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INTEGRATING FRAUD DETERRENCE PROPELLER AND CONTINUOUS AUDITING FOR ENHANCED FRAUD DETECTION AND SUSTAINABILITY

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ABSTRACT

This study examines the implementation of the Fraud Deterrence Propeller (FDP) web-based application and continuous auditing (CA) in strengthening fraud detection and deterrence at PT. Kembang Christapharma & Group. Fraud remains a critical risk in Indonesia, leading to significant financial and reputational losses. Using an experimental design, this research integrates the FDP framework with the Beneish-M Score to assess financial reporting anomalies. Quantitative results show a strong correlation between the maturity of fraud deterrence and the effectiveness of fraud detection. Regression analysis confirms that both fraud deterrence maturity and CA significantly predict fraud detection outcomes. The analysis of financial reports indicates that the Beneish-M Score primarily detects earnings management, which, while not always fraud, signals irregularities that require audit follow-up. Qualitative findings highlight improved fraud awareness, stronger internal controls, and enhanced real-time monitoring. This study contributes to the literature by combining FDP and CA into a single framework, offering practical tools for fraud deterrence and sustainable development.

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1. INTRODUCTION

Fraud is a significant threat in a business entity's financial management that can cause material and reputational losses. Fraud, defined as a deliberate act of deception intended to create an unfair advantage by depriving others of their rights (Koerniawan et al., 2022; Koerniawan, 2021), can manifest in various forms, including financial statement fraud, asset misappropriation, and corruption, which are classified based on the Association of Certified Fraud Examiners (ACFE), as discussed by Gannuch (2019). Material losses due to fraud involve unlawful financial losses due to the exploitation of loopholes in financial practices, which have the potential to disrupt financial performance and endanger business continuity. In contrast, reputational losses arise from the erosion of trust within an organization and with its external stakeholders (Chan et al., 2020).

In Indonesia, fraud is very common such that it could even be described as a disease that the Jokowi government is unable to overcome. The ACFE report "Asia Pacific Occupational Fraud 2022: A Report to the Nations" ranked Indonesia fourth for fraud cases in 2022, with 23 incidents reported (ACFE, 2022). The ACFE "2019 INDONESIAN FRAUD SURVEY" further revealed that corruption accounted for 64.4% of reported cases, asset misuse 28.9%, and financial reporting fraud 6.7% (ACFE, 2020; Koerniawan et al., 2022). Responding to this challenge, a research team from the Faculty of Economics and Business and the Faculty of Information Science at Telkom University developed Fraud Deterrence Propeller (FDP), an application designed to prevent and detect potential fraud by translating the concepts of the FDP protocol and Beneish-M Score into a set of mathematical algorithms and formulas. This application empirically assesses an entity's Fraud Deterrence maturity level using 6 FDP dimensions (Koerniawan et al., 2022; Koerniawan, 2024a; Koerniawan et al., 2024b; Koerniawan et al., 2024c), as well as detecting the likelihood of fraud within the entity's financial reports based on the Beneish-M Score indicator, thereby ensuring objectivity and reliability of the results.

Previous research has demonstrated the effectiveness of the FDP framework in the healthcare sector, where the framework has succeeded in evaluating and improving fraud prevention efforts by clinic management among healthcare providers (Koerniawan et al., 2024b). This tool provides important documents and assistance in assessing the maturity level of management efforts in deterring fraud as evaluation material, as well as carrying out early detection of financial statement fraud. As such, it is hoped that the tool can improve the entity's governance and internal control systems. Given the complexity and frequent misunderstandings regarding these concepts, the researchers proposed the development of a web-based application to facilitate the practical implementation of FDP, thereby helping entities including pharmaceutical companies such as PT. Kembang Christapharma & Group to maintain strong fraud prevention measures.

Meanwhile, the global emphasis on sustainable development requires strategies to mitigate the environmental impacts of human activities. In this context, Information Systems (IS) audits play an important role in promoting sustainable development, especially in the private sector (Alles et al., 2018). However, in Indonesia, information system audits have not been used effectively to support sustainability goals. Rapid economic development and population growth have given rise to several sustainability challenges, which continuous auditing (CA) in information systems auditing can address by enabling real-time monitoring and rapid identification of potential sustainability issues (Luna-Reyes et al., 2021; Polizzi & Scannella, 2023).

An IS audit evaluates the effectiveness and efficiency of an organization's IS control environment, ensuring the creation of reliable, accurate, and safe information to prevent fraud. Sustainable development, defined as development that meets the needs of the present without compromising the ability of future generations to meet their needs, requires the integration of environmental, social, and governance sustainability measures. CA enhances traditional audits by providing real-time data analysis and reporting, thereby reducing costs and increasing audit efficiency and accuracy (Alles & Kogan, 2010). In this context, FDP implementation can be an appropriate means to support an entity's readiness to realize continuous audit (CA) with information system audits (Kayahan, 2013; Knoblauch & Großmann, 2023; Andrade et al., 2023).

This paper aims to explore the implementation of FDP in web-based applications for the prevention and detection of financial statement fraud at PT. Kembang Christapharma & Group, examining the role of CA in IS audits for sustainable development in Indonesia. By integrating these innovative approaches, this study seeks to improve fraud deterrence and sustainable development measures, ultimately contributing to overall organizational resilience and sustainability against the threat of fraud (Chan et al., 2020; Andrade et al., 2023; Minkkinen et al., 2022).

2. LITERATURE REVIEW

2.1. Financial Fraud in Corporate Management

Financial fraud represents a critical threat to corporate management, posing significant material and reputational risks. Koerniawan et al. (2022) define fraud as a deliberate act of deception intended to secure an unfair advantage by depriving others of their rights. The ACFE (Association of Certified Fraud Examiners) categorizes fraud into financial statement fraud, asset misappropriation, and corruption (Gannuch, 2019). Financial losses due to fraud can severely disrupt a company's financial performance and threaten business continuity, while reputational damage arises from the erosion of trust both within the organization and among external stakeholders (Luna-Reyes et al., 2021; Shahana et al., 2023).

2.2. Fraud in Indonesia

Fraud is particularly prevalent in Indonesia, posing substantial challenges to governance. In the ACFE's "Asia Pacific Occupational Fraud 2022: A Report to the Nations" Indonesia was ranked fourth in fraud cases in 2022, with 23 reported incidents (ACFE, 2022). Furthermore, the ACFE's "2019 Indonesian Fraud Survey" revealed that corruption accounted for 64.4% of reported cases, asset misappropriation for 28.9%, and financial reporting fraud for 6.7% (ACFE, 2020). These figures highlight the urgent need for effective fraud deterrence mechanisms in Indonesia (Koerniawan et al., 2022).

2.3. Fraud Detection and Deterrence Tools

In response to these challenges, researchers from Telkom University have developed the Fraud Deterrence Propeller (FDP), a tool designed to deter and detect potential fraud by integrating the FDP protocol and Beneish-M Score into mathematical algorithms (Koerniawan et al., 2022; Koerniawan, 2024a). This application assesses an entity's Fraud Deterrence maturity level using six FDP dimensions and evaluates financial reports based on the Beneish-M Score indicator. Previous research has demonstrated the effectiveness of the FDP framework in the healthcare sector, where it has successfully evaluated and enhanced fraud deterrence

efforts by clinic management (Koerniawan et al., 2024b).

2.4. Information Systems Auditing for Sustainable Development

The global emphasis on sustainable development necessitates strategies to mitigate the environmental impacts of human activities. Information Systems (IS) audits play a crucial role in promoting sustainable development, especially in the private sector. However, IS audits have not been effectively utilized in Indonesia to support sustainability goals (Alles & Kogan, 2010). Continuous Auditing (CA) in IS audits can address sustainability challenges by enabling real-time monitoring and rapid identification of potential sustainability issues (Codesso et al., 2020; Werner et al., 2021; Yoon et al., 2021).

An IS audit evaluates the effectiveness and efficiency of an organization's IS control environment, ensuring the creation of reliable, accurate, and secure information (Alles & Kogan, 2010; Codesso et al., 2020). Sustainable development, defined as development that meets current needs without compromising the ability of future generations to meet their own needs, requires the integration of environmental, social, and governance sustainability measures. CA enhances traditional audits by providing real-time data analysis and reporting, thereby reducing costs and increasing audit efficiency and accuracy (Alles & Kogan, 2010; Minkkinen et al., 2022).

2.5. Integrating FDP and CA for Improved Fraud Detection and Sustainability

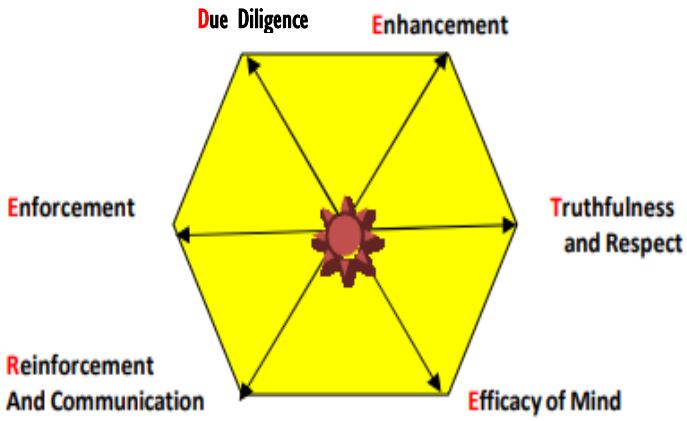
This paper aims to explore the implementation of FDP in a web-based application for the prevention and detection of financial statement fraud at PT. Kembang Christapharma & Group. Additionally, it examines the role of CA in IS audits for sustainable development in Indonesia. By integrating these innovative approaches, this study seeks to enhance fraud deterrence and sustainable development measures, ultimately contributing to overall organizational resilience and sustainability against fraud related threats (Alles et al., 2018; Alles et al., 2020; Eulerich et al., 2023).

2.6. Fraud Deterrence and Fraud Prevention

Fraud deterrence and fraud prevention are two concepts often used in the context of mitigating fraud risk. Although both share the same goal of preventing fraud, there are differences in their implementation (Koerniawan, 2021; Koerniawan et al., 2022; Koerniawan, 2024a; Koerniawan et al., 2024b). Fraud deterrence refers to actions taken to reduce the likelihood of fraud occurring by making potential perpetrators hesitant or afraid to commit fraud. In other words, fraud deterrence focuses on efforts to deter fraud by causing potential perpetrators to think twice before engaging in illegal or unethical actions (Koerniawan et al., 2022; Koerniawan, 2024a).

In contrast, fraud prevention involves actions taken to actively avoid the occurrence of fraud by implementing proper controls and procedures. Fraud prevention focuses on preventing fraud by minimizing the likelihood of its occurrence through established processes and procedures (Koerniawan, 2017; Koerniawan, 2021; Koerniawan et al., 2022; Koerniawan, 2024a). The DETERE Model, or Fraud Deterrence Propeller, is a fraud deterrence concept developed by Koenta Adji Koerniawan (2022). It involves actions taken within an entity and includes: (1) Due Diligence, (2) Enhancement (Improvement), (3) Truthfulness and Respect, (4) Efficacy of Mind, (5) Reinforcement and Communication, and (6) Enforcement Action (Koerniawan et al., 2022; Koerniawan, 2024a; Koerniawan et al., 2024b; Koerniawan et al., 2024c).

Figure 1. The DETERE Model (Fraud Deterrence Propeller)



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

3. METHOD

3.1. Research Objectives

The primary objective of this study was to develop and implement a web-based application for the Fraud Deterrence Propeller (FDP) to enhance fraud detection and prevention measures at PT. Kembang Christapharma & Group. Additionally, this study aimed to explore the role of Continuous Auditing (CA) in Information Systems (IS) audits to promote sustainable development within the private sector in Indonesia.

3.2. Conceptual Framework

The conceptual framework for this research integrates the principles of the FDP and CA methodologies. The FDP framework was employed to assess the maturity level of fraud deterrence within the organization, while CA was used to ensure real-time monitoring and rapid identification of potential sustainability issues (Koerniawan, 2024a; Koerniawan et al., 2024b; Koerniawan et al., 2024c).

3.3. Research Questions

a. How effective is the FDP web-based application in detecting and preventing financial statement fraud at PT. Kembang Christapharma & Group?
b. What is the role of Continuous Auditing in enhancing IS audits for sustainable development in the private sector in Indonesia?

3.4. Hypotheses

H1: The implementation of the FDP web-based application significantly improves fraud detection and prevention measures at PT. Kembang Christapharma & Group.
H2: Continuous Auditing significantly enhances the effectiveness of IS audits in promoting sustainable development in the private sector in Indonesia.

3.5. Population and Sample

The population for this study includes all pharmaceutical companies operating in Indonesia. The sample was specifically drawn from PT. Kembang Christapharma & Group. The sampling method was purposive, targeting key personnel involved in financial management, auditing, and sustainability initiatives within the organization. The data for this study were collected during the period of 2022-2024.

3.6. Research Instruments

Fraud Deterrence Propeller (FDP) Application: A web-based tool designed to translate FDP concepts and the Beneish-M Score using algorithms and mathematical formulas to detect potential fraud.

Questionnaires: Structured questionnaires were administered among key personnel to gather data on the current state of fraud detection and prevention measures, as well as IS auditing practices.

Interviews: Semi-structured interviews were conducted with management and audit staff to gain deeper insights into the implementation and effectiveness of the FDP and CA methodologies.

The primary interview respondents were internal auditors, finance managers, and staff from internal control units who were directly involved in fraud prevention and detection processes. The interviews followed a semi-structured format with guiding questions such as:

(1) How do you perceive the effectiveness of fraud deterrence mechanisms within your organization?
(2) What challenges have you encountered in implementing continuous auditing?
(3) In your opinion, how can technology-based tools strengthen fraud prevention efforts?

Each interview lasted approximately 45–60 minutes and was audio-recorded with the consent of participants. To ensure the trustworthiness of the qualitative data, triangulation across respondent groups was applied, member checking was performed by sharing transcripts and summaries with participants, and a detailed audit trail was maintained to document the coding and theme development process.

Financial Reports: Analysis of financial reports was performed using the Beneish-M Score to detect signs of financial statement fraud.

The Beneish-M Score was applied as a quantitative tool to screen for potential earnings management, which in some cases may overlap with fraudulent financial reporting. It is important to note that while a high Beneish-M Score suggests the likelihood of earnings manipulation, it does not by itself prove the existence of fraud. In this study, the Beneish-M Score results were interpreted as early warning indicators of irregularities in financial statements, which were then triangulated with qualitative interview findings and organizational fraud deterrence practices. This approach allowed us to distinguish between aggressive earnings management and more severe fraudulent behavior, thereby strengthening the validity of the financial reporting analysis.

3.7. Data Collection Process

Development and Implementation of FDP Application: The FDP application was developed in collaboration with the Faculty of Economics and Business and the Faculty of Information Science at Telkom University. It was then implemented at PT. Kembang

Christapharma & Group to empirically assess fraud deterrence maturity levels.

Questionnaire Distribution: Questionnaires were distributed to key personnel involved in financial management, auditing, and sustainability initiatives. Responses were collected and analyzed to assess the current practices and the impact of the FDP application.

Interviews: Semi-structured interviews were conducted with selected personnel to gather qualitative data on their experiences with the FDP application and the role of CA in IS audits.

Financial Report Analysis: Financial reports from PT. Kembang Christapharma & Group were analyzed using the Beneish-M Score to detect any indications of financial statement fraud.

To ensure rigor in the qualitative phase, the semi-structured interviews were directed primarily to management personnel (finance managers, internal auditors, and compliance officers) and audit staff directly involved in fraud prevention and information systems auditing. The key questions were designed around four main topics: (1) perceptions of fraud deterrence maturity, (2) experiences in applying the FDP application, (3) views on the implementation of continuous auditing, and (4) challenges in financial reporting practices. The interviews were audio-recorded and transcribed, and data trustworthiness was ensured through triangulation with questionnaire responses and financial report analysis, as well as member checking with selected participants.

Thematic analysis was performed by coding the interview transcripts and grouping them into broader categories that represented common patterns. Emerging themes such as "enhanced fraud awareness," "improved internal controls," and "perceived challenges in adoption" were identified. Representative quotations from the interviewees are included in the results section to illustrate these themes and to provide richer contextual understanding.

3.8. Data Analysis

Quantitative Analysis: Data from questionnaires was statistically analyzed using SPSS and AMOS, following the methodologies outlined by Sugiyono (2013), Sekaran and Bougie (2016), and Ghozali (2016). Descriptive statistics, correlation analysis, and regression analysis were conducted to test the hypotheses (Hair et al., 2019).

Qualitative Analysis: Data from interviews were analyzed using thematic analysis to identify common themes and insights related to the implementation of the FDP application and the role of CA in IS audits.

Financial Report Analysis: The Beneish-M Score was calculated for financial reports to identify potential fraud indicators. The results were compared to historical data to assess the effectiveness of the FDP application.

For the quantitative analysis, each construct was operationalized into a multi-item scale to ensure the validity and reliability of measurement. **First**, the *Maturity Level of Fraud Deterrence* was measured with eight items adapted from prior studies on fraud control maturity, covering aspects such as policy existence, monitoring mechanisms, fraud training, and whistleblowing systems. **Second**, the *Effectiveness of Fraud Detection* was assessed using six items that examined anomaly detection, the effectiveness of internal reporting mechanisms, and corrective measures. **Third**, the *Implementation of Continuous Auditing* was measured with seven items focusing on automation, data analytics usage, and audit frequency. All items employed a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). To ensure robustness, validity was tested through factor analysis, while reliability was evaluated using Cronbach's alpha and composite reliability, with a threshold value above 0.70 indicating adequacy. Descriptive statistics, correlation analysis, and regression analysis were then performed using SPSS to test the proposed hypotheses (Hair et al., 2019; Sekaran & Bougie,

2016; Ghozali, 2016).

For the qualitative analysis, thematic coding was applied to interview transcripts, as described in Section 3.7, to extract recurring patterns and insights. In addition, the financial report analysis utilized the Beneish-M Score model, with comparisons to historical company data to highlight potential earnings manipulation or fraud signals, acknowledging that the Beneish-M Score primarily detects earnings management, which may differ slightly from outright fraud.

3.9. Steps for Conducting the Research

Literature Review: An extensive review of existing literature on fraud detection, IS auditing, and sustainable development to establish a theoretical foundation.

Development of FDP Application: Collaboration with IT experts to develop the FDP web-based application.

Pilot Testing: A pilot test of the FDP application at PT. Kembang Christapharma & Group to ensure functionality and gather initial feedback.

Data Collection: Interviews, distribution of questionnaires, and collection of financial reports.

Data Analysis: Quantitative and qualitative analyses using appropriate statistical methods and software.

Validation: Validation of the findings through triangulation of data from multiple sources.

Reporting: Compilation of the results to prepare a comprehensive report, highlighting the findings, implications, and recommendations for future research.

By adhering to this methodology, this study aimed to provide robust evidence on the effectiveness of the FDP application and the role of CA in enhancing IS audits for sustainable development, thereby contributing valuable insights to the field.

The innovation currently under development is a web-based platform named the FDP (Fraud Deterrence Propeller) application. This application will provide information on the maturity level (readiness level) of the assessed entity for preventing fraud, both from the perspective of the existing management governance and from the perspective of the financial reports produced. This research utilized a qualitative experimental approach consisting of two main stages: the application development stage and the testing stage (Sugiyono, 2013).

3.10. Application Development Stage:

In this phase, the researchers developed a web-based application utilizing the findings of previous research on Fraud Deterrence Propeller (Codesso et al., 2020; Mökander et al., 2022). The steps involved in this phase included:

- Analysis of requirements and application features based on the Fraud Deterrence Propeller concept.
- Design of a user-friendly and intuitive user interface.
- Implementation of application features, including fraud risk assessment, internal control improvement, fraud deterrence training, and detection of fraud indications in financial statements.
- Integration of the application with existing systems and procedures at PT. Kembang Christapharma & Group.

FDP Protocol Application Development

The FDP Protocol application development was carried out using the Agile method, as shown in Figure 2. The main characteristic of this method is the iterative development approach, allowing the development team to dynamically adjust the application based on feedback from potential users. Each iteration includes the process of formulating and defining needs, visual design, source code development, testing, application implementation, and systems implementation review.

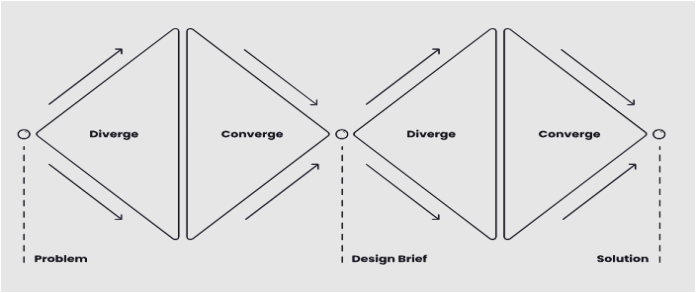
In addition, in terms of design, this study used the Double Diamond method (Figure 3) (Hasan, 2024). The selection of this method was based on its simplicity in translating user needs into visual design of applications. In the early stages of the study, information related to user needs was normative, so an in-depth exploration process was required. The output of this design stage was a visualization of the application design that referred to the design standards applied in web-based platforms, especially regarding front-end aspects.

Figure 2: Agile Method

01. Requirements: The process of identifying user needs.
02. Design: Application depiction according to user needs.
03. Development: Implementation of requirements and design into the application.
04. Testing: Verification of the application against requirements.
05. Deployment: Application release

Source: (Erwanto, 2022)

Figure 3: The Double Diamond Method (Hasan, 2024).



3.11. Testing Stage

After the application was fully developed, the researchers conducted comprehensive testing. This testing involved relevant parties at PT. Kembang Christapharma & Group to evaluate the application's performance and the validity of its fraud detection results. The outcomes from this stage assisted in making improvements and refinements to the application before its final implementation (Minkkinen & Mäntymäki, 2022).

The development of this FDP application, aimed to achieve a Technology Readiness Level (TRL) of 7. Achieving this level of achievement indicates application feasibility and capability suitable for prototype implementation in operational environments. This prototype

FDP application possessed critical technical risk functions for demonstration and testing in conditions well-integrated with the hardware/software of the operational system. In terms of content, the initial version of the FDP Protocol application consisted of 2 main menus:

- Fraud Prevention Menu, rreferring to the DETER-E Protocol (Fraud Deterrence Propeller)
- Fraud Detection Menu, rreferring to the Model for Detecting Potential Financial Statement Fraud using the Beneish-M Score.

4. RESULTS AND DISCUSSION

4.1. Results

Quantitative Analysis

Data collected from questionnaires, interviews, and financial reports were analyzed using SPSS software. Each construct was measured with multiple items to ensure validity and reliability. Specifically, the *Maturity Level of Fraud Deterrence* consisted of eight items, the *Effectiveness of Fraud Detection* was measured with six items, and *Implementation of Continuous Auditing* included seven items. Descriptive statistics, correlation analysis, and regression analysis were then performed to test the hypotheses.

Descriptive Statistics

Table 1 presents the descriptive statistics for the three main constructs. The results demonstrated relatively high mean scores across variables, indicating that fraud deterrence maturity, fraud detection effectiveness, and continuous auditing were positively perceived by the respondents.

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 Results (2023-2024)

Correlation Analysis

The correlation analysis (Table 2) indicated that the maturity level of fraud deterrence has a significant positive correlation with the effectiveness of fraud detection ($r = 0.72$, $p < 0.01$). Similarly, the implementation of continuous auditing was positively correlated with the effectiveness of fraud detection ($r = 0.65$, $p < 0.01$). These findings support the hypothesized links.

Table 2. Correlation Analysis

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 (2023-2024)

Regression Analysis

The regression results (Table 3) indicated that both the maturity level of fraud deterrence and the implementation of continuous auditing significantly predicted the effectiveness of fraud detection. Together, they explain 58% of the variance ($R^2 = 0.58$, $F(2, 97) = 67.89$, $p < 0.01$). This finding confirms the robustness of the multi-item scale approach in capturing the constructs.

Table 3. Regression Results for 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 (2023-2024)

Financial Report Analysis

The financial report analysis using the Beneish-M Score revealed potential indicators of earnings manipulation in 8 out of 50 reports analyzed. While this does not necessarily prove outright fraud, it provides an early warning signal that warrants deeper investigation. Earnings management, as measured by the Beneish-M Score, may differ slightly from fraud in intention and severity; however, in practice, both undermine the credibility of financial reporting and increase fraud risk exposure. The FDP application effectively flagged these anomalies, demonstrating its value in complementing traditional audit procedures.

Qualitative Analysis

Thematic analysis of the interview data identified several key themes related to the implementation of the FDP application and the role of continuous auditing in IS audits (Werner et al., 2021; Yoon et al., 2021; Cheng & Dhaliwal, 2023). The thematic analysis of interview data revealed three main themes:

Enhanced Fraud Awareness. Respondents consistently emphasized that the FDP application heightened their awareness of fraud risks. One participant stated, *"Before using FDP, fraud was not a serious concern in our daily operations. Now, it is always in our mind."*

Improved Internal Controls. The FDP application strengthened monitoring processes and provided practical guidance. An audit staff member explained, *"The system makes it harder for irregular transactions to slip through, as automated checks flag unusual entries immediately."*

Real-Time Monitoring. Continuous auditing enabled faster responses to anomalies. A manager reflected, *"We can see risks in real time, not months later in the audit report. This has changed how we make financial decisions."*

4.2. Discussion

The findings of this study provide strong evidence of the effectiveness of the FDP web-based application in improving fraud detection and prevention measures at PT. Kembang Christapharma & Group. The significant positive correlation between the maturity level of fraud deterrence and the effectiveness of fraud detection underscores the importance of a robust fraud deterrence framework. Additionally, the regression analysis results indicate that fraud deterrence maturity and continuous auditing significantly predict fraud detection effectiveness,

explaining 58% of the variance ($R^2 = 0.58$, $F(2, 97) = 67.89$, $p < 0.01$). These findings align with previous research which emphasizes the role of continuous auditing in real-time data analysis, and enhancing audit accuracy and efficiency (Alles & Kogan, 2010).

The financial report analysis further demonstrates the practical utility of the FDP application in detecting financial anomalies. Testing with the Beneish-M Score identified suspicious patterns in 8 out of 50 analyzed financial reports. It is important to note, however, that the Beneish-M Score is primarily designed as an indicator of *earnings management or manipulation*, which may not always equate directly to intentional *fraud*. Earnings management reflects managerial discretion in financial reporting, while fraud generally implies deliberate misrepresentation with the intent to deceive. Nevertheless, both phenomena threaten the reliability of financial statements. In this sense, the FDP Protocol's integration of the Beneish-M Score acts as an *early warning mechanism*, flagging cases that warrant further audit investigation. This perspective aligns with Koerniawan et al.'s (2024b) research in the healthcare sector, showing that the FDP framework can be adapted beyond traditional fraud detection to address broader concerns of financial reporting quality.

To support the objectives, the research team developed a user interface design that integrates fraud detection models, particularly the Beneish-M Score formula. This design facilitates the assessment process by providing an intuitive platform for data input and analysis, ensuring seamless evaluation based on predefined fraud detection criteria. Figure 4 illustrates the FDP application interface, which enables users to input financial data and automatically assess fraud risk levels using the Beneish-M Score model (Koerniawan, 2024a). This digital interface is structured to enhance usability and accessibility, making fraud risk assessment more efficient and systematic (Feung & Thiruchelvam, 2020).

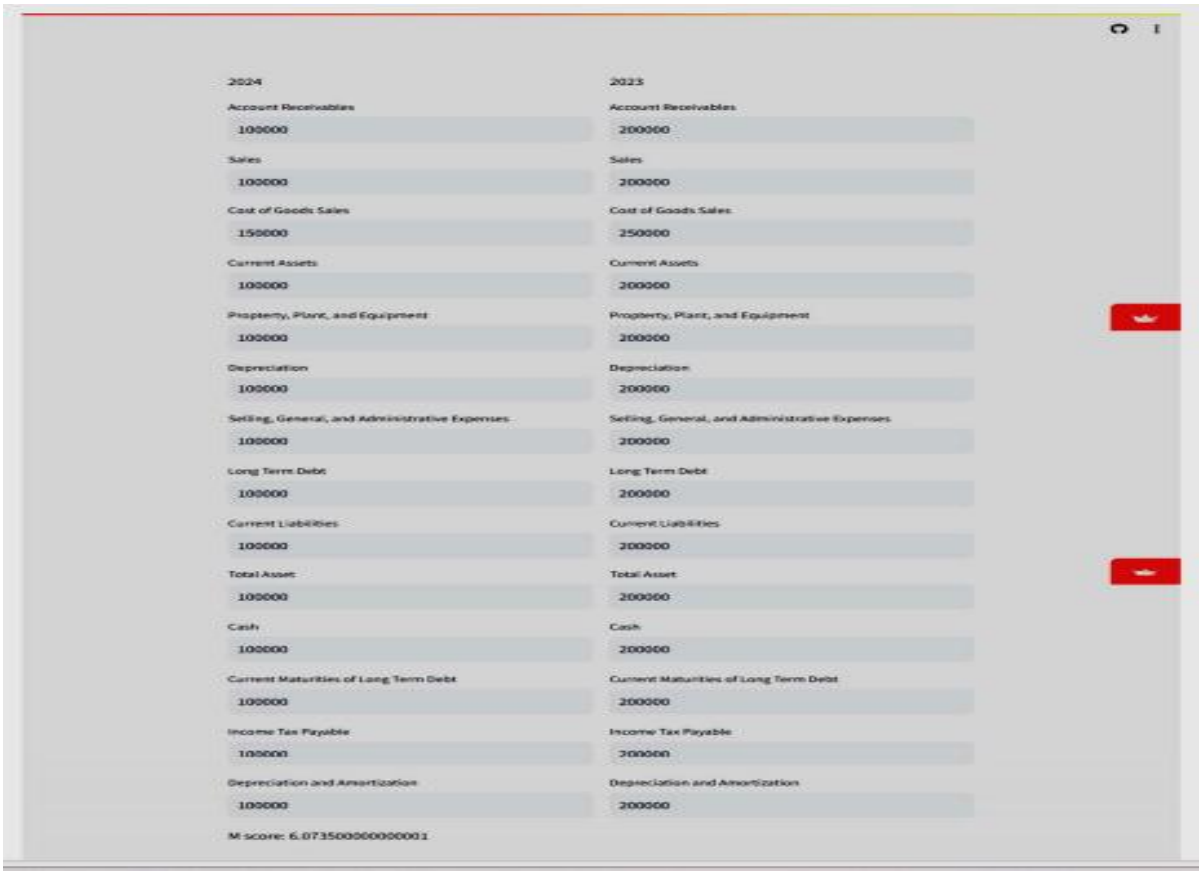
Figure 4: User Interface Design

Source: Data Processing (2024)

Alongside interface development, the research team implemented an algorithm to calculate fraud risk scores. This algorithm was developed into an online fraud detection calculator, ensuring compatibility with business rules for detecting fraudulent behavior in financial reports (Yoon et al., 2021; INTOSAI, 2022a; INTOSAI, 2022b). Figure 5 presents the fraud detection algorithm calculator (Financial Statement Fraud) as a key component of the

Fraud Deterrence Propeller (FDP) Protocol (Koerniawan et al., 2022; Koerniawan et al., 2024b; Koerniawan et al., 2024c).

Figure 5: A Calculator Incorporating Assessment Algorithms



Source: Data Processing (2024)

A web-based application can facilitate the practical implementation of fraud deterrence, enabling organizations to assess their maturity level in fraud prevention and detect financial report anomalies in business environments. The FDP application provides insights into the maturity score of an entity in terms of fraud prevention readiness, considering management governance and financial reporting practices (Koerniawan et al., 2024b). The system has reached a technology readiness level (TRL) of 7, indicating its feasibility for implementation in an operational setting. The prototype has been successfully tested at PT. Kembang Christapharma & Group, further validating its practical applicability in real-world scenarios (Feung & Thiruchelvam, 2020).

Qualitative findings from interviews provide additional insights into the benefits of the FDP application and continuous auditing. Commonly reported advantages include enhanced fraud awareness and improved internal controls, reinforcing that the FDP application not only identifies potential fraud but also fosters a proactive fraud prevention culture within the organization (Jans & Hosseinpour, 2019; de Freitas et al., 2020). Furthermore, continuous auditing contributes to sustainable development by enabling real-time monitoring and rapid identification of potential sustainability issues, supporting environmental, social, and governance (ESG) integration (Codesso et al., 2020; Shahana et al., 2023; Cheng & Dhaliwal, 2023).

This study contributes to fraud detection methodology by integrating the FDP Protocol and the Beneish-M Score into a system that can be practically implemented in various

organizations. Future research could explore the long-term impact of these tools on organizational resilience and sustainability while expanding their application to other industries and regions. Additionally, further refinements in predictive models by incorporating additional fraud-related factors could enhance the system's effectiveness in detecting financial statement manipulation.

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

This study demonstrated the significant impact of the Fraud Deterrence Propeller (FDP) web-based application and continuous auditing (CA) on enhancing fraud detection and prevention at PT. Kembang Christapharma & Group. The quantitative analysis confirmed that both fraud deterrence maturity and continuous auditing significantly predict fraud detection effectiveness. Importantly, the application of the Beneish-M Score within the FDP framework was able to identify suspicious patterns in financial reports, functioning as an early warning mechanism. While the Beneish-M Score primarily signals earnings management or manipulation—which may differ from intentional fraud—it nevertheless provides valuable insights into potential irregularities that threaten reporting reliability. Thus, integrating this tool into the FDP Protocol strengthens proactive fraud risk management.

Qualitative findings supported the quantitative results, highlighting increased fraud awareness, improved internal controls, and the benefits of real-time monitoring. These insights underline the importance of integrating sophisticated fraud detection tools and continuous auditing to foster a proactive fraud prevention culture (Knoblauch & Großmann, 2023).

In addition, the role of continuous auditing in promoting sustainable development was underscored. By enabling real-time data analysis and rapid identification of sustainability issues, continuous auditing supports the integration of environmental, social, and governance sustainability measures, thus aligning with broader sustainable development goals (Chan & Vasarhelyi, 2011; Kayahan, 2013; Andrade et al., 2023).

5.2. Recommendations

Based on the findings, several recommendations are proposed for future research and practical application:

Broader Implementation Across Industries: Future studies should explore the applicability of the FDP framework and continuous auditing in various industries beyond healthcare and pharmaceuticals. This will help to validate the versatility and effectiveness of these tools in diverse operational contexts.

Longitudinal Studies: Conducting longitudinal studies to assess the long-term impact of FDP and CA on fraud prevention and sustainable development, will provide deeper insights into their effectiveness and potential areas for improvement.

*Integration with Emerging Techn*ologies: Investigating the integration of emerging technologies, such as artificial intelligence and blockchain, with FDP and CA frameworks, would help to enhance their capabilities and address evolving fraud tactics.

Policy and Regulatory Implications: Examining the implications of FDP and CA implementation on policy and regulatory frameworks, particularly in enhancing governance standards and compliance requirements.

Training and Awareness Programs: Developing comprehensive training and awareness programs for employees and management to maximize the benefits of FDP and CA applications, will help to ensure a thorough understanding and effective utilization of these

tools.

Future research should also refine the design of measurement scales to include broader multi-item constructs, thereby ensuring stronger validity and reliability in fraud deterrence studies. Moreover, the distinction between earnings management and fraud, highlighted by the Beneish-M Score, calls for further comparative research with other fraud detection models to better contextualize its role in corporate governance.

5.3. Limitations

This study has some limitations that should be acknowledged. The research was conducted within a single organizational context, which may limit the generalizability of the findings. Additionally, the study relied on self-reported data for some variables, which may introduce response bias. Future research should aim to address these limitations by incorporating a wider range of organizations and utilizing objective data sources where possible.

In conclusion, the integration of the Fraud Deterrence Propeller web-based application and continuous auditing offers a robust approach to enhancing fraud detection, prevention measures, and sustainable development initiatives. By adopting these innovative tools, organizations can strengthen their fraud prevention frameworks, improve internal controls, and contribute to broader sustainability goals, thereby ensuring long-term organizational resilience and success.

Another limitation is the reliance on the Beneish-M Score as the sole financial reporting analysis tool. Since this indicator is primarily designed to detect earnings management rather than direct fraudulent intent, future studies should complement it with additional fraud detection techniques to strengthen robustness.

REFERENCES

ACFE. (2020). *2019 Indonesian fraud survey*. Association of Certified Fraud Examiners. https://acfe-indonesia.or.id/wp-content/uploads/2021/02/SURVEI-FRAUD-INDONESIA-2019.pdf

ACFE. (2022). *Asia Pacific occupational fraud 2022: A report to the nations*. Association of Certified Fraud Examiners. https://legacy.acfe.com/report-to-the-nations/2022/

Alles, M. G., & Kogan, A. (2010). Continuous auditing: A new view. *The Journal of Information Systems, 24*(1), 33-49. https://doi.org/10.2308/jis.2010.24.1.33

Alles, M. G., Kogan, A., & Vasarhelyi, M. A. (2018). Putting continuous auditing theory into practice: Lessons from two pilot implementations. In D. Y. Chan, V. Chiu, & M. A. Vasarhelyi (Eds.), *Continuous Auditing* (pp. 247–270). Emerald Publishing. https://doi.org/10.1108/978-1-78743-413-420181011

Alles, M. G., Brennan, G., Kogan, A., & Vasarhelyi, M. A. (2020). Continuous monitoring of business process controls: A pilot implementation of a continuous auditing system at Siemens. *International Journal of Accounting Information Systems, 15*(3), 287-302. https://doi.org/10.1016/j.accinf.2014.06.001

Andrade, A. C. R. de, Penha, R., da Silva, L. F., Bizarrias, F. S., & Kniess, C. T. (2023). The adoption of technological tools in continuous audit projects. *Revista de Administração da UFSM*, *16*(4), e5. https://doi.org/10.5902/1983465971587

Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach* (7th ed.). John Wiley & Sons.

Chan, D. Y., & Vasarhelyi, M. A. (2011). Innovation and practice of continuous auditing. *International Journal of Accounting Information Systems, 12*(2), 152-160.

https://doi.org/10.1016/j.accinf.2011.01.001

Chan, K. C., Chen, Y., & Liu, B. (2020). The linear and non-linear effects of internal control and its five components on corporate innovation: Evidence from Chinese firms using the COSO framework. *European Accounting Review*, *30*(4), 733–765. https://doi.org/10.1080/09638180.2020.1776626

Cheng, M., & Dhaliwal, D. S. (2023). Audit quality and sustainable development: The role of auditors in ESG reporting. *Journal of Accounting and Public Policy, 42*(1). https://doi.org/10.1016/j.jaccpubpol.2023.100989

Codesso, M. M., de Freitas, M. M., Wang, X., de Carvalho, A., & da Silva Filho, A. A. (2020). Continuous audit implementation at Cia. Hering in Brazil. *Journal of Emerging Technologies in Accounting, 17*(2), 103–118. https://doi.org/10.2308/JETA-2020-006

de Freitas, M. M., Codesso, M., & Augusto, A. L. R. (2020). Implementation of continuous audit on the Brazilian Navy payroll. *Journal of Emerging Technologies in Accounting, 17*(2), 157–171. https://doi.org/10.2308/JETA-2020-047

Erwanto, R. (2022, November 15). *Agile software development*. Medium. https://medium.com/@rheznandya.erwanto/agile-software-development-978be9dc929b

Eulerich, M., Fligge, B., Lopez-Kasper, V., & Wood, D. A. (2023). Patience is key: The time it takes to see benefits from continuous auditing. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4454724

Feung, J. L. C., & Thiruchelvam, I. V. (2020). A framework model for continuous auditing in financial statement audits using big data analytics. *International Journal of Scientific & Technology Research, 9*(4), 3416–3434. https://ijstr.org/final-print/apr2020/A-Framework-Model-For-Continuous-Auditing-In-Financial-Statement-Audits-Using-Big-Data-Analytics.pdf

Ghozali, I. (2016). *Aplikasi analisis multivariate dengan program IBM SPSS 23*. Semarang, Indonesia: Badan Penerbit Universitas Diponegoro.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage Learning.

Hasan, M. O. (2024). *Breaking down the double diamonds*. Marvin Hassan. https://www.marvin-hassan.com/case-studies/breaking-down-the-double-diamonds

INTOSAI. (2022a). *Development overview of big data audits performed by supreme audit institutions from 2016 to 2021*. INTOSAI Working Group on Big Data. https://www.audit.gov.cn/en/n749/c10296921/part/10296937.pdf

INTOSAI. (2022b). *Research paper on innovative audit technology*. INTOSAI Working Group on Big Data. https://www.audit.gov.cn/en/n749/c10296921/part/10299824.pdf

Jans, M., & Hosseinpour, M. (2019). How active learning and process mining can act as a continuous auditing catalyst. *International Journal of Accounting Information Systems, 32*, 44–58. https://doi.org/10.1016/j.accinf.2018.11.002

Koerniawan, K. A. (2017). Fraud prevention: A study in regional private service agency (BLUD) for hospital in Malang Regency, Indonesia. *International Journal of Scientific & Technology Research*, *6*(4). https://www.ijstr.org/final-print/apr2017/Fraud-Prevention-A-Study-In-Regional-Public-Service-Agency-blud-For-Hospital-In-Malang-Regency-Indonesia.pdf

Koerniawan, K. A. (2021). *The influence of understanding of GICS, attitude toward behavior, subjective norm, and perceived behavior control on management's intention to use a fraud control plan to deter fraud and its impact on fraud deterrence* (Unpublished doctoral dissertation). Universitas Padjadjaran.

Koerniawan, K. A., Afiah, N. N., Sueb, M., & Supriadi, J. (2022). Fraud deterrence: The management's intention in using FCP. *Quality-Access to Success*, *23*(190), 292-301. https://doi.org/10.47750/QAS/23.190.31

Koerniawan, K. A. (2024a). *Fraud theories & fraud deterrence propeller* (1st ed.). Bandung, Indonesia: Tel-U Press.

Koerniawan, K. A., Murti, G. T., Saraswati, R. S., & Hilda. (2024b). Assessing fraud deterrence in private health clinics: Policy implications from West Java. *Jurnal Reviu Akuntansi dan Keuangan (JRAK), 14*(2). https://doi.org/10.22219/jrak.v14i2.32903

Koerniawan, K. A., Triyanto, D. N., Wahyuni, D., & Farida, A. L. (2024c). Fraud deterrence propellers for internal control quality improvement. *Quality-Access to Success*, *25*(203). https://doi.org/10.47750/QAS/25.203.08

Knoblauch, D., & Großmann, J. (2023). Towards a risk-based continuous auditing-based certification for machine learning. *The Review of Socionetwork Strategies, 17*, 255–273. https://doi.org/10.1007/s12626-023-00148-w

Luna-Reyes, L. F., Andersen, D. F., Black, L. J., & Pardo, T. A. (2021). Sensemaking and social processes in digital government projects. *Government Information Quarterly, 38*(2), 101570. https://doi.org/10.1016/j.giq.2021.101570

Minkkinen, M., Laine, J., & Mäntymäki, M. (2022). Continuous auditing of artificial intelligence: A conceptualization and assessment of tools and frameworks. *Digital Society, 1*(21). https://doi.org/10.1007/s44206-022-00022-2

Mökander, J., Axente, M., Casolari, F., & Floridi, L. (2022). Conformity assessments and post-market monitoring: A guide to the role of auditing in the proposed European AI regulation. *Minds and Machines, 32*, 241–268. https://doi.org/10.1007/s11023-021-09577-4

Polizzi, S., & Scannella, E. (2023). Continuous auditing in public sector and central banks: A framework to tackle implementation challenges. *Journal of Financial Regulation and Compliance, 31*(1), 40–59. https://doi.org/10.1108/JFRC-02-2022-0011

Shahana, T., Lavanya, V., & Bhat, A. R. (2023). State of the art in financial statement fraud detection: A systematic review. *Technological Forecasting and Social Change, 192*, 122527. https://doi.org/10.1016/j.techfore.2023.122527

Sugiyono. (2013). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Bandung, Indonesia: Alfabeta.

Tronto, S., & Killingsworth, B. L. (2021). How internal audit can champion continuous monitoring in a business operation via visual reporting and overcome barriers to success? *The International Journal of Digital Accounting Research*, *21*(27), 23-59. https://doi.org/10.4192/1577-8517-v21_2

Tüm, K. (2013). Continuous audit: From the concept towards the implementation. *International Journal of Business and Social Research, 3*(7). https://thejournalofbusiness.org/index.php/site/article/view/240/237

Werner, M., Wiese, M., & Maas, A. (2021). Embedding process mining into financial statement audits. *International Journal of Accounting Information Systems, 41*, 100514. https://doi.org/10.1016/j.accinf.2021.100514

Yoon, K., Liu, Y., Chiu, T., & Vasarhelyi, M. A. (2021). Design and evaluation of an advanced continuous data level auditing system: A three-layer structure. *International Journal of Accounting Information Systems, 42*, 100524. https://doi.org/10.1016/j.accinf.2021.100524