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Enhancing fraud detection based on technology to improve auditor's performance in greater Jakarta area

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Abstract: This research investigates the relationship between digital skills and forensic accounting skills in fraud detection and their impact on audit performance among external auditors in the Greater Jakarta area. Using a quantitative descriptive approach, data were collected from 62 external auditors through structured questionnaires and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4. The analysis shows that digital skills do not directly affect fraud detection; however, they impact the improvement of forensic accounting skills, which are essential for detecting fraud. The results also indicate that fraud detection does not significantly influence audit performance, suggesting that other factors may mediate this relationship. Nonetheless, digital skills positively influence audit outcomes, demonstrating their critical role in modern auditing practices. This study emphasizes that audit practices should incorporate digital and forensic skills to enhance both fraud detection capabilities and overall audit quality.

Keywords: *Audit performance, Digital proficiency, Forensic accounting skills, Fraud detection.*

1. Introduction

Fraud detection has an important role among the external auditors to ensure the accuracy and the reliability of financial statements. The misappropriation of financial statements still happens, increasing the risk of fraud in financial reporting [1]. These fraudulent activities can lead to financial losses, reduce public trust in financial markets, and trigger changes of regulation about transparency and accountability, which can affect the investors, creditors and regulators [2] Financial statement fraud is one of the most financially damaging types of fraud with an average loss of $766,000 per case. The Occupational Fraud 2024: A Report to the Nations by ACFE, shows the difficulty in detecting fraud, there are only 15% fraud cases are detected through external audits, while 43% still discovered by whistleblowers [3]. These data indicate the limitations of conventional audit procedures in detecting fraud proactively.

Traditional audits focus more on examining financial evidence, while the complexity of fraud is often not revealed only by authenticating financial statements [4]. With the development of technology in the industry 4.0 era, forensic accounting has significantly increased the sophistication of fraud detection, [5]. Techniques such as data mining, trend and big data analytics, play a key role in identifying financial anomalies that conventional audits might miss [6, 7]. Artificial Intelligence (AI), blockchain, and automation technologies also enhance the forensic accounting methodologies, though their effectiveness depends on auditors' ability to use them while maintaining accountability [8].

Forensic accounting skills—such as auditing, investigating, and the application of information and communication technology (ICT) significantly enhance fraud indicators. Prior research shows these skills support external in identifying fraud indicators [9, 10]. The Wirecard and Toshiba scandals illustrate. The consequences of inadequate fraud detection. In both cases, failure to adopt forensic approve the forensic methods and digital audit tools has led to significant losses and detected frauds that have been

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delayed [11]. These examples emphasize the importance of analytical, investigative, and digital capacity to improve the accuracy of audits and prevent fraud in financial relationships [12].

Based on these findings, we aim to do a further investigation about the relationship between the essential skills of external auditors and the key outcomes in audit performance. We will examine how forensic accounting skills and digital skills influence fraud detection, how digital skills influence forensic accounting skills, and how fraud detection influences audit performance. By analyzing these relationships, our study will provide insight to improve the fraud detection strategies and audit quality, ensuring reliable financial statements.

2. Related Literature

The advancement of technology has significantly increased the effectiveness of the audit by improving the ability to detect abnormalities and enhance internal control assessment [10] and Daraojimba, et al. [5]. It is important to analyze the factors that affect forensic accounting and digital skills in the detection of fraud, as well as the impact of digital skills on forensic accounting skills and frauds that affect the performance of the audit. Among technological advances requires the participation of a verification and researcher to develop research hypotheses to explore these relationships in detail.

2.1. The Relationship Between Forensic Accounting Skills and Fraud Detection

According to Alsaif [11] forensic accounting includes investigative skills, fraud detection knowledge, and understanding of financial reporting. Investigative skills refer to the ability to conduct systematic inquiries and research to collect some information [13]. These skills help external auditors identify irregularities that could indicate fraudulent activities. Therefore, a solid understanding of forensic accounting is essential for accurately analyzing transactions and financial records.

Hypothesis 1: Forensic accounting skills positively affect fraud detection.

2.2. The Relationship Between Digital Skills and Forensic Accounting Skills

Based on Appelbaum, et al. [14] research defined digital skills as the ability to use technology and digital information effectively. As financial investigations become more complex, digital skills are important in forensic accounting. According to Matrood and Khilkhal [15] forensic accounting relies heavily on digital tools like anomaly detection, forensic auditing, and data analytics to detect fraud. External auditors require forensic accounting knowledge to process transactions. Therefore, strong digital skills enhance auditors' ability to operate forensic software, analyze transaction patterns, and evaluate digital evidence, improving fraud detection and prevention.

Hypothesis 2: Digital Skills have a positive effect on forensic accounting skills.

2.3. The Relationship between Digital Skills and Fraud Detection

Fraud is closely related to the audit process and accounting cycle [9]. Based on what has been explained before, external auditors should have digital skills to detect anomalies and uncover fraud. Digital tools itself support external auditors in detecting fraud by automatically marking anomalies, initiating investigations, and implementing corrective actions immediately. Alonge, et al. [16] highlighted that the integration of digital technologies in auditing improves auditors' capabilities in identifying risks and financial irregularities. These skills increase the effectiveness of fraud detection by ensuring accuracy in identifying irregularities and mitigating risks.

Hypothesis 3: Digital Skills positively affect fraud detection.

2.4. The Relationship Between Fraud Detection and Audit Performance

The study by Burzinji, et al. [17] explains that fraud detection is a crucial aspect in the auditing process. To detect fraud effectively, external auditors should have analytical skills which play a key role in improving audit accuracy. Analytical skills enable auditors to process financial data systematically

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through procedures such as ratio analysis, sampling, reconciliation, and re-performance [18]. Given the significant role of analytical audit procedures in identifying financial statement manipulations and misstatements, these procedures assist auditors in planning and scheduling audits [19]. Effective fraud detection will enhance the accuracy of audit performance, ultimately improving the overall quality of financial statements.

Hypothesis 4: Fraud detection positively affects audit performance.

2.5. The Relationship Between Digital Skills and Audit Performance

Based on Joshi, et al. [20] research, digital technologies including advanced accounting software, Artificial Intelligence (AI), streamline data collection and data entry will help reduce the risk of error and improve the data accuracy and reliability. Therefore, external auditors need to possess digital skills to operate those technologies to reduce the risk of human error and create financial statements with consistent and reliable information [19].

Hypothesis 5: Digital Skills positively affect audit performance.

2.6. Research Framework

To discover fraud, external auditors use a combination of accounting, auditing, and investigation approaches. Strong digital skills enhance their ability to analyze transactions and identify fraud using technology. Forensic accounting enhances fraud detection, which ultimately improves financial reporting and audit quality [21]. Furthermore, digital skills support fraud detection and enhance audit performance by improving accuracy in financial analysis [22].

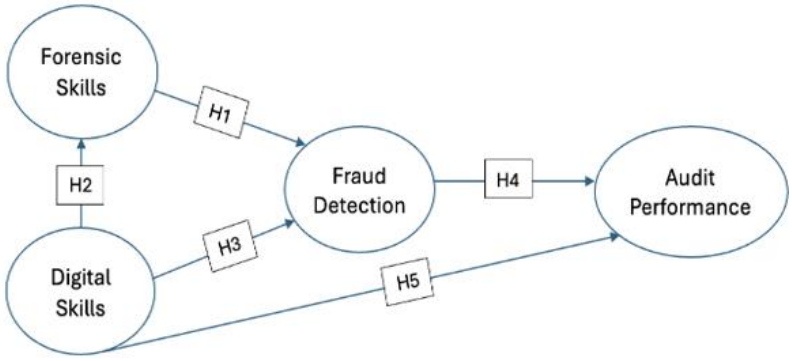

Figure 1.
Theoretical Framework.

3. Research Methodology

3.1. Research Method

This research adopts a quantitative descriptive methodology with a survey approach. According to Yusoff, et al. [23] in quantitative research, ensuring reliability is crucial by applying the measurement instrument consistently across all respondents. Through this method, the study can identify current audit practices and auditors' perceptions of forensic accounting skills, digital skills, and fraud detection effectiveness, as well as their impact on audit performance. The quantitative method also enables statistical analysis, such as correlation and multiple linear regression analysis, such as correlation and multiple linear regression analysis, to determine whether these variables have a significant impact on audit performance.

3.2. Data Collection

Primary data will be collected through online surveys using Google Forms or Microsoft Forms. The questionnaire will include questions closed by a 4-point Likert scale (1 = strongly disagree, 4 = strongly

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agree) to measure the responses of external auditors [24]. The survey is distributed through the professional auditor networks, social media platforms, and direct contact with audit firms, where it focused on the frequency of forensic accounting techniques used in auditing and their effectiveness in fraud. Secondary data obtained by a Systematic Literature Review (SLR), including recent journal articles and industry reports [25].

The target population of the research is external auditors in Greater Jakarta, where this study uses a purposive sampling technique, a non-probability sampling method in which the respondents is chosen on the basic specific criteria for research [26]. According to Roscoe's rule in Adejumo and Ogburie [27] the minimum sample size of 40 samples is considered to be sufficient for studies related to three independent variables and a dependent variable.

The collected data will be analyzed using by descriptive and inferential statistical methods [28]. Frequency measures will be applied to categorical data, while quantitative data will be analyzed by analysis correlated with linear regression to assess the relationship between skills in forensic accounting, digital skills, fraud detection efficiency and audit performance.

A more internal analysis will use Structural Equation Model (SEM) with a Partial Least Squares (PLS) processed using SmartPLS ver 4.1.1.2. [29]. PLS-SEM is used to check relationships between hidden works, especially with small sample sizes or unusual data [30]. We will check the convergent validity (indicator loadings ≥ 0.70 and AVE ≥ 0.50), valid by the criteria of Fornell-Larcker criterion and HTMT ratio (< 0.90), and the reliability of the internal consistency reliability using Cronbach's Alpha and Composite Reliability (both ≥ 0.70). The size of the effect (f^2) will also be calculated, with thresholds of 0.02 (small), 0.15 (medium), and 0.35 (large).

4. Result and Discussion

After distributing the questionnaires, the researchers obtained 62 respondents with zero missing values. The majority of respondents having a position of Junior Associate (62.90%), possess one to five years of auditing experience (77.42%), and work in non–Big 4 and non–Big 10 firms (43.55%), where most of them also hold a relevant professional certifications and having a proficiency in accounting software, particularly SAP (40 respondents), Oracle Financials (22 respondents), and MYOB (19 respondents). These statistics reflects their efforts to enhance their competencies and utilize digital tools to support audit implementation.

According to Hussain, et al. [31] auditors have increasingly adapted to the use of computer-based audit tools to assess system operations and analyze data stored in digital form. Then, all of the data's were analyzed using SmartPLS version 4 to construct a structural model based on the Structural Equation Modeling (SEM) approach, which includes assessments of convergent validity, discriminant validity, the Fornell-Larcker criterion, and hypothesis testing [32].

All constructs were measured reflectively, with most indicator loadings exceeding the recommended threshold of 0.70, indicating satisfactory reliability [33]. The analysis results show that Digital Skills have a direct effect on Forensic Skills ($\beta = 0.328$) and Fraud Detection ($\beta = 0.192$), while Forensic Skills exert a strong influence on Fraud Detection ($\beta = 0.715$). Furthermore, both Fraud Detection and Digital Skills affect Audit Performance with path coefficients of 0.388 and 0.348 respectively. The R^2 values of 0.638 for Fraud Detection and 0.387 for Audit Performance indicate moderate to substantial levels of explained variance [34].

4.1. Validity Test Analysis

According to a study by Hair, et al. [35] validity testing is a crucial aspect of research because it ensures that the instrument accurately measures what it is intended to, which will enhance the credibility and usefulness of the results. Convergent validity is employed to ensure that observed indicators reliably represent their respective latent constructs, confirming data readability and internal consistency within the measurement model [34]. Figure 2 displays the structural model of this study.

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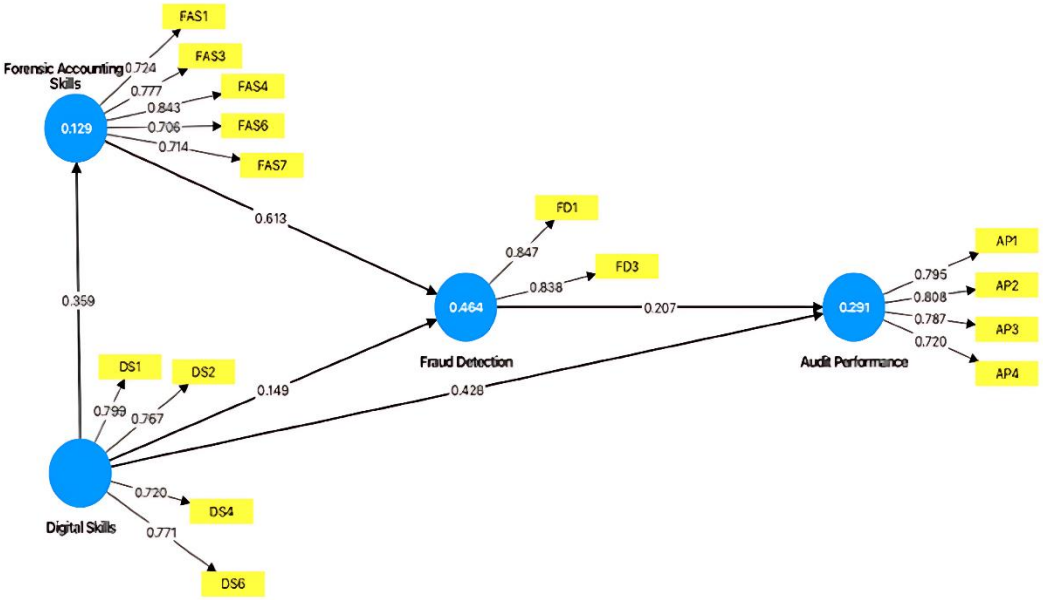

Figure 2.
Structural Models.

According to Cleff [34] an outer loading value > 0.70 is generally considered acceptable for convergent validity testing in reflective measurement models. Meanwhile, 11 indicators such DS3, DS5, FAS2, FAS5, FD2, FD4, FD5, FD6, FD7, FD8, and FD9 were removed due below the specified validity value. This invalidity may be due to the varying interpretations among the respondents. Removing these indicators helped improve the overall measurement model by retaining only the valid items. Discriminant validity was confirmed as all HTMT values were below the 0.90 threshold, and the Fornell-Larcker criterion was also satisfied.

4.2. Reliability Test

Reliability testing aims to ensure that a measurement instrument consistently generates stable and trustworthy results, accurately reflecting the construct being studied without being influenced by random errors [35]. Reliability testing will assess internal consistency using Cronbach's Alpha (α) and Composite Reliability with indicator loadings both ≥ 0.70 and Average Variance Extracted (AVE) (≥ 0.50). The results indicate that all variables, except Fraud Detection, meet the traditional thresholds for Cronbach's alpha and Composite Reliability (ρ_a>0.7), suggesting good internal consistency.

However, Avkiran and Ringle [36] note that these traditional measures can underestimate reliability in PLS-SEM due to their assumption of equal indicator loadings. Despite having lower Cronbach's Alpha and Composite Reliability (ρ_a) with a values (both 0.591), the Fraud Detection construct still demonstrated strong Composite Reliability (ρ_a = 0.830) and high convergent validity (AVE = 0.710), that indicate the construct sufficiently explains the variance of its indicators. As explained by Hair, et al. [35] composite reliability provides a more accurate estimate in models with varying indicator loadings. But, all of the variables meet the recommended thresholds for composite reliability and Average Variance Extracted (AVE) which is considered reliable and valid for inclusion in further analysis.

4.3. Determinant Coefficient

Determinant coefficient testing or as it called R-Squared (R^2) is important because it quantifies how well a regression model explains the variability of the dependent variable based on the independent variables. A higher R^2 value indicates that the model effectively captures the underlying relationship

between variables, making it a key tool for evaluating model fit, predictive accuracy, and the relevance between the variables [36].

Table 1.
R-square Test.

Construct	R-square	R-square adjusted
Audit Performance	0.291	0.267
Forensic Accounting Skills	0.129	0.114
Fraud Detection	0.464	0.446

The R-square values on the table I show how much each variable has an impact on the outcome. Fraud Detection shows the highest R-square value with (46.4%), making it the strongest factor. Audit Performance shows a moderate result by (29.1%) of the factors in the model, meanwhile forensic Skills has the weakest influence (12.9%). The adjusted R-square numbers are slightly lower, which is normal, they give a more careful estimate by considering the number of variables used. So overall, Fraud Detection has the most impact, and Forensic Skills has the least impact in this model.

4.4. Hypothesis Testing

After conducting validity and reliability tests, and confirming that all data are considered appropriate, the next step is hypothesis testing at a 95% confidence level. According to Adejumo and Ogburie [27] a hypothesis can be accepted if the T-statistic value exceeds 1.96 and the P-value is less than 0.05. The results of the hypothesis testing (bootstrapping) for each latent variable are presented in the table below.

Table 2.
Hypothesis Testing (Bootstrapping).

Construct	T-Statistic	P Values
FAS -> FD	5.189	0.000
DS -> FAS	2.905	0.004
DS-> FD	1.302	0.193
FD -> AP	1.653	0.098
DS-> AP	3.712	0.000

Based on the hypothesis testing result presented in table 6, there are several relationships between variables, such as the following:

1. Hypothesis 1 confirms that Forensic Accounting Skills significantly influence Fraud Detection (T-statistic = 5.189, P-value = 0.000).
2. Hypothesis 2 shows a significant positive effect of Digital Skills on Forensic Accounting Skills (T-statistic = 2.905, P-value = 0.004).
3. Hypothesis 3 shows that Digital Skills do not have a significant direct effect on Fraud Detection (T-statistic = 1.302, P-value = 0.193).
4. Hypothesis 4 reveals that Fraud Detection does not significally affect Audit Performance (T-statistic = 1.653, P-value of 0.098).
5. Hypothesis 5 confirms a significant positive effect of Digital Skills on Audit Performance (T-statistic = 3.712, P-value = 0.000.

5. Discussion

Hypothesis 1 explains that forensic accounting skills have an influence on fraud detection within the auditor's work process. The findings indicate that the forensic accounting skills and fraud detection capabilities possessed by external auditors in the Greater Jakarta area are relatively high. This is consistent with previous research conducted by Alsaif [11] who stated that forensic accounting skills, including investigative skills, can enhance the integrity of financial statements. In addition, Adejumo and

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Ogburie [27] highlighted that forensic accounting has evolved into a primary tool for fraud detection and prevention, not only relying on traditional techniques but also integrating advanced technologies such as data analytics and machine learning. These findings reinforce the importance of mastering forensic accounting skills for effective fraud detection.

Hypothesis 2 states a significant positive relationship between digital skills and forensic accounting skills, with a T-statistic value of 2.905 (> 1.96) and a P-value of 0.004 (< 0.05). This indicates that an increase in digital skills has an impact on improving the forensic accounting skills among the external auditors in the Greater Jakarta area. These results are consistent with the previous research of Ali, et al. [37] which emphasizes the essential role of advanced digital technologies in enhancing forensic accounting practices and improving the effectiveness of fraud detection and prevention mechanisms. Similarly, Pramano, et al. [38] discovered that digital skills significantly affect the effectiveness of forensic accounting practices, particularly in improving fraud detection quality.

The 3rd hypothesis is formulated to test the extent to which digital skills affect fraud detection by external auditors. However, the results of the statistical test showed that the effects of digital skills on fraud detection is not directly significant, the statistical value of T-statistic value is 1.302 and a P-value is 0.193. However, indirect path analysis has shown that digital skills have a significant influence on forensic skills, thereby improving fraud detection [39]. This means that digital skills serve as an initial foundation that enhances specific technical skills such as forensic accounting, playing a more direct role in the process of fraud detection [40]. This is in line with the view of Barac, et al. [41] who state that auditor capability, including technological proficiency, forensic skills, and interdisciplinary understanding, is a fundamental pillar in ensuring audit quality amid the growing complexity of the business environment. Thus, although not playing a direct role, digital skills remain an important component in building adaptive and resilient auditor capabilities in the digital era.

Hypothesis 4 suggests that Fraud Detection has a significant effect on Audit Performance. However, the results of the hypothesis testing shows that Fraud Detection does not have a significant effect on Audit Performance, with a T-statistic value of 1.653 and a p-value of 0.098. This result indicates that although auditors may possess the ability to detect fraud indicators, such ability does not directly enhance audit performance. This may be due to limited role of external auditors in conducting direct fraud investigations compared to forensic accountants. This may be due to the limited role of external auditors in conducting direct fraud surveys compared to forensic accountants. In addition, according to ISA 240, as shown by the International Auditing and Assurance Standards Board [42] external auditors are required to assess abnormal risks of documents due to fraud, but they are not authorized. investigators. These results indicate that the ability to detect fraud may not contribute significantly to the audit performance, especially when the efficiency is measured on audit efficiency, procedural efficiency or compliance with audit standards.

The 5th hypothesis indicates that digital skills have a positive impact on audit performance, as shown by the hypothesis testing results indicating a statistically significant relationship. This shows that digital skills contribute meaningfully to improving the performance of external auditors. This observation is supported by Alonge, et al. [16] arguing that digital conversion helps overcome the challenges of traditional audit and emphasize that the use of technologies such as accounting software, artificial intelligence and automated data systems can be reduce human errors. Alonge, et al. [16] also highlights that the integration of digital tools plays a crucial role, which highly depends on the auditor's ability to understand and apply these tools effectively. In other words, digital skills not only support automation processes but also play a role in analytical thinking and complex audit decision-making. Thus, the study confirms that digital competence is essential to improve audit performance in the modern era.

6. Limitation

This study has several limitations. First, data collection was conducted during auditors' peak season, potentially affecting the time respondents spent on the questionnaire. Nevertheless, this study managed to collect 62 respondents, exceeding the initial target of only 40. Second, the scope was the location is

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limited, as most respondents came from certain regions, making it less cannot represent the condition of auditors nationally. Suggestions for future research are that broader exploration be carried out, for example by collecting data in larger quantities or using a mixed methods approach supplemented by interviews with auditors and regulators, in order to identify needs that can help improve practitioner performance in facing technology-based and forensic audit challenges.

7. Conclusion

This study aims to examine the role of digital skills and forensic accounting skills in enhancing fraud detection and improving auditor performance among external auditors in the Greater Jakarta Area. As the financial fraud becomes more complex, auditors are now required to strengthen their technological and forensic capabilities to maintain audit quality and integrity. Majority of auditors in Greater Jakarta have adapted to digital tools into their audit processes to complement their professional expertise.

The research developed five hypotheses to explore the relationships between digital skills, forensic accounting skills, fraud detection, and audit performance. The findings indicate that forensic accounting skills significantly contribute to the effectiveness of fraud detection, while digital skills enhance both forensic accounting skills and audit performance.

However, two hypotheses were found to be statistically insignificant. The direct influence of digital skills on fraud detection was not supported, implying that digital skills should be complemented by strong forensic accounting skills. Similarly, fraud detection did not show an insignificant impact on audit performance, possibly due to the external auditor's limited scope in conducting deep fraud investigations, as mandated by ISA 240 [42].

Overall, these results emphasize the importance of integrating digital proficiency with forensic expertise in auditing practices. These findings underline the need for continuous training that combines accounting expertise with digital proficiency to meet the evolving demands of the audit profession.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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