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Research paper

The Role of Internal Audit, Whistleblowing Systems, and Ethical Culture in Fraud Prevention: Evidence from Indonesian Shipping Companies

Ahmad Mughis *, Lindrianasari

Department of Accounting, School of Accounting, Bina Nusantara University, Jakarta, Indonesia
**Corresponding author E-mail: ahmad.mughis@binus.ac.id*

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Abstract

Fraud remains a persistent challenge in the shipping industry due to complex operations, geographically dispersed activities, and high-value transactions. While internal audit, whistleblowing systems, and ethical culture are widely recognised as key fraud prevention mechanisms, empirical evidence examining their combined effectiveness within the shipping industry, particularly in emerging economies, remains limited. This study investigates the influence of internal audit quality, whistleblowing systems, and organizational ethical culture on fraud prevention in Indonesian shipping companies. Using a survey-based research design, data were collected from 306 employees across multiple shipping companies and analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM). The results indicate that internal audit quality has a significant but relatively weak effect on fraud prevention, whereas whistleblowing systems and ethical culture exert significant and moderate effects. Notably, ethical culture emerges as the strongest predictor of fraud prevention, suggesting that informal control mechanisms may play a more decisive role than formal controls in complex operational environments. This study contributes to the fraud and governance literature by integrating internal audit, whistleblowing systems, and ethical culture into a single empirical model within the under-researched context of the shipping industry. The findings offer practical insights for shipping companies by highlighting the need to align formal assurance mechanisms with a strong ethical culture to enhance fraud prevention effectiveness.

Keywords: *Ethical Culture; Fraud Prevention; Internal Audit; Shipping Companies; Whistleblowing Systems.*

1. Introduction

The shipping industry plays a critical role in supporting global and national economies, accounting for more than 90 per cent of international trade by volume. Its operational characteristics such as geographically dispersed activities, cross-jurisdictional regulations, and high-value assets create complex governance challenges that increase exposure to fraud risks. In emerging economies, including Indonesia, these challenges are further amplified by heterogeneous organizational practices and uneven enforcement of internal controls.

Fraud in the shipping industry frequently arises in operational and administrative activities, including fuel procurement, vessel maintenance, cargo handling, and vendor management. The dispersed nature of maritime operations limits direct oversight from headquarters, creating opportunities for asset misappropriation, collusion with external parties, and documentation manipulation. Recent reports indicate that fraud-related losses in the transportation and logistics sectors remain substantial, highlighting the urgent need for effective fraud prevention mechanisms.

Internal audit, whistleblowing systems, and ethical culture are widely recognised as key components of organizational fraud prevention frameworks. Internal audit functions provide independent assurance by evaluating internal controls, risk management, and governance processes, thereby reducing opportunities for fraudulent behaviour. Whistleblowing systems serve as early detection mechanisms by enabling employees to report misconduct, while ethical culture influences individual behaviour by shaping shared norms and values that discourage unethical actions.

Despite extensive research examining these mechanisms individually, empirical evidence on their combined effectiveness remains fragmented. Prior studies have predominantly focused on manufacturing, financial institutions, or public sector organizations, with limited attention given to asset-intensive and operationally complex industries such as shipping. Moreover, existing studies often assume that formal control mechanisms, such as internal audit, play a dominant role in fraud prevention, while overlooking the relative influence of informal controls, including ethical culture, particularly in emerging market contexts.

Indonesia's shipping industry provides a relevant empirical setting to address this gap. As an archipelagic nation with extensive maritime activities, Indonesia faces unique governance challenges that require integrated fraud prevention strategies. However, empirical studies investigating how internal audit quality, whistleblowing systems, and ethical culture jointly influence fraud prevention in this sector remain scarce.

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The Indonesian context is particularly relevant for examining fraud prevention mechanisms. As a rapidly developing economy, Indonesia continues to strengthen regulatory frameworks related to corporate governance, auditing standards, and anti-corruption initiatives. However, variations in enforcement effectiveness and governance practices across industries remain a challenge. The maritime sector, which involves complex logistics operations, high-value assets, and multiple stakeholders, may be particularly vulnerable to fraud risks. Additionally, cultural characteristics such as relatively high power distance and collectivist organizational norms may influence whistleblowing behavior and ethical decision-making within firms.

Accordingly, this study aims to examine the influence of internal audit quality, whistleblowing systems, and organizational ethical culture on fraud prevention in Indonesian shipping companies using a survey-based approach and Partial Least Squares Structural Equation Modelling (PLS-SEM). By integrating these three mechanisms into a single empirical model, this study contributes to the fraud and governance literature by highlighting the relative importance of formal and informal control mechanisms within an under-researched industry context. From a practical perspective, the findings offer insights for shipping companies seeking to strengthen fraud prevention by aligning assurance functions with ethical and reporting mechanisms.

This study contributes to the fraud prevention literature in several important ways. First, it integrates formal governance mechanisms (internal audit and whistleblowing systems) with informal governance mechanisms (organizational ethical culture) within a single empirical framework. While prior studies frequently examine these mechanisms separately, this research provides a more comprehensive understanding of how multiple governance instruments jointly influence fraud prevention.

Second, the findings extend the application of agency theory, fraud triangle theory, and deterrence theory by demonstrating that ethical culture can play a dominant role in shaping employee behavior and reducing fraud risk. This suggests that informal cultural controls may complement and reinforce formal monitoring mechanisms in organizational governance.

Third, by focusing on the Indonesian shipping industry, this study provides empirical evidence from an underexplored sector characterized by high operational complexity, dispersed activities, and significant financial transactions, thereby enriching fraud prevention research within emerging economy contexts.

2. Literature Review and Hypotheses

2.1. The effect of internal audit on fraud prevention

Internal audit functions as one of the core internal control mechanisms designed to ensure compliance with organizational policies, support effective risk management, and enhance the accountability of business processes. According to Agency Theory (Jensen & Meckling, 1976), internal audit acts as a monitoring mechanism bridging the interests of management (agents) and owners or stakeholders (principals) to minimise information asymmetry that may lead to fraudulent behaviour. Through systematic supervision of managerial activities, internal audit helps reduce the opportunity for misuse of authority and strengthens organizational transparency.

Furthermore, the Fraud Triangle Theory proposed by Cressey (1953) explains that fraud occurs due to three factors: pressure, opportunity, and rationalisation. An effective internal audit function minimises the "opportunity" element by strengthening internal control systems and establishing early detection mechanisms, thus reducing the likelihood of fraud.

Empirical studies support this theoretical foundation. Lenz and Hahn (2015) found that the effectiveness of internal audit is positively associated with an organization's ability to detect and prevent fraud. Similarly, Cohen, Krishnamoorthy, and Wright (2007) demonstrated that high audit quality enhances monitoring effectiveness and reduces fraud incidents. Albrecht et al. (2018) further emphasised that risk-based audit approaches are more effective in identifying fraud-prone areas, enabling proactive preventive actions.

Within the transportation and shipping sector, Kurniawan, Hartono, and Prasetyo (2022) revealed that structured, risk-based internal audit activities increase compliance with operational procedures, particularly in asset and cargo management. This finding reinforces the notion that internal audit plays a critical role in mitigating fraud risk in industries characterised by operational complexity and geographical dispersion.

In addition, the Association of Certified Fraud Examiners (ACFE, 2024) reported that although internal audit may not be the most dominant method for detecting fraud compared with whistleblowing systems, it remains a vital layer of control that fortifies an organization's internal defence system. Therefore, the higher the quality and effectiveness of internal audit, the stronger the organization's capacity to prevent fraudulent acts.

H1: Internal audit has a positive effect on fraud prevention in the Indonesian shipping industry.

2.2. The effect of whistleblowing system effectiveness on fraud prevention

A whistleblowing system (WBS) is a formal reporting mechanism that enables individuals within an organization to disclose suspected fraud, misconduct, or violations either anonymously or openly without fear of retaliation. From the perspective of Agency Theory (Jensen & Meckling, 1976), whistleblowing serves as an additional monitoring mechanism that strengthens the role of owners and stakeholders in overseeing managerial behaviour. An effective reporting channel reduces information asymmetry, as employees act as supplementary internal monitors.

The Fraud Triangle Theory (Cressey, 1953) posits that "opportunity" is one of the key factors that drive fraudulent behaviour. An effective whistleblowing system can mitigate this opportunity by creating a perception that unethical actions are more likely to be detected, thus deterring potential offenders. Complementing this, Becker's (1968) Deterrence Theory suggests that individuals' intention to commit fraud decreases when they perceive a higher probability of detection and punishment.

Empirical evidence supports these theoretical arguments. Near and Miceli (1995) identified whistleblowing as one of the most effective mechanisms for uncovering organizational misconduct. Similarly, Park and Blenkinsopp (2009) emphasised that the effectiveness of a whistleblowing system depends largely on employees' trust and the presence of protection mechanisms for reporters. Dyck, Morse, and Zingales (2010) found that whistleblowing is often more effective than internal or external audit mechanisms in exposing corporate fraud cases.

According to the Association of Certified Fraud Examiners (ACFE, 2024), approximately 43 per cent of fraud cases are initially detected through whistleblowing reports surpassing internal audit (14 per cent) and management review (12 per cent) as detection channels. This finding demonstrates that a credible WBS functions not only as a detection mechanism but also as a preventive measure by fostering an organizational culture intolerant of fraudulent conduct.

In the shipping industry, which involves high transaction values, complex logistics, and potential misuse of assets, the implementation of an effective whistleblowing system is crucial. Kurniawan, Hartono, and Prasetyo (2022) found that a trusted internal reporting mechanism improves operational compliance and reinforces employee integrity. Therefore, an effective whistleblowing system substantially contributes to reducing the likelihood of fraud in maritime companies.
H2: The whistleblowing system has a positive effect on fraud prevention in the Indonesian shipping industry.

2.3. The effect of organizational ethical culture on fraud prevention

Organizational ethical culture reflects the shared values, norms, and beliefs that guide employees' behaviour in their daily business activities (Treviño, Butterfield, & McCabe, 1998). A strong ethical culture fosters collective perceptions of what is considered right or wrong within the organization, thereby influencing ethical decision-making (Victor & Cullen, 1988). Within the framework of the Fraud Triangle Theory (Cressey, 1953), ethical culture plays a vital role in reducing the rationalisation element that perpetrators often use to justify fraudulent acts. Thus, organizational ethical culture acts as an informal control mechanism that complements formal fraud prevention systems.
Empirical studies support this argument. A strong ethical culture enhances compliance and reduces opportunistic behaviour among employees (Treviño et al., 1998). Ethical culture also strengthens the effectiveness of internal controls and encourages employees to use whistleblowing mechanisms to report unethical conduct (Kaptein, 2008; Kaptein, 2011). Research within Indonesia's transportation sector further shows that ethical culture promotes operational compliance and reduces the risk of misconduct (Kurniawan, Santoso, & Pratama, 2022).
Global evidence also highlights its importance. Organizations with weak ethical tone at the top tend to experience higher levels of fraud, particularly in asset misappropriation and procurement-related corruption (Association of Certified Fraud Examiners [ACFE], 2024). Conversely, organizations that consistently uphold ethical values report lower fraud losses and greater employee integrity.
In the maritime industry, where operational activities are complex and geographically dispersed, a strong ethical culture not only limits rationalisation but also reinforces formal mechanisms such as internal audit and whistleblowing systems. Therefore, cultivating an ethical culture significantly contributes to preventing fraud in Indonesian shipping companies.
H3: Organizational ethical culture has a positive effect on fraud prevention in the Indonesian shipping industry.

3. Methodology

This study adopts a quantitative research design with a cross-sectional approach aimed at examining the influence of internal audit, whistleblowing systems, and organizational ethical culture on fraud prevention within the Indonesian shipping industry. The quantitative design was selected to enable statistical testing of relationships between variables and to ensure objectivity and generalisability of findings (Ghozali, 2018).
Data were collected from employees of shipping companies across Indonesia who are directly involved in governance, compliance, operations, finance, logistics, and internal audit functions. A purposive sampling technique was employed to ensure that respondents possessed adequate knowledge and experience regarding internal control mechanisms and fraud prevention practices (Hair et al., 2021).
The study utilised primary data, obtained through an online questionnaire distributed via Google Forms between 19 October 2025 and 5 November 2025. The instrument was structured using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), developed from validated constructs adapted from prior research and theoretical foundations. The questionnaire comprised four main sections:

- Section A: Internal Audit
- Section B: Whistleblowing System
- Section C: Organizational Ethical Culture
- Section D: Fraud Prevention

Measurement items were adapted from established studies such as Albrecht et al. (2018), Kaptein (2008), and the Association of Certified Fraud Examiners (ACFE, 2024). In total, 29 indicators were used to represent the four latent constructs. Following the rule of thumb proposed by Hair et al. (2021), which recommends between 5 and 10 respondents per indicator, the minimum sample size required ranged from 145 to 290 participants to ensure model robustness and statistical power.
Univariate analysis of demographic characteristics was conducted using frequency distributions to describe respondent profiles. Hypothesis testing and structural modelling were performed using Partial Least Squares–Structural Equation Modelling (PLS-SEM) implemented in SmartPLS version 4.0 (Ringle, Wende, & Becker, 2023). This method was chosen because it is suitable for complex models with multiple latent variables, does not require multivariate normality, and is effective for predictive analysis in social science research (Hair et al., 2021; Chin, 1998).
The evaluation of the PLS-SEM model consisted of three stages:

1) Outer Model Evaluation – assessing the relationships between latent variables and their indicators through reliability and validity testing, including convergent validity, composite reliability, and discriminant validity (Fornell & Larcker, 1981).
2) Inner Model Evaluation – analysing structural relationships among variables using several statistical measures such as the Path Coefficient Test, R^2 (coefficient of determination), t-statistics via bootstrapping, f^2 (effect size), Q^2 (predictive relevance), and multicollinearity testing via inner VIF values (Chin, 1998; Henseler, Hubona, & Ray, 2016).
3) Overall Model Fit Evaluation – assessing global model quality using the Standardised Root Mean Square Residual (SRMR) and PLS Predict metrics to ensure that the estimated model adequately fits the empirical data (Henseler et al., 2016).

This methodological approach provides a comprehensive analytical framework for testing the theoretical relationships proposed in this study while ensuring measurement validity and predictive accuracy.

3.1. Common method bias assessment

Because all constructs in this study were measured using self-reported survey data, the potential for common method bias (CMB) was considered. Several procedural and statistical remedies were implemented to mitigate this issue. First, respondents were assured of anonymity to reduce evaluation apprehension and social desirability bias. Second, questionnaire items were designed using clear and neutral wording to minimize response bias. Third, Harman's single-factor test was conducted to assess whether a single factor accounted for the

majority of the variance. The results indicated that no single factor dominated the variance, suggesting that common method bias is unlikely to significantly influence the results.

4. Results

4.1. Demographic data results

The demographic characteristics of respondents in this study include gender, age, educational attainment, length of service in the shipping industry, department or division, job position, and type of shipping company. Respondents were employees from various maritime organizations across Indonesia who were directly involved in governance, compliance, finance, operations, logistics, or internal audit functions. A total of 306 valid responses were collected and included in the final analysis. During the data screening process, 11 responses were excluded because the respondents had less than one year of work experience in the shipping industry, which did not meet the inclusion criteria for this study. After data cleaning, the final sample size of 306 met the minimum threshold for PLS-SEM analysis, satisfying the statistical power requirement and ensuring adequate representation of the target population (Hair et al., 2021; Henseler, Hubona, & Ray, 2016).

Table 1 presents the demographic distribution of the respondents, which reflects a diverse composition of employees from multiple shipping sectors. This diversity strengthens the external validity of the study by ensuring that perspectives are captured from different organizational levels and operational divisions.

Table 1: Characteristics of 306 Valid Respondents from Shipping Companies (N = 306)

Characteristic	Frequency (n)	Percentage (%)
Gender:		
Male	221	72.2%
Female	85	27.8%
Age:		
< 25 years	55	18.0%
25-34 years	124	40.5%
35-44 years	73	23.9%
45-54 years	48	15.7%
≥ 55 years	6	2.0%
Education:		
High School / Vocational School	12	3.9%
Diploma (Associate Degree)	21	6.9%
Bachelor's Degree	168	54.9%
Master's Degree	33	10.8%
Doctorate Degree (Ph.D.)	0	0.0%
Others	72	23.5%
Years of Experience:		
1-5 years	133	43.5%
6-10 years	78	25.5%
> 10 years	95	31.0%
Division/Department:		
Internal Audit	82	26.8%
Risk Management	12	3.9%
Investigation Audit	18	5.9%
Finance & Accounting	13	4.2%
Commercial	11	3.6%
Operation	24	7.8%
Crewing	114	37.3%
Procurement & Logistic	9	2.9%
HSE/HSSE	3	1.0%
Others	20	6.5%
Position/Job Title:		
Staff	100	32.7%
Supervisor/AssistantManager/Section Head	60	19.6%
Manager / Department Head	27	8.8%
General Manager / Division Head	19	6.2%
Director	6	2.0%
Others	94	30.7%
Type of Shipping Company:		
State-Owned Enterprise (SOE)	68	22.2%
Private National Company	234	76.5%
Multinational / Joint Venture Company	4	1.3%

Table 1 presents the demographic characteristics of the respondents in this study. The majority of respondents are male (n = 221; 72.2%), while female respondents account for 85 individuals (27.8%). Most respondents fall within the 25–34 age range (n = 124; 40.5%), followed by those aged 35–44 years (n = 73; 23.9%). Regarding work experience in the shipping industry, 133 respondents (43.5%) reported having 1–5 years of experience.

In terms of educational background, most respondents hold a Bachelor's degree (n = 168; 54.9%), followed by a Master's degree (n = 33; 10.8%) and professional maritime certifications such as ATT-I/II/III and ANT-I/II/III (n = 72; 23.5%). The respondents were distributed across multiple departments, with the highest representation in the Crewing Department (n = 114; 37.3%) and Internal Audit Department (n = 82; 26.8%), followed by Operations (n = 24; 7.8%), Investigation Audit (n = 18; 5.9%), and other departments including Fleet Management, Technical, and Fuel Monitoring (n = 20; 6.5%).

Regarding job positions, most respondents work as Staff (n = 100; 32.7%), followed by Supervisors/Assistant Managers/Section Heads (n = 60; 19.6%), and 94 respondents (30.7%) occupy other operational roles, including ship crew positions such as Master, Chief Engineer,

and Chief Officer. Based on company type, the majority are employed by Private National Shipping Companies (n = 234; 76.5%), followed by State-Owned Enterprises (n = 68; 22.2%) and Multinational or Joint Venture Companies (n = 4; 1.3%).
Overall, the demographic data indicate a diverse composition of employees across gender, age, education, tenure, department, and job positions, reflecting the organizational and operational structure of Indonesia's shipping industry.

4.2. PLS-SEM analysis results

To improve clarity and readability, the results are presented concisely by focusing on the key statistical indicators relevant to the evaluation of the measurement and structural models.
The factors influencing the effectiveness of internal auditors, the implementation of the whistleblowing system, and the development of an ethical organizational culture in fraud prevention were identified through Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis. This method allows for the simultaneous examination of complex relationships among latent variables and provides robust estimates in cases of small to medium sample sizes or non-normal data distributions (Hair et al., 2021; Henseler et al., 2015).

4.3. Outer model evaluation

The outer model was structured in accordance with the conceptual framework, where each construct is linked to its respective sub-variables. Convergent validity was assessed by examining the correlation between each indicator score and its construct, represented by the loading factor value. Indicators with a loading factor greater than 0.70 are considered valid, while significance is determined by a p-value less than 0.05 (Hair et al., 2021).
Additionally, convergent validity was evaluated using the Average Variance Extracted (AVE), with a minimum threshold of 0.50, indicating that the construct explains at least 50% of the variance of its indicators (Fornell & Larcker, 1981). The outer model analysis was conducted iteratively, removing invalid indicators sequentially, starting from those with the lowest outer loading values, until the final valid outer model was achieved, as illustrated in Figure 1.

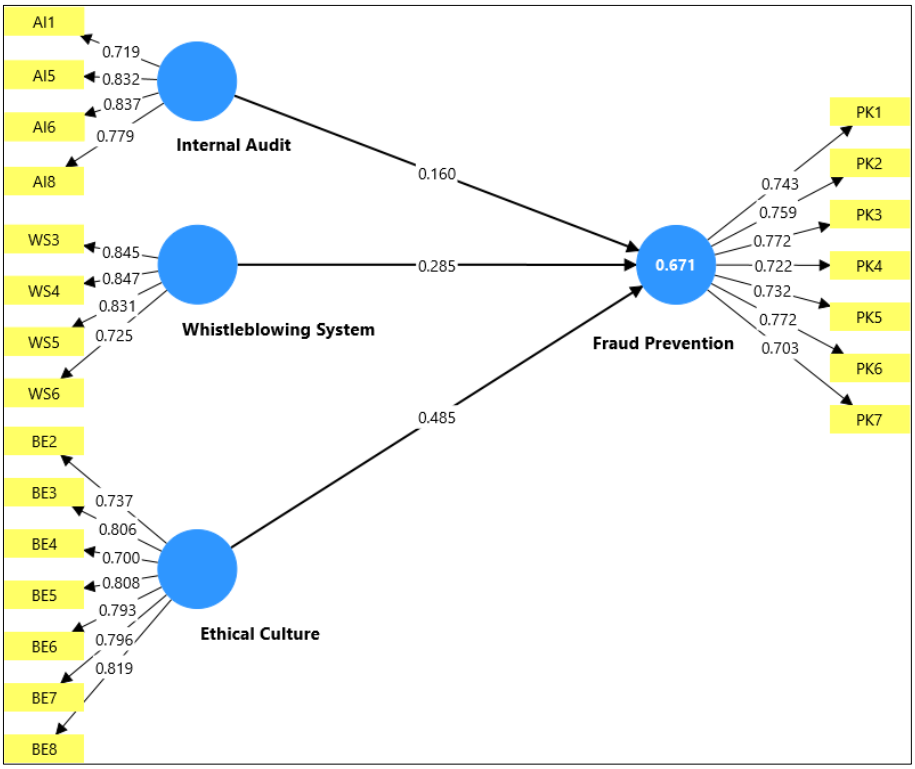


Fig. 1: Outer Model PLS-SEM.

Based on the analysis presented in Figure 1, Table 2 provides an overview of the validity of the latent variable indicators, as assessed by the loading factor values obtained from the first estimation of the PLS-SEM outer model. The table summarizes the measurement results for all indicators, allowing evaluation of their individual contribution to the corresponding constructs (Hair et al., 2021; Henseler et al., 2015).

Table 2: Results of Outer Loading Factor Measurement of Latent Variables in the PLS-SEM Outer Model (n = 306)

Latent Variable	Indicator Variable	Loading Factor	Conclusion
Internal Audit (X1)	AI1	0.719	Valid
	AI5	0.832	Valid
	AI6	0.837	Valid
	AI8	0.779	Valid
Whistleblowing System (X2)	WS3	0.845	Valid
	WS4	0.847	Valid
	WS5	0.831	Valid
	WS6	0.725	Valid
Ethical Culture (X3)	BE2	0.737	Valid
	BE3	0.806	Valid
	BE4	0.700	Valid

Latent Variable	Indicator Variable	Loading Factor	Conclusion
	BE5	0.808	Valid
	BE6	0.793	Valid
	BE7	0.796	Valid
	BE8	0.819	Valid
Fraud Prevention (Y)	PK1	0.743	Valid
	PK2	0.759	Valid
	PK3	0.772	Valid
	PK4	0.722	Valid
	PK5	0.732	Valid
	PK6	0.772	Valid
	PK7	0.703	Valid

Based on the results presented in Table 2, all research indicator variables were found to be valid, as evidenced by outer loading factor values exceeding the threshold of 0.70. The Internal Audit construct (X1) is measured using four valid indicators, with outer loading values ranging from 0.719 to 0.779. The Whistleblowing System construct (X2) is represented by four valid indicators, with outer loading values between 0.725 and 0.847. The Ethical Culture construct (X3) consists of seven valid indicators, with outer loading values ranging from 0.737 to 0.819. The Fraud Prevention construct (Y) is measured by six valid indicators, all demonstrating acceptable outer loading values. Table 2 confirms that all indicator variables are valid and adequately represent their respective constructs. Table 3 further presents the detailed results of the outer loading analysis, demonstrating that all indicators effectively reflect the measurement of each research variable (Hair et al., 2021; Henseler et al., 2015; Sarstedt et al., 2017).

Table 3: Analysis of Indicator Variables in the PLS-SEM Outer Model (n = 306).

Latent Variable	Indicator Variable		Mean	Standard Deviation
Internal Audit (X1)	AI1	The internal auditor is free from management intervention in performing duties.	4.183	0.657
	AI5	Internal audits cover all critical areas within the organization.	4.507	0.623
	AI6	Internal audits ensure compliance with company regulations and standard operating procedures (SOPs).	4.510	0.562
	AI8	Internal audit recommendations are followed up by management.	4.258	0.618
	Average		4.365	0.615
Whistleblowing System (X2)	WS3	The confidentiality of the whistleblower's identity is guaranteed.	4.212	0.541
	WS4	The company provides protection to whistleblowers against threats or retaliation.	4.098	0.528
	WS5	Whistleblowing reports are processed in accordance with established procedures.	4.114	0.496
	WS6	The results of whistleblowing investigations are communicated to relevant parties.	4.160	0.503
	Average		4.146	0.517
Ethical Culture (X3)	BE2	Integrity values are used as the foundation in decision-making.	3.752	0.727
	BE3	Management consistently upholds ethical principles.	3.725	0.685
	BE4	Ethical considerations are always part of business decisions.	3.569	0.680
	BE5	Company leaders set an example of ethical behavior in the workplace.	4.039	0.605
	BE6	Leaders take firm action against ethical violations committed by subordinates.	3.980	0.627
	BE7	The he company implements a fair reward and punishment system.	3.732	0.720
	BE8	Company rules are enforced without favoritism or discrimination.	3.938	0.657
	Average		3.819	0.672
Fraud Prevention (Y)	PK1	The company has a written anti-fraud policy.	4.232	0.629
	PK2	The anti-fraud policy is communicated to all employees.	3.961	0.691
	PK3	The company's standard operating procedures (SOPs) and internal controls operate effectively.	3.739	0.656
	PK4	Segregation of duties is implemented to reduce the risk of fraud.	4.141	0.609
	PK5	The company routinely monitors high-risk activities.	3.788	0.641
	PK6	The company has an investigative audit mechanism to detect fraud.	3.964	0.618
	PK7	The company imposes strict sanctions on individuals involved in fraud.	4.131	0.689
	Average		3.994	0.648

After confirming the validity of all indicator variables, further analysis was conducted to evaluate the Average Variance Extracted (AVE), Composite Reliability (CR), and Cronbach's Alpha values. These measures were used to assess the reliability and convergent validity of the constructs, ensuring that the data adequately represent the underlying latent variables. The results of the reliability and validity tests for each latent variable, performed using SmartPLS software, are presented in Table 4 (Hair et al., 2021; Fornell & Larcker, 1981; Henseler et al., 2015).

Table 4: Results of Convergent Reliability and Validity Tests on the PLS-SEM Outer Model (n = 306).

Variables	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
Internal Audit	0.802	0.809	0.871	0.629
Whistleblowing System	0.828	0.833	0.886	0.662
Ethical Culture	0.894	0.901	0.916	0.610
Fraud Prevention	0.865	0.866	0.896	0.553

The results of the PLS-SEM outer model reliability analysis indicate satisfactory outcomes, with Cronbach's Alpha and Composite Reliability (CR) values exceeding the threshold of 0.70 (Hair et al., 2021; Henseler et al., 2015). These results demonstrate that the measurement of all indicator variables exhibits high internal consistency and is reliable in representing the corresponding constructs. Furthermore, convergent validity is confirmed, as the Average Variance Extracted (AVE) values for all constructs exceed 0.50, indicating that the indicators are strongly correlated with their respective latent variables and adequately capture the underlying constructs (Fornell & Larcker, 1981).
Discriminant validity was subsequently assessed using the Heterotrait-Monotrait Ratio (HTMT) and the Fornell-Larcker criterion. The results of the HTMT analysis for the fourth estimated measurement model are presented in Table 5, confirming that each construct is distinct from the others and that discriminant validity requirements are satisfied.

Table 5: Results of Discriminant Validity Test with HTMT on PLS-SEM Outer Model (n = 306).

Variables	Internal Audit	Ethical Culture	Fraud Prevention	Whistleblowing System
Internal Audit				
Ethical Culture	0.671			
Fraud Prevention	0.699	0.869		
Whistleblowing System	0.630	0.806	0.831	

Table 5 shows that the HTMT values of all constructs in the PLS-SEM outer model are below 0.90, indicating that discriminant validity is satisfied. These results suggest that each construct explains a greater proportion of variance in its own indicators than in the indicators of other constructs, confirming construct distinctiveness (Henseler et al., 2015; Hair et al., 2021).
Furthermore, discriminant validity was also evaluated using the Fornell-Larcker criterion. The results of this analysis for the fourth estimated PLS-SEM measurement model are presented in Table 6, confirming that all constructs exhibit adequate discriminant validity according to the Fornell-Larcker standard (Fornell & Larcker, 1981).

Table 6: Discriminant Validity Test with Fornell-Larcker Criteria on PLS-SEM Outer Model (n = 306).

Variables	Internal Audit	Ethical Culture	Fraud Prevention	Whistleblowing System
Internal Audit	0.793			
Ethical Culture	0.579	0.781		
Fraud Prevention	0.588	0.776	0.744	
Whistleblowing System	0.517	0.697	0.706	0.814

Based on the results presented in Table 6, the square roots of the AVE values for the constructs are as follows: Internal Audit (0.793), Ethical Culture (0.781), and Whistleblowing System (0.814). All of these values exceed their correlations with other constructs, indicating that each variable demonstrates adequate discriminant validity according to the Fornell-Larcker criterion (Fornell & Larcker, 1981; Hair et al., 2021).

4.4. Inner model evaluation

Once the estimated model satisfies the outer model criteria, the next step is to evaluate the inner model. Inner model evaluation involves hypothesis testing to examine the relationships between the research constructs. Structural model assessment includes testing for multicollinearity using the Inner Variance Inflation Factor (VIF), evaluating the significance of path coefficients between constructs, and assessing the effect size (F^2) to determine the substantive impact of each predictor on the endogenous constructs (Hair et al., 2021; Henseler et al., 2015).

4.5. Multicollinearity check with inner VIF value

Multicollinearity among constructs is assessed using the Inner VIF values. A VIF value below 5 indicates the absence of multicollinearity concerns (Hair et al., 2021). The results of the Inner VIF analysis for the PLS-SEM structural model (inner model) are presented in Table 7.

Table 7: Inner VIF Test Results for the PLS-SEM Inner Model (n = 306).

Variables	VIF
Internal Audit -> Fraud Prevention	1.564
Ethical Culture -> Fraud Prevention	2.229
Whistleblowing System -> Fraud Prevention	2.022

Based on the results presented in Table 7, the Inner VIF values for all constructs are below 5, indicating that multicollinearity among the variables is low. These findings suggest that the estimated parameters of the PLS-SEM model are acceptable and unbiased, ensuring the stability and reliability of the model estimates (Hair et al., 2021; Henseler et al., 2015).

4.6. Examination of influence testing between variables (hypothesis testing)

Hypothesis testing was conducted to assess the influence between constructs. A relationship is considered statistically significant if the p-value is less than 0.05. This study employs a two-tailed test, where a t-statistic greater than 1.96 indicates a significant effect between

constructs. The results of the Two-Tailed T-Test for the PLS-SEM inner model are presented in Table 8, showing the significance of the hypothesized relationships among the research variables (Hair et al., 2021; Sarstedt et al., 2017).

Table 8: Hypothesis Test on the Inner Model PLS-SEM (n = 306)

Variables	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Internal Audit (X1) -> Fraud Prevention (Y)	0.160	0.163	0.045	3.581	0.000
Whistleblowing System (X2) -> Fraud Prevention (Y)	0.285	0.288	0.064	4.427	0.000
Ethical Culture (X3) -> Fraud Prevention (Y)	0.485	0.481	0.062	7.832	0.000

Based on the results of the Two-Tailed T-Test presented in Table 8, the following conclusions can be drawn regarding the hypothesized relationships:

1) The first hypothesis (H1) is supported, indicating that Internal Audit (X1) has a significant positive effect on Fraud Prevention (Y), with a path coefficient of 0.160, t-statistic = 3.581 ($t > 1.96$), and p-value = 0.000 ($p < 0.05$).
2) The second hypothesis (H2) is supported, indicating that the Whistleblowing System (X2) has a significant positive effect on Fraud Prevention (Y), with a path coefficient of 0.285, t-statistic = 4.427 ($t > 1.96$), and p-value = 0.000 ($p < 0.05$).
3) The third hypothesis (H3) is supported, indicating that Ethical Culture (X3) has a significant positive effect on Fraud Prevention (Y), with a path coefficient of 0.485, t-statistic = 7.832 ($t > 1.96$), and p-value = 0.000 ($p < 0.05$).

4.7. Effect size (f-square) test check

To assess the substantive impact of each predictor construct at the structural level, the Effect Size (F^2) was calculated. The F^2 value can be interpreted as indicating low ($F^2 = 0.02$), moderate ($F^2 = 0.15$), or high ($F^2 = 0.35$) effects on the endogenous construct (Hair et al., 2022). The results of the F^2 analysis for the PLS-SEM inner model are presented in Table 9, demonstrating the relative contribution of each exogenous variable to the explained variance of Fraud Prevention.

Table 9: F-Square Test on the PLS-SEM Inner Model (n = 306)

Variables	f-square
Internal Audit (X1) -> Fraud Prevention (Y)	0.050
Ethical Culture (X2) -> Fraud Prevention (Y)	0.320
Whistleblowing System (X3) -> Fraud Prevention (Y)	0.122

Based on the F-Square test results presented in Table 9, the following conclusions can be drawn regarding the effect sizes of the predictor constructs on Fraud Prevention (Y) at the structural level:

1) The effect of Internal Audit (X1) on Fraud Prevention (Y) has an Effect Size (F^2) of 0.050, which is classified as a low effect.
2) The effect of the Whistleblowing System (X2) on Fraud Prevention (Y) has an Effect Size (F^2) of 0.122, which is classified as a moderate effect.
3) The effect of Ethical Culture (X3) on Fraud Prevention (Y) has an Effect Size (F^2) of 0.320, which is classified as a moderate effect (Hair et al., 2022).

4.8. Evaluation of goodness and fit of the model

PLS-SEM is a variance-based structural equation modeling approach primarily aimed at prediction and theory testing. To assess the adequacy of the proposed model, several fit measures are employed, including R-Square (R^2), Q-Square predictive relevance (Q^2), Standardized Root Mean Square Residual (SRMR), and PLS Predict (Hair et al., 2021; Hair et al., 2022). These measures collectively indicate the predictive capability and overall goodness of fit of the PLS-SEM model.

4.9. Coeffient of determination (r- square) test

The R-Square (R^2) statistic represents the proportion of variance in the endogenous variable that is explained by the exogenous variables in the model. According to Chin (1998), the qualitative interpretation of R^2 values is as follows: 0.19 indicates low explanatory power, 0.33 indicates moderate explanatory power, and 0.66 indicates high explanatory power. The results of the R^2 test for the PLS-SEM inner model are presented in Table 10.

Table 10: R-Square Test on the PLS-SEM Inner Model (n = 306)

Variables	R-square	R-square adjusted
Fraud Prevention (Y)	0.671	0.668

Table 10 shows that the R-Square (R^2) value of the PLS-SEM inner model is 0.671. This indicates that the combined effect of Internal Audit (X1), Whistleblowing System (X2), and Ethical Culture (X3) on Fraud Prevention (Y) explains 67.1% of the variance, representing a high level of influence according to the qualitative interpretation of R^2 values (Chin, 1998; Hair et al., 2021).

4.10. Predictive relevance test (q-square predict)

The Predictive Relevance (Q^2 Predict) test is used in PLS-SEM to assess the predictive accuracy of the model, indicating how well the changes in exogenous constructs can predict endogenous constructs (Hair et al., 2021; Henseler et al., 2015). A Q^2 Predict value greater than 0 indicates that the model has satisfactory predictive relevance. The results of the Q^2 Predict analysis for the PLS-SEM inner model are presented in Table 11, demonstrating the adequacy of the model in predicting the dependent construct.

Table 11: Q-Square Test on the PLS-SEM Inner Model (n = 306)

Variables	Q^2predict
Fraud Prevention	0.657

Table 11 shows that the Q-Square Predict (Q^2) value for the PLS-SEM inner model is 0.657, which is greater than 0. This indicates that the proposed research model demonstrates high predictive accuracy, and thus, the model's predictive relevance is confirmed (Hair et al., 2021; Henseler et al., 2015).

4.11. Measuring standardized root mean square residual (SRMR)

The Standardized Root Mean Square Residual (SRMR) is used to assess the goodness of fit of the PLS-SEM model by comparing the correlation matrix of the estimated model with the empirical correlation matrix. An SRMR value below 0.08 is considered indicative of an acceptable model fit (Hair et al., 2021). The results of the SRMR analysis for the PLS-SEM inner model are presented in Table 12, confirming that the model meets the recommended goodness-of-fit criteria.

Table 12: SRMR Test for the PLS-SEM Inner Model (n = 306)

	Saturated model	Estimated model
SRMR	0.073	0.073

Table 12 shows that the SRMR value of the PLS-SEM inner model is 0.073, which is below the recommended threshold of 0.08. This indicates that the proposed PLS-SEM model demonstrates an acceptable level of fit, confirming that the model adequately represents the observed data (Hair et al., 2021; Henseler et al., 2015).

4.12. PLS predict

PLS Predict is a relatively recent approach in PLS-SEM designed to assess the predictive performance of the proposed model (Shmueli et al., 2016). This technique evaluates how well the PLS-SEM model can predict outcomes compared to benchmark models, such as the linear regression model (LM). A PLS-SEM model is considered to have high predictive power if the Root Mean Squared Error (RMSE) or Mean Absolute Error (MAE) of the PLS predictions is lower than that of the linear regression model. The results of the PLS Predict analysis for the PLS-SEM inner model are presented in Table 13, demonstrating the model's predictive capability.

Table 13: PLS Predict for the PLS-SEM Inner Model (n = 306)

	Q^2predict	PLS-SEM_RMSE	PLS-SEM_MAE	LM_RMSE	LM_MAE
PK1	0.354	0.506	0.382	0.509	0.381
PK2	0.415	0.529	0.406	0.536	0.407
PK3	0.397	0.510	0.407	0.504	0.399
PK4	0.339	0.495	0.350	0.490	0.342
PK5	0.370	0.509	0.424	0.492	0.401
PK6	0.309	0.515	0.368	0.524	0.373
PK7	0.336	0.562	0.417	0.573	0.426

The evaluation results presented in Table 13 indicate that all indicators of the endogenous construct representing internal audit effectiveness in fraud prevention and detection (Y), namely PK1, PK2, PK3, PK4, PK5, PK6, and PK7, have lower Root Mean Squared Error (RMSE) values in the PLS-SEM model compared to the Linear Regression (LM) model. Furthermore, the majority of these indicators also exhibit lower Mean Absolute Error (MAE) values in the PLS-SEM model relative to the LM model. These findings demonstrate that the proposed PLS-SEM model possesses high predictive power (Shmueli et al., 2016; Hair et al., 2021).

Based on the comprehensive evaluation of the model, the results confirm that the proposed PLS-SEM model is acceptable. It can therefore be concluded that the empirical data adequately capture the relationships among constructs, with both a high level of model fit and strong predictive accuracy, validating the suitability of the model for explaining the influence of Internal Audit, Whistleblowing System, and Ethical Culture on Fraud Prevention.

5. Discussion

The findings of this study provide several theoretical implications for fraud prevention research. The results confirm that formal governance mechanisms, such as internal audit and whistleblowing systems, play an important role in strengthening organizational control and reducing fraud risk. However, the stronger effect of ethical culture suggests that informal governance mechanisms may exert a greater influence on employee behavior. This finding supports the view that fraud prevention strategies should not rely solely on structural monitoring systems but should also incorporate cultural and behavioral dimensions within organizations.

5.1. Internal audit and fraud prevention

The findings reveal that internal audit quality has a statistically significant but relatively weak effect on fraud prevention within Indonesian shipping companies. This result suggests that, although internal audit functions contribute to reducing fraud risk, their influence is limited when operating in isolation. This finding partially supports prior studies that identify internal audit as a key component of fraud prevention frameworks (Lenz & Hahn, 2015; Cohen et al., 2007), while simultaneously challenging the assumption that internal audit serves as the dominant control mechanism in complex operational environments.

The weak structural effect contrasts with respondents' high perceptions of internal audit effectiveness, indicating a gap between perceived audit quality and actual preventive impact. This discrepancy implies that internal audit activities in the shipping industry may be largely compliance-oriented, focusing on procedural adherence rather than proactive fraud risk mitigation. In industries characterised by geographically dispersed operations and extensive involvement of third parties, such as shipping, internal audit effectiveness is likely constrained by limited real-time oversight and dependence on management follow-up. This finding extends previous research by demonstrating that

high audit competence alone does not guarantee strong fraud prevention outcomes without adequate organizational support and integration with other control mechanisms.

5.2. Whistleblowing systems and fraud prevention

The results show that whistleblowing systems exert a significant and moderate influence on fraud prevention, supporting the role of reporting mechanisms as effective tools for reducing fraud risk. Consistent with prior empirical evidence (Near & Miceli, 1995; Dyck et al., 2010), this finding reinforces the argument that employees act as critical internal monitors who can detect misconduct that formal control mechanisms may overlook.

Compared with internal audit, the whistleblowing system demonstrates a stronger structural effect, highlighting its importance in environments where fraud opportunities arise in operational settings that are difficult to audit continuously. This result aligns with deterrence theory, suggesting that the perceived likelihood of detection through reporting channels discourages potential offenders. However, the effect size remains moderate, indicating that the effectiveness of whistleblowing systems depends on organizational trust, confidentiality assurance, and protection against retaliation. Without these supporting conditions, reporting mechanisms may function symbolically rather than substantively, limiting their preventive capacity.

5.3. Ethical culture and fraud prevention

Ethical culture emerges as the strongest predictor of fraud prevention in this study, underscoring the critical role of informal control mechanisms in shaping employee behaviour. This finding supports prior research emphasising that shared ethical values and leadership integrity reduce the rationalisation of fraudulent acts (Treviño et al., 1998; Victor & Cullen, 1988). Unlike formal mechanisms, ethical culture operates continuously and permeates daily decision-making, making it particularly influential in operationally complex industries.

The dominance of ethical culture over internal audit and whistleblowing systems suggests that fraud prevention in the shipping industry is more strongly driven by behavioural and normative factors than by procedural controls alone. This finding extends existing literature by demonstrating that ethical culture not only complements formal mechanisms but may also compensate for their limitations in contexts where oversight is fragmented. In emerging economies, where regulatory enforcement and monitoring intensity may vary, ethical culture appears to serve as a stabilising force that enhances organizational resilience against fraud.

5.4. Integrating formal and informal control mechanisms

Taken together, the findings highlight the importance of integrating formal and informal fraud prevention mechanisms. While internal audit and whistleblowing systems provide essential structural controls, their effectiveness is significantly enhanced when embedded within a strong ethical culture. The relatively weak effect of internal audit, combined with the stronger influence of ethical culture, suggests that formal assurance mechanisms alone are insufficient to address fraud risks in industries characterised by dispersed operations and high asset mobility.

This study addresses a key gap in the fraud prevention literature by empirically demonstrating the relative importance of formal versus informal controls within an under-researched industry context. By integrating internal audit, whistleblowing systems, and ethical culture into a single empirical model, the findings offer a more nuanced understanding of how these mechanisms interact rather than operate independently. The results challenge conventional governance assumptions that prioritise formal controls and highlight the need for a more holistic approach to fraud prevention.

6. Conclusion

6.1. Conclusion

This study demonstrates that Internal Audit quality, Whistleblowing Systems, and Ethical Culture have significant effects on fraud prevention in the shipping industry. Although respondents perceive internal auditors as highly competent and generally evaluate whistleblowing systems and ethical culture positively, the structural influence of these variables ranges from low to moderate. This finding indicates that actual effectiveness in fraud prevention is determined not only by these mechanisms individually but also by other organizational factors, such as corporate culture, management support, and reporting procedures. Overall, the results highlight that fraud prevention is a multifactorial process requiring the integration of audit quality, reporting mechanisms, and ethical practices (Albrecht et al., 2015; Susanto, 2020; Treviño et al., 2014).

6.2. Practical implications

1) Strengthening Internal Audit: Shipping companies should enhance the capacity and quality of internal audit functions to ensure effective oversight and fraud prevention.
2) Enhancing Whistleblowing Systems: Organizations should implement effective whistleblowing mechanisms with proper training, confidentiality guarantees, and active promotion to encourage reporting of unethical behavior.
3) Promoting Ethical Culture: Leaders should actively reinforce ethical values, enforce policies against violations, and support employees to cultivate a culture that discourages fraud.
4) Integrated Anti-Fraud Strategies: Management can utilize the study's findings to design strategies combining internal audit, whistleblowing systems, and ethical culture initiatives for comprehensive fraud prevention (Near & Miceli, 2016; Fahmi & Nugroho, 2019).

6.3. Theoretical implications

1) The study provides empirical evidence that internal audit quality, whistleblowing systems, and ethical culture significantly influence fraud prevention in a non-financial sector, thereby enriching the existing literature.
2) It highlights the gap between perceived auditor competence and actual structural effectiveness, contributing to the theoretical understanding of organizational factors that moderate audit effectiveness and ethical behavior.

3) By integrating these three mechanisms within a PLS-SEM framework, the study offers a comprehensive model for understanding the multifactorial nature of fraud prevention in organizations (Hair et al., 2021; Shmueli et al., 2016).

6.4. Recommendations for future research

1) Explore additional organizational factors that may influence fraud prevention, such as leadership style, internal controls, transparency, or corporate governance.
2) Conduct comparative studies across industries or countries to assess contextual differences in fraud prevention effectiveness.
3) Apply longitudinal research designs to examine how improvements in internal audit quality, whistleblowing systems, and ethical culture affect actual fraud incidence over time.
4) Utilize qualitative methods, such as interviews or case studies, to gain deeper insights into barriers and enablers of effective fraud prevention practices.

From a policy perspective, the findings highlight the importance of strengthening governance mechanisms not only at the organizational level but also within industry regulatory frameworks. Maritime regulators and industry associations may encourage companies to implement integrated fraud prevention strategies that combine strong internal audit functions, secure whistleblowing channels, and programs aimed at fostering ethical organizational cultures. The development of standardized compliance training and ethics programs may also support more effective fraud prevention practices across the maritime industry.

6.5. Limitations

1) Context and Sample: The study is limited to the shipping industry in Indonesia, which may affect generalizability to other industries or countries.
2) Cross-Sectional Design: Data were collected at a single point in time, limiting the ability to establish causal relationships.
3) Self-Reported Data: Reliance on respondents' perceptions may introduce subjective bias or social desirability effects.
4) Limited Variables: Only three main variables (Internal Audit, Whistleblowing, Ethical Culture) were analyzed, omitting other organizational factors that may influence fraud prevention.
5) No Measurement of Actual Fraud: The study focuses on perceived effectiveness and structural influence without directly measuring real fraud incidents, which may differ from actual outcomes (Susanto, 2020; Albrecht et al., 2015).

In addition, future research may strengthen the robustness of findings by incorporating objective indicators of fraud occurrence, archival data, or longitudinal research designs to better capture the dynamics of fraud prevention over time.

Declarations

Conflict of interest

The authors declare no conflict of interest.

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This research received no external funding.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethical Approval

This study involved human participants and was conducted in accordance with institutional ethical standards. Participation was voluntary and anonymous.

Data Avaibility Statement

The dataset supporting the findings of this study was obtained from primary survey data collected from employees of various shipping companies across Indonesia. Due to confidentiality agreements and ethical considerations, the raw data cannot be publicly shared. However, the anonymized dataset and the SmartPLS output files used in the analysis are available from the corresponding author upon reasonable request via email (ahmad.mughis@binus.ac.id).

Author Contributions

Conceptualization: Ahmad Mughis, Lindrianasari
Data Curation: Ahmad Mughis
Formal Analysis: Ahmad Mughis
Funding Acquisition: Ahmad Mughis
Investigation: Ahmad Mughis
Methodology: Ahmad Mughis, Lindrianasari
Project Administration: Ahmad Mughis, Lindrianasari
Resources: Ahmad Mughis

Software: Ahmad Mughis
Supervision: Lindrianasari
Validation: Lindrianasari
Visualization: Ahmad Mughis
Writing – Original Draft: Ahmad Mughis
Writing – Review & Editing: Lindrianasari

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