

How Does Board Gender Diversity Impact on Corporate Green Innovation?

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Abstract. This research aims to provide empirical evidence about the impact of Gender Diversity on the Corporate Sustainable Governance Board. The gender issues raised in this study are in line with the Sustainable Development Goals (SDGs) programme. The fifth goals of the SDGs relates to gender equality, including ending all forms of discrimination against women wherever and guaranteeing effective participation of women and equal opportunities for leadership at all levels of decision-making. The increase the number of women in the board is built on the premise that it will improve corporate governance. The research was conducted on companies with ESG scores published in IDX. ESG refers to three key factors of sustainability impact measurement and ethics in investment decision-making. ESG assessment is an important part of evaluating the implementation of ESG practices in companies. Therefore, the IDX is continuously committed to encouraging long-term sustainable investment and improving ESG practice in Indonesian capital markets by working with ESG appraisal agencies and conducting ESG evaluations of IDX-listed companies. Research findings show that gender diversity has a negative impact on green innovation when measured using green processes, but it has no effect when green innovation is measured using green products. The results of this research have contributed to supporting the general hypothesis that women's social preferences and environmental concerns are stronger than men's, which has practical implications for companies seeking to improve environmental competitiveness by improving corporate governance.

Keywords: Gender diversity, green innovation, ESG.

1 Introduction

The Sustainable Development Goals (SDGs) are a program established by the United Nations (UN) to a better and sustainable life for all people on earth. There are 17 inter-related SDGs goals to address the various global challenges facing, including combating inequality (<https://sdgs.bappenas.go.id/>). The fifth goal of the SDGs relates to gender equality, including ensuring the effective participation of women, equal opportunities for leadership at all levels of decision-making in the political, economic and public

fields to end all forms of discrimination against women everywhere (<https://www.unwomen.org/en/node/36060>). Based on the international SDGs program, research is needed to generate empirical evidence related to gender diversity in board of directors and board of commissioners of companies. The fifth study has produced evidence that companies with more than three female boards have better performance in terms of corporate governance [1]. The increase in the number of women in the board is built on the premise that it will improve corporate governance [2]; [3]; [4]. Despite the results of the research [5] shows that the presence of women in the board has a negative impact on corporate environmental governance/green innovation. Therefore, research is needed to produce empirical evidence on the question of whether gender diversity in board has an impact on green innovation as a form of sustainable corporate governance.

2 Literature Review

Research on gender diversity in boards and its relationship to corporate performance has been done by previous researchers [6]; [7]; [8]; [9]; [10]. The system is different from the two-tier system which distinguishes the board as the board of directors that manages the company and the council of commissioners that perform the role of oversight over the management of the company. In addition, previous research also used environmental performance or CSR as a dependent variable [8]; [11]; [12]. Research uses sustainable governance variables projected with green innovation. Green innovation requires a sustainable approach to new markets and applications as a competitive resource for business strategy [13]. Environmentally friendly Innovation as an important way for companies to protect the environment and achieve long-term economic benefits [14]. Research that connects gender diversity in the board (two-tier system) with green innovation is important to do especially for companies in Indonesia that have ESG scores on the Indonesian Stock Exchange (IDX), given the existence of ESG scoring companies is a new thing in the IDX.

3 Research Methods

This research method uses a quantitative research approach that emphasizes the testing of the theory by measuring the variables used in research. The study will test the Gender Diversity Impact on Sustainable Governance of Companies. The research uses secondary data sources derived from financial reports, annual reports, and sustainability reports available on the website www.idx.co.id and the company's website. The sample of this research is a company that has an ESG score in the IDX in 2023. The dependent variable in this study is sustainable governance. Corporate governance uses a green innovation proxy measured using green product disclosure indices and green processes. The independent variable of this study is gender diversity measured using the percentage of women in board. Data collection is done using documentation techniques. Documentation techniques are techniques for collecting data using the results of available data. The required data can be obtained from the company's financial statements, annual

reports, and sustainability reports. This study uses linear regression analysis with the help of SPSS software. The process of data analysis is initiated by performing descriptive statistical testing. It contains a general view of data related to mean, maximum, minimum, and standard deviation values. There are three classical assumptions: the normality test, the multicollinearity test and the heteroscedasticity test. The linear regression analysis is a regression model on data that has more than one independent variable to analyse the extent of the influence caused by independent variables on dependent variables. The model in the research is as follows:

$$Y1 = \alpha + \beta_1X_1 + \beta_2X_2 + e \dots\dots\dots[1]$$
$$Y2 = \alpha + \beta_1X_1 + \beta_2X_2 + e \dots\dots\dots[2]$$

Description :

- Y1 = Green Product
- Y2 = Green Process
- α = Constant coefficient
- β_1, β_2 = Regression coefficient
- X_1 = Diversity of the Board of Directors
- X_2 = Diversity of the Board of Commissioners
- e = error

The next stage is to test the hypothesis. The first test conducted is the F Test. The F Test is used to calculate the magnitude of the relationship between all independent variables simultaneously to explain the dependent variable used in the study. Furthermore, the determination coefficient Test (R^2) is used to describe the size of the impact that can contribute to the variable. The final stage is to conduct a t-test. The t-test is used to prove the hypothesis of this study, by categorizing the significant level of 1%, 5%, and 10%.

4 Results and Discussion

This study uses companies that have ESG scores on the IDX as research samples. There are 79 companies that have ESG scores on the IDX that collaborate with Morningstar Sustainalytics to conduct the ESG assessment.

4.1 Descriptive statistics

The following are the results of descriptive statistical testing:

Table 1. Descriptive Statistical Test Results					
	N	Minimum	Maximum	Mean	Std. Deviation
X1	79	0,00	0,7	0,173	0,1710
X2	79	0,00	0,75	0,1368	0,16682
Y1	79	0,00	1,00	0,2110	0,27826
Y2	79	0,00	1,00	0,5411	0,31376

Valid N (listwise) 79

Based on table 1, it can be seen that several sample companies in this study do not have a female board of directors or board of commissioners, which is indicated by a value of 0 (zero) on x1 and x2. Likewise, the dependent variable green innovation is indicated by a value of 0 for both variables y1 and y2. This shows that not all companies in this study sample disclose activities related to efforts related to green products or green processes.

4.2 The classic assumption test

Based on tables 2a, the results of the normality test for all variables studied show normality, as indicated by the significance value. $0,200 > 0,05$.

Table 2a. Results of Normality Testing with Green Product as Dependent Variable

One-Sample Kolmogorov-Smirnov Test		Unstandardized Residual
N		79
Normal Parameters ^{a,b}	Mean	,0000000
	Std. Deviation	,19722177
Most Extreme Differences	Absolute	,087
	Positive	,071
	Negative	-,087
Test Statistic		,087
Asymp. Sig. (2-tailed)		,200 ^{c,d}

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. This is a lower bound of the true significance.

Based on tables 2b, the results of the normality test for all variables studied also show normality, as indicated by the significance value. $0,200 > 0,05$.

Table 2b. Results of Normality Testing with Green Process as Dependent Variable

One-Sample Kolmogorov-Smirnov Test		Unstandardized Residual
N		79
Normal Parameters ^{a,b}	Mean	,0000000
	Std. Deviation	,23777443
Most Extreme Differences	Absolute	,082
	Positive	,082
	Negative	-,054

Test Statistic	,082
Asymp. Sig. (2-tailed)	,200 ^{c,d}

- a. Test distribution is Normal.
- b. Calculated from data.
- c. Lilliefors Significance Correction.
- d. This is a lower bound of the true significance.

Based on tables 3a and 3b, the results show that all variables studied are free from multicollinearity, as indicated by a VIF value of <10.00 and a Tolerance value of >0.10. It can be said that there are no correlation between the independent variables.

Table 3a. Multicollinearity Test Results with Green Product as Dependent Variable

Coefficients ^a							
	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1 (Constant)	0,203	0,049		4,118	0,000		
X1	-0,042	0,190	-0,026	-0,219	0,827	0,957	1,045
X2	0,110	0,195	0,066	0,565	0,574	0,957	1,045

a. Dependent Variable: Y1

Table 3b. Multicollinearity Test Results with Green Process as Dependent Variable

Coefficients ^a								
		Unstandardized Coefficients		Standardized Coefficients		Collinearity Statistics		
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	0,700	0,033		21,347	0,000		
	X1	-0,401	0,137	-0,296	-2,927	0,005	0,674	1,483
	X2	-0,658	0,139	-0,478	-4,734	0,000	0,674	1,483

a. Dependent Variable: Y2

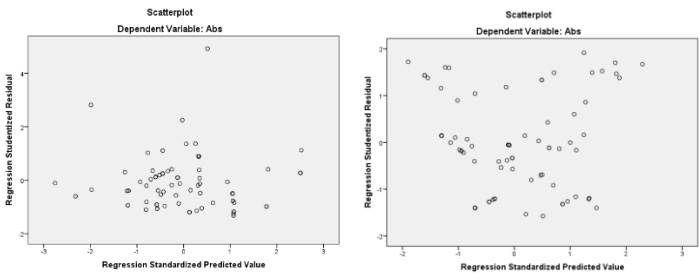


Fig 1. The heteroscedasticity test results

Figure 1 related to the scatterplot of the heteroscedasticity test results. It shows that there is no particular pattern in the scatterplot graph, thus indicating that heteroscedasticity does not occur.

4.3 Hypothesis test

4.3.1 F-test

Table 5a. F Test Results of Dependent Variable Green Product

ANOVA ^a						
	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3,005	2	1,503	37,644	0,000 ^b
	Residual	3,034	76	0,040		
	Total	6,039	78			

a. Dependent Variable: Y1

b. Predictors: (Constant), X₂, X₁

Table 5b. F Test Results of Dependent Variable Green Process

ANOVA ^a						
	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3,666	2	1,833	34,714	0,000 ^b
	Residual	4,013	76	0,053		
	Total	7,679	78			

a. Dependent Variable: Y2

b. Predictors: (Constant), X₂, X₁

Based on tables 5a and 5b, the F test results show a significance value of <0.05. It indicates that all of these research models are appropriate and worthy of being studied.

4.3.2 The Coefficient of Determination Test (R² test)

Tables 6a and 6b will present the results of the determination coefficient test.

Table 6a. Results of Determination Coefficient of Dependent Variable Green Product
Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,066 ^a	0,004	-0,022	0,28129

a. Predictors: (Constant), X₂, X₁

b. Dependent Variable: Y1

Table 6b. Results of Determination Coefficient of Dependent Variable Green Process

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,691 ^a	0,477	0,464	0,22979

a. Predictors: (Constant), X_2, X_1

b. Dependent Variable: Y2

Based on table 6a, the determination coefficient value shows that gender diversity of the board is only able to explain its influence on green products by 2%. The remaining 98% is influenced by other variables not examined in this study. Different results are shown in table 6b which shows that the determination coefficient value for green process is 46% which means that the remaining 54% is influenced by variables other than gender diversity of the board.

4.3.3 T-test

Table 7a shows the results of testing variables the gender diversity of board on green products. The test results show that the significance value is $0.827 > 0.05$ and $0.574 > 0.05$. It means that variables the gender diversity of board do not affect green innovation as measured using green product.

Table 7a. Results of Hypothesis Testing of Dependent Variables of Green Product

Coefficients^a					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	0,203	0,049		4,118	0,000
X1	-0,042	0,190	-0,026	-0,219	0,827
X2	0,110	0,195	0,066	0,565	0,574

a. Dependent Variable: Y1

Different results are shown in table 7b, the results of testing variables of X1 and X2 on variable Y2. The test results show that the significance value is $0.005 < 0.05$ with a beta value of -0.401 and $0.000 < 0.05$ with a beta value of -0.658. This explains that gender diversity of board has a negative effect on green process.

Table 7b. Results of Hypothesis Testing of Dependent Variables of Green Process

Coefficients^a					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	0,700	0,033		21,347	0,000
X1	-0,401	0,137	-0,296	-2,927	0,005

X2	-0,658	0,139	-0,478	-4,734	0,000
a. Dependent Variable: Y2					

4.4 Discussion

Based on the results of hypothesis testing, the gender diversity of the board has no effect on on green innovation, measured using green product, but has a negative effect on green process. The majority of the board in Indonesia are male, and only 14-18% are female. This indicates that male boards consider it more important to improve performance so that it can provide a positive signal to investors. Company expenditures for waste management activities, reducing GHG emissions, and using alternative energy are considered as expenditures that have an impact on decreasing company profits which will ultimately reduce the company's value, so these activities are still carried out but to comply with existing regulations. In addition, company expenditures for activities related to environmental concerns such as how to produce products whose raw materials are recycled, packaging and products can also be recycled are not important considerations in decision making by the board of directors. In addition, the board of commissioners as supervisors also prioritizes achieving the company's short-term performance. Therefore, the existence of a minority female gender does not have an impact on green products. In addition, the very small number of women in board shows that the board in Indonesia is still dominated by men. This is in accordance with the patriarchal system that still applies in Indonesia, so that the existence of women is less prioritized. The results of this study can prove the hypothesis [15] about women's social preferences and better environmental concerns than men, which has practical implications for companies to improve corporate governance in order to increase environmental competitiveness.

5 Conclusion

This study aims to test whether there is an influence of gender diversity in the board on green innovation as measured using green products and green processes. The results of the study indicate that gender diversity does not affect green products but has a negative effect on green process. This shows that environmental awareness activities have not been a primary consideration by the manager and the commissioners. The number of female gender minorities on the board in companies shows that the patriarchal system in Indonesia is still strong.

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References

1. H. H. Mirza, S. Mahmood, S. Andleeb, and F. Ramzan, "Gender Diversity and Firm Performance: Evidence from Pakistan," 2012.
2. H. Li and P. Chen, "Board gender diversity and firm performance: The moderating role of firm size," in *Business Ethics*, 2018, pp. 294–308. doi: 10.1111/beer.12188.
3. S. N. Abdullah, K. N. I. Ku Ismail, and N. L., "Does Having Women on Boards Create Value ? Does Having Women on Boards Create Value ?," *Strategic Management Journal*, vol. 37, no. 3, pp. 466–476., 2016.
4. R. B. Adams and D. Ferreira, "Women in the boardroom and their impact on governance and performance," *J financ econ*, vol. 94, no. 2, pp. 291–309, 2009, doi: 10.1016/j.jfineco.2008.10.007.
5. Y. Qi, "Board Gender Diversity and Corporate Green Innovation," in *2nd International Conference on Financial Economics and Investment Management (FEIM 2022)*, 2022.
6. Y. Wang, D. S. Ones, Y. Yazar, and I. Mete, "Board gender diversity and organizational environmental performance: An international perspective," *Current Research in Ecological and Social Psychology*, vol. 5, Jan. 2023, doi: 10.1016/j.cresp.2023.100164.
7. Q. Long Kweh, N. Ahmad, I. Wei Kiong Ting, C. Zhang, and H. Bin Hassan, "Board Gender Diversity, Board Independence and Firm Performance in Malaysia," 2019.
8. M. del Mar Fuentes-Fuentes, C. Quintana-García, M. Marchante-Lara, and C. G. Benavides-Chicón, "Gender diversity, inclusive innovation and firm performance," *Sustainable Development*, vol. 31, no. 5, pp. 3622–3638, Oct. 2023, doi: 10.1002/sd.2615.
9. M. Adusei, S. Y. Akomea, and K. Poku, "Board and management gender diversity and financial performance of microfinance institutions," *Cogent Business and Management*, vol. 4, no. 1, Jan. 2017, doi: 10.1080/23311975.2017.1360030.
10. M. Mirza, T. Dordi, P. Alguindigue, R. Johnson, and O. Weber, "Sustainability in Private Capital Investing: A Systematic Literature Review," *Journal of Management and Sustainability*, vol. 13, no. 1, p. 119, Apr. 2023, doi: 10.5539/jms.v13n1p119.
11. F. Gennari, "Women on boards and corporate social responsibility," *Corporate Board: Role, Duties and Composition*, vol. 12, no. 1CONT1, pp. 101–108, 2016, doi: 10.22495/cbv12i1c1art3.
12. J. S. Matitaputty and A. Davianti, "Does broad gender diversity affect corporate social responsibility disclosures?," *JEMA: Jurnal Ilmiah Bidang Akuntansi dan Manajemen*, vol. 17, no. 1, p. 35, 2020, doi: 10.31106/jema.v17i1.3612.
13. Y. S. Chen, S. B. Lai, and C. T. Wen, "The influence of green innovation performance on corporate advantage in Taiwan," *Journal of Business Ethics*, vol. 67, no. 4, pp. 331–339, 2006, doi: 10.1007/s10551-006-9025-5.
14. J. Hao and F. He, "Corporate social responsibility (CSR) performance and green innovation: Evidence from China," *Finance Research Letter*, vol. 48, no. December 2021, pp. 1–8, 2022, doi: 10.1016/j.frl.2022.102889

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