using primary data. BPKP Riau was selected as the research location because it has handled significant fraud cases, such as the fictitious official travel order case at the Riau DPRD Secretariat, and is currently promoting audit digitalization through Big Data Analytics as part of its 2020–2024 Strategic Plan. In addition, previous research on fraud disclosure has been conducted more extensively at BPKP offices in other provinces, leaving a research gap for similar studies at BPKP Riau. The novelty of this study lies in the development of a model that integrates forensic accounting, data analytics, and a whistleblowing system to explain fraud detection, as well as in the use of the context of auditors at the Riau Province BPKP as a government oversight environment that has rarely been specifically studied.

Based on the foregoing background, this study addresses the research question of whether forensic accounting, data analytics, and the whistleblowing system influence fraud disclosure at the Representative Office of BPKP in Riau Province. Accordingly, the objective of this study is to examine and analyze the effect of forensic accounting, data analytics, and the whistleblowing system on fraud disclosure. This study adopts a quantitative approach using multiple linear regression analysis based on primary data collected through questionnaires administered to 68 auditors, selected using a purposive sampling technique. The findings of this study are expected to enrich agency theory by providing empirical evidence on the role of control and monitoring mechanisms in reducing information asymmetry and supporting fraud disclosure. In practical terms, the results are also expected to provide useful implications for government internal supervisory institutions, particularly BPKP, in strengthening fraud disclosure through the enhancement of forensic accounting practices, the effective use of data analytics, and the implementation of a more reliable whistleblowing system.

## **Theoretical Study and Hypothesis**

### ***Agency Theory***

Agency theory, introduced by Jensen & Meckling (1976), explains the relationship between principals (owners) and agents (management). In this relationship, principals delegate authority to agents to manage organizational activities. However, conflicts of interest often arise because agents may prioritize their personal interests over the principals' interests. The core issue in agency theory is information asymmetry, where agents possess more information about their actions and organizational conditions than principals do. This information asymmetry creates opportunities for opportunistic behavior, including fraud (Sihombing & Rahardjo, 2014). In the context of fraud detection, agency theory is relevant because fraud occurs when agents exploit information asymmetry to conceal irregularities. Therefore, effective oversight mechanisms are needed to reduce information asymmetry and detect misconduct early. Forensic accounting serves as an investigative tool to trace hidden transactions and reconstruct financial evidence, thereby reducing information asymmetry between agents and auditors. Data analytics enables auditors to process large volumes of data and detect anomalous patterns that may be hidden by agents, making it easier to identify fraud indicators that would otherwise remain concealed. The whistleblowing system provides an alternative reporting channel for internal parties to disclose suspected fraud, offering information that can break the information asymmetry barrier between principals and agents (Srikandhi & Suryandari, 2020).

Thus, all three variables in this study forensic accounting, data analytics, and the whistleblowing system function as mechanisms to reduce information asymmetry and support the detection and disclosure of fraud, aligning with the core principles of agency theory.

### ***Fraud Hexagon Theory***

The Fraud Hexagon Theory explains that fraud occurs due to six main factors: pressure, opportunity, rationalization, capability, arrogance, and collusion. This theory was developed by Vousinas (2019) as an enhancement of the Fraud Triangle by adding the elements of capability, arrogance, and collusion to provide a more comprehensive explanation of the causes of fraud. In the context of this study, the Fraud Hexagon theory is relevant because the detection of fraud is influenced not only by the presence or absence of fraud itself but also by the complexity of the underlying factors. The stronger the pressure, opportunity, rationalization, perpetrator's capability, arrogance, and collusion within an organization, the higher the risk of fraud becomes, and the detection process grows increasingly difficult. Therefore, forensic accounting, data analytics, and whistleblowing systems are needed as tools to help auditors identify, trace, and uncover fraud more effectively (Vousinas, 2019; Kusumosari & Solikhah, 2021).

### ***Forensic Accounting***

Forensic accounting combines accounting, auditing, and investigation techniques to identify, trace, and document evidence for legal or administrative purposes (Singleton & Singleton, 2010). Several previous studies have confirmed that forensic accounting and investigative audits significantly contribute to fraud detection and disclosure. These approaches enable auditors to identify suspicious transactions, observe behavioral indicators, and develop comprehensive evidence, thereby improving the effectiveness of fraud investigation (Kuntadi et al., 2022; Prasetyo et al., 2023).

Previous studies have examined the effect of forensic accounting on fraud disclosure. Khatimah (2024) found that forensic accounting had a positive and significant effect on fraud disclosure among auditors at the

BPKP Representative Office of South Sulawesi. Similarly, Achyarsyah & Rani (2018) reported a positive influence of forensic accounting on fraud disclosure at the BPKP Representative Office of Central Java. However, Pamungkas & Jaeni (2022) found non-significant results, while Ardianysah (2023) noted that forensic accounting is not always effective in detecting fraud because it is often applied only after initial indications have emerged. Based on the theoretical foundation and empirical evidence from previous studies, the following hypothesis is proposed:

*H<sub>1</sub>: Forensic accounting influences the disclosure of fraud.*

#### **Data Analytics**

Data analytics refers to the examination, transformation, and interpretation of data to generate useful information and support decision making (Ghavami, 2020). In auditing, data analytics helps auditors process larger volumes of data, identify anomalies, improve risk assessment, and test suspicious entries more efficiently (Fay & Negangard, 2017; Balios et al., 2020). Evidence also shows that analytical tools support fraud identification in internal examinations and improve the speed and precision of fraud-related procedures (Tang & Karim, 2019; Prasetyo et al., 2023; Zheng et al., 2024).

Several studies have investigated the role of data analytics in fraud detection. Prasetyo et al. (2023) found that the application of data analytics had a positive impact on fraud identification in internal audits, facilitating evidence collection, risk prediction, and rapid data analysis. Sidauruk (2024) reported that data analytics had a positive and significant effect on fraud prevention and detection, particularly in central government institutions. However, Claudiastuti (2023) found that big data integration did not have a significant positive effect on internal fraud detection, suggesting that contextual factors such as auditor competence and resource availability may influence effectiveness. Based on the theoretical foundation and empirical evidence from previous studies, the following hypothesis is proposed:

*H<sub>2</sub>: Data analytics influences the disclosure of fraud.*

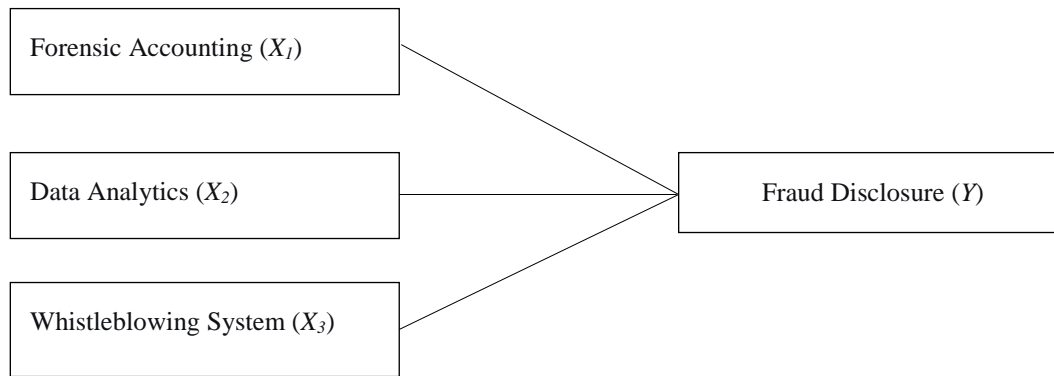
#### **Whistleblowing System**

A whistleblowing system is a formal mechanism for reporting violations, misconduct, or suspected fraud within an organization. Similar to forensic accounting and data analytics, the whistleblowing system serves as an anti-fraud tool, but with a different approach. While forensic accounting focuses on investigative procedures and data analytics emphasizes technology-based detection, the whistleblowing system relies on human intelligence and internal reporting channels. It becomes effective when the organization provides confidentiality, protection, clear follow-up, and trust in the reporting process (KNKG, 2008; Pramudyastuti et al., 2021). Prior studies show that whistleblowing can improve organizational transparency and provide early information for auditors or control units to investigate irregularities (Siregar & Surbakti, 2019; Srikandhi & Suryandari, 2020). The fraud literature also places strong weight on tips and complaints as a major channel for detecting occupational fraud (ACFE, 2020). Furthermore, Oktaviani et al. (2024) found that whistleblowing system, together with apparatus competence and ethical climate, plays a significant role in fraud prevention. Previous research has also examined the effect of whistleblowing systems on fraud disclosure, complementing the studies on forensic accounting and data analytics. Damayanty (2023) found that the whistleblowing system had a significant effect on fraud disclosure at the BPKP Representative Office of West Java. Similarly, Hanie (2024) also reported that the whistleblowing system positively and significantly influenced the ability of BPKP auditors to detect fraud indicators. However, in contrast to the consistent positive findings for forensic accounting and data analytics in this study, Pramudyastuti et al. (2021) found that the effectiveness of whistleblowing systems may weaken when trust in the system and whistleblower protection remains low. Likewise, Maisaroh & Nurhidayati (2021) reported that the whistleblowing system did not have a significant effect on fraud in Islamic commercial banks, suggesting that contextual factors may influence its effectiveness. Based on the theoretical foundation and empirical evidence from previous studies, the following hypothesis is proposed:

*H<sub>3</sub>: Whistleblowing System influences the disclosure of fraud.*

#### **Research Framework**

This conceptual framework is developed to clarify how the dependent variable, namely fraud disclosure, is influenced by the independent variables, namely forensic accounting, data analytics, and the whistleblowing system, as presented in Figure 1



**Figure 1. Research framework**

**Research Methods**

This study uses a quantitative approach. The research was conducted at the BPKP Representative Office of Riau Province from February to March 2026. The population consisted of 83 auditors. The study applied purposive sampling, so all members of the population were targeted as respondents. Of 83 distributed questionnaires, 68 were returned and 63 were complete and usable for analysis.

The dependent variable was fraud disclosure. The independent variables were forensic accounting, data analytics, and whistleblowing systems. Fraud disclosure was measured through indicators related to audit procedures, understanding of fraud characteristics, monitoring, and disclosure methods. Forensic accounting was measured through professional compliance, evidence collection and analysis, legal understanding, system understanding, and communication capability. Data analytics was measured through perceived usefulness and perceived ease of use. Whistleblowing systems were measured through structural, operational, and maintenance aspects.

The questionnaire used Likert scales. The data were tested through validity and reliability procedures. Classical assumption tests covered normality, multicollinearity, and heteroskedasticity. The hypotheses were tested using multiple linear regression with SPSS version 31. The conceptual framework above can be expressed in the form of an equation model as follows:

$$Y = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$$

**Legend**

Symbol	Description
$Y$	Fraud Disclosure (Dependent Variable)
$X_1$	Forensic Accounting (Independent Variable)
$X_2$	Data Analytics (Independent Variable)
$X_3$	Whistleblowing System (Independent Variable)
$\alpha$	Constant
$\beta_1, \beta_2, \beta_3$	Regression Coefficients
$\varepsilon$	Error term (other variables outside the model)

**Data Analysis and Discussion**

***Descriptive Statistical and Analysis Results***

Table 1 presents the descriptive statistics. The highest mean score appears in forensic accounting, followed by data analytics, whistleblowing systems and fraud disclosure. The relatively small standard deviations suggest moderate variation across responses.

**Table 1  
Descriptive Statistics**

	$N$	Minimum	Maximum	Mean	Std. Deviation
Fraud Disclosure	63	27	39	34.48	2.928
Forensic Accounting	63	38	49	44.79	2.610
Data Analytics	63	35	45	41.37	2.451
Whistleblowing system	63	29	39	35.13	2.479
Valid $N$ (listwise)	63				

**Validity and Reliability Test Results**

Table 2 shows that the validity test results indicate that all questionnaire items in this study were deemed valid because each item had a calculated *r value* greater than the critical *r value* of 0.248. The validity values for the fraud disclosure variable range from 0.617 to 0.830, forensic accounting from 0.549 to 0.790, data analytics from 0.407 to 0.656 and the whistleblowing system from 0.706 to 0.828. Thus, all indicators are suitable for measuring their respective research variables.

**Table 2**  
**Validity Test**

Variable	Item	<i>r value</i>	<i>r table</i>	Decision
Fraud Disclosure	1	0.768	0.248	Valid
	2	0.796	0.248	Valid
	3	0.830	0.248	Valid
	4	0.807	0.248	Valid
	5	0.819	0.248	Valid
	6	0.617	0.248	Valid
	7	0.636	0.248	Valid
	8	0.807	0.248	Valid
Forensic Accounting	1	0.790	0.248	Valid
	2	0.700	0.248	Valid
	3	0.617	0.248	Valid
	4	0.641	0.248	Valid
	5	0.549	0.248	Valid
	6	0.653	0.248	Valid
	7	0.754	0.248	Valid
	8	0.673	0.248	Valid
	9	0.742	0.248	Valid
	10	0.683	0.248	Valid
Data Analytics	1	0.488	0.248	Valid
	2	0.558	0.248	Valid
	3	0.656	0.248	Valid
	4	0.594	0.248	Valid
	5	0.494	0.248	Valid
	6	0.630	0.248	Valid
	7	0.618	0.248	Valid
	8	0.407	0.248	Valid
	9	0.506	0.248	Valid
Whistleblowing System	1	0.706	0.248	Valid
	2	0.717	0.248	Valid
	3	0.791	0.248	Valid
	4	0.828	0.248	Valid
	5	0.748	0.248	Valid
	6	0.706	0.248	Valid
	7	0.741	0.248	Valid
	8	0.795	0.248	Valid

**Reliability Test Results**

The reliability test results indicate that all research variables were deemed reliable, as their respective Cronbach’s Alpha values were above the minimum threshold of 0.60. The reliability coefficients were 0.895 for fraud detection 0.867 for forensic accounting 0.702 for data analytics and 0.890 for the whistleblowing system. These results indicate that all questionnaire items exhibit good consistency making them suitable for use in this study.

**Table 3**  
**Reliability Test**

Variable	Cronbach's Alpha	Decision
Fraud Disclosure (Y)	0.895	Reliable
Forensic Accounting (X <sub>1</sub> )	0.867	Reliable
Data Analytics (X <sub>2</sub> )	0.702	Reliable
Whistleblowing System (X <sub>3</sub> )	0.890	Reliable

**Normality Test Results**

The normality test was conducted using the One–Sample Kolmogorov–Smirnov test to determine whether the residuals in the regression model are normally distributed. As presented in Table 4, the Asymp. Sig. (2–tailed) value is 0.200. This value exceeds the predetermined significance level of 0.05 (0.200 > 0.05). Consequently, the null hypothesis (H<sub>0</sub>) stating that the data are normally distributed cannot be rejected. Based on these results, it can be concluded that the regression model in this study satisfies the normality assumption and the residual data follow a normal distribution.

**Table 4**  
**Normality Test**

One–Sample Kolmogorov–Smirnov Test		Unstandardized Residual
N		63
Normal Parameters <sup>ab</sup>	Mean	0.000000
	Std. Deviation	1.28480256
Most Extreme Differences	Absolute	0.097
	Positive	0.049
	Negative	–0.097
Test Statistic		0.097
Asymp. Sig. (2–tailed) <sup>c</sup>		0.200 <sup>d</sup>

**Multicollinearity Test Results**

The multicollinearity test was conducted to detect whether there is a high or perfect correlation among the independent variables in the regression model. As shown in Table 5, the tolerance values for all independent variables range from 0.522 to 0.651, which are all greater than the threshold of 0.10. Similarly, the VIF values range from 1.536 to 1.916, which are all below the threshold of 10. These results indicate that there is no significant correlation between forensic accounting, data analytics and the whistleblowing system. Consequently, the regression model does not suffer from multicollinearity problems. Based on these findings, it can be concluded that the model has satisfied the multicollinearity assumption, allowing for reliable estimation of the regression coefficients.

**Table 5**  
**Multicollinearity Test**

Model	Collinearity Statistics	
	Tolerance	VIF
1 (Constant)		
Forensic Accounting	0.586	1.706
Data Analytics	0.651	1.536
Whistleblowing system	0.522	1.916

a. Dependent Variable: Fraud Disclosure

### Heteroscedasticity Test Results

Based on Figure 2, The scatterplot above shows that the data points are randomly distributed and lie both above and below the value of 0 (zero) on the Y-axis. Therefore, it can be concluded that the regression model in this study is free from heteroscedasticity.

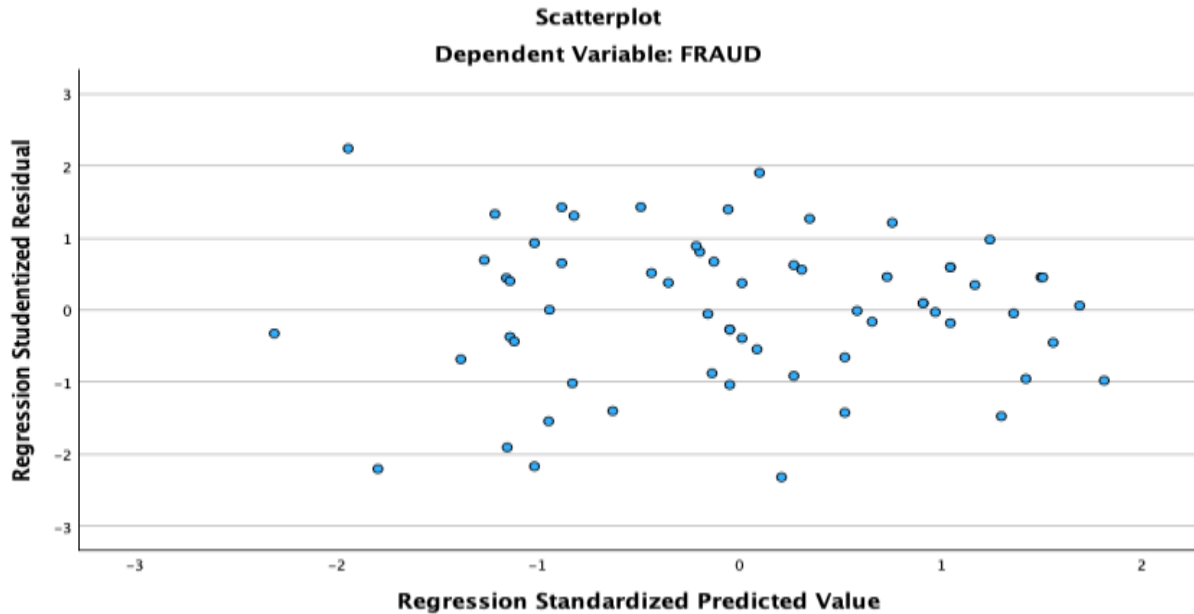


Figure 2. Heteroscedasticity test

### Multiple Regression Test Results

The results of the multiple linear regression analysis are presented in Table 6. The estimated regression equation is formulated as  $Y = -15.081 + 0.648X_1 + 0.246X_2 + 0.290X_3 + e$ . In this equation,  $Y$  denotes fraud disclosure,  $X_1$  represents forensic accounting,  $X_2$  represents data analytics,  $X_3$  represents the whistleblowing system, and  $e$  is the error term. The constant value of -15.081 indicates that if all independent variables are zero, the predicted value of fraud disclosure would be -15.081. The coefficient of  $X_1$  (0.648) suggests that a one-unit increase in forensic accounting will increase fraud disclosure by 0.648 units, holding other variables constant. Similarly, the coefficients for  $X_2$  and  $X_3$  are 0.246 and 0.290, respectively. Furthermore, the adjusted  $R^2$  value is 0.798, meaning that 79.8% of the total variance in fraud disclosure can be explained collectively by forensic accounting, data analytics and the whistleblowing system. The remaining 20.2% is attributable to other factors outside the model, including but not limited to auditor competence, internal control effectiveness, organizational commitment and ethical climate.

Table 6  
Multiple Regression Test

Variable	B	t	Sig.
Constant	-15.081	-3.189	0.002
Forensic accounting	0.648	5.356	0.001
Data analytics	0.246	2.064	0.043
Whistleblowing system	0.290	2.231	0.029
Adjusted $R^2$	0.798		

### t-Test Results

The  $t$ -test was performed to determine the partial significance of each independent variable on fraud disclosure. As shown in Table 7, all three independent variables exhibit  $p$ -values below the predetermined significance level of 0.05. Specifically, forensic accounting has a  $p$ -value of 0.001, data analytics has a  $p$ -value

of 0.043 and the whistleblowing system has a *p*-value of 0.029. Since all *p*-values are less than 0.05, it can be concluded that each independent variable has a statistically significant partial effect on fraud detection. These results confirm that improvements in forensic accounting, data analytics and the whistleblowing system can partially enhance the effectiveness of fraud detection within the BPKP Representative Office of Riau Province. In other words, increasing the quality or implementation of any of these three variables individually will lead to a significant improvement in fraud disclosure.

**Table 7**  
*t*-Test

Hypothesis	Hypothesis Test	Sig.	Decision
$H_1$	$X_1 \rightarrow Y$	0.001	$H_1$ Accepted
$H_2$	$X_2 \rightarrow Y$	0.043	$H_2$ Accepted
$H_3$	$X_3 \rightarrow Y$	0.029	$H_3$ Accepted

### Discussion

#### *Forensic Accounting and Fraud Disclosure*

The statistical analysis shows that forensic accounting has a positive and significant effect on fraud disclosure ( $\beta = 0.648$ ;  $p < 0.001$ ), indicating that forensic accounting is the strongest predictor among the three variables examined. This finding can be interpreted in the context of BPKP Riau's operational reality. In practice, forensic accounting enables auditors to go beyond routine audit procedures by applying investigative techniques such as evidence tracing, transaction reconstruction, and financial document analysis. At BPKP Riau, forensic accounting has been applied in handling significant fraud cases, such as the fictitious official travel order case at the Riau DPRD Secretariat. In that case, forensic auditors successfully traced manipulated financial documents and identified discrepancies between reported activities and actual implementations. This real-world application explains why forensic accounting has a strong effect on fraud disclosure not merely because of its technical procedures, but because it provides concrete evidence that can be used in legal proceedings. The finding is consistent with prior studies (Kuntadi et al., 2022; Pamungkas & Jaeni, 2024), but it adds empirical weight from the specific context of government internal audit in Riau Province. From an agency perspective, forensic accounting reduces information asymmetry by allowing auditors to uncover hidden transactions that agents might otherwise conceal. In the Fraud Hexagon framework, forensic accounting directly mitigates the opportunity and capability elements by making fraud more difficult to hide and easier to detect.

#### *Data Analytics and Fraud Disclosure*

The analysis reveals that data analytics also has a positive and significant effect on fraud disclosure ( $\beta = 0.246$ ;  $p = 0.043$ ), though its influence is relatively smaller compared to forensic accounting. The practical interpretation of this finding is grounded in BPKP Riau's current digitalization initiatives. According to the BPKP Riau Strategic Plan 2020–2024, the office has been actively developing Big Data Analytics capabilities, including the Mata Bansos application for continuous auditing of social assistance distribution. However, field observations suggest that the adoption of data analytics is still in its early stages. While auditors recognize its usefulness in processing large volumes of transactions and detecting anomalies, challenges such as limited technical training, data integration issues, and reliance on manual verification may reduce its immediate effectiveness. This explains why data analytics has a positive but less dominant effect compared to forensic accounting in this study. When auditors perceive analytical tools as useful and easy to use (Davis, 1989; Albawwat & Frijat, 2021), they are more willing to adopt them, but full integration into audit workflows takes time. Linked to the Fraud Hexagon Theory, data analytics helps close oversight gaps by continuously monitoring transactions and identifying collusion patterns that manual audits might miss. Nevertheless, the lower coefficient suggests that BPKP Riau still needs to invest more in auditor training and infrastructure to fully leverage data analytics for fraud detection.

#### *Whistleblowing Systems and Fraud Disclosure*

The results indicate that the whistleblowing system has a significant effect on fraud disclosure ( $\beta = 0.290$ ;  $p = 0.029$ ). In practical terms, this means that at BPKP Riau, the availability of a secure and credible reporting channel increases the likelihood that fraud will be reported and investigated. BPKP Riau has implemented a whistleblowing system through its online portal (wbs.bpkp.go.id) and the BPKP Kawal service, allowing

internal and external parties to report suspected violations confidentially. However, field realities suggest that the effectiveness of this system may vary. Some potential whistleblowers may hesitate to report due to fear of retaliation or lack of trust in follow-up mechanisms. This explains why, although significant, the effect of the whistleblowing system is not as strong as forensic accounting. The finding aligns with ACFE (2020) evidence that tips are the most common method of fraud detection, but it also echoes Pramudyastuti et al. (2021) who found that the system's effectiveness weakens when trust and protection are insufficient. From an agency theory perspective, the whistleblowing system reduces information asymmetry by creating an alternative communication channel beyond the formal hierarchy. In practice, strengthening whistleblower protection and ensuring transparent follow-up could enhance this mechanism's contribution to fraud disclosure at BPKP Riau.

## **Conclusions, Limitations, and Suggestions**

### ***Conclusions***

This study confirms that fraud disclosure within government internal audit institutions is strengthened when three key mechanisms are developed together: investigative capability through forensic approaches, technology adoption through data analytics, and reporting mechanisms through a credible whistleblowing system. These findings support agency theory by demonstrating that reducing information asymmetry between auditors and the audited parties can be achieved through a combination of forensic investigation, data-driven monitoring, and early warning channels. The results also align with the fraud hexagon theory, which suggests that fraud occurs due to multiple interrelated factors, including opportunity, capability, and collusion. The integrated use of forensic accounting, data analytics, and whistleblowing systems can mitigate these factors by making concealment more difficult, closing oversight gaps, and accelerating fraud detection. Thus, effective fraud disclosure does not rely on a single mechanism but rather on a holistic approach that combines investigative expertise, technological tools, and participatory reporting systems. These findings imply that strengthening fraud detection requires not only individual auditor competence but also organizational investment in technology, protection for whistleblowers, and a culture of transparency.

### ***Limitations***

This study has several limitations that should be acknowledged. First, the research was limited to auditors at the BPKP Representative Office of Riau Province, so the findings may not be generalizable to other government agencies, inspectorates, or the private sector. Second, this study relied on self-reported questionnaires, which may be subject to respondent bias. Third, only three independent variables were examined, leaving other potential factors such as auditor independence, professional skepticism, organizational culture, and internal control effectiveness unexplored. Fourth, the data were collected at a single point in time (cross-sectional), which does not capture changes over time. Future research should address these limitations by expanding the scope, using mixed methods, and incorporating additional variables.

### ***Suggestions***

Based on the conclusions and limitations of this study, several suggestions are proposed for future research and practical implications. For future research, it is recommended to expand the population and geographical scope by involving BPKP offices from multiple provinces or other government internal supervisory institutions such as inspectorates, and including the private sector to obtain more representative and generalizable results. Future studies should also consider adding other independent variables such as auditor independence, professional skepticism, investigative audit, organizational culture, and internal control effectiveness, and may incorporate moderating or mediating variables such as the whistleblowing system as a mediating variable to enrich the research model. Additionally, future research is encouraged to combine quantitative and qualitative approaches (mixed methods), such as questionnaires followed by in-depth interviews or document analysis, and to collect data over a longer period (longitudinal study) to capture changes in auditors' perceptions and the effectiveness of fraud detection mechanisms over time. For practical implications, BPKP and other government internal supervisory institutions should strengthen forensic training by providing ongoing training for auditors in forensic accounting techniques to enhance their ability to trace evidence, analyze suspicious patterns, and disclose fraud cases more effectively. Institutions should also expand the use of data analytics by continuing to develop and implement data analytics technology in audit processes, investing in information technology infrastructure, and providing continuous training for auditors in data analytics applications to improve the speed and accuracy of fraud detection. Furthermore, institutions should improve the whistleblowing system by

strengthening protection systems for whistleblowers, ensuring the confidentiality of reporters, establishing clear follow-up mechanisms for every report received, and conducting regular evaluation and socialization of the whistleblowing system to maintain its effectiveness. Finally, the findings confirm that fraud disclosure becomes stronger when investigative capability (forensic accounting), technology use (data analytics), and reporting mechanisms (whistleblowing system) develop together; therefore, an integrated approach combining these three mechanisms is recommended for optimal fraud detection.

### References

- ACFE. (2020). *Report to the nations on occupational fraud and abuse*. Association of Certified Fraud Examiners. <https://legacy.acfe.com/report-to-the-nations/2020/>
- ACFE. (2022). *Occupational fraud 2022: A report to the nations*. Association of Certified Fraud Examiners. <https://legacy.acfe.com/report-to-the-nations/2022/>
- Achmad, F. A., & Galib, S. (2022). Pengaruh red flags, independensi, dan skeptisme profesional terhadap kemampuan auditor dalam mendeteksi fraud: Studi empiris pada KAP di Jakarta Selatan. *Jurnal Ilmiah Akuntansi Kesatuan*, 10(2), 379–392. <https://doi.org/10.37641/jiakes.v10i2.1420>
- Achyarsyah, P., & Rani, M. (2021). Pengaruh akuntansi forensik dan audit investigatif terhadap pengungkapan kecurangan pelaporan keuangan (Studi pada Badan Pemeriksa Keuangan Republik Indonesia). *AkunNas: Jurnal Akuntansi*, 17(2), 107–131.
- Albawwat, I., & Frijat, Y. A. (2021). An analysis of auditors' perceptions towards artificial intelligence and its contribution to audit quality. *Accounting*, 7(4), 755–762.
- Ardianysah. (2023). The effectiveness of forensic accounting in fraud detection at BPKP Riau. *Jurnal Akuntansi Forensik*, 5(1), 12–25.
- Balios, D., Kotsilaras, P., Eriotis, N., & Vasiliou, D. (2020). Big data, data analytics and external auditing. *Journal of Modern Accounting and Auditing*, 16(5), 211–219. <https://doi.org/10.17265/1548-6583/2020.05.002>
- Claudiasuti, A. (2023). Pengaruh mitigasi akuntansi forensik dan integrasi teknologi big data terhadap deteksi kecurangan internal. *Jurnal Ekonomi Trisakti*, 3(2), 3415–3424. <http://dx.doi.org/10.25105/jet.v3i2.18132>
- Damayanty, D. M. (2023). *Pengaruh pengendalian internal dan whistleblowing system terhadap pengungkapan fraud pada Perwakilan BPKP Provinsi Jawa Barat*. Skripsi. Universitas Komputer Indonesia.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>
- Dewi, F. S., & Dewayanto, T. (2024). Peran big data analytics, machine learning, dan artificial intelligence dalam pendeteksian financial fraud: A systematic literature review. *Diponegoro Journal of Accounting*, 13(3), 1–15.
- Dyck, A., Morse, A., & Zingales, L. (2020). How pervasive is corporate fraud? *Review of Accounting Studies*, 25(3), 1–34. <https://doi.org/10.1007/s11142-022-09738-5>
- Fay, R. G., & Negangard, E. M. (2017). Manual journal entry testing: Data analytics and the risk of fraud. *Journal of Accounting Education*, 38, 37–49. <https://doi.org/10.1016/j.jaccedu.2016.12.004>
- Ghavami, P. (2020). *Big data analytics methods: Analytics techniques in data mining, deep learning and natural language processing* (2nd ed.). De Gruyter.
- Hanie, U. (2024). Pengaruh audit internal dan whistleblowing system terhadap pengungkapan fraud. *Jurnal Akuntansi Kontemporer*, 8(2), 55–70.
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305–360. [https://doi.org/10.1016/0304-405X\(76\)90026-X](https://doi.org/10.1016/0304-405X(76)90026-X)
- Khatimah, H. (2024). Pengaruh akuntansi forensik dan audit investigatif terhadap pengungkapan fraud pada BPKP Sulawesi Selatan. *Jurnal Akuntansi dan Keuangan*, 12(2), 100–115. <https://doi.org/10.56750/csej.v7i4.1023>
- KNKG. (2008). *Pedoman sistem pelaporan pelanggaran (whistleblowing system)*. Komite Nasional Kebijakan Governance.
- Kuntadi, C., DeviAina, Z., Rakhmanita, G., & Handayani, W. (2022). Influence power, governance, and compensation against corruption. *Scholars Bulletin*. 8(5). <https://doi.org/10.36348/sb.2022.v08i05.002>
- Kusumosari, L., & Solikhah, B. (2021). Analisis kecurangan laporan keuangan melalui fraud hexagon theory. *Fair Value: Jurnal Ilmiah Akuntansi dan Keuangan*. 4(3), 753–767. <https://doi.org/10.32670/fairvalue.v4i3.735>

- Maisaroh, P., & Nurhidayati, M. (2021). Pengaruh komite audit, good corporate governance dan whistleblowing system terhadap fraud bank umum syariah di Indonesia periode 2016–2019. *Etihad: Journal of Islamic Banking and Finance*, *1*(1), 23–60. <https://doi.org/10.21154/etihad.v1i1.2752>
- Muhyidin, A., Nurfauziah, F. L., & Suharti, S. (2025). An effective whistleblowing system model for regional inspectorates: A qualitative study in fraud prevention. *Journal of Accounting Auditing and Business*, *8*(2), Article 2.
- Oktaviani, R. Y., Puspitasari, D. P., & Samsiah, S. (2024). Pengaruh kompetensi aparatur, whistleblowing system, kesadaran anti-kecurangan dan ethical climate terhadap pencegahan kecurangan: Studi kasus pada Perwakilan BPKP Provinsi Riau. *Neraca: Jurnal Ekonomi, Manajemen dan Akuntansi*, *2*(12), 1182–1194.
- Pamungkas, W., & Jaeni (2022). Pengaruh akuntansi forensik, audit investigatif, independensi, dan skeptisme profesional terhadap pengungkapan fraud (Studi pada BPKP perwakilan Jawa Tengah). *Kompak: Jurnal Ilmiah Komputerisasi Akuntansi*, *15*(1), 99–109. <https://doi.org/10.51903/kompak.v15i1.622>
- Pramudyastuti, O. L., Rani, U., Nugraheni, A. P., & Susilo, G. F. A. (2021). Pengaruh penerapan whistleblowing system terhadap tindak kecurangan dengan independensi sebagai moderator. *Jurnal Ilmiah Akuntansi*, *6*(1), 88–102. <https://doi.org/10.23887/jia.v6i1.32335>
- Prasetyo, D. E., Wulandari, G. A. A., Meini, Z., & Fauziah. (2023). Identifikasi fraud dalam pemeriksaan internal melalui data analytics. *Equity: Jurnal Ekonomi, Manajemen, Akuntansi*, *26*(1), 78–98. <https://doi.org/10.34209/equ.v26i1.7418>
- Prasetyo, Y., Paramitha, D., Riyani, E. I., & Mubarak, F. (2023). Integrasi penerapan akuntansi forensik dan audit investigatif dalam mendeteksi fraud: Studi literatur. *Jurnal Buana Akuntansi*. *8*(1), 16–29. <https://doi.org/10.36805/akuntansi.v8i1.3062>
- Putri, I. M., Marta, M., & Machdar, N. M. (2024). Pengaruh pemanfaatan teknologi informasi, whistleblowing system, dan peran audit investigatif terhadap pengungkapan fraud. *Profit: Jurnal Manajemen, Bisnis, dan Akuntansi*, *3*(3), 28–46. <https://doi.org/10.58192/profit.v3i3.2159>
- Sidauruk, D. L. (2024). Data analytics in fraud prevention and detection by government internal supervisory apparatuses at ministries/institutions/local governments: A mixed-method study. *Asia Pacific Fraud Journal*, *9*(2), 33–48. <http://doi.org/10.21532/apfjournal.v9i2.340>
- Sihombing, K. S., & Rahardjo, S. N. (2014). *Analisis fraud diamond dalam mendeteksi financial statement fraud: Studi empiris pada perusahaan manufaktur yang terdaftar di Bursa Efek Indonesia (BEI) tahun 2010–2012. Skripsi*. Fakultas Ekonomika dan Bisnis, Universitas Diponegoro.
- Singleton, T. W., & Singleton, A. J. (2010). *Fraud auditing and forensic accounting* (4th ed.). John Wiley & Sons.
- Siregar, A., & Surbakti, A. S. (2019). Analisis pengaruh whistleblowing system dan rapat komite audit terhadap jumlah kecurangan. *BALANCE: Jurnal Akuntansi, Auditing, dan Keuangan*, *16*(1), 41–61. <https://doi.org/10.25170/balance.v16i1.1286>
- Srikandhi, M. F., & Suryandari, D. (2020). Audit quality moderates the effect of independent commissioners, audit committee, and whistleblowing system on the integrity of financial statement. *Accounting Analysis Journal*, *9*(3), 186–192. <https://doi.org/10.15294/aaj.v9i3.41625>
- Tang, J., & Karim, K. E. (2019). Financial fraud detection and big data analytics: Implications on auditors' use of fraud brainstorming session. *Managerial Auditing Journal*, *34*(3), 324–337. <https://doi.org/10.1108/MAJ-01-2018-1767>
- Vousinas, G. L. (2019). Advancing theory of fraud: The S.C.O.R.E. model. *Journal of Financial Crime*, *26*(1), 372–381. <https://doi.org/10.1108/JFC-12-2017-0128>
- Zheng, X., Abdul Hamid, M. A., & Hou, Y. (2024). Data mining algorithm in the identification of accounting fraud by smart city information technology. *Heliyon*, *10*(14), e30048. <https://doi.org/10.1016/j.heliyon.2024.e30048>