The Influence of Directors on Waste Disclosure in High-Impact Environmental Sector

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Abstract

This study examines the effect of board characteristics on waste disclosure in high-impact environmental sector companies listed on the Indonesia Stock Exchange (IDX) during 2022–2024. The independent variables include board age, board education level, board size, and women directors, while leverage is used as a control variable. Waste disclosure is measured based on the Global Reporting Initiative (GRI) 306 Standards. Using purposive sampling, this study obtained 117 companies with 351 firm-year observations. Panel data regression analysis with the Random Effect Model (REM) was employed to test the hypotheses. The results reveal that board education level and board size have a positive and significant effect on waste disclosure, indicating that boards with higher educational backgrounds and larger memberships tend to encourage greater environmental transparency. Conversely, board age and women directors do not significantly affect waste disclosure. In addition, leverage is found to have no significant effect on waste disclosure. These findings suggest that directors' educational background and board size are important governance attributes in enhancing waste disclosure practices, while age and gender diversity are not key determinants of waste disclosure among high-impact environmental sector companies. The study contributes to the literature on corporate governance and environmental disclosure by providing evidence from the Indonesian context and supports the relevance of Legitimacy Theory and Resource Dependence Theory in explaining corporate environmental reporting practices.

Keywords: Waste Disclosure, Board Age, Board Education, Board Size, Board Women

INTRODUCTION

Sustainability has become a major concern for companies as public awareness of the environmental impacts of business activities continues to increase. One of the most critical environmental issues is the waste generated from corporate operational activities, particularly in high-impact environmental sectors. Improperly managed waste can lead to soil, water, and air pollution, resulting in adverse consequences for human health and ecosystems. Therefore, companies are expected not only to manage waste responsibly but also to disclose waste management information transparently as a form of accountability to stakeholders (Abd-Mutalib *et al.*, 2021).

The energy, mining, oil and gas, and manufacturing sectors generate substantial amounts of waste and are therefore classified as high-impact environmental sectors (Gaur *et al.*, 2020). According to the Indonesian Central Bureau of Statistics (2025), the mining, energy, and oil and gas sectors produced approximately 81.89 million tons of hazardous and toxic waste (*B3 waste*), while the manufacturing sector generated approximately 17.58 million tons. The large volume of waste produced indicates that companies operating in these sectors bear significant responsibility for managing the environmental impacts of their operations. Consequently, stakeholders increasingly demand greater corporate transparency regarding waste management practices and environmental performance.

In response to these growing transparency demands, sustainability reporting has become an important mechanism through which companies communicate their economic, social, and environmental impacts to stakeholders. The

Global Reporting Initiative (GRI) 306 has emerged as one of the most widely adopted reporting standards because it provides comprehensive guidelines for waste management disclosure (Nirwana and Wedari, 2023). Disclosure based on GRI 306 enables stakeholders to obtain clearer information regarding the amount of waste generated, waste management methods, and corporate efforts to minimize environmental impacts.

Despite these developments, previous studies indicate that the level of waste disclosure remains suboptimal. Many companies do not fully disclose all GRI 306 indicators, resulting in limited and insufficient information for stakeholders (Abd-Mutalib *et al.*, 2021). Other studies also report that the quality of waste disclosure remains at a poor disclosure level and fails to adequately meet stakeholders' information needs (Bogdan *et al.*, 2022). This situation reflects a gap between the availability of sustainability reporting standards and their implementation in corporate practice (Christensen, Hail and Leuz, 2021; Vitolla *et al.*, 2023).

One factor that may influence the extent of waste disclosure is the characteristics of the board of directors as part of the corporate governance mechanism. The board of directors plays a crucial role in determining corporate policies, including those related to transparency and environmental information disclosure. According to Legitimacy Theory, companies seek to obtain and maintain legitimacy from society by demonstrating conformity with social values and expectations, including through environmental disclosure. Meanwhile, Resource Dependence Theory suggests that the board of directors serves as a strategic resource by providing knowledge, expertise, experience, and external networks that enable firms to respond effectively to environmental demands(Pfeffer and Salancik, 1978; Suchman, 1995)).

Board characteristics, including board age, educational level, board size, and female directors, are expected to influence corporate decisions regarding waste disclosure. Directors with higher educational attainment are more likely to possess a better understanding of environmental issues and sustainability regulations. A larger board provides greater access to resources, expertise, and diverse perspectives in the decision-making process. In addition, the presence of female directors is often associated with greater attention to social and environmental issues. Nevertheless, previous studies have reported mixed and inconsistent findings regarding the influence of board characteristics on environmental disclosure.

Although numerous studies have examined the relationship between board characteristics and sustainability disclosure, most have focused on sustainability disclosure or environmental disclosure in general as the dependent variable. Research specifically investigating waste disclosure based on the GRI 306 standard remains limited, particularly among companies operating in high-impact environmental sectors in Indonesia. Therefore, this study aims to examine the effects of board age, board educational level, board size, and female directors on waste disclosure among high-impact environmental sector companies listed on the Indonesia Stock Exchange during the 2022–2024 period. The findings are expected to provide empirical evidence regarding the role of board characteristics in enhancing corporate transparency in waste disclosure.

Board age reflects the level of directors' experience and maturity in corporate decision-making. Older directors generally possess broader managerial experience and a better understanding of the importance of maintaining corporate reputation and relationships with stakeholders through transparent information disclosure. Legitimacy Theory suggests that firms seek to maintain legitimacy by meeting stakeholders' expectations, while Resource Dependence Theory (RDT) views directors' experience as a strategic resource that enhances the quality

of corporate decision-making (Pfeffer and Salancik, 1978; Suchman, 1995). Ha et al. (2024) and Rashid and Barokah (2024) found that board age has a positive effect on environmental disclosure. Therefore, a higher average board age is expected to be associated with more extensive waste disclosure.

H1: Board age has a positive effect on waste disclosure.

Board educational level reflects directors' knowledge and analytical capabilities in understanding environmental issues and stakeholder demands. Directors with higher educational attainment are more likely to recognize the importance of transparency and corporate sustainability practices. Legitimacy Theory argues that companies seek stakeholders' support by disclosing relevant information, whereas Resource Dependence Theory (RDT) considers education a strategic resource that enhances the quality of corporate decision-making (Pfeffer and Salancik, 1978; Suchman, 1995). Kipngetich, Bonuke and Tenai (2019) and Beji et al. (2021) found that board educational level has a positive effect on environmental disclosure. Therefore, a higher level of board education is expected to result in more extensive waste disclosure.

H2: Board educational level has a positive effect on waste disclosure.

Board size refers to the number of directors involved in the corporate decision-making process. A larger board provides greater diversity in terms of experience, knowledge, and perspectives, which can enhance the effectiveness of monitoring and strengthen the company's response to stakeholder demands. Legitimacy Theory suggests that firms are encouraged to increase transparency to gain and maintain legitimacy, while Resource Dependence Theory (RDT) views the board of directors as a strategic resource that provides the information and capabilities required by the company (Pfeffer and Salancik, 1978; Suchman, 1995). Agyemang et al. (2020), Beji et al. (2021), and Ha et al. (2024) reported that board size has a positive effect on corporate sustainability disclosure. Therefore, a larger board is expected to be associated with more extensive waste disclosure.

H3: Board size has a positive effect on waste disclosure.

Female directors represent gender diversity that can enrich perspectives in the corporate decision-making process. The presence of women on the board is often associated with greater concern for social and environmental issues, as well as a stronger commitment to promoting responsible business practices. Legitimacy Theory suggests that companies seek to meet stakeholder expectations through greater transparency and accountability, while Resource Dependence Theory (RDT) views gender diversity as a strategic resource that enhances the quality of corporate decision-making (Suchman, 1995; Hillman, Cannella and Paetzold, 2000). Beji et al. (2021), Bai, Qin and Dasgupta (2025), and Hidayah, Purnomowati and Cummings (2024) found that female directors have a positive effect on environmental disclosure. Therefore, a higher proportion of female directors is expected to result in more extensive waste disclosure.

H4: Female directors have a positive effect on waste disclosure.

RESEARCH METHODOLOGY

This study employs a multiple linear regression approach to examine the extent to which the independent variables influence the dependent variable, both simultaneously and individually. This analytical method was selected because it enables the identification of the relationship patterns, direction of influence, and statistical significance among the variables within the proposed research model. Conceptually, the multiple linear regression model used in this study is expressed by the following equation:

$$WD = \alpha + \beta_1 BODAGE_{it} + \beta_2 BODEDUC_{it}$$

$$+\beta_3 BODSIZE_{it} + \beta_4 BODWOMEN_{it} + \beta_5 LEV_{it} + e$$

This study adopts a quantitative research approach using secondary data obtained from the annual reports and sustainability reports of companies listed on the Indonesia Stock Exchange (IDX) during the 2022–2024 period. The study population consists of companies operating in the energy, basic materials, industrials, and consumer non-cyclicals sectors**,** which are classified as high-impact environmental sectors. The sample was selected using a purposive sampling method based on the following criteria: (1) companies listed on the IDX throughout the study period; (2) companies that consistently published annual reports and/or sustainability reports during the study period; (3) companies that adopted the Global Reporting Initiative (GRI) standards; and (4) companies with complete data for all research variables.

RESULTS AND DISCUSSION

Descriptive Statistics

Based on the descriptive statistics, this study analyzed 351 observations obtained from 117 high-impact environmental sector companies listed on the Indonesia Stock Exchange (IDX) during the 2022–2024 period. The dependent variable, waste disclosure (WD), has a mean value of 0.7356, with a minimum of 0.0000 and a maximum of 1.0000. These results indicate that, overall, the level of corporate waste disclosure is relatively high, although some companies have not fully disclosed all GRI 306 indicators. The standard deviation of 0.3303 suggests variation in waste disclosure practices across companies.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Max	Min	Std. Dev
WD	351	0.7356	1.0000	0.0000	0.3303
BODAGE	351	53.9835	75.3333	39.3333	5.7320
BODEDUC	351	0.4598	1.0000	0.0000	0.2823
BODSIZE	351	5.2764	15.0000	2.0000	2.5107
BODWOMEN	351	0.1201	0.5000	0.0000	0.1498
LEV	351	0.4665	2.6417	0.0003	2.9855

Source: Processed Data Output, Eviews 13, 2026

The independent variables consist of board age (BODAGE), board educational level (BODEDUC), board size (BODSIZE), and female directors (BODWOMEN). The average board age is 53.9835 years, indicating that most directors are in a mature and experienced age group. The mean value of board educational level is 0.4598, suggesting that the proportion of directors holding postgraduate degrees (master's degree or higher) accounts for less than 50% of the total board members. Meanwhile, the average board size is 5.2764 members, indicating that the sample companies generally have approximately five directors. The standard deviations of these three variables are lower than their respective mean values, indicating relatively homogeneous distributions across the sample companies.

The female directors (BODWOMEN) variable has an average value of 0.1201, indicating that women represent only about 12% of the total board members, reflecting relatively low female representation on corporate boards. In addition, the leverage (LEV) variable has a mean value of 0.4665, indicating that, on average, corporate debt accounts for 46.65% of total assets. The standard deviations of both female directors and leverage exceed their respective mean values, suggesting relatively high variation across companies. These findings indicate considerable differences in corporate governance characteristics and capital

structures among high-impact environmental sector companies during the study period.

Coefficient of Determination Test (R^2)

The coefficient of determination (R^2) measures the extent to which the independent variables explain the variation in the dependent variable. An R^2 value close to zero indicates that the independent variables have limited explanatory power, whereas a value close to one indicates that they explain a substantial proportion of the variation in the dependent variable (Badawi et al., 2022). As shown in Table 2, the adjusted R-squared value is 0.0735 (7.35%). This indicates that the independent variables—board age, board educational level, board size, and female directors—collectively explain 7.35% of the variation in waste disclosure, while the remaining 92.65% is explained by other factors not included in this study.

Table 2. Random Effect Model Regression Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.5245	0.2355	2.2271	0.0266
BODAGE	-0.0017	0.0039	-0.4381	0.6616
BODEDUC	0.2980	0.0698	4.2660	0.0000***
BODSIZE	0.0307	0.0089	3.4451	0.0006***
BODWOMEN	-0.0021	0.1363	-0.0156	0.9876
LEV	0.0102	0.0799	0.1274	0.8987

*Note: R-Squared= 0.0867: Adjusted R-Squared= 0.0735: F-Statistic= 6,5498: Prob (F-statistic)= 0.0000: N= 351. ***p<0.01, **p<0.05*

Source: Processed Data Output, Eviews 13, 2026

F-Test (Simultaneous Significance Test)

The F-test was conducted to determine whether the independent variables jointly affect the dependent variable (Ghozali, 2021). As presented in Table 2, the probability value of the F-statistic is 0.0000, indicating that board age, board educational level, board size, and female directors simultaneously have a significant effect on waste disclosure.

t-Test (Individual Significance Test)

The t-test was performed to examine the individual effect of each independent variable on waste disclosure. The results indicate that board educational level (BODEDUC) and board size (BODSIZE) have a positive and statistically significant effect on waste disclosure. Board educational level has a coefficient of 0.2980 with a probability value of 0.0000 ($p < 0.05$), supporting H_2. Similarly, board size has a coefficient of 0.0307 with a probability value of 0.0006 ($p < 0.05$), supporting H_3. These findings suggest that companies with a higher proportion of highly educated directors and larger boards tend to disclose more comprehensive waste-related information.

In contrast, board age (BODAGE), female directors (BODWOMEN), and leverage (LEV) do not significantly affect waste disclosure, as their probability values exceed 0.05. Board age has a coefficient of −0.0017 with a probability value of 0.6616, leading to the rejection of H_1. Likewise, female directors have a coefficient of −0.0021 with a probability value of 0.9876, resulting in the rejection of H_4. In addition, leverage has no significant effect on waste disclosure, with a coefficient of 0.0102 and a probability value of 0.8987. These results indicate that only board educational level and board size are significant determinants of waste disclosure among high-impact environmental sector companies during the study period.

The Influence of Board Age on Waste Disclosure

The results indicate that board age has no significant effect on waste disclosure; therefore, H_1 is rejected. This is evidenced by

a coefficient of −0.0017 with a probability value of 0.6616 ($p > 0.05$), indicating that the average age of board members does not influence the level of corporate waste disclosure. These findings suggest that neither younger nor older directors differ significantly in promoting waste disclosure, as such practices are more strongly influenced by corporate policies, regulations, and stakeholder demands. The results are consistent with the findings of Limbong, Usman and Aujirapongpan (2025) and Teng et al. (2025), who reported that board age does not significantly affect corporate sustainability disclosure. Furthermore, these findings do not support either Legitimacy Theory or Resource Dependence Theory (RDT), as board age has not been shown to encourage companies to enhance waste disclosure as a means of gaining legitimacy or serving as a strategic resource for improving environmental transparency.

The Influence of Board Educational Level on Waste Disclosure

The results indicate that board educational level has a positive and significant effect on waste disclosure; therefore, H_2 is supported. This is evidenced by a coefficient of 0.2980 with a probability value of 0.0000 ($p < 0.05$), indicating that a higher proportion of highly educated directors leads to more extensive waste disclosure. Directors with higher educational qualifications are more likely to possess a better understanding of environmental issues, sustainability regulations, sustainability-related risks, and the importance of transparency toward stakeholders. Consequently, they are more likely to encourage companies to disclose environmental information more comprehensively. These findings are consistent with those of Kipngetich, Bonuke and Tenai (2019) and Beji et al. (2021), who found that board educational level positively influences sustainability disclosure. The findings also support Legitimacy Theory and Resource Dependence Theory (RDT), as directors' educational background constitutes an important strategic resource that enables companies to enhance waste disclosure in order to gain legitimacy and satisfy stakeholders' information needs (Pfeffer and Salancik, 1978; Suchman, 1995).

The Influence of Board Size on Waste Disclosure

The results indicate that board size has a positive and significant effect on waste disclosure; therefore, H_3 is supported. This is evidenced by a coefficient of 0.0307 with a probability value of 0.0006 ($p < 0.05$), indicating that companies with larger boards tend to disclose more comprehensive waste-related information. A larger board provides companies with greater resources, experience, knowledge, and diverse perspectives in decision-making and oversight of sustainability practices, thereby enhancing environmental transparency. These findings are consistent with those reported by Abd-Mutalib et al. (2021), Agyemang et al. (2020), Kumari et al. (2022), and Kurnia Sari and Fitriani (2023), who found that board size positively influences sustainability disclosure. The findings also support Legitimacy Theory and Resource Dependence Theory (RDT), as a larger board reflects greater availability of resources, expertise, and external networks that encourage companies to enhance waste disclosure in order to gain legitimacy and meet stakeholder expectations (Pfeffer and Salancik, 1978; Suchman, 1995).

The Influence of Female Directors on Waste Disclosure

The results indicate that female directors have no significant effect on waste disclosure; therefore, H_4 is rejected. This is evidenced by a coefficient of −0.0021 with a probability value of 0.9876 ($p > 0.05$), indicating that the proportion of women on the board does not influence the extent of corporate waste disclosure. This finding may be attributed to the relatively low representation of women on corporate boards,

with an average proportion of only 12%, limiting their influence on strategic decision-making. Furthermore, decisions regarding waste disclosure appear to be driven more by corporate policies, regulatory requirements, and stakeholder pressure than by the gender composition of the board. These findings are consistent with those of Agyemang et al. (2020), Almaqtari et al. (2023), and Kumari et al. (2022), who reported that female directors do not have a significant effect on sustainability disclosure. The findings also suggest that female directors do not support the predictions of either Legitimacy Theory or Resource Dependence Theory (RDT), as their presence on the board has not been sufficient to promote greater waste disclosure or to serve as a strategic resource capable of influencing corporate environmental disclosure practices (Pfeffer and Salancik, 1978; Suchman, 1995).

CONCLUSION

This study aims to examine the effects of board age, board educational level, board size, and female directors on waste disclosure among high-impact environmental sector companies listed on the Indonesia Stock Exchange (IDX) during the 2022–2024 period. The sample consists of 117 companies, yielding a total of 351 observations, which were analyzed using panel data regression with the Random Effects Model. The results indicate that board educational level and board size have a positive effect on waste disclosure, whereas board age and female directors have no significant effect on corporate waste disclosure.

The positive effect of board educational level suggests that directors with higher educational attainment possess a better understanding of environmental issues, regulations, and the importance of transparency toward stakeholders, thereby encouraging companies to disclose more comprehensive waste-related information. In addition, larger board size enhances waste disclosure by providing companies with greater resources, experience, expertise, and diversity of perspectives in decision-making and the oversight of sustainability practices. In contrast, board age and female directors do not significantly influence waste disclosure, indicating that decisions regarding waste disclosure are driven more by corporate policies, regulatory requirements, and stakeholder demands than by the demographic characteristics of the board.

This study has several limitations. A considerable number of observations were excluded from the sample because of the unavailability of reports, the use of reporting standards other than the Global Reporting Initiative (GRI), or incomplete data. In addition, the assessment of waste disclosure using GRI 306 content analysis may involve a degree of subjectivity. Therefore, future research is recommended to expand the sample coverage and extend the observation period to increase the number of observations. Future studies are also encouraged to employ more detailed assessment guidelines or alternative measurement methods to improve the objectivity and accuracy of waste disclosure measurement.

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