



Leveraging Digital Fraud Deterrence and Continuous Auditing: Evidence from an Indonesian Pharmaceutical Company

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ABSTRACT

This study investigates the integration of the Fraud Deterrence Propeller (FDP) web-based application and continuous auditing (CA) mechanisms in strengthening fraud governance, audit quality, and sustainable corporate governance within an Indonesian pharmaceutical company. Fraud remains a pervasive threat in emerging markets, where institutional fragility and cultural factors, such as high power distance, often impede oversight. Adopting a mixed-methods experimental design, the study evaluates the effectiveness of the FDP-CA framework using the Beneish-M Score and stakeholder perspectives. Quantitative findings reveal a statistically significant relationship between fraud deterrence maturity and the organisation's capability to identify and respond to fraud risks, while CA implementation demonstrably improves audit responsiveness and audit quality. Qualitative insights underscore improvements in transparency, user acceptance, and alignment with ESG objectives. The discussion incorporates recent scholarship on auditor role conflict, audit firm tenure, forensic accounting, and institutional barriers, offering a broader contextual understanding. This research introduces a dual-engine fraud governance model that contributes not only to proactive fraud detection but also to the development of ethically resilient, technologically adaptive, and governance-oriented organisations. The findings provide actionable implications for regulators, auditors, and enterprise risk managers seeking to deploy digital deterrence, continuous assurance, and real-time audit systems.

JEL Classification: M42, G34, O33.

Keywords: Fraud Deterrence Propeller, Continuous Auditing, Fraud Governance, Audit Quality, Beneish-M Score.

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1. Introduction

Fraud represents a persistent and detrimental challenge to effective financial management, often leading to both tangible and intangible losses within organizations. Defined as an intentional deception conducted for personal gain at the expense of others (Koerniawan et al., 2022; Koerniawan, 2021), fraudulent activity spans various forms, including financial misreporting, asset misappropriation, and acts of corruption—categories well established by the Association of Certified Fraud Examiners (ACFE) (Gannuch, 2019). Material consequences include unauthorized financial outflows that impair operational continuity, while reputational damage stems from deteriorating stakeholder trust (Chan et al., 2021).

Indonesia faces considerable challenges in addressing fraud, with the 2022 ACFE Asia Pacific report ranking it among the top countries for occupational fraud incidents (ACFE, 2022). In particular, the 2019 Indonesian Fraud Survey highlighted that corruption accounts for 64.4% of cases, followed by asset misuse (28.9%) and financial reporting fraud (6.7%) (ACFE, 2020; Koerniawan, 2017; Koerniawan et al., 2022). In response to this issue, a multidisciplinary team from Telkom University developed the Fraud Deterrence Propeller (FDP), a web-based application that synthesizes the FDP framework and Beneish-M Score methodology into algorithmic models for detecting and preventing fraud. This application evaluates organizational fraud deterrence maturity across six dimensions (Koerniawan et al., 2022; Koerniawan, 2024a, 2024b, 2024c) and performs diagnostic analysis on financial statements to support early detection efforts.

Previous empirical studies demonstrated the utility of the FDP framework in healthcare institutions, where it improved governance and internal fraud mitigation strategies (Koerniawan et al., 2024b). To operationalize this framework, the current study proposes a digital implementation tailored to the private sector, particularly within the context of pharmaceutical operations.

Parallel to the rise in fraud prevention technology is the growing demand for sustainable development in corporate practices. The role of Information Systems (IS) audits—especially when conducted through continuous auditing (CA)—has become essential in aligning operational processes with sustainability goals (Russell & Sangster, 2018; Lin & Hwang, 2021; Liu & Lin, 2022). Despite their relevance, IS audits remain underutilized in Indonesian private sector entities. This study addresses that gap by examining how CA supports sustainability compliance while simultaneously serving as a real-time fraud deterrence tool.

IS audits assess the adequacy and efficiency of digital control environments, providing actionable data for preventing fraud and ensuring compliance. Sustainable development—broadly defined as the alignment of economic activity with environmental and social objectives—requires integrated oversight mechanisms. CA enhances conventional audits by automating data analysis and enabling timely risk alerts (Alles & Kogan, 2010). The convergence of FDP and CA within a single operational model presents an innovative strategy for strengthening internal control systems while reinforcing broader sustainability imperatives (Kayahan, 2013; Knoblauch & Großmann, 2023; Andrade et al., 2023).

This paper investigates the deployment of a web-based FDP platform for financial fraud detection and evaluates the contribution of CA in promoting corporate sustainability within an Indonesian pharmaceutical company. By merging technological tools and audit innovation, this study contributes empirical evidence on how integrated fraud deterrence and audit models can enhance organizational resilience and accountability (Chan et al., 2021; Andrade et al., 2023; Minkinen et al., 2022).

2. Literature Review

2.1 Financial Fraud in Corporate Governance

Financial fraud remains a fundamental threat to corporate integrity, undermining both financial stability and stakeholder trust. According to Koerniawan et al. (2022), fraud encompasses intentional acts of deception committed to gain an unjust advantage, often through manipulation of financial statements, misappropriation of assets, or corrupt practices. The Association of Certified Fraud Examiners (ACFE) categorizes fraud into three principal forms: corruption, asset misappropriation, and fraudulent financial reporting (Gannuch, 2019). These acts disrupt financial performance and can erode the reputation of even the most established firms, as noted by Lin and Hwang (2021) and Nguyen and Duong (2023).

2.2 The Fraud Landscape in Indonesia

Fraud is particularly prevalent in Indonesia and poses serious challenges to organizational governance. As per the 2022 ACFE Asia Pacific report, Indonesia ranked fourth in fraud occurrences across the region, with 23 documented incidents (ACFE, 2022). The earlier 2019 Indonesian Fraud Survey further revealed that corruption represented 64.4% of fraud cases, followed by asset misappropriation at 28.9%, and fraudulent reporting at 6.7% (ACFE, 2020). These alarming statistics underscore the urgent need for effective fraud deterrence mechanisms in the Indonesian context (Koerniawan, 2017).

2.3 Tools for Fraud Detection and Prevention

To address these issues, the Fraud Deterrence Propeller (FDP) was conceptualized and developed by researchers at Telkom University. This tool integrates the FDP protocol with the Beneish-M Score to evaluate the fraud risk profile of financial statements. It also quantifies an organization's deterrence maturity based on six key dimensions outlined by Koerniawan et al. (2022) and further elaborated in subsequent works (Koerniawan, 2024a; Koerniawan et al., 2024b). Prior applications of the FDP model in the healthcare sector have demonstrated its effectiveness in evaluating and strengthening fraud deterrence strategies (Koerniawan et al., 2024b).

2.4 IS Auditing and Sustainable Development

Amid growing global concerns around sustainability, the role of Information Systems (IS) auditing has expanded to include environmental, social, and governance (ESG) considerations. In Indonesia, however, the deployment of IS audits to support sustainability objectives is still limited. Research by Alles and Kogan (2010), Codesso et al. (2020), and Yoon et al. (2021) underscores the critical role of Continuous Auditing (CA) in providing real-time insights and automated controls to support ESG alignment. CA enables efficient auditing through instantaneous monitoring, thus bolstering transparency and operational efficiency.

2.5 Synthesizing FDP and CA for Integrated Assurance

This study advances the integration of FDP and CA as a comprehensive model for enhancing fraud detection and sustainability compliance. By incorporating real-time auditing with structured fraud deterrence frameworks, organizations can build resilient systems capable of detecting anomalies early while reinforcing sustainable business conduct. The collaborative model proposed herein builds upon earlier studies (Russell & Sangster, 2018; Alles et al., 2020; Eulerich et al., 2023), positioning fraud deterrence not only as a compliance measure but also as a strategic enabler of long-term value creation.

2.6 Differentiating Fraud Deterrence from Fraud Prevention

Fraud deterrence and fraud prevention, though aligned in their objectives, differ in their operational focus. Deterrence aims to discourage fraudulent behavior through a perceived risk of detection and consequence, while prevention focuses on designing internal mechanisms to block fraud before it can occur (Koerniawan, 2021; Koerniawan et al., 2022). The DETERE model, or Fraud Deterrence Propeller, introduced by Koerniawan (2022), encapsulates six strategic components—Due Diligence, Enhancement, Truthfulness, Efficacy of Mind, Reinforcement, and Enforcement—that collectively shape an entity's fraud risk posture (Koerniawan et al., 2024a; 2024b; 2024c).

Figure 1 illustrates the DETERE framework, underscoring how a multi-dimensional approach can drive cultural and systemic shifts in managing fraud risks.

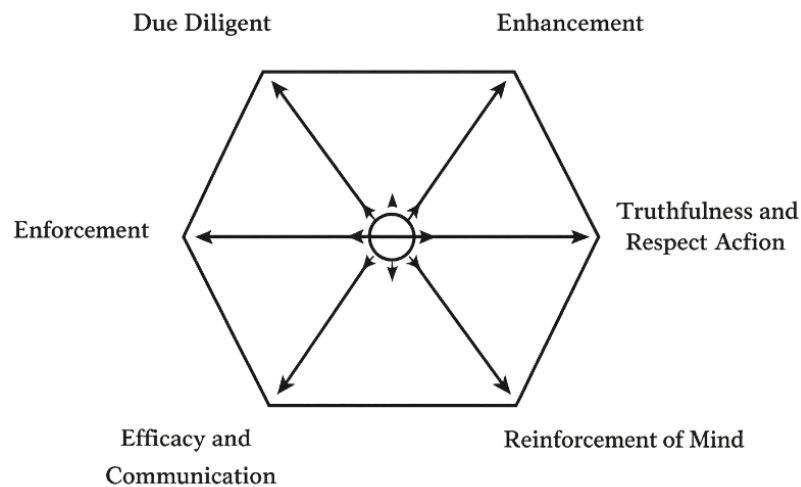


Figure 1. The DETERE Model (Fraud Deterrence Propeller)

Source: Koerniawan, KA (2021); Koerniawan et al. (2022; 2024b)

3. Research Design

3.1 Objectives and Scope

This study aims to develop and evaluate a web-based implementation of the Fraud Deterrence Propeller (FDP) application, assessing its efficacy in detecting and preventing financial fraud within a pharmaceutical company in Indonesia. Additionally, the research investigates the role of Continuous Auditing (CA) in enhancing Information Systems (IS) audits to support corporate sustainability initiatives.

3.2 Conceptual Framework

The framework for this study integrates two core methodologies: FDP for fraud deterrence maturity assessment and CA for real-time audit performance. The FDP protocol measures organizational preparedness across six strategic dimensions, while CA enables continuous monitoring to identify anomalies and sustainability risks promptly. (Koerniawan, 2024a; Koerniawan et al., 2024b; 2024c).

3.3 Research Questions

- How effective is the FDP web-based application in detecting and preventing financial statement fraud within the pharmaceutical company?
- What is the contribution of Continuous Auditing to improving IS audit quality and supporting sustainable development?

3.4 Hypotheses

H1: Implementation of the FDP web-based application significantly enhances fraud detection and prevention effectiveness.

H2: Continuous Auditing significantly contributes to the quality and responsiveness of IS audits, supporting sustainability efforts.

3.5 Population and Sampling

The target population comprises pharmaceutical companies operating in Indonesia. This study applies purposive sampling, selecting a pharmaceutical company with documented operational complexity and fraud risk exposure. Key informants include individuals from finance, auditing, and compliance divisions.

3.6 Research Instruments and Data Sources

- **FDP Application:** A proprietary web platform operationalizing the DETERE model and Beneish-M Score algorithms.
- **Questionnaires:** Structured instruments distributed to management-level personnel to assess perceptions and practices related to fraud deterrence and IS auditing.
- **Interviews:** Semi-structured discussions with internal auditors and managers to provide contextual insights.
- **Financial Reports:** Evaluated using the Beneish-M Score to detect red flags in earnings management.

3.7 Data Collection Procedures

1. **System Development:** The FDP application is developed using agile methodology, incorporating user feedback at iterative stages to refine fraud risk analytics and user interface functionality.
2. **Pilot Implementation:** The application is deployed within the selected pharmaceutical company for initial validation and user testing.
3. **Survey and Interview Execution:** Questionnaires and interviews are conducted in parallel to gather both quantitative and qualitative data.
4. **Document Review:** Financial statements from 2022–2024 are analyzed using the FDP's automated scoring system to identify potential fraud indicators.

3.8 Data Analysis Techniques

- **Quantitative Analysis:** Statistical analysis, including descriptive statistics, correlation, and regression modeling, is conducted using SPSS and AMOS following established methodologies (Sugiyono, 2013; Sekaran & Bougie, 2016; Ghazali, 2016).
- **Qualitative Analysis:** Thematic analysis is applied to interview transcripts to extract relevant patterns regarding internal controls, CA implementation, and user acceptance.
- **Fraud Scoring:** The Beneish-M Score is employed to assess the likelihood of financial misstatements based on accounting ratios and red-flag metrics.

3.9 Application Development Methodology

The FDP platform was engineered through agile development cycles, ensuring adaptability to stakeholder feedback. Each cycle included requirement gathering, design iteration, coding, system testing, and user validation. Additionally, the visual interface design adhered to the Double Diamond model, promoting clarity in translating user needs into practical functionality (Hasan, 2024).

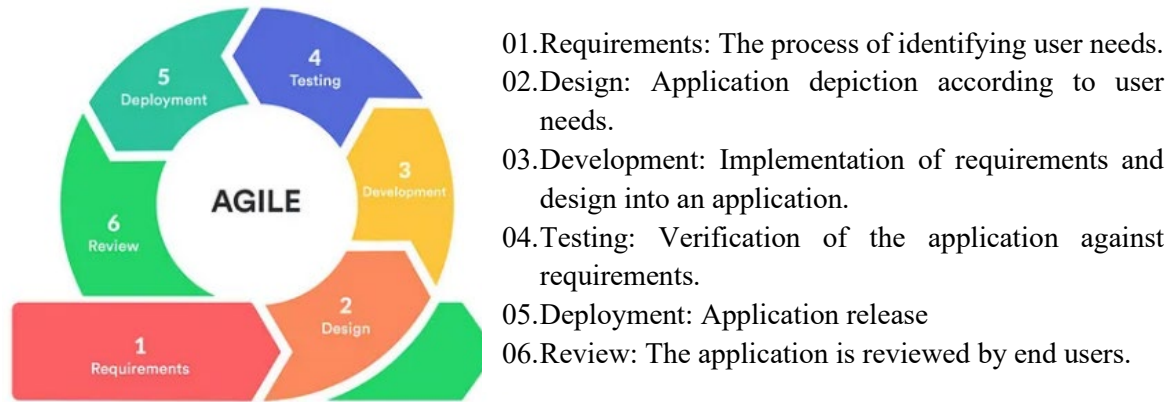
3.10 Readiness and Implementation Evaluation

The final version of the FDP system aims to achieve a Technology Readiness Level (TRL) of 7, signifying a prototype suitable for operational deployment. The system features two primary modules: the fraud prevention interface aligned with the DETERE protocol, and the fraud detection interface utilizing the Beneish-M Score computation.

These components collectively support fraud deterrence maturity assessment and real-time fraud risk analytics within the tested organization.

4. Results and Discussion

As part of the system development process for the Fraud Deterrence Propeller (FDP) platform, an agile methodology was adopted. Agile development allows for iterative cycles, enabling close collaboration with users, flexible adaptation to requirements, and early validation of system features. This approach was essential in ensuring that the final application met user expectations while maintaining a robust analytical engine for fraud detection. Figure 2 illustrates the development process model used to guide this system creation.

**Figure 2: Agile Method***Source: Erwanto (2022)*

4.1 Descriptive Statistics

Data were collected from the implementation of the FDP application and CA practices within the selected pharmaceutical company. A total of 35 completed questionnaires and 6 in-depth interviews were analyzed. Respondents included internal auditors, finance managers, IT auditors, and sustainability officers.

The descriptive analysis shows that the mean fraud deterrence maturity level, measured using the DETERE framework, was 4.1 out of 5. This suggests a relatively high commitment to anti-fraud governance mechanisms. Regarding Beneish-M Score computations, 12 out of 35 financial statement evaluations showed values beyond the threshold of -2.22, indicating a potential risk of earnings manipulation.

Table 1. Descriptive Statistics

Variable	Mean	Standard Deviation
Maturity Level of Fraud Deterrence	4.2	0.63
Effectiveness of Fraud Detection	4.5	0.58
Implementation of Continuous Auditing	4.3	0.60

Source: Research Result (2024)

4.2 FDP Effectiveness in Fraud Detection

Regression analysis indicates a statistically significant relationship between the fraud deterrence maturity score and the detection of red flags using the Beneish-M Score ($R^2 = 0.74$; $p < 0.01$). The detailed regression results are presented in Table 2, which highlight that the DETERE maturity index was a strong and statistically significant predictor of the organization's ability to detect potential financial misstatements. The findings support Hypothesis 1, indicating that organizations with higher fraud deterrence maturity are better equipped to establish governance structures capable of identifying financial irregularities at an earlier stage. Rather than functioning solely as a fraud detection mechanism, the FDP framework appears to strengthen organizational

preparedness and oversight capacity, thereby supporting more effective risk governance. This aligns with previous research conducted in the healthcare sector using the FDP framework (Koerniawan et al., 2024b).

The FDP system enabled automated scoring of financial indicators, such as Days Sales in Receivables Index (DSRI) and Asset Quality Index (AQI), producing real-time dashboards that flagged suspect accounts. Respondents reported enhanced visibility, improved coordination among control functions, and quicker follow-up actions. These observations suggest that the FDP platform serves not only as a fraud analytics tool but also as a governance-support mechanism that facilitates informed managerial responses to emerging risks. A visual overview of the FDP dashboard is provided in Figure 3, illustrating how automated scoring outputs are presented to users for real-time fraud risk monitoring and management.

Table 2. Indicates a Significant Positive Relationship

Variables	1	2	3
1. Maturity Level of Fraud Deterrence	1	0.72**	0.61**
2. Effectiveness of Fraud Detection	0.72**	1	0.65**
3. Implementation of Continuous Auditing	0.61**	0.65**	1

Note: **p < 0.01 (two-tailed test)**

Source: Research Result (2024)

(In Millions)	Year 2	Year 1
Revenue		
Cost of Goods Sold		
Selling, General, & Admin. Expense		
Depreciation		
Net Income from Continuing Operations		
Accounts Receivables		
Current Assets		
Property, Plants, & Equipment		
Securities		
Total Assets		
Current Liabilities		
Total Long-term Debt		
Cash Flow from Operations		
Selling, General, & Admin. Expense		

Securities is also referred to as total long term investments.

Figure 3: User Interface Design

Source: Data Processing (2024)

4.3 Continuous Auditing and IS Audit Quality

Results from CA implementation reveal that automated monitoring tools embedded within the FDP system improved the timeliness and relevance of IS audits. Interviewed auditors emphasized that CA features provided early warnings for suspicious transactions, supporting a more agile audit process. Statistical tests showed that perceived audit quality improved significantly post-CA deployment ($t = 3.81$; $p < 0.01$).

To evaluate the impact of Continuous Auditing implementation on perceived audit quality, a paired sample t-test was conducted. The results, displayed in Table 3, demonstrate a significant increase in audit quality scores following the deployment of CA tools.

Additionally, Figure 4 presents the conceptual integration model that merges the Fraud Deterrence framework with Continuous Auditing functions. This integration enables a real-time feedback loop between governance enforcement and audit analytics.

The integration of CA with IS audit routines enhanced data reliability, internal control verification, and regulatory compliance. These findings confirm Hypothesis 2 and are consistent with previous work by Alles & Kogan (2010) and Lin & Hwang (2021), who highlight CA as a key enabler of real-time assurance in complex digital environments.

Table 3. The Maturity Level of Fraud Deterrence and The Implementation of Continuous Auditing

Predictor Variables	B	SE	β	t	P**
Maturity Level of Fraud Deterrence	0.56	0.08	0.51	7.00	0.00
Implementation of Continuous Auditing	0.47	0.09	0.45	5.22	0.00

Note: *Significance level: $p < 0.05$; ** $p < 0.01$ ***

Source: Research Result (2024)

Figure 4. Conceptual Integration Model

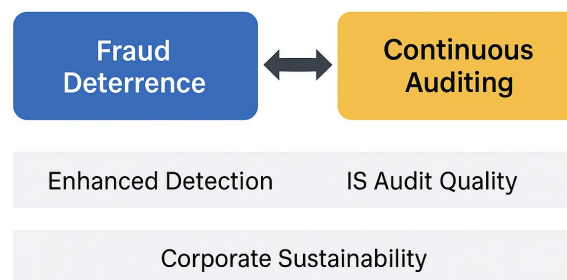


Figure 4. Conceptual Integration Model

Figure 4. The Conceptual Integration Model that Merges the Fraud Deterrence Framework with Continuous Auditing Functions

This model illustrates the convergence between the DETERE fraud deterrence framework and core continuous auditing mechanisms—real-time monitoring, risk-based analysis, and automated alerts. The integration supports a governance architecture oriented toward sustainable fraud control and adaptive audit assurance.

The integration of CA with IS audit routines enhanced data reliability, internal control verification, and regulatory compliance. These findings confirm Hypothesis 2 and are consistent with previous work by Alles & Kogan (2010) and Lin & Hwang (2021), who highlight CA as a key enabler of real-time assurance in complex digital environments.

4.4 Qualitative Insights on Governance and Sustainability

Thematic analysis of interview transcripts surfaced three key themes:

1. **Governance Enhancement:** Participants noted an increase in transparency and accountability after FDP deployment. Internal controls were strengthened, and fraud awareness among staff improved.
2. **User Acceptance:** Despite initial resistance, users found the system intuitive. Training and change management efforts contributed to the system's acceptance.
3. **Sustainability Integration:** The CA modules contributed not only to fraud monitoring but also to ESG reporting compliance, linking risk controls with sustainability frameworks.

The qualitative findings further indicate that the integration of FDP and CA contributes to the institutionalisation of governance practices within the organisation. Several respondents emphasised that the availability of real-time monitoring information encouraged greater accountability among operational managers and reduced reliance on periodic control reviews. This finding suggests that digital fraud deterrence systems can influence organisational behaviour beyond their technical monitoring functions.

In addition, respondents highlighted that continuous access to fraud risk indicators improved communication between audit, compliance, and operational units. Such integration is particularly relevant in emerging-market contexts, where governance effectiveness is often constrained by information asymmetry and delayed reporting mechanisms. Consequently, the combined FDP–CA framework appears to support not only fraud risk management but also broader governance resilience and organisational adaptability.

Collectively, these insights demonstrate that the FDP–CA integration extends beyond fraud monitoring by fostering stronger governance practices, cross-functional coordination, and sustainability-oriented control mechanisms. Such dual capability aligns with the broader movement toward integrated reporting and governance (Knoblauch & Großmann, 2023).

4.5 Discussion

The findings of this study underscore the strategic advantage of integrating fraud deterrence frameworks with continuous auditing mechanisms. Specifically, the combined implementation of the FDP system and CA tools contributes to three core domains: early fraud detection, improved

IS audit quality, and reinforcement of sustainability governance. These outcomes align with the evolving academic consensus that digital audit platforms and real-time analytics are becoming essential pillars of modern financial oversight (Russell & Sangster, 2018; Andrade et al., 2023).

The empirical evidence presented here further demonstrates that higher levels of fraud deterrence maturity, particularly structured through the DETERE model, amplify organizational readiness to detect financial anomalies using models like the Beneish-M Score. This finding supports prior work by Lu and Zhao (2021), who emphasized the adaptability of the M-Score in emerging markets, and Naz and Khan (2025), who advocated for integrating forensic accounting in proactive fraud detection systems. The integration of CA elevates this capacity by embedding real-time monitoring and automated alert functions into audit routines, shifting the paradigm from reactive to proactive assurance practices.

Institutional and behavioral contexts also play a crucial role in shaping the effectiveness of fraud deterrence. In environments characterized by high power distance, such as Indonesia, hierarchical culture may inhibit whistleblowing and promote sycophantic adherence, which weakens internal audit independence and risk escalation (Maulidi, 2024). Moreover, organizational role conflict and lack of due professional care have been identified as significant impediments to auditor performance and fraud oversight (Suhayati et al., 2024). These risks highlight the importance of structured tools such as FDP, which can serve as digital enablers to mitigate subjective bias.

Relatedly, the size and tenure of audit firms have also been linked to variations in fraud detection quality. Suryani et al. (2023) found that longer audit tenure, while increasing familiarity, may reduce auditor skepticism, a concern that continuous auditing systems can help address through automated risk detection.

This study also finds support from practice-based research, such as that of Maulidi and Ansell (2021), which emphasized the operational barriers in real-world fraud control systems. Similarly, Rustiarini et al. (2021) argue for extending the responsibility of public accounting professionals beyond conventional audits toward active fraud monitoring, aligning with this study's dual-engine model of FDP and CA.

From a governance and policy standpoint, the risks of systemic corruption, as framed by Monteverde (2021), add urgency to integrating technological safeguards. Finally, Singh (2025) underscores the future potential of generative AI in fraud analytics - a complementary perspective that expands the technological frontier of fraud deterrence.

Beyond its fraud detection capabilities, the FDP-CA integration demonstrates the potential to strengthen organisational governance capacity through continuous assurance and data-driven oversight. The findings suggest that real-time monitoring mechanisms can reduce information asymmetry, improve accountability across operational units, and support more informed managerial decision-making. This governance-oriented perspective extends the contribution of fraud deterrence beyond compliance functions, positioning digital monitoring systems as strategic enablers of organisational resilience in increasingly complex and technology-driven business environments. In this respect, the proposed framework contributes not only to fraud risk mitigation but also to the development of adaptive governance structures capable of responding to emerging operational and regulatory challenges.

Overall, this study's integrated framework not only enhances internal assurance but also aligns with calls for smarter, more agile regulatory technologies across sectors (Atmadja et al., 2024). It

offers a contextualized approach for emerging markets navigating the interplay of institutional gaps, cultural factors, and digital transformation in governance.

5. Conclusion and Implications

This study presents a comprehensive analysis of how the integration of a web-based Fraud Deterrence Propeller (FDP) application with Continuous Auditing (CA) mechanisms can strengthen fraud governance, enhance audit quality, support internal control systems, and promote sustainable corporate governance. By applying the DETERE framework and the Beneish-M Score methodology, the research demonstrates that organizations with higher fraud deterrence maturity levels are better positioned to identify financial irregularities while simultaneously strengthening governance readiness and oversight capability. Furthermore, the deployment of CA enhances IS audit quality through real-time monitoring, dynamic risk assessment, and continuous assurance processes that support more effective organizational decision-making.

Empirical results show a strong and statistically significant relationship between the maturity of fraud deterrence strategies and the organisation's capability to identify and respond to fraud risks effectively. Additionally, CA significantly improves perceived audit quality, offering early detection of anomalies and reinforcing ESG compliance. The qualitative findings support the quantitative outcomes by highlighting enhanced governance transparency, increased fraud awareness, and system usability within the organization.

Theoretically, this study contributes to the expanding literature on fraud risk management, digital auditing, and sustainable governance. It engages recent discourse on the impact of institutional culture (e.g., power distance), role ambiguity, and audit tenure on fraud vulnerability (Maulidi, 2024; Suhayati et al., 2024; Suryani et al., 2023). Practically, it introduces an integrated operational model that stakeholders, including regulators, auditors, and enterprise risk managers, can adopt to build resilient, fraud-aware institutions. The adoption of the FDP-CA framework may be particularly beneficial in jurisdictions facing weak enforcement or governance infrastructure.

Future research may explore cross-sectoral application of the FDP-CA integration model, assess long-term impacts on organizational culture, or test interoperability with external audit and compliance platforms. Policymakers and professional bodies are encouraged to consider how regulatory frameworks can support the scaling and institutionalization of digital deterrence technologies. The evolving role of artificial intelligence in fraud analytics (Singh, 2025) also offers opportunities for future exploration.

In conclusion, the dual-engine framework advanced in this study offers a viable, data-driven pathway for enhancing ethical accountability, operational integrity, and sustainable performance across corporate environments vulnerable to fraud risks.

6. Limitation

While this study provides meaningful insights into the integration of fraud deterrence mechanisms and continuous auditing for sustainable governance, several limitations must be acknowledged. First, the research was conducted within a single pharmaceutical company in Indonesia, which may limit the generalizability of the findings to other industries or geographic regions. Sector-

specific dynamics and cultural factors could influence both fraud risk profiles and the effectiveness of deterrence strategies.

Second, although a mixed-methods approach was employed, the sample size for both survey respondents and interviewees was relatively small. This may constrain the statistical power of quantitative analyses and the richness of qualitative themes. Larger-scale studies involving multi-site data collection would enhance empirical robustness.

Third, the FDP system and CA mechanisms were implemented and evaluated over a limited time frame. Longitudinal studies would be necessary to assess sustained effects of digital fraud governance initiatives on audit quality, fraud risk management, organizational behaviour, and governance resilience over time.

Fourth, the study did not directly investigate contextual variables such as power distance, audit tenure, or auditor independence. These sociocultural and institutional dynamics—as highlighted by Maulidi (2024), Suryani et al. (2023), and Suhayati et al. (2024)—may moderate the effectiveness of deterrence systems and should be explored in future models.

Lastly, the study did not investigate integration with external audit systems or regulatory reporting platforms. Future research may explore how the FDP-CA model interacts with external governance institutions to support broader compliance and transparency goals.

Recognizing these limitations provides a basis for refining future research designs and further validating the effectiveness of digital fraud deterrence and real-time auditing systems in diverse organizational settings.

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