

The Roles of Fraud Hexagon, Intellectual Capital, and Information Technology in Fraudulent Financial

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ABSTRACT

Fraudulent financial reporting (FFR) remains a significant concern because it undermines the reliability of financial information and may adversely affect stakeholders' decision-making. Although fraud hexagon, intellectual capital, and examined FFR using the fraud hexagon information technology in fraudulent framework, limited evidence integrates financial. *International Journal of Accounting and Finance in Asia-Pacific*, and information technology (IT), particularly in the context of Indonesian listed manufacturing companies. This study examines the effects of fraud hexagon dimensions, intellectual capital, and IT on FFR. Using a quantitative approach, the study analyzes 447 firm-year observations from manufacturing companies listed on the Indonesia Stock Exchange (IDX) during 2020–2022. FFR is measured using the Beneish M-Score, and the hypotheses are tested using panel data regression. The results show that financial stability ($b = 4.025$, $p < 0.01$), external pressure ($b = 18.440$, $p < 0.01$), and financial targets ($b = 24.302$, $p < 0.05$) have significant positive effects on FFR, while the remaining variables show no significant effects. The model explains 69.5% of the variation in FFR. These findings highlight pressure-related factors as important indicators of potential FFR and suggest that firms should strengthen monitoring mechanisms and fraud-prevention controls, particularly when experiencing financial pressure.

Keywords: Fraudulent Financial Reporting; Fraud Hexagon; Indonesia Stock Exchange; Intellectual Capital; Information Technology

JEL Classification: M41; G33

INTRODUCTION

Fraudulent financial reporting (FFR) remains a significant concern in corporate governance and financial accountability because it undermines the reliability of financial information and stakeholders' confidence in corporate disclosures. FFR involves the intentional misstatement or omission of financial information to mislead users of financial statements (Shakouri et al., 2021). Such practices may adversely affect investors, creditors, regulators, and other stakeholders who rely on financial reports to evaluate corporate performance and make economic decisions. Occupational fraud continues to represent a substantial challenge across the Asia-Pacific region, including Indonesia. This highlights the importance of identifying organizational conditions that may increase the risk of FFR and strengthening mechanisms for its prevention and detection.

Several financial reporting controversies in Indonesia have demonstrated the importance of transparency and accountability in corporate reporting. For example, the financial reporting controversy involving PT Garuda Indonesia (Persero) attracted public attention and raised concerns regarding the recognition and presentation of financial information. Previous research has also discussed suspected financial statement manipulation involving Envy Technologies Indonesia Ltd. (Christian et al., 2022). These cases illustrate how financial reporting irregularities may undermine stakeholder confidence and emphasize the need for effective corporate governance and internal control mechanisms. Although Indonesian listed companies are subject to financial reporting and disclosure requirements, regulatory compliance alone cannot entirely eliminate the risk of FFR. Accordingly, understanding the factors associated with potential financial reporting manipulation remains an important research priority.

Agency theory provides a theoretical foundation for explaining FFR through conflicts of interest and information asymmetry between shareholders and management (Ajaegbu & Mmayie, 2025). Shareholders, as principals, delegate responsibility for managing corporate resources to managers, who act as agents. However, managers may pursue objectives that differ from those of shareholders, particularly when facing performance expectations, financial pressures, or personal incentives. Furthermore, managers generally possess more detailed information about corporate operations and financial conditions than external stakeholders. This information asymmetry may create opportunities for management to influence reported financial performance in ways that do not fully reflect the company's underlying economic circumstances (Sagala & Siagian, 2023; Lastanti et al., 2022). Consequently, agency theory helps explain why managerial incentives, organizational conditions, and monitoring mechanisms are relevant to the examination of FFR.

One framework commonly employed to investigate the determinants of FFR is the fraud hexagon, which incorporates six dimensions: pressure, opportunity, rationalization, capability, arrogance, and collusion (Wuryandini et al., 2023). These dimensions represent different conditions that may motivate, facilitate, or justify fraudulent behavior. Pressure may arise from financial instability, external financing obligations, or demanding financial targets (Abbas & Ilyas, 2025). Opportunity may emerge from weaknesses in monitoring and internal controls, while rationalization reflects the justification of inappropriate behavior. Capability concerns an individual's ability to exploit organizational weaknesses, arrogance reflects excessive confidence or disregard for established controls, and collusion involves coordinated misconduct among multiple parties. By integrating these dimensions, the fraud hexagon provides a comprehensive framework for examining potential determinants of FFR.

Previous empirical studies have examined the relationship between fraud-related factors and FFR, although their findings remain inconsistent. Ghaisani & Supatmi (2023), Lastanti et al. (2022), and Sagala & Siagian (2023) examined fraud-related determinants and highlighted the relevance of pressure-related indicators, including financial stability and other financial conditions. Nevertheless, the significance of individual fraud dimensions varies across studies, suggesting that the relationship between fraud-related characteristics and FFR may depend on organizational circumstances, measurement approaches, and research settings. These inconsistencies indicate the need for further empirical investigation into the explanatory roles of individual fraud hexagon indicators.

Beyond the fraud hexagon, intellectual capital represents an organizational resource that may influence the reliability of financial reporting (Waromi et al., 2024). Intellectual capital encompasses knowledge, competencies, expertise, and other intangible resources that contribute to organizational effectiveness. In the context of financial reporting, financial knowledge and educational background may affect the ability of organizational members to understand accounting standards, evaluate financial information, and identify reporting irregularities. Financial knowledge is particularly relevant to organizational decision-making and the development of effective financial management practices (Andriani & Arsjah, 2022). However, the relationship between intellectual capital and FFR is not necessarily straightforward. Greater financial expertise may strengthen oversight and improve reporting quality, but technical knowledge may also provide individuals with the ability to understand and potentially exploit complex accounting processes. Therefore, examining intellectual capital-related indicators alongside fraud hexagon dimensions may provide additional insights into the organizational conditions associated with FFR.

Information technology (IT) is another important factor in contemporary financial reporting environments. The increasing adoption of accounting information systems and digital technologies has transformed how organizations process, record, analyze, and communicate financial information (Prasetianingrum & Sonjaya, 2024). Effective IT may improve reporting accuracy, operational efficiency, transaction traceability, and internal monitoring (Widianingsih et al., 2018). Furthermore, technology-enabled accounting systems may support the identification of unusual transactions and strengthen financial reporting controls. However, IT may also introduce new vulnerabilities when system access, data integrity, and technological controls are inadequately managed. Novianti and Firmanto (2022) emphasized that technological capabilities may create both organizational benefits and potential fraud-related risks. Thus, the presence of IT does not necessarily guarantee reliable financial reporting, and its relationship with FFR requires empirical examination.

Despite the growing literature on FFR, several research gaps remain. First, previous studies have predominantly focused on fraud-related behavioral and organizational indicators derived from the fraud triangle, fraud diamond, fraud pentagon, and fraud hexagon frameworks. Although these perspectives provide valuable explanations of potential fraudulent behavior, they may not fully account for the roles of organizational knowledge and technological resources in modern financial reporting environments. Second, previous empirical findings concerning the individual dimensions of the fraud hexagon remain inconsistent, particularly regarding the relative importance of pressure, opportunity, rationalization, capability, arrogance, and collusion. Third, limited empirical attention has been devoted to examining fraud hexagon indicators, intellectual capital-related characteristics, and IT within a single analytical framework, particularly among manufacturing companies listed on the Indonesia Stock Exchange (IDX).

To address these gaps, this study examines the relationships between fraud hexagon dimensions, intellectual capital-related indicators, IT, and FFR among Indonesian listed manufacturing companies. Specifically, the study incorporates financial knowledge and educational background as indicators related to intellectual capital, while IT is examined through the adoption of accounting-related technological systems. The study employs a quantitative approach using 447 firm-year observations from 149 manufacturing companies during the 2020–2022 period. Potential FFR is assessed using the Beneish M-Score, and the proposed relationships are examined through panel data regression analysis.

The novelty of this study lies in integrating fraud hexagon indicators with intellectual capital-related characteristics and IT within a single empirical model. Rather than examining fraud-related factors independently, the study considers whether organizational knowledge and technological characteristics provide additional explanatory insights into potential financial reporting manipulation. The study contributes theoretically by extending the empirical application of the fraud hexagon framework and examining its relevance alongside organizational resources within an agency theory perspective. Practically, the findings are expected to provide insights for management, auditors, regulators, and corporate governance bodies in identifying potential FFR risk indicators and strengthening financial reporting oversight. By focusing on Indonesian manufacturing companies during a period characterized by substantial economic uncertainty, this study also provides contextual evidence regarding the factors associated with potential FFR.

LITERATURE REVIEW

Theoretical Review

Agency Theory

Agency theory explains the relationship between principals and agents, in which shareholders delegate managerial responsibilities to corporate executives (Zajac & Goranova, 2026). Although managers are expected to act in shareholders' interests, differences in objectives and access to information may create agency conflicts. Managers generally possess more detailed information about corporate operations and financial performance than external stakeholders, creating information asymmetry that may facilitate opportunistic behavior (Lastanti et al., 2022; Sagala & Siagian, 2023).

In the context of FFR, agency conflicts may arise when managers face pressure to achieve financial targets, maintain corporate stability, or satisfy creditors' expectations (Alexander et al., 2025). Such conditions may encourage the manipulation of accounting information, particularly when governance and monitoring mechanisms are ineffective. Agency theory therefore provides a foundation for understanding how financial incentives and organizational conditions may be associated with FFR.

The theory also supports the inclusion of intellectual capital and IT in the research framework (Abdallah et al., 2025). Financial knowledge and professional expertise may influence managerial decisions and the effectiveness of financial reporting oversight, while IT may affect information transparency, monitoring capabilities, and internal control processes. Accordingly, these organizational characteristics may influence the extent to which information asymmetry and opportunistic financial reporting behavior arise.

Fraud Hexagon

The fraud hexagon framework extends earlier fraud theories by incorporating six dimensions: pressure, opportunity, rationalization, capability, arrogance, and collusion (Pamungkas et al., 2025). The framework builds on the fraud triangle and subsequent

theoretical developments by recognizing that fraudulent behavior may involve not only individual motivations and opportunities but also organizational authority and cooperation among multiple parties.

Pressure refers to circumstances that motivate individuals to achieve particular financial or organizational outcomes. Opportunity represents conditions that enable fraudulent activities, particularly weaknesses in internal controls and monitoring. Rationalization concerns the justification of unethical behavior, whereas capability reflects an individual's ability to exploit organizational weaknesses. Arrogance refers to excessive confidence or disregard for established rules, while collusion involves cooperation among parties to facilitate misconduct (Salihi, 2025; Setiawan & Soewarno, 2025).

Previous empirical studies have reported inconsistent findings regarding the relationships between fraud hexagon dimensions and FFR. Ghaisani & Supatmi (2023), Lastanti et al. (2022), and Sagala & Siagian (2023) examined fraud-related indicators and demonstrated the relevance of financial and organizational conditions in explaining potential financial reporting manipulation. However, differences in research settings and operational measurements suggest that the explanatory power of individual fraud dimensions may vary. These findings support the examination of fraud hexagon indicators separately rather than assuming that all dimensions have equivalent relationships with FFR. These findings support the examination of fraud hexagon indicators separately rather than assuming that all dimensions have equivalent relationships with FFR.

Intellectual Capital

Intellectual capital represents knowledge-based organizational resources that contribute to organizational performance, decision-making, and the effectiveness of business processes (Jordão et al., 2020). It is commonly understood to encompass human capital, structural capital, and relational capital. Human capital includes employees' knowledge, skills, and professional expertise, while structural capital concerns organizational processes and knowledge systems. Relational capital reflects knowledge-based relationships with external stakeholders.

In financial reporting, intellectual capital may influence the ability of managers and employees to interpret accounting information, apply reporting standards, and identify irregularities. Greater financial expertise may strengthen financial reporting oversight and reduce unintentional errors (Roszkowska, 2021). However, technical expertise may also provide individuals with greater discretion in applying accounting judgments or managing complex financial transactions.

Empirical evidence suggests that the relationship between intellectual capital and financial reporting misconduct deserves further investigation. A study by Lotfi et al. (2022) reported a significant negative relationship between intellectual capital and financial statement fraud. This finding indicates that knowledge-based organizational resources may contribute to reducing financial reporting misconduct.

Nevertheless, financial expertise does not necessarily guarantee reporting integrity. Research by Ngo and Nguyen (2024) found that chief executives with financial and accounting expertise were associated with greater intervention in earnings management and lower financial reporting quality among Vietnamese listed companies. These findings indicate that financial expertise may influence financial reporting outcomes in different directions depending on managerial incentives and organizational controls. In this study, intellectual capital is represented by two human-capital-related indicators: financial knowledge and educational background. These indicators do not measure

intellectual capital in its entirety but provide observable characteristics through which the relationship between financial expertise and FFR can be examined.

Information Technology (IT)

IT plays an important role in contemporary accounting and financial reporting processes. Accounting information systems support the recording, processing, storage, and communication of financial information and may improve operational efficiency, information accuracy, and reporting timeliness (Widianingsih et al., 2018). From an agency theory perspective, IT may reduce information asymmetry by improving transaction documentation, audit trails, and the accessibility of financial information. Effective technological controls may also support the detection of unusual transactions and strengthen financial reporting oversight.

Empirical studies provide support for the relationship between accounting technology, internal controls, and financial reporting quality. Arisandi et al. (2022) found a significant relationship between internal control disclosure and financial reporting quality among Indonesian banking companies. Yanti et al. (2026) reported that accounting information systems and internal controls contributed positively to preventing FFR. Furthermore, Shin and Park (2022) examined investments in internal control and IT personnel in relation to audit efficiency, demonstrating the relevance of technological and control-related resources to auditing processes.

Nevertheless, the adoption of IT does not automatically guarantee effective financial reporting controls. The effectiveness of technological systems may depend on their implementation, integration, security, and monitoring mechanisms. IT may also create opportunities for misconduct when access restrictions and data controls are inadequate (Novianti & Firmanto, 2022).

Therefore, IT is examined as an organizational characteristic potentially associated with FFR. The present study measures this variable through the use of accounting-related technological systems, while recognizing that system adoption does not necessarily capture the quality or effectiveness of technological controls.

Hypotheses Development

Pressure and FFR

Pressure is a fundamental dimension of the fraud hexagon framework. Managers may experience pressure to maintain financial stability, satisfy creditors, achieve profitability targets, or protect personal financial interests. Under agency theory, such pressures may create incentives to influence reported financial performance when actual outcomes differ from stakeholder expectations.

Financial stability reflects changes in a company's financial condition. Significant fluctuations in financial performance may increase managerial pressure to demonstrate favorable results. External pressure, represented by leverage, reflects obligations to creditors and other financing providers. Personal financial needs may create incentives arising from managerial ownership, while financial targets represent expectations concerning corporate profitability (Ghaisani & Supatmi, 2023; Lastanti et al., 2022; Sagala & Siagian, 2023). Accordingly, the following hypotheses are proposed:

H1: Financial stability has a positive effect on FFR

H2: External pressure has a positive effect on FFR

H3: Personal financial needs have a positive impact on FFR

H4: Financial target has a positive effect on FFR

Opportunity and FFR

Opportunity arises when organizational conditions allow individuals to manipulate financial information without effective detection. Weak monitoring, complex accounting estimates, and governance deficiencies may increase the possibility of inappropriate financial reporting.

In this study, opportunity is represented by the nature of the industry, ineffective monitoring, and organizational structure. The nature of the industry reflects accounting conditions involving judgment and estimation, particularly inventory-related measurements. Ineffective monitoring concerns weaknesses in external oversight, while organizational structure is represented by changes in directors. These indicators are examined as observable proxies for organizational conditions potentially associated with FFR (Lastanti et al., 2022).

H5: Nature of industry has a positive effect on FFR

H6: Ineffective monitoring has a positive impact on FFR

H7: Organizational structure has a positive effect on FFR

Rationalization and FFR

Rationalization refers to the process through which individuals justify unethical or fraudulent actions. Individuals may perceive financial reporting manipulation as acceptable when they believe it is necessary to protect the organization, satisfy stakeholders, or achieve expected performance.

In this study, auditor changes are employed as an observable proxy for rationalization. Auditor switching may sometimes be associated with attempts to reduce external scrutiny, although such changes can also arise from legitimate business or regulatory considerations. Consequently, auditor changes are treated as an indirect indicator rather than direct evidence of rationalization (Achmad et al., 2022).

H8: Rationalization has a positive effect on FFR

Capability and FFR

Capability reflects an individual's ability to recognize and exploit opportunities for fraudulent behavior. Such ability may depend on organizational position, authority, knowledge, and access to financial information. Individuals with substantial decision-making authority may be better positioned to influence reporting processes when monitoring mechanisms are insufficient (Pamungkas et al., 2025).

The present study examines capability using a board-composition-related indicator. Although this proxy does not directly measure an individual's fraudulent capability, it provides an observable governance characteristic for empirical examination within the fraud hexagon framework.

H9: Capability has a positive effect on FFR

Arrogance and FFR

Arrogance refers to excessive confidence, a sense of superiority, or the belief that established organizational rules do not apply to an individual. Within the fraud hexagon framework, managerial arrogance may increase the risk of inappropriate financial reporting when executives disregard oversight mechanisms.

Previous fraud-related studies have employed the frequency of chief executive officer (CEO) photographs in annual reports as a proxy for managerial arrogance (Tarjo et al.,

2021). Although this indicator may also reflect corporate communication practices, it is examined as an observable characteristic potentially associated with FFR.

H10: Ego has a positive effect on FFR

Collusion and FFR

Collusion involves cooperation between two or more parties to engage in misconduct or circumvent organizational controls. Within the fraud hexagon framework, collusion may increase fraud risk because coordinated actions can weaken the effectiveness of individual monitoring mechanisms (Rikawati et al., 2026; Pamungkas et al., 2025; Salihu, 2025).

The present study employs government-project involvement as an indirect indicator associated with potential collusion risk. However, involvement in government projects does not itself establish collusion or misconduct. The proxy is therefore interpreted as an organizational characteristic rather than evidence of fraudulent cooperation.

H11: Collusion has a positive effect on FFR

Intellectual Capital and FFR

Financial knowledge and educational background represent human-capital-related characteristics that may influence financial reporting decisions. Financial knowledge may strengthen employees' and managers' understanding of accounting procedures, while relevant educational qualifications may improve the ability to interpret financial information and identify irregularities (Andriani & Arsjah, 2022).

However, the relationship between financial expertise and FFR may be complex. Greater knowledge may improve monitoring and compliance, but it may also provide technically skilled individuals with the ability to exercise discretion over accounting estimates and reporting decisions. Existing empirical research has documented both the potential fraud-reducing role of intellectual capital and the possibility that managerial financial expertise may be associated with earnings management.

Given the possibility that financial knowledge and expertise may facilitate sophisticated financial reporting manipulation under certain agency conditions, the following directional hypotheses are examined:

H12: Financial knowledge has a positive effect on FFR

H13: Educational background has a positive impact on FFR

IT and FFR

IT may influence FFR through its effects on financial information processing, internal controls, and managerial access to accounting data. Effective accounting information systems may improve transaction traceability and reduce opportunities for manipulation. Empirical findings concerning accounting information systems and internal controls support their relevance to financial reporting reliability (Arisandi et al., 2022; Yanti et al., 2026).

Conversely, IT may create new vulnerabilities when system access, data integrity, and technological controls are insufficient. Organizations that rely on technological systems without appropriate governance mechanisms may remain exposed to financial reporting manipulation.

Because the present study uses an indicator of accounting-related technology adoption rather than a comprehensive measure of technological control effectiveness, the proposed hypothesis examines the potential positive association between the technology indicator and FFR.

H14: Information systems have a positive effect on FFR

Research Model

Figure 1. Conceptual Framework

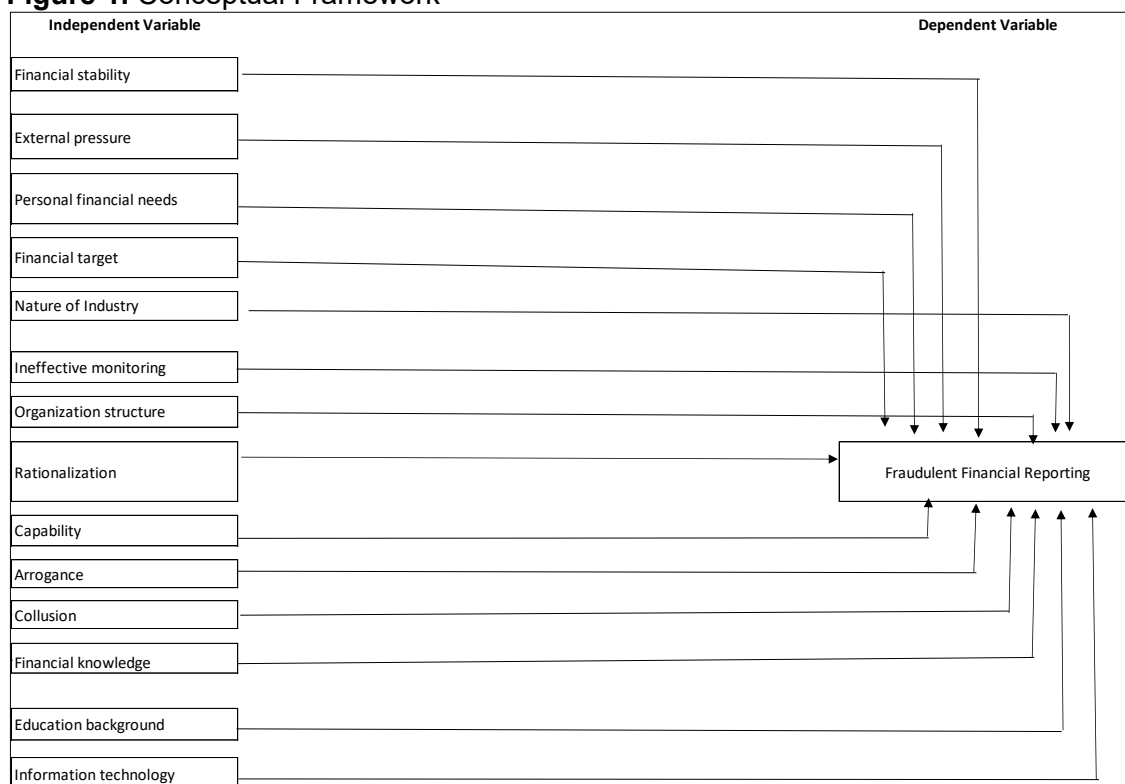


Figure 1 presents the conceptual framework of this study, illustrating the proposed relationships between the independent variables and FFR. The independent variables comprise eleven indicators representing the six dimensions of the fraud hexagon, two indicators related to intellectual capital, and one IT indicator. The fraud hexagon indicators include financial stability, external pressure, personal financial needs, financial targets, nature of the industry, ineffective monitoring, organizational structure, rationalization, capability, arrogance, and collusion. Intellectual capital is represented by financial knowledge and educational background, while IT is represented by the adoption of accounting-related technological systems. All fourteen independent variables are hypothesized to have positive relationships with FFR, as specified in H1–H14. The framework integrates fraud-related organizational conditions with knowledge-based and technological characteristics to examine their associations with potential financial reporting manipulation among Indonesian listed manufacturing companies.

RESEARCH DESIGN

Research Design

This study employs a quantitative research design to examine the relationships between fraud hexagon dimensions, intellectual capital-related indicators, IT, and FFR. An explanatory approach is adopted to investigate the statistical associations between the independent variables and FFR. The study uses secondary data obtained from publicly

available corporate reports and applies panel data regression to analyze observations across companies and reporting periods.

The research focuses on manufacturing companies listed on the IDX during 2020–2022. Panel data analysis is considered appropriate because the dataset combines cross-sectional observations from multiple companies with time-series observations over three consecutive financial years. The statistical analysis is conducted using EViews 12.

The final sample consists of 149 manufacturing companies observed over three consecutive financial years, resulting in 447 firm-year observations. This represents a balanced panel of companies with complete observations for the study period. The sample-selection process should be presented in a separate table showing the initial population, the number of companies excluded under each criterion, and the final sample.

Data Collection

This study uses secondary data collected from audited financial statements, annual reports, and sustainability reports, where relevant information is available. The documents were obtained from the official IDX website (www.idx.co.id) and the respective companies' official websites.

Data collection covers financial information and corporate characteristics for the 2020–2022 financial years. Financial statement data are used to calculate the Beneish M-Score and financial ratios, while annual reports and other corporate disclosures provide information on governance characteristics, financial training, directors' educational backgrounds, and accounting-related technological systems (Ramadhan et al., 2026).

The collected information is organized into a firm-year dataset to ensure consistency across companies and reporting periods. Where variable calculations require prior-year financial information, the relevant comparative figures are obtained from the financial statements.

Dependent Variable

Table 1 presents the formula to calculate FFR with the Beneish M-Score (Santosa & Ginting, 2019).

Table 1. FFR with Beneish M-Score Formula

Ratio or Index	Ratio Formula
Day sales in receivable index (DSRI)	$(\text{Account Receivables} / \text{Sales}) / (\text{Account Receivables}^{t-1} / \text{Sales}^{t-1})$
Gross margin index (GMI)	$[(\text{Sales}^{t-1} - \text{Cost of Goods Sold}^{t-1}) / \text{Sales}^{t-1}] / [(\text{Sales} - \text{Cost of Goods Sold}) / \text{Sales}^t]$
Asset Quality Index (AQI)	$[1 - (\text{Current Assets}^t + \text{Net Fixed Assets}) / \text{Total Assets}^t] / [1 - (\text{Current Assets}^{t-1} + \text{Net Fixed Assets}^{t-1}) / \text{Total Assets}^{t-1}]$
Sales growth index (SGI)	$(\text{Sales} / \text{Sales}^{t-1})$
Depreciation index (DEPI)	$[\text{Depreciation Expense}^{t-1} / (\text{Depreciation Expense}^{t-1} + \text{Net PPE}^{t-1})] / [\text{Depreciation Expense}^t / (\text{Depreciation Expense}^t + \text{Net PPE}^t)]$
Sales, general and administrative expenses index (SGAI)	$(\text{Sales, General and Administrative Expenses} / \text{Sales}) / (\text{Sales, General and Administrative Expenses}^{t-1} / \text{Sales}^{t-1})$

Leverage index (LVGI)	$\frac{[(\text{Long Term Debt}^t + \text{Current Liabilities}) / \text{Total Assets}^t]}{[(\text{Long Term Debt}^{t-1} + \text{Current Liabilities}^{t-1}) / \text{Total Assets}^{t-1}]}$
Total accruals to total assets (TATA)	$\frac{[(\text{Working Capital} - \text{Working Capital}^{t-1}) - [\text{Cash}^t - \text{Cash}^{t-1}] + [\text{Income Tax Payable} - \text{Income Tax Payable}^{t-1}] + [\text{Current Maturities of Long Term Debt}^t - \text{Current Maturities of Long Term Debt}^{t-1}] - \text{Depreciation Expenses}] / (\text{Total Assets})}{1}$

Below is the equation for calculating the Beneish M-Score:

$$M - \text{Score} = -4.84 + 0.92 \times DSRI + 0.528 \times GMI + 0.404 \times AQI + 0.892 \times SGI + 0.115 \times DEPI - 0.172 \times SGAI + 4.679 \times TATA - 0.327 \times LVGI \dots \dots \dots (1)$$

Note:

- DSRI = Day Sales in Receivables Index
- GMI = Gross Margin Index
- AQI = Asset Quality Index
- SGI = Sales Growth Index
- DEPI = Depreciation Index
- SGAI = Sales, General and Administrative Expenses Index
- TATA = Total Accruals to Total Assets
- LVGI = Leverage Index

Independent Variable

The independent variables comprise eleven indicators representing fraud hexagon dimensions, two intellectual capital-related indicators, and one IT indicator.

Pressure is represented by financial stability, external pressure, personal financial needs, and financial targets. Financial stability (FST) is measured by the annual change in total assets relative to prior-year total assets. External pressure (DTA) is measured using the debt-to-assets ratio. Personal financial needs (PFN) are represented by managerial share ownership relative to total outstanding shares. Financial targets are measured using return on assets (ROA), calculated as net income divided by average total assets.

Opportunity is represented by the nature of the industry, ineffective monitoring, and organizational structure. The nature of the industry (NOI) is measured using changes in the ratio of inventory to sales between consecutive financial years. Ineffective monitoring (IM) is operationalized using an audit-firm classification indicator, with a value of 1 for companies audited by a Big Four public accounting firm and 0 for companies audited by a non-Big Four firm. Organizational structure (OS) is measured as a dummy variable equal to 1 when a change in directors occurs and 0 otherwise.

Rationalization (RT) is represented by auditor changes. A dummy variable takes the value of 1 when the company changes its auditor during the observation year and 0 otherwise.

Capability (CAP) is measured using the proportion of independent board members relative to the total number of board members. This indicator represents an observable governance characteristic rather than a direct measurement of an individual's ability to commit fraud.

Arrogance (ARG) is measured by the number of CEO photographs appearing in the company's annual report. The indicator is used as an indirect proxy for managerial prominence or arrogance, although the number of photographs may also reflect corporate communication practices.

Collusion (COL) is measured using a dummy variable associated with government-project involvement. A value of 1 is assigned when such involvement is identified and 0 otherwise. Government-project involvement is treated as an indirect research proxy and should not be interpreted as evidence of collusion.

Intellectual capital-related characteristics are represented by financial knowledge and educational background. Financial knowledge (FK) is measured using the availability of financial training, with a value of 1 when no relevant financial training is provided and 0 when such training is available. Educational background (EDU) is measured using directors' financial expertise, with a value of 1 when relevant financial expertise is absent and 0 when it is present. These indicators represent selected human-capital characteristics rather than a comprehensive measurement of intellectual capital.

IT is measured using the adoption of accounting-related technological systems. The indicator is assigned a value of 1 when a modern accounting system is not used and 0 when an accounting-related technological system is employed. This measure identifies system adoption status but does not assess technological sophistication, integration, or internal control effectiveness.

Regression equation

$$FFR = \beta_0 + \beta_1 FST_t + \beta_2 DTA_t + \beta_3 PFN_t + \beta_4 ROA_t + \beta_5 NOI_t + \beta_6 IM_{t+} + \beta_7 OS_t + \beta_8 RT_t + \beta_9 CAP_t + \beta_{10} ARG_t + \beta_{11} COL_t + \beta_{12} FK_t + \beta_{13} EDU_t + \beta_{14} IT_t + \varepsilon_t \quad (2)$$

Note:

FFR : Fraudulent Financial Reporting
FST : Financial Stability
DTA : Debt-to-Total-Assets Ratio
PFN : Personal Financial Need
ROA : Return on Assets
NOI : Nature of Industry
IM : Ineffective Monitoring
OS : Organization Structure
RT : Rationalization
CAP : Capability
ARG : Arrogance
COL : Collusion
FK : Financial Knowledge
EDU : Education Background
IT : Information Technology

RESULTS

Descriptive Statistics

Table 2. Descriptives Statistic

Variable	Mean	SD	Minimum	Maximum
M-Score	0.109	31.643	-25.338	547.136
FST	0.365	6.358	-0.559	134.412
DTA	0.472	0.300	0.033	3.388

PFN	0.137	1.087	0.000	22.451
ROA	0.033	0.105	-0.642	0.621
NOI	2.028	20.525	-117.239	313.800
I'M	0.288	0.453	0.000	1.000
OS	0.114	0.318	0.000	1.000
RT	0.149	0.357	0.000	1.000
CAP	2.503	0.567	1.000	5.000
ARG	2.935	2.842	0.000	34.000
COL	0.055	0.230	0.000	1.000
FK	1.239	1.934	0.000	14.000
EDU	0.565	0.496	0.000	1.000
IT	0.979	0.140	0.000	1.000

Table 2 shows that the minimum FST, ROA, and NOI values are negative. When FST is negative, the assets' value in period t-1 exceeds the value in period t. The period in this study is 2020-2022; for example, the total assets in 2020 are smaller than in 2019. The occurrence was a direct result of the impact of the COVID-19 pandemic on Indonesia. The same occurs with ROA and NOI. The negative amount was shown only in 2020-2021; from 2021 to 2022, most companies experienced an increase, resulting in FST, ROA, and NOI becoming positive.

About 5% of the sample in this study have a political connection. This indicates that the remaining 95% do not have any political affiliations or involvement in government employment or programs that contribute to their sales. Further study is needed to measure collusion because not all companies have political connections. So, new metrics for conspiracy that can be universally applied to all companies are required.

The study did not conduct tests for normality and autocorrelation assumptions since these tests are not necessary for panel data analysis. A heteroskedasticity test and multicollinearity test were also conducted in this study, showing that the data passed the tests.

Panel Regression Model Selection

Panel data regression analysis was performed using EViews 12. Three alternative estimation approaches were evaluated: the Common Effect Model (CEM), the Fixed Effect Model (FEM), and the Random Effect Model (REM). The selection procedures consisted of the redundant fixed effects test, the Breusch–Pagan Lagrange Multiplier (LM) test, and the Hausman specification test.

Table 3. Panel Regression Model Selection

Test	Test Statistic	P-Value	Interpretation
Chow test: Cross-section F	1.210141	0.0875	Does not reject pooled model
Chow test: Cross-section Chi-square	218.569852	0.0001	Supports fixed effects
LM test: Cross-section Breusch–Pagan	0.022062	0.8819	Does not support random effects
LM test: Time Breusch–Pagan	0.021753	0.8827	Does not support time random effects
LM test: Both Breusch–Pagan	0.043815	0.8342	Does not support joint random effects
Hausman test: Cross-section random	31.388764	0.0049	Supports fixed effects over random effects

The redundant fixed effects test was first performed to evaluate whether unobserved company-specific effects should be included in the regression model. According to Table 3, the cross-section F-statistic was 1.210141, with a probability value of 0.0875. Since this probability exceeds the 5% significance level, the null hypothesis that the cross-sectional fixed effects are redundant could not be rejected based on the F-test. This result does not provide sufficient evidence to prefer the fixed effects specification over the pooled model.

However, the cross-sectional chi-square statistic was 218.569852, with a probability value of 0.0001, indicating a statistically significant result. Thus, the two statistics associated with the redundant fixed effects test yielded different conclusions at the 5% significance level.

The LM test was subsequently performed to assess whether the random effects specification was preferable to the pooled model. The cross-section Breusch–Pagan statistic was 0.022062, with a probability value of 0.8819. Similarly, the time and combined Breusch–Pagan tests yielded probability values of 0.8827 and 0.8342, respectively. All three probability values exceeded 0.05, indicating that the tests did not provide sufficient statistical evidence in favor of random effects over the pooled model. The Hausman specification test was also conducted to compare the fixed effects and random effects estimators. The test produced a Chi-square statistic of 31.388764 with 14 degrees of freedom and a probability value of 0.0049. The result rejects the null hypothesis associated with the random effects estimator and favors fixed effects relative to random effects.

Taken together, the model-selection results were not entirely consistent. The cross-section F-test and LM test did not provide sufficient evidence against the pooled model, whereas the cross-section Chi-square and Hausman tests supported fixed effects in their respective comparisons. For the primary regression analysis, the pooled specification was provisionally retained based on the cross-section F-test and LM test. Fixed effects estimates were also reported as a sensitivity analysis to evaluate the stability of the principal findings under an alternative panel specification.

Diagnostic Tests

Diagnostic testing was conducted to evaluate multicollinearity and heteroskedasticity in the regression model. Multicollinearity was assessed using the Variance Inflation Factor (VIF), while heteroskedasticity was evaluated using a residual variance test.

Table 4. Diagnostic Test Results

Diagnostic Test	Result	Decision
Multicollinearity	All VIF values below 5	No indication of severe multicollinearity
Heteroskedasticity	p-value = 0.150	Null hypothesis of homoskedasticity not rejected

Multicollinearity testing was performed to determine whether the independent variables exhibited excessively strong linear relationships. The VIF was employed as the diagnostic measure, with a threshold of 5 adopted to identify potentially problematic multicollinearity. The results in Table 4 indicate that all fourteen independent variables have VIF values below 5. This finding suggests that severe multicollinearity is not evident in the estimated model based on the adopted diagnostic criterion. Accordingly, all independent variables were retained in the regression analysis.

Panel Regression Results

The primary regression analysis was conducted using the pooled panel least squares specification. Fourteen independent variables were included to examine the associations between fraud hexagon indicators, intellectual capital-related characteristics, IT, and FFR.

Table 5. Multiple Regression Analysis

Variables	Estimated Coefficients	Std Error	t-statistic	Prob
FST	4.025	0.135	29.640	0.000**
DTA	18.440	3.240	5.691	0.000**
PFN	-0.001	0.782	-0.001	0.998
ROA	24.302	9.912	2.451	0.014**
NOI	-0.007	0.042	-0.166	0.868
IM	-1.116	2.029	-0.564	0.572
OS	0.234	2.713	0.086	0.931
RT	-1.514	2.424	-0.624	0.532
CAP	-0.591	1.525	-0.387	0.698
ARG	-0.314	0.309	-1.013	0.313
COL	-3.698	3.846	-0.961	0.336
FK	0.176	0.450	0.391	0.695
EDU	1.143	1.727	0.661	0.508
IT	1.345	6.186	0.217	0.827
R-squared	69.5%			
Adjusted R-squared	68.5%			
F-test	70.34			0.000

Note: Observation = 447, * Significant at 5% level, ** significant at 1% level

Regression model:

$$FFR = \beta_0 + 4.025FST_t + 18.440DTA_t - 0.001PFN_t + 24.302ROA_t - 0.007NOI_t - 1.116IM_t + 0.234OS_t - 1.514RT_t - 0.591CAP_t - 0.314ARG_t - 3.698COL_t + 0.176FK_t + 1.143EDU_t + 1.345IT_t + \varepsilon_t \dots\dots\dots (3)$$

The multiple regression analysis results are presented in Table 5. This study shows that the independent variables can explain the dependent variable by 68.5%, whereas other variables outside this research can explain 31.5%. Financial stability, debt-to-total assets, and return on assets have a positive significant effect on FFR. The findings indicate that pressure plays a vital role in FFR. The results also show that the significant pressure indicators are financial stability, external pressure, and financial targets.

Personal financial needs, measured by managerial share ownership, do not significantly affect FFR because all of the companies in this sample have an average of 13.7% managerial ownership. This indicates that the level of managerial ownership in the organizations sampled is minimal, preventing managers from playing a significant role in engaging in fraudulent activities.

Aside from pressure, factors within the fraud hexagon do not exert a notable impact on FFR. Further research is required to quantify each of these dimensions. The probability of financial knowledge is 0.695 (>0.05), meaning personal financial knowledge doesn't significantly affect FFR. Based on the data, 77 companies out of 149 companies in this sample provide training, and none of the others do. The frequency of the training from 77 companies is below five times a year. This indicates that more organizational knowledge should be offered in financial training. In this research, IT is a dummy variable

that only determines if the organization has utilized the technology. The role of IT must be focused on IT Control with COSO to minimize fraud (Dharmesti, 2019).

DISCUSSION

Key Findings Analysis

Financial Pressure and FFR (H1-H4)

The findings indicate that financial stability ($\beta = 4.025$, $p < 0.001$), external pressure ($\beta = 18.440$, $p < 0.001$), and financial targets ($\beta = 24.303$, $p = 0.0146$) are positively and significantly associated with FFR. These results support H1, H2, and H4, suggesting that financial pressure-related indicators are the most consistent correlates of potential earnings manipulation among Indonesian manufacturing companies.

These findings are broadly consistent with previous studies emphasizing the relevance of financial pressure in FFR, including Ghaisani & Supatmi (2023), Lastanti et al. (2022), and Sagala & Siagian (2023). However, they differ partly from Achmad et al. (2022), who identified external pressure as significant but found no significant relationships for financial stability and financial targets among Indonesian banking companies. These differences may reflect variations in industry characteristics, observation periods, and measurement approaches.

From the perspective of agency theory, financial pressure may be associated with conflicts of interest between managers and shareholders, particularly when financial performance influences external evaluations. Similarly, the fraud hexagon framework identifies pressure as a condition potentially associated with fraudulent behavior. Nevertheless, the findings establish statistical associations rather than demonstrating that financial pressure directly causes manipulation.

In contrast, personal financial needs ($\beta = -0.002$, $p = 0.9984$) are not significantly associated with FFR, indicating that H3 is not supported. Managerial ownership, when used as a proxy for personal financial needs, may capture both managerial incentives and the alignment of interests with shareholders. However, these mechanisms were not directly tested. Overall, the results suggest that the empirical relevance of financial pressure varies across its individual indicators.

Opportunity-Related Indicators and FFR (H5-H7)

Nature of the industry (H5), ineffective monitoring (H6), and organizational structure (H7) do not demonstrate statistically significant relationships with FFR. These findings suggest that the selected opportunity-related indicators do not provide sufficient explanatory evidence of potential earnings manipulation in the sampled companies.

The insignificant finding for ineffective monitoring is consistent with Achmad et al. (2022), who also reported no significant relationship between this indicator and FFR. Although agency theory emphasizes the importance of monitoring mechanisms in reducing information asymmetry, observable governance characteristics may not fully capture the effectiveness of actual oversight.

Similarly, accounting estimates and organizational changes may arise from legitimate operational or governance activities rather than fraudulent intentions. Consequently, the insignificant results do not imply that monitoring and organizational controls are unimportant. Instead, they suggest that the selected proxies may not adequately represent the underlying opportunities for fraudulent conduct. Further research incorporating direct measures of internal control effectiveness and governance practices may provide additional insights.

Rationalization, Capability, Arrogance, and Collusion (H8-H11)

Rationalization (H8), capability (H9), arrogance (H10), and collusion (H11) are not statistically significant in the primary pooled regression model. These results indicate that the selected indicators do not exhibit significant associations with FFR, despite their theoretical relevance within the fraud hexagon framework.

The findings for rationalization and collusion are consistent with [Achmad et al. \(2022\)](#), who reported insignificant relationships for auditor switching and collusion. However, the insignificant arrogance result differs from their finding of a significant relationship. Previous research, including [Tarjo et al. \(2021\)](#), has discussed observable executive characteristics and organizational relationships as potential indicators of arrogance and collusion. Nevertheless, these proxies may not directly capture psychological attitudes or concealed fraudulent coordination.

An important distinction emerges for capability. Although its coefficient is insignificant under the pooled model ($\beta = -0.592$, $p = 0.6983$), the fixed effects specification produces a significant negative association ($\beta = -7.608$, $p = 0.0264$). This difference indicates that the capability result is sensitive to model specification and does not support the hypothesized positive relationship.

Overall, these findings suggest that behavioral dimensions of the fraud hexagon may be difficult to measure using publicly available corporate information. However, the study does not establish that these dimensions are irrelevant to fraudulent behavior.

Intellectual Capital and FFR (H12-H13)

Financial knowledge (H12) and educational background (H13) are not significantly associated with FFR, with p-values of 0.6954 and 0.5084, respectively. These findings suggest that the selected intellectual capital-related characteristics do not demonstrate statistically significant relationships with potential earnings manipulation.

Previous research has emphasized the relevance of financial knowledge for financial decision-making and organizational performance ([Andriani & Arsjah, 2022](#)). However, knowledge and educational qualifications do not necessarily reflect ethical judgment, professional integrity, or the effectiveness of financial reporting controls. Thus, evidence that financial knowledge is beneficial for decision-making does not necessarily imply a direct relationship with FFR.

The findings contribute to the literature by indicating that incorporating these intellectual capital-related indicators does not yield significant additional associations with FFR in the present model. Future research could examine more specific characteristics, including accounting expertise, professional certifications, ethical competence, and organizational knowledge management.

IT and FFR (H14)

IT (H14) does not demonstrate a statistically significant relationship with FFR ($\beta = 1.346$, $p = 0.8279$). This result suggests that the selected technology indicator is not significantly associated with potential earnings manipulation in the sampled manufacturing companies.

Previous studies have highlighted the relevance of IT for organizational efficiency and accounting processes ([Widianingsih et al., 2018](#)), while [Zanaria \(2017\)](#) discussed accounting information systems in relation to fraud prevention. [Novianti and Firmanto](#)

(2022) also recognized that technological capabilities may create both organizational benefits and opportunities for misuse.

The present finding does not necessarily contradict these studies because technology adoption, operational efficiency, and FFR represent different constructs. One possible explanation is that the selected technology indicator does not capture the quality of information systems, automated controls, or monitoring effectiveness. However, this explanation requires further empirical examination.

From an agency theory perspective, IT may support transparency and reduce information asymmetry. Nevertheless, the present results do not establish whether these mechanisms operate within the sampled companies. Therefore, the insignificant relationship should not be interpreted as evidence that IT is ineffective in preventing fraud.

Theoretical and Practical Implications

The findings provide partial empirical support for the fraud hexagon framework by demonstrating that financial pressure-related indicators are consistently associated with FFR, whereas most other dimensions are not statistically significant. This suggests that the empirical relevance of fraud hexagon components varies according to their operational measures and research contexts.

From an agency theory perspective, the findings are compatible with the importance of managerial incentives and information asymmetry in financial reporting. However, the study does not directly observe managerial intentions or establish causal mechanisms.

The inclusion of intellectual capital-related characteristics and IT extends the empirical analysis beyond conventional fraud hexagon indicators. Their insignificant results highlight the need for more precise measures of organizational knowledge and technological capabilities when examining financial reporting integrity.

Practically, the findings suggest that financial stability, leverage, and profitability indicators may be useful considerations in corporate fraud risk assessments. Boards of directors, audit committees, and auditors may incorporate these indicators into their monitoring procedures while recognizing that the Beneish M-Score identifies potential manipulation rather than confirmed fraud.

CONCLUSION

This study examined the relationships between fraud hexagon dimensions, intellectual capital-related characteristics, IT, and FFR among 149 manufacturing companies listed on the IDX during 2020–2022, comprising 447 firm-year observations. The findings indicate that financial stability, external pressure, and financial targets have positive and statistically significant associations with FFR, as measured by the Beneish M-Score. These relationships remain significant under both pooled and fixed effects specifications. In contrast, personal financial needs, opportunity-related indicators, rationalization, capability, arrogance, collusion, financial knowledge, educational background, and IT do not demonstrate statistically significant associations under the primary pooled model. However, capability exhibits a significant negative association under the fixed effects specification, indicating sensitivity to model selection.

This study contributes to the FFR literature by integrating fraud hexagon dimensions, intellectual capital-related characteristics, and IT within a single empirical framework. The findings provide partial support for the fraud hexagon perspective, particularly the

relevance of financial pressure-related indicators. The insignificant relationships for most other variables suggest that the empirical relevance of these theoretical dimensions may depend on their operational measurements and research contexts. The results also provide additional evidence for evaluating agency theory in relation to financial reporting risks, without establishing causal mechanisms.

The findings suggest that financial stability, leverage, and profitability indicators may be useful considerations in financial reporting risk assessments. Corporate management, audit committees, and auditors may incorporate these indicators into their monitoring and evaluation procedures. Nevertheless, these financial characteristics should not be interpreted as direct evidence of fraud, as the Beneish M-Score identifies potential earnings manipulation rather than confirmed fraudulent activities.

LIMITATION

This study is limited to Indonesian manufacturing companies during a three-year period and relies on secondary data and observable proxies that may not fully capture behavioral and organizational characteristics. The presence of extreme observations and differences across panel specifications also warrant cautious interpretation. Future research could examine longer observation periods, additional industries, alternative measures of financial reporting irregularities, and more direct indicators of managerial incentives, intellectual capital, and IT capabilities. Further robustness testing would also help strengthen the reliability of the findings.

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DECLARATION OF CONFLICTING INTERESTS

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