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The mediation effect of firm performance on the association between two-tier independent boards and green innovation practices: Evidence from Indonesia

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Abstract

Purpose: This research examines the role of firm performance in the effect of a two-tier independent board on green innovation practices.

Design/methodology/approach: This study employs a simple mediation model-4 using the Hayes Process approach to OLS regression with the R package. The dataset uses a total 518 public companies listed on the Indonesia Stock Exchange for 2017 to 2019, having 1,554 firm-year observations.

Findings: The study revealed, based on the two-tier system, the role of a composite independent board on firm performance and green innovation is positive and significant. However, individual results for both independent commissaries and directors in terms of firm performance and green innovation practices are not significant. This result implies that a composite of independent boards is essential to reduce and mitigate the failure of corporate governance.

Research limitations/implications: This research only applied to a sample of companies from one country adopting a two-tier system. Future research might be conducted as a comparative analysis of countries with a two-tier system as opposed to countries with one-tier system.

Practical implications: First, companies need to enhance the knowledge and expertise of both independent directors and independent commissaries to improve their roles. Second, it is important to provide support for the campaign and incentives for green innovation practices. Third, insight drawn from this study leads to the latest regulation from the Financial Services Authority (as the representative of the Indonesian government), whereby independent directors are no longer mandatory for publicly listed companies starting in December 2021 and must be evaluated because the composite independent board is an effective tool to execute green projects and to accelerate the SDG agenda in 2030.

Social Implications: The social implication of this study is companies' awareness to produce more eco-based products, which are expected by stakeholders, can be actualized. Also, public perception shows companies with green products have better performance.

Originality/value: This research is the first study examining the mediating role of firm performance on the effect of a two-tier independent board on green innovation practices. Second, this study introduces the latest methodology for the simple mediation model using a Hayes-based approach in the field of accounting with an open-source software R package.

Keywords: Independent board, Green innovation, Two-tier system, Hayes process, Firm performance, SDG

Jel Codes: G34, L25, O30

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1. Introduction

The calls for green innovation and development necessitate immediate action, and sustainability is a crucial concern (Zhang, Rong & Ji, 2019). According to Couto and Rangel (2023) and Da Fonseca (2015), the 17 Sustainable Development Goals (SDGs) promoted by the United Nations (UN) aim to balance economic, social, and environmental developments while addressing the needs of current and future stakeholders and ensuring a better and more sustainable future for all. Indonesia, as a member of the Paris Agreement, has set the target for reducing carbon emissions at 41% by 2030 (Bappenas, 2017). Indonesia as one of the emerging countries is currently the largest contributors to global greenhouse gas emissions (McKinsey, 2022). Hence, sustainability issues are significant for Indonesia, specifically green innovation practices.

Green innovation is a mean to achieve better sustainability by connecting a firm's operation and its environment (Cancino, La Paz, Ramaprasad & Syn, 2018). The importance of green innovation implementation for companies is also supported by several previous studies including (Agustia, Sawarjuwono & Dianawati, 2019; Zhang et al., 2019; Tang, Walsh, Lerner, Fitza & Li, 2018; Huang & Li, 2017). Those studies also provide significant implications for firm performance improvement. Prior research also examined the importance of companies adopting eco-green practices and building a green mindset. Furthermore, independent boards as a part of top management, and they are considered essential for maintaining the commitment on sustainability (Sharma, Prakash, Kumar, Mussada, Antony & Luthra, 2021) and the most powerful instruments for corporate governance effectiveness (Dahya, Dimitrov & McConnell, 2009).

Studies related to the role of the independent board have become an attractive topic, and significant since the collapse of big companies such as Enron, Lehman Brothers, and Worldcom (Lew, Yu & Park, 2018; Fuzi, Halim & Julizaerma, 2016). Previous evidence indicates an independent board was substantial in enhancing firm performance (Adams, Hermalin & Weisbach, 2010; Li, Lu, Mittoo & Zhang, 2015), and reducing agency conflicts (Naciti, 2019). Furthermore, independent boards also provide input and direction in designing and executing the company's strategy, particularly the strategy for implementing green innovation practices (Zhang, Zhang, Li & Zhang, 2023; Xiang, Liu & Yang, 2022). As outlined in previous studies, the role of an independent board in green innovation can be explicated by agency theory (Jensen & Meckling, 1976), an independent board performs an indispensable role in controlling the manager and guiding the corporate strategy, including the green innovation strategy (García□Sánchez, Gallego□Álvarez & Zafra□Gómez, 2021). Indonesia is one of the countries applying two-tier system (Adams & Ferreira, 2007; Bezemer, Peij, De Kruijs & Maassen, 2014). The role of an independent board with a two-tier board system is significant to alleviate agency problems (Jungmann, 2006) and carry out the strategic role (Van den Berghe & Baelden, 2005).

Previous research has demonstrated the role of an independent board significantly affects corporate green innovation practices (Zhang et al., 2023; Asni & Agustia, 2022; Xiang et al., 2022). However, research by Wang, Deng, Álvarez-Otero, Sial, Comite, Cherian et al. (2021) found independent directors do not actually perform a significant role in decision-making, especially on specific decisions such as the implementation of CSR (corporate social responsibility). Independent directors have a negative impact on green process innovation (He & Jiang, 2019), and independent boards also show an insignificant impact on environmental performance (Cong & Freedman, 2011). According to the contradictory results above, this empirical study identifies the assumption that the role of an independent board in green innovation is influenced by other factors.

Other studies indicate green innovation requires internal and external funding (Xiang et al., 2022) and it is also affected by corporate profitability (Li, Zhao, Zhang, Chen & Cao, 2018). Hence, this study identifies the another factor that having a role in the relationship between independent boards and green innovation is firm performance. Therefore, this study proposed a question: does firm performance mediate the effect of an independent board on corporate green innovation practices? particularly within the framework of Indonesia as an emerging country with a two-tier system (Shu, Zhou, Xiao & Gao, 2016). Green initiatives are significant to be implemented in a company as relate to the need for more sustainable solutions, and top management commitment is a significant factor (Sharma et al., 2021). Therefore, this study is essential because research on green innovation is a relevant issue in the era of sustainability. This research is the first empirical study to investigate the mediating role of firm performance on the association between independent boards and green innovation. The findings of this study contribute to the agency theory literature, as an independent board is an effective mean not only to maximize profits for shareholders but also to control and guide the managers on the 'green innovation' strategic issues.

Based on 1,554 firm-year observations for the period of 2017 to 2019 and utilizing observed variables, this research employs OLS regression by *Hayes Process Macro* (Hayes, 2022). The research reveal , based on the two-tier system, the role of a composite independent board on firm performance and green innovation is positive and significant. However, individual results for both independent commissaries and directors in terms of firm performance and green innovation practices are not significant. The result of this study discovers the mediating role of firm performance on the effect of a composite independent board on green innovation practices is significant. This result is in accordance with the study by (Zhang et al., 2023; Xiang et al., 2022; Tam, Liang, Chen & Liu, 2021; Liu, Miletkov, Wei & Yang, 2015) as independent boards have a positive and significant role in enhancing both firm performance and green innovation practices. The findings of this study has an implication a comprehensive role for both independent directors and commissaries is required to generate better performance and investment in green innovation.

The subsequent sections of the study are proceeded as follows: In Section 2, is a review of the literature and hypothesis development; Section 3 presents the research methodology; Section 4 is a discusión of the findings. Lastly, Section 5 is the conclusion, complemented by contribution, practical implication, and research limitation.

2. Literature Review and Hypotheses Development

Indonesia is a country adopting a two-tier system, the CEO and executive directors are responsible for the day-to-day operations of the company. Meanwhile, non-executive directors are responsible for supervising the executive directors (Bezemer et al., 2014; Jungmann, 2006). Companies in Indonesia listed on the Indonesia Stock Exchange must comply with the regulations defined by the government, refer to the capital market law, *Bapepam-LK* regulations (Capital Market and Financial Services Supervisory Institution), Financial Services Authority regulations, and IDX regulations. There are two types of two-tier board structure in Indonesia, namely the board of directors (BOD), and the board of commissioners (BOC) (Darmadi, 2011). Therefore, research support is needed in countries with two-tier systems related to the contribution of independent directors' and commissaries effectiveness to corporate performance improvement. Moreover, since the elimination of independent directors' representation on boards of companies is effective as of 27 December 2018. Meanwhile, green innovation was introduced as a trending issue on changing the company's strategic future orientations to support the policies related to the transitions towards a greener economy (Istudor, Dinu & Nitescu, 2021). Research trends have largely studied the commitment of companies to sustainability practices, particularly green innovation implementation (Lau, Lu & Liang, 2016). Although the government of Indonesia has committed to engage in the SGDs on the strategic program with 41% emission reductions by 2030 (Bappenas, 2017). According to previous research conducted by Mahsina and Agustia (2023), only 36% of the companies participated in green innovation implementation in Indonesia, and efforts from the authorities are still required to support the green innovation's campaigns, providing an incentive for firms which adopted green innovation. Therefore, this empirical research is significant to examine the effectiveness of both independent directors and commissaries on green innovation practices.

2.1. Independent Board and Firm Performance

According to Michelon and Parbonetti (2012), the presence of an independent board is protecting shareholder from the manager opportunism, as from the agency theory point of view. The term independent board is at times used synonymously and interchangeably, wherein it occasionally refers to non-executive or external directors (board). In developed countries, all public companies are recommended to disclose the number of independent directors in order to mitigate the risk and reduce failure of corporate governance (Lew et al., 2018; Hussainey & Al-Najjar, 2012). This recommendation is also widely adopted as a general requirement at various levels, including the World Bank, the European Union, the US, and other countries. Prior research done by (Liu et al., 2015) implied a positive and significant relationship between an independent board and firm performance. Likewise, in the context of research on the banking industry conducted by Tam et al. (2021), shown significant results as the proportion of independent directors increased, followed by an improvement in company performance.

The existence of independent boards are considered as effective approach (Li, Crook, Andreeva & Tang, 2020), and listed in the corporate governance guidelines. Independent board is important for enhancing firm performance (Ullah & Kamal, 2020) and increasing the quality of disclosure (Michelon & Parbonetti, 2012). According to Indonesia's Corporate Act No. 40 (2007), the director's functions are already independent, and the commissioners' role in supervising the board independently. Independent commissaries commonly represent the shareholders to monitor and control the companies (Darmadi, 2011). Therefore, the contribution of this study, particularly in the aspect of implementation for firms in countries that adopted a two-tier system, is essential. Thus, it can be used as a reference in formulating government policies that adopt a two-tier system. Therefore, this research proposes the following hypotheses:

H1.1: An independent board has a positive effect on firm performance.

H1.2: Independent directors have a positive effect on firm performance.

H1.3: Independent commissaries have a positive effect on firm performance.

2.2. Independent Board and Green Innovation

Green innovation is one of the key factors in achieving the firm sustainability performance (Asadi, Pourhashemi, Nilashi, Abdullah, Samad, Yadegaridehkordi et al., 2020). Several critical programs for companies aims to eliminate the environmental issues, hence the concept such as green management, green marketing, green production and green innovation (Sezen & Cankaya, 2013). Agency theory is generally used as the basis for the relationship between board structure, governance, and corporate social responsibility (CSR), it recommends a higher proportion of independent directors to achieve superior governance (Dahya & McConnell, 2005). The significant role of an independent director is one component serving powerful mechanism to prevent the risk of value reduction or diversion of corporate resources by the majority controlling shareholders (Dahya et al., 2009).

Research conducted by Bhuiyan, Huang and de Villiers (2021) empirically found firms with more independent boards member have more concerns in the environmental aspect. Likewise, the role of independent boards on particular issues, such as the environment, as shown in several previous research indicating the role of an independent board has a significant impact on decision making of environmental corporate social responsibility (ECSR) fund distribution (Post, Rahman & Rubow, 2011). Study from Lu and Wang (2018) discovered more independent boards can positively impact on innovation. Particularly, high independent boards could significantly affect corporate green innovation practices (Zhang et al., 2023; Xiang et al., 2022). The importance of independent commissaries in the Indonesian context is also presented in the research held by Asni and Agustia (2022) stated independent commissaries positively and significantly affect green innovation. Therefore, this study postulates the following hypothesis:

H2.1: An independent board has a positive effect on the implementation of green innovation practices.

H2.2: Independent directors have a positive effect on the implementation of green innovation practices.

H2.3: Independent commissaries have a positive effect on the implementation of green innovation practices.

2.3. The Mediation Effect of Firm Performance on Independent Board and Green Innovation Practices

According to the perspective of agency theory, corporate governance is a mean to enhance green innovation performance (Lai & Sohail, 2022; Amore & Bennedsen, 2016). Green innovation implementation could reduce agency conflicts and transform corporate development through the values of compliance with regulations (Zhang, Liu & Li, 2022). Green innovation implementation is also an essential strategy for companies for sustainability (Demirel & Kesidou, 2019; Pedersen, Gwozdz & Hvass, 2018). Implementation of green innovation could create a firm's reputation for being committed to develop innovative eco-products and overcome environmental issues (Cheng, 2008). In turn, it could create firm value (Hussaini, Hussain, Nguyen & Rigoni, 2021; Yu, Guo & Luu, 2018).

Despite several prior research have indicated a positive and significant role of independent boards in the implementation of green innovation (Zhang et al., 2023; Asni & Agustia, 2022; Xiang et al., 2022), there are some previous studies results showed differently, namely independent directors had a negative impact on green process innovation (He & Jiang, 2019), and independent boards also showed an insignificant impact on environmental performance (Cong & Freedman, 2011). Green innovation is part of a company's effort to create eco-products in order to address environmental issues by promoting sustainability (Cheng, 2008). Therefore, considering the contradictory results above, this study assumes there are other factors affecting the effect of an independent board on green innovation practices in a company.

Previous study done by from Mahsina and Agustia (2023) and Lee and Min (2015) implied green innovation investment is costly. Therefore, a company's green innovation implementation requires both internal and external funding (Xiang et al., 2022). Thus, it is supported by the evidence of (Li et al., 2018) stating corporate profitability affects green innovation practices. Based on those empirical research findings, this study posits the following hypothesis:

H3.1: Firm performance mediates the effect of an independent board on the implementation of green innovation practices.

H3.2: Firm performance mediates the effect of independent directors on the implementation of green innovation practices.

H3.3: Firm performance mediates the effect of independent commissaries on the implementation of green innovation practices.

Based on the above theoretical framework, the model of this study is focusing on the relationship between independent board and firm performance and green innovation, as shown in the framework model in Figure 1.

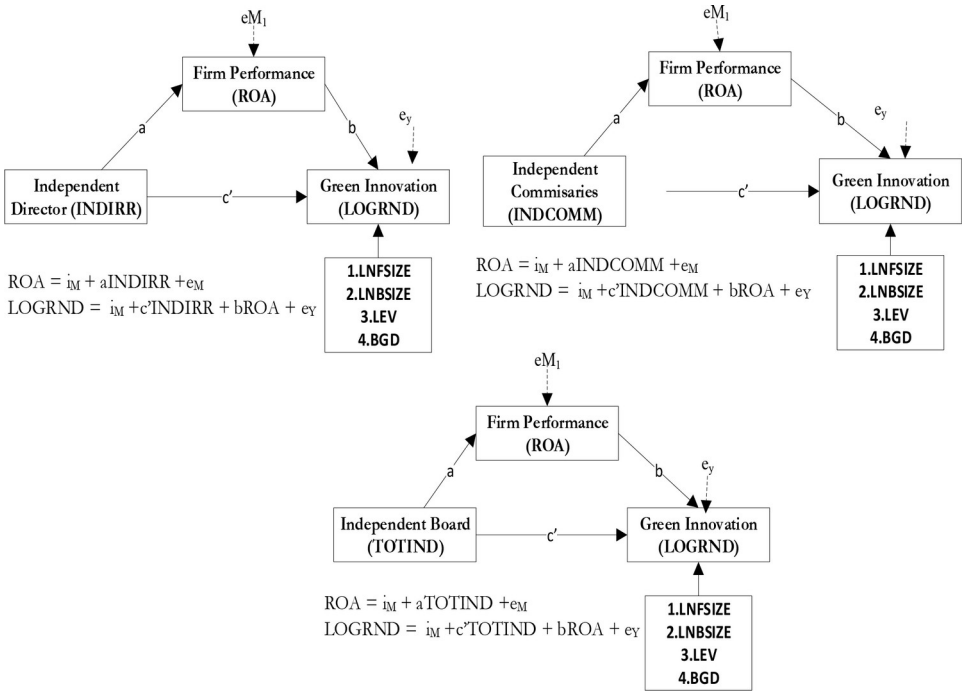

Figure 1. Simple Mediation – Model 4 Research Framework

3. Research Methodology

3.1. Research Model

In order to examine the simple mediation model 4 *Hayes Process Macro,* the mediation effect of firm performance on an independent board, and green innovation practices, this research employs these following models:

Model 1:

$$ROA_{it} = \beta_0 + \beta_1 INDIRR_{it} + \beta_2 INCOMM_{it} + \beta_3 TOTIND_{it} + \beta_4 LNFSIZE_{it} + \beta_5 LEV_{it} + \beta_6 LNBSIZE_{it} + \beta_7 BGD_{it} + \varepsilon_{it}$$

Model 2:

$$LOGRND_{it} = \beta_0 + \beta_1 INDIRR_{it} + \beta_2 INCOMM_{it} + \beta_3 TOTIND_{it} + \beta_4 FP_{it} + \beta_5 LNFSIZE_{it} + \beta_6 LEV_{it} + \beta_7 LNBSIZE_{it} + \beta_8 BGD_{it} + \varepsilon_{it}$$

This study applies a simple mediation model using *Hayes Process Macro* approach (Hayes, 2022). It uses observed variables, and PROCESS is a tool used for observed variables, the concept is OLS regression (Hayes, Montoya & Rockwood, 2017). RStudio version 2023.03.1**.** package software is used to perform ordinary least squares (OLS) regression to examine the models above. "The criterion to establish mediation" commonly used and described by Baron and Kenny (1986), referred to as the cause-and-effect approach based on Sobel's test by Sobel (1982), should no longer be used (Hair Jr, Hult, Ringle, Sarstedt, Danks & Ray, 2021). *Hayes Process Macro* approach implements the bootstrap confidence Interval. It means, in mediation tests, bootstrap is used to generate a representative sampling distribution of the indirect effect and requires no assumption of normality (Hayes, 2022), or statistical sampling distribution can be applied to a small sample size with more confidence (Hair Jr et al., 2021). The bootstrapping technique could handle an imbalanced sample condition. PROCESS will also accept a dichotomous outcome variable, Y.

3.2. Operational Definitions and Measurement of Variables

3.2.1. Dependent Variable

The dependent variable of this study is green innovation (LOGRND). R&D expenses as a proxy (García-Granero, Piedra-Muñoz & Galdeano-Gómez, 2018; Rodriguez & Wiengarten, 2017; Cainelli, De Marchi & Grandinetti, 2015; Kemp & Pearson, 2007). R&D expenses are relevant indicator representing innovation (Kemp & Pearson, 2007). R&D expenses contribute to the increase in green patent publication and sustainability practices in a company (Fujii & Managi, 2019). It follows the study by Rodriguez and Wiengarten (2017) using the logarithm of R&D expenses as a proxy (LOGRND).

3.2.2. Mediating Variable

Table 1 illustrates that the study uses firm performance (FP) as first mediating variable. This research uses return on assets (ROA) as the measurement of firm performance (FP). The study done by (Li et al., 2015; Shan & McIver, 2011) has highlighted ROA is an accounting-based measurement reflecting backward-looking information. It means, ROA provides information related to the performance of a company. ROA supplies information to investors and shareholders on how effectively the management manages the resources to generate net income. ROA is derived from the result of the calculation of earnings before interest and tax (EBIT) divided by total assets.

3.2.3. Independent Variable

This study uses independent variables from an independent board. It is conducted in Indonesia which the two-tier system adopted is unique as there are two components to the board: namely the board of management (board of directors) and the board of commissaries. Thus, it also applied for an independent board, as it has independent directors and also independent commissaries. However, in this context of an independent board, since 2018, the financial services authority as the representative of the government of Indonesia has published a new policy stating companies are not required to have independent directors. A new rule is effective since 27 December 2018. Therefore, in accordance with the prevailing practices in countries with a two-tier system, this study employs three independent variables: independent directors (INDIRR), independent commissaries (INDCOMM), and the total number of both independent directors and independent commissaries (TOTDIR). Adhering the prior empirical studies by Chen, Crossland and Huang (2016); Levi, Li and Zhang (2014) and Gul,

Srinidhi and Ng (2011), INDIRR is a proportion of the number of independent directors to the total directors, and INDCOMM is a proportion of the number of independent commissaries to the total commissaries. Meanwhile, TOTDIR is the total number of independent directors and independent commissaries.

Variable type	Variable name	Measurement	Reference	Sources
Dependent Variable	Green Innovation (LOGRND)	The logarithm of R&D expenses as a proxy (Robustness test)	(Cainelli et al., 2015; García-Granero et al., 2018; Kemp & Pearson, 2007; Rodriguez & Wiengarten, 2017)	OSIRIS database
Mediating variable	Firm Performance (ROA)	Return on Asset Ratio	(Berrone, Fosfuri, Gelabert & Gomez Mejia, 2013; He & Jiang, 2019; Li et al., 2015; Liu, 2018; Shan & McIver, 2011)	OSIRIS database
Independent Variable	Independent boards (TOTIND) Independent Directors (INDIRR) Independent commissioner (INDCOMM)	Total number of independent board (directors and commissaries) Number of independent directors/total directors Number of independent commissaries/ Total commissaries	(Chen, Crossland & Huang, 2016; Gul et al., 2011; Levi, Li & Zhang, 2014)	Annual report, Indonesia Stock Exchange website
Control Variable	Leverage (LEV) Board Size (LNBSIZE) Firm Size (LNFSIZE)	Total liability/ total asset Logarithm of number of board size Logarithm total asset	(Li et al., 2015) (Hillman, Cannella Jr & Harris, 2002; Li et al., 2015) (He & Jiang, 2019; Leal-Rodríguez, Eldridge, Roldán, Leal-Millán & Ortega-Gutiérrez, 2015)	OSIRIS database Annual report, Indonesia Stock Exchange website OSIRIS database
	Board Gender Diversity (BGD)	Number of Woman Director/ Total Directors	(Abdul, Marzuki, Jaafar & Masron, 2018; Chen et al., 2016; Gul et al., 2011; Levi et al., 2014; Frondel, Horbach & Rennings, 2008; He & Jiang, 2019)	Annual report, Indonesia Stock Exchange website

Table 1. Operational definitions and measurement of variables

3.3. Sample

This study constructs the sample by using two databases, namely the OSIRIS database and the annual report from the Indonesia Stock Exchange database, within a time span of 2017, 2018, and 2019. The purposive sampling technique is applied in this study, which utilises a sample of 518 firms from the population of 883 public companies listed on the Indonesia Stock Exchange, with the criteria firms with the Standard Industrial Classification (SIC) non-financial and banking sectors. The non-financial and banking sectors are more appropriate as they can exhibit larger impact from the corresponding inferences (Foerster & Sapp, 2005) and these industries sectors are tends to be related with green innovation issues (Mahsina & Agustia, 2023; Zhang et al., 2019). For these reasons, these non-financial and banking sectors are worth investigated. Furthermore, the primary rationale for omitting the financial and banking sectors was because of their restricted direct impact on the eco-environment issues. Considering the three-year period, this research had 1,554 observations in a balanced panel dataset. The study uses financial data measurement of the variable ROA as an indicator of firm performance, LEV as a proxy of the leverage variable, and LNFSIZE as a proxy of firm size. Those financial data were taken from the OSIRIS database. Meanwhile, for those non-financial data, LOGRND is the proxy for the green innovation variable, INDIRR and INCOMM are the proxy for independent directors and independent

commissaries, and TOTIND is the proxy for the total number of independent directors and independent commissaries. BGD is the proxy for board gender diversity; this research conducts content analysis from the annual report, downloaded from the Indonesia Stock Exchange database.

The composition of independent directors and independent commissaries from the research sample for the period 2017 to 2019. It indicates the composition of independent commissaries (69.74%) has a higher proportion compared to the composition of independent directors (30.26%). Furthermore, the ratio of independent directors to total directors is less than 10%, and the ratio of independent commissaries to total commissaries is 21%. Shareholders have granted more authority to independent parties to perform the supervisory function for the executive board.

4. Result and Discussion

4.1. Descriptive Statistic Analysis

Table 2 presents the statistical sample characteristics. LOGRND shows a mean value of 0.11 and the standard deviation (0.34) is higher than the mean value (0.11). It means, the data is heterogeneous. Although this value of 0.11 is higher than the research conducted by (He & Jiang, 2019) which only reached 0.05 for the participation of the firm sample in green innovation practices, it might consider this research to have low participation. Indonesia will likely require to boost its green innovation practices to reach the target of 41% emission reduction by 2030. ROA indicates a mean value of 2,35 with a wide range of differences, with range values of -130 and 110. It means, the sample variance of firm performance measured by ROA is quite varied. TOTDIR presents a mean value of 4.3 higher than its standard deviation of 2.49, means the data is homogenous. INDIRR only applies a mean value 0.52 higher than INDCOMM 0.22. Thus, the independent commissaries have less composition and less concern for the company compared to independent directors. Therefore, the role of independent commissaries might be inadequate to affect board decision-making at the company. Therefore, shareholders have fewer independent representative on the board of commissaries. Shareholders are expected to receive more advice and insight from independent directors and independent commissaries in order to monitor and control the executives.

Variable	Obs	Mean	Std. Dev.	Min	Max
LOGRND	1554	.111	.344	0	1.337
ROA	1554	2.347	12.081	-130.82	110.26
INDIRR	1554	.524	.549	0	3
INDCOMM	1554	.222	.124	0	.5
TOTIND	1554	5.515	3.13	0	18
LNFSIZE	1554	18.075	7.915	0	26.587
LEV	1554	.508	1.212	0	22.611
LNBSIZE	1554	1.316	.654	0	2.708
BGD	1554	.112	.184	0	1

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$; Pearson rank correlation are reported in the table; LOGRND is green innovation; ROA is firm performance; INDIRR isindependent directors; INDCOMM is independent commisaries; TOTIND is independent boards composite; LNFSIZE is firm size; LEV is leverage; LNBSIZE is board size; BGD is board gender diversity

Table 2. Descriptive Statistic

4.2. Correlation Matrix

Table 3 displays the correlation among the variables. The correlation results reveal the relationship between ROA and LOGRND (0.116*), TOTIND and LOGRND (0.174*) is positively significant at the one percent level. However, the correlation between INDIRR and LOGRND (0.034), INDCOMM and LOGRND (0.035) are not significant. This research also found some control variables were positive and significant, such as LNFSIZE (0.093*) and LNBSIZE (0.152*), and that they were significant to the one percent level. However, this research found LEV and BGD showed insignificant negative results.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) LOGRND	1.000								
(2) ROA	0.116*	1.000							
(3) INDIRR	0.034	-0.034	1.000						
(4) INDCOMM	0.035	0.006	0.404*	1.000					
(5) TOTIND	0.174*	0.105*	0.488*	0.656*	1.000				
(6) LNFSIZE	0.093*	0.095*	0.154*	0.112*	0.238*	1.000			
(7) LEV	-0.021	-0.389*	0.038	0.016	0.030	0.160*	1.000		
(8) LNBSIZE	0.152*	0.084*	0.527*	0.662*	0.952*	0.240*	0.038	1.000	
(9) BGD	0.006	0.006	0.107*	0.208*	0.173*	0.041	0.017	0.204*	1.000
VIF	2.06	1.25	1.42	1.86	3.96	1.12	1.24	4.58	1.06

Note: *** p<0.01, ** p<0.05, * p<0.1; Pearson rank correlation are reported in the table; LOGRND is green innovation; ROA is firm performance; INDIRR isindependent directors; INDCOMM is independent commisaries; TOTIND is independent boards composite; LNFSIZE is firm size; LEV is leverage; LNBSIZE is board size; BGD is board gender diversity

Table 3. Pairwise Correlations

Table 3 also presents the mean variance of inflation factors (VIF) for independent variables, mediator, and control variables applied, with values ranging from 1.12 and 4.58, which are below cut-off value of 10 (Đ□ng, Houanti, Reddy & Simioni, 2020; Wooldridge, 2006). Therefore, this research does not have any multicollinearity problems.

4.3 Regression Analysis

This research aims to identify the research question, 'Does Firm Performance Affect the Effect of a Two-Tier Independent Board on Green Innovation Practices?' This research uses the context of Indonesia as a country with a two-tier system to construct the sample research. This research is performed using the Hayes Process, a regression-based approach to examine the hypothesis of the simple mediation model, also called model 4. The hypothesis consists of direct effects (H1.1, H1.2, H1.3, H2.1, H2.2, H2.3) and indirect effects (mediation) (H3.1, H3.2, H3.3). This research is applied using R Studio Package Software version 2023.03.1. Based on Table 4 the coefficient regression summary, the statistical diagram of the model, this study composes the research model estimation for the Hayes Process Simple Mediation Model as follows:

a. Model A (M)

Model A.1 - TOTIND (X_1)

$$ROA = -0.6841 + 0.8689TOTIND + 0.2186LNFSIZE - 2.7419LNBSIZE - 4.1197LEV - 0.1061BGD + \varepsilon_{RM1} .$$

Model A.2 - INDDIR (X_2)

$$ROA = -0.9702 - 13.1712INDDIR + 0.2290LNFSIZE + 2.0194LNBSIZE - 0.4155LEV - 0.0023BGD + \varepsilon_{RM1} .$$

Model A.3 - INDCOMM (X_3)

$$ROA = -0.5946 - 8.2205INDCOMM + 0.2160LNFSIZE + 2.2507LNBSIZE - 4.1394LEV - 0.0025BGD + \varepsilon_{RM1}$$

b. Model B (Y)

Model B.1 - TOTIND (X_1)

$$LOGRND = -0.0232 + 0.0301TOTIND + 0.0027ROA + 0.0021LNFSIZE - 0.0653LNBSIZE + 0.0015LEV - 0.0360BGD + \varepsilon_{RM1} .$$

Model B.2 - INDDIR (X_2)

$$LOGRND = -0.0238 + 0.2200INDDIR + 0.0026ROA + 0.0024LNFSIZE - 0.0853LNBSIZE + 0.0005LEV - 0.0425BGD + \varepsilon_{RM1}.$$

Model B.3 - INDCOMM (X_3)

$$LOGRND = -0.0078 - 0.2838INDCOMM + 0.0028ROA + 0.0020LNFSIZE + 0.1073LNBSIZE + 0.0009LEV - 0.0324BGD + \varepsilon_{RM1}$$

4.4. Direct Effect Hypothesis Testing

The results of model-4 simple mediation model, Hayes Process Macro as presented on Table 4 show the direct effects of main regression, for hypotheses H1.1, H1.2, H1.3, H2.1, H2.2 and H2.3. This research discovered a positive and significant effect of TOTIND on ROA as expressed on Model A (a: 0.8689, ϱ=0.0027** < 0.01). Therefore, hypothesis H1.1 is supported. Hence, independent boards have a positive and significant effect on firm performance. This research is aligned with previous research done by (Liu et al., 2015; Tam et al., 2021) as stating independent board acts positively and significantly in enhancing firm performance. The findings of this study support the idea that the existence of a composite of independent directors and independent commissaries is an effective approach to monitoring and controlling firm performance. The combination of placing the independent party in both board directors (management) and board commissaries (supervisory board) is effective in reducing the information-asymmetry so that management and shareholders have better information concerning all aspects of the operation and management of the firm (Liu et al., 2015). The role of an independent member in board of directors is expected to be more effective in strategic decision-making and monitoring activities. Meanwhile, the role of an independent member in the board of commissaries (supervisory board) may decrease the cost of monitoring and increase the quality of advice. This research also endorses the idea of a composite of inside and outside (supervisory board) independent boards is important to alleviate and mitigate the failure of corporate governance, especially in emerging countries that have adopted a two-tier system. **The implication of this finding is significant** because, in a two-tier system, the existence of both independent boards and independent commissary representatives to have an effect on a company's decision-making is still necessary for companies to improve their firm's performance. This **finding contributes** to the literature that a composite of independent boards and independent commissaries is a powerful mechanism for controlling and monitoring to avoid agency problems and generate more profits, particularly in countries with two-tier systems.

The empirical result of this study also found a positive sign and a significant effect of TOTIND on LOGRND (c': 0.0301, ϱ=0.0008**) < 0.001). Therefore, hypothesis H2.1 is also supported, or independent boards have a positive and significant effect on green innovation. This result is supported by the study of (Xiang et al., 2022; Zhang et al., 2023) stated independent boards have a positive and significant effect on green innovation practices. This result also indicates a composite independent board is a powerful tool of corporate governance to enhance companies' value (Dahya et al., 2009). This result supports agency theory that an independent board is an effective tool to control managers and guide the 'green innovation' strategic issue (García-Sánchez et al., 2021). A composite independent board is significantly contributing to the increase in corporate R&D investment (LOGRND). The independent board can also serve the company in improving existing technologies and production processes to promote green innovation practices (Zhang et al., 2023). The **significant implication** of this study is that companies will become more aware of the importance of green innovation with the support of both independent boards and independent commissaries, whose purpose is to increase the company's reputation.

Table 4 also portrays the hypothesis testing on the separation of independent boards as a two-tier system practiced indicates the direct effects of INDDIR and INDCOMM on ROA (Model A) are insignificant. The research is aligned with the study conducted by (Fuzi et al., 2016; Lew et al., 2018; Rahman & Ali, 2006) as mentioned independent directors insignificantly affect performance. Moreover, this study found INDDIR to ROA is negative and significant (a: -13.1712, ϱ=0.0000*** < 0.001) and INDCOMM to ROA is also negative and significant (a: -8.2205, ϱ=0.0063** < 0.01). Hence, H1.2 and H1.3 are not supported.

		ROA (M)				LOGRND (Y)			Hypothesis Remark
		Coeff.	SE	ϱ		Coeff.	SE	ϱ	
TOTIND (X_1)	a	0.8689	0.2888	0.0027** (H1.1)	c'	0.0301	0.0089	0.0008*** (H2.1)	H1.1 Supported
		----	----	----	b	0.0027	0.0008	0.0005***	H2.1Supported
LNFSIZE		0.2186	0.0365	0.0000***		0.0021	0.0011	0.0620	
LNBSIZE		-2.7419	1.3921	0.0491*		-0.0653	0.0430	0.1295	
LEV		-4.1197	0.2318	0.0000***		0.0015	0.0079	0.8510	
BGD		-0.1061	1.5435	0.9452		-0.0360	0.0477	0.4506	
Constant	i_M	-0.6841	0.8236	0.4063	i_Y	-0.0232	0.0241	0.3362	
		R^2 =0.1856, F(5,1548)=70.5606, ϱ=0.0000				R^2 =0.0441 F(6,1547) = 11.8983, ϱ=0.0000			
INDDIR (X_2)	a	-13.1712	2.5868	0.0000*** (H1.2)	c'	-0.2200	0.0811	0.0067** (H2.2)	H1.2 Not Supported
		----	----	----	b	0.0026	0.0008	0.0008***	H2.2 Not Supported
LNFSIZE		0.2290	0.0363	0.0000***		0.0024	0.0011	0.0370	
LNBSIZE		2.0194	0.4699	0.0000***		0.0853	0.0147	0.0000	
LEV		-0.4155	0.2305	0.0000***		0.0005	0.0079	0.9528	
BGD		-0.0023	1.5325	0.9230		-0.0425	0.0476	0.3728	
Constant	i_{M1}	-0.9702	0.8061	0.2290	i_{Y2}	-0.0238	0.0251	0.3423	
		R^2 = 0.1943 F(5,1548)= 74.6806, ϱ=0.0000				R^2 = 0.0417 F(5,1548) =11.2176, ϱ=0.0000			
INDCOMM (X_3)	a	-8.2205	3.0052	0.0063** (H1.3)	c'	-0.2838	0.0930	0.0023** (H2.3	H1.3 Not Supported
		----	----	----	b	0.0028	0.0008	0.0005***	H2.3 Not Supported
LNFSIZE		0.2160	0.0366	0.0000***		0.0020	0.0011	0.0750	
LNBSIZE		2.2507	0.5825	0.0001***		0.1073	0.0181	0.0000***	
LEV		-4.1394	0.2318	0.0000***		0.0009	0.0079	0.9049	
BGD		-0.0025	1.5483	0.9987		-0.0324	0.0478	0.4982	
Constant	i_{M1}	-0.5946	0.8340	0.4759	i_{Y2}	-0.0078	0.0258	0.7626	
		R^2 = 0.1848 F(5,1548)= 70.1777, ϱ=0.0000				R^2 = 0.0429 F(6,1547) =11.5546, ϱ=0.0000			

Note: ***ϱ<0.001; **ϱ<0.01; *ϱ<0.05; TOTIND(X_1), INDDIR (X_2), INDCOMM(X_3) – ROA (M) – LOGRND (Y); Model 4 – *Simple Mediation Process Macro* (PROCESS). LOGRND is green innovation; ROA is firm performance; INDIRR isindependent directors; INDCOMM is independent commisaries; TOTIND is independent boards composite; LNFSIZE is firm size; LEV is leverage; LNBSIZE is board size; BGD is board gender diversity
(Appendices A, B and C, 2023)

Table 4. Summary Model Coefficient Regression, Standard Errors Model 6 – Simple Mediation Process (Main Regression: Direct Effect)

The negative and significant effect of INDDIR on ROA in this research indicates the independent director role is not effective in supporting companies' performance. Furthermore, the involvement of independent directors may tend to create difficulties for the company in achieving better performance. It might occur because independent directors become powerless in board discussions (Fauzi & Locke, 2012). Therefore, the company require to conduct an efficiency audit and make changes to the independent directors' existence and role. The mandatory role of an independent director in a two-tier system might not be adequate to influence the board's strategic decision-making, and there is a possibility of agency problems. The result of this study is supported by prior research (Fauzi & Locke, 2012) mentioned the involvement of independent directors tends to reduce firm performance. Moreover, it might also be possible that the negative and significant impact of the relationship between independent directors and firm performance is caused by a lack of capabilities, irrelevant background, and individual lack of knowledge and experience in charge of independent directors when dealing with executive

powers (Fuzi et al., 2016). The implication of this result study is that companies will need to improve the knowledge and insight of their independent directors to increase their role in improving firm performance.

Furthermore, intriguing results have been shown on the relationship between INDCOMM and ROA. In the setting of sample firms in Indonesia, which adopted a two-tier system, the existence of independent commissaries had no significant effect on firm performance. The independent commissaries are representatives of shareholders and perform monitoring for the executives (management) (Darmadi, 2011). This result indicates independent commissaries are not directly involved in the company's decision-making due to the dominant role of the executives, particularly in the strategic direction of the company's decision-making. It may cause agent-principal misunderstanding due asymmetry information. The findings of this study are aligned with those Rahman and Ali (2006). The result also relates to the ineffectiveness of the independent commissaries in their monitoring role of the managers and other executives' members on the board. Therefore, the role of independent commissaries is not significant for the firm's performance improvement. This result may have the implication that independent commissaries need to increase their ability, knowledge, and expertise to perform the supervision role in monitoring the boards.

Table 4. also presents the direct effects of INDDIR and INDCOMM on LOGRND are negative and significant. This research finds INDDIR to LOGRND is negative and significant (a: -0.2200, ϱ=0.0067** < 0.01) and INDCOMM to ROA is also negative and significant (a: -0.2838, ϱ=0.0023** < 0.01). Hence, H2.2 and H2.3 are not supported. The negative and significant relationship between INDDIR and INDCOMM towards LOGRND indicates that in a particular decision-making process related to environmental strategic practices, in this case green innovation practices, the role of independent commissaries will provide opposite result from the hypothesis: the decline of green innovation practices. Independent commissaries, as the representatives of the shareholders, have a monitoring role towards the executives, as the shareholders expectation is to create a high profit with minimum cost expenditures for the company, and green innovation practices investment is commonly applied as high-cost investment (Lee & Min, 2015; Liu, Dai & Cheng, 2011). Therefore, it is the primary reason why independent commissaries have no concerns and could potentially reject green innovation practices.

The results also imply shareholders and independent commissaries have poor understanding of the urgent call for green innovation practices. Thus, this research recommends the government of Indonesia enhance the campaign on the importance of green innovation practices for companies in the era of SDGs. It is significant to provide support with incentives and initiatives for companies adopting green innovation practices as a part of Indonesia's commitment to the SDGs.

4.4.1 Indirect Effect Hypothesis Testing

Table 5 is indirect effect regression result with bootstrapping process applied from the model-4 simple mediation Hayes Process using R Studio package software. The mediation model presents the regression model of X -> M -> Y. This research has performed model B for three indirect effect model hypotheses (labelled" Ind**"**). The first model is

TOTIND (X_1) -> ROA (M) -> LOGRND (Y),

the second model is

INDDIR (X_2) -> ROA (M) -> LOGRND (Y)

and the third model is

INDCOMM (X_3) -> ROA (M) -> LOGRND (Y).

Table 5 implies the composite of independent boards **TOTIND (X_1) -> ROA (M) -> LOGRND (Y)** (a,b) = 0.8689 (0.0301)=0.0024 indicates a positive sign. The indirect effect or mediation model "ind_1" is positive and significant, as its indication with the bootstrap confidence interval lower level is above zero (>0) = 0.0005 and the upper level of the bootstrap confidence interval shows 0,0047. Hence, hypothesis 3.1 is supported, or it can be concluded firm performance mediates the role of an independent board on green innovation practices. This research reveals a composite independent board is required to accommodate the increasing amount of funding, both internal and external, in order to boost the quality of green innovation practices (Xiang et al.,

2022). Better firm performance will increase the role of a composite independent board on the increasing of R&D expenditure for improvement of existing technologies and production processing tool investment to produce eco-based product output. This **result contributes** to the agency theory perspective that the effectiveness of a composite independent board will reduce the risk of agency conflicts when implementing the green strategy in a company, particularly in two-tier system countries. Furthermore, this study also provides the implication that the ability of a company to implement green innovation practices is an effective tool and signal for stakeholders to monitor the firm's performance. The results of this study **also deliver an implication for authorised governments** that the composite role of independent directors and independent commissaries is **still significant in encouraging green innovation practices as a commitment to environmental sustainability.** Therefore, the latest regulation from the Financial Services Authority (OJK) as the representative of the Indonesian government, whereby independent directors are no longer mandatory for publicly listed companies since December 2021, **needs to be reviewed**.

	Bootstrap Confidence Interval				
	Effect	**BootSE**	**BootLLCI**	**BootULCI**	**Remark**
Ind_1 TOTIND (X_1) -> ROA (M) -> LOGRND (Y)	0.0024	0.0011	0.0005	0.0047	H3.1 Supported
Ind_2 INDDIR (X_2) -> ROA (M) -> LOGRND (Y)	-0.0348	0.0170	-0.0725	-0.0078	H3.2 Not Supported
Ind_3 INDCOMM (X_3) -> ROA (M) -> LOGRND (Y)	-0.0226	0.0138	-0.0546	0.0021	H3.3 Not Supported

Note: TOTIND(X_1), INDDIR (X_2), INDCOMM (X_3) – ROA (M1) – LOGRND (Y) Model 4 – *Simple Mediation Model Process Macro* (PROCESS). *Processed by* RStudio version 2023.03.1; LOGRND is green innovation; ROA is firm performance; INDIRR isindependent directors; INDCOMM is independent commisaries; TOTIND is independent boards composite; LNFSIZE is firm size; LEV is leverage; LNBSIZE is board size; BGD is board gender diversity
(Appendices A, B, C; 2023)

Table 5. Indirect Effect (Mediation) Analysis Results

However, the indirect effect or mediation models "ind_2" and "ind_3", both indicate a negative sign, whereas for indirect model "ind_2"

INDDIR (X_2) -> ROA (M) -> LOGRND (Y)

shows (a,b) = - 13.1712 (-0.2200) = -0.0348, and for indirect model "ind_3"

INDCOMM (X_3) -> ROA (M) -> LOGRND (Y)

showed (a,b) = -8.2205 (-0.2838) =-0.0226. Both indirect models "ind_2" and "ind_3" are not significant; the bootstrap confidence interval showed below zero (-0.0725 to -0.0078) for "ind_2" and straddled zero (-0.0546 to 0.0021) for "ind_3". Both "ind_2" and "ind_3" indicate hypotheses H3.2 and H3.3 are not supported. Therefore, firm performance fails to mediate the effect of independent directors on green innovation practices, and firm performance also fails to mediate the effect of independent commissaries on green innovation practices.

This result is aligned the study by (Fauzi & Locke, 2012; Fuzi et al., 2016) independent directors have no significant impact on firm performance, and independent directors have no significant impact on green innovation practices (Lee & Min, 2015; Liu et al., 2011). The results of individual hypothesis testing on both independent directors and independent commissaries indicate firm performance is not adequate to accelerate data and information sent to both independent directors and independent commissaries. Hence, the risk of information asymmetry and agency conflict from making optimal strategic decisions, particularly on green innovation, is high.

Good firm performance was not adequate to improve the individual role of independent commissaries and independent directors in encouraging companies to adopt green innovation practices. This confirms that only 11% of companies are allocating R&D expenses. Hence, **this finding carries the implication** that companies need to enhance the role of independent commissaries in supervising, advising, and directing the board of

directors in the creation of green innovation practices as part of their strategic projects. This study provides **the important implication** that green projects will be successfully effective when the independent roles of both board commissaries and the board of directors are collaborated. Therefore, the authorised government needs to enforce the policy where the collaboration role between the independent directors and independent commissaries is an effective tool to execute green projects, accelerating the sustainability agenda in 2030.

5. Conclusion

Indonesia represents a unique setting as related to the implementation of the two-tier system, where it has adopted two, which are a board of directors and a board of commissioners. It also applied to the role of an independent board, which has independent directors and independent commissioners. This research examines the role of firm performance in the effect of a two-tier independent board on green innovation. This research finds the direct effect of a composite independent board on firm performance and green innovation is positive and significant. It indicates a composite independent board is still a powerful tool for effective corporate governance to increase the value of the company. This research might come up with the conclusion as a composite independent board might still be the best mechanism to reduce the failure of corporate governance practice, particularly in emerging countries that have adopted a two-tier system. This research also discovers a composite independent board contributes to the increase in R&D expenditure for green innovation practices through the improvement of the existing technologies and processes used by companies.

This research also finds evidence the indirect effect of firm performance on the effect of a composite independent board tends to increase green innovation practices. A composite of independent boards increases firm performance. Better performance will result in better investment. It will contribute to the role of a composite independent board by increasing R&D expenditure to enhance the technological and production processes used by companies to produce more eco-based products. **The implication of this finding is that the composite role of both independent directors and independent commissaries is still important in encouraging green innovation practices**; hence, the latest regulation, whereby independent directors are no longer mandatory, needs to be evaluated in a two-tier system.

However, the role of independent directors and independent commissaries in a separation function is found to be negative and not significant for firm performance or the practice of green innovation. The implication of this result is that both independent directors and independent commissaries need to improve their ability, knowledge, and expertise to improve their role in advising, supervising, and directing the boards. Firm performance also fails to mediate the effect of both independent directors and independent commissaries on green innovation practices. This confirms that only 11% of companies are allocating R&D expenses. These results indicate the separation function is 'powerless' and make companies struggle in achieving better performance or performing strategic role in green innovation practices. It might occur due to independent directors and independent commissaries become powerless in a board of discussion. Also, there are some issues of lack of capabilities, lack of knowledge, and less contribution to board discussion compared to the executive's board. Moreover, shareholders and independent commissaries have shown poor understanding of the urgent calls for green innovation practices. Therefore, independent directors' and independent commissaries existence must accelerate, and their role must be evaluated in the two-tier system. Both independent directors and independent commissaries should be designed as a comprehensive function to perform internal and external supervisory board. This comprehensive role must be designed for this independent party on both the board of directors and the board of commissaries to avoid any asymmetry of information (agency conflicts).

This research has practical implications for the latest regulation from Financial Services Authority (as the representative of Indonesian government), as independent directors are no longer mandatory for public companies starting in December 2021 and must be evaluated. A comprehensive role for both independent directors and independent commissaries is required to generate better performance and investment in green innovation. Independent directors may contribute data and information related to the operations and production processing of management decisions. Based on the comprehensive data and information from the independent directors, independent commissaries may perform their role in supervision, and both could provide the best advice and monitoring to increase firm performance and improve green innovation practices. Therefore, a

company may adopt and apply the function of an independent director who have more knowledge and capabilities to be able to contribute on board discussions and have an impact in improving firm performance.

Thus, as a practical implication, this research recommends the Indonesian government enhance the campaign on the importance of green innovation practices for companies in the era of the SDGs. It is significant to provide support with incentives and initiatives for companies with adopt green innovation practices as a part of Indonesia's commitment to the SDGs. **This research contributes** to the literature on the role of an independent board in a two-tier system of firm decision-making to improve both firm performance and green innovation practices. **From the agency theory perspective, the composite role of independent directors and independent commissaries will reduce the risk of agency conflicts**. The social implication of this research is that eco-based products expected by consumers are possible to be realized due to the comprehensive role of independent directors and independent commissaries.

This research is not devoid of limitations. First, it only uses sample firms from one country, which applied a two-tier system; no comparative analysis is applied. Second, this research only uses to a single proxy of measurement. Further research might utilize more sample firms from multiple countries or provide a comparative study between firms that adopt a one-tier compared to two-tier system. Hence, the implication might be applicable for both one-tier and two-tier system-adopted countries, and it might be applicable not only for emerging countries but also developed countries. Further research is expected to use more measurement of green innovation so that the result is more robust and has more impacts.

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Appendix A

```
********************* PROCESS for R Version 4.3.1 *********************

            Written by Andrew F. Hayes, Ph.D.  www.afhayes.com
    Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************

Model : 4
    Y : LOGRND
    X : TOTIND
    M : ROA

Covariates:
       LNFSIZE LNBSIZE LEV BGD

Sample size: 1554

Custom seed: 654321

**************************************************************************
Outcome Variable: ROA

Model Summary:
          R      R-sq       MSE         F       df1       df2         p
     0.4308    0.1856  119.2415   70.5606    5.0000 1548.0000    0.0000

Model:
             coeff        se         t         p      LLCI      ULCI
constant   -0.6841    0.8236   -0.8306    0.4063   -2.2995    0.9314
TOTIND      0.8689    0.2888    3.0084    0.0027    0.3024    1.4354
LNFSIZE     0.2186    0.0365    5.9830    0.0000    0.1469    0.2902
LNBSIZE    -2.7419    1.3921   -1.9697    0.0491   -5.4725   -0.0114
LEV        -4.1197    0.2318  -17.7748    0.0000   -4.5744   -3.6651
BGD        -0.1061    1.5435   -0.0687    0.9452   -3.1336    2.9214

Standardized coefficients:
             coeff
TOTIND      0.2251
LNFSIZE     0.1432
LNBSIZE    -0.1484
LEV        -0.4131
BGD        -0.0016

**************************************************************************
Outcome Variable: LOGRND

Model Summary:
          R      R-sq       MSE         F       df1       df2         p
     0.2100    0.0441    0.1137   11.8983    6.0000 1547.0000    0.0000

Model:
             coeff        se         t         p      LLCI      ULCI
constant   -0.0109    0.0254   -0.4277    0.6689   -0.0608    0.0390
TOTIND      0.0301    0.0089    3.3610    0.0008    0.0125    0.0476
ROA         0.0027    0.0008    3.4636    0.0005    0.0012    0.0043
LNFSIZE     0.0021    0.0011    1.8673    0.0620   -0.0001    0.0044
```

```
LNBSIZE    -0.0653    0.0430   -1.5170    0.1295   -0.1497    0.0191
LEV         0.0015    0.0079    0.1878    0.8510   -0.0139    0.0169
BGD        -0.0360    0.0477   -0.7546    0.4506   -0.1294    0.0575

Standardized coefficients:
            coeff
TOTIND     0.2737
ROA        0.0948
LNFSIZE    0.0483
LNBSIZE   -0.1240
LEV        0.0053
BGD       -0.0192

************************ TOTAL EFFECT MODEL ***************************
Outcome Variable: LOGRND

Model Summary:
          R      R-sq       MSE         F       df1       df2         p
     0.1916    0.0367    0.1145   11.7949    5.0000 1548.0000    0.0000

Model:
             coeff        se         t         p      LLCI      ULCI
constant   -0.0127    0.0255   -0.4992    0.6177   -0.0628    0.0373
TOTIND      0.0324    0.0089    3.6228    0.0003    0.0149    0.0500
LNFSIZE     0.0027    0.0011    2.4070    0.0162    0.0005    0.0049
LNBSIZE    -0.0727    0.0431   -1.6863    0.0919   -0.1573    0.0119
LEV        -0.0097    0.0072   -1.3538    0.1760   -0.0238    0.0044
BGD        -0.0362    0.0478   -0.7580    0.4486   -0.1301    0.0576

Standardized coefficients:
            coeff
TOTIND     0.2947
LNFSIZE    0.0621
LNBSIZE   -0.1381
LEV       -0.0341
BGD       -0.0193

**************************************************************************
Bootstrapping progress:
  |>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>| 100%

************ TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y ************


Total effect of X on Y:
     effect        se         t         p      LLCI      ULCI      c_cs
     0.0324    0.0089    3.6228    0.0003    0.0149    0.0500    0.2948

Direct effect of X on Y:
     effect        se         t         p      LLCI      ULCI     c'_cs
     0.0301    0.0089    3.3610    0.0008    0.0125    0.0476    0.2734

Indirect effect(s) of X on Y:
       Effect    BootSE  BootLLCI  BootULCI
ROA    0.0024    0.0011    0.0005    0.0047

Completely standardized indirect effect(s) of X on Y:
       Effect    BootSE  BootLLCI  BootULCI
ROA    0.0215    0.0097    0.0047    0.0424

********** BOOTSTRAP RESULTS FOR REGRESSION MODEL PARAMETERS **********

Outcome variable: ROA

             Coeff  BootMean    BootSE  BootLLCI  BootULCI
constant   -0.6841   -0.6737    0.6185   -1.9280    0.5104
TOTIND      0.8689    0.8667    0.2418    0.4048    1.3503
LNFSIZE     0.2186    0.2209    0.0298    0.1643    0.2807
```

```
LNBSIZE    -2.7419   -2.7422    1.2402   -5.1013   -0.3043
LEV        -4.1197   -4.1921    0.9170   -6.0960   -2.4675
BGD        -0.1061   -0.1766    1.9775   -4.3133    3.4334
----------
Outcome variable: LOGRND

            Coeff  BootMean    BootSE  BootLLCI  BootULCI
constant   -0.0109   -0.0110    0.0187   -0.0467    0.0271
TOTIND      0.0301    0.0300    0.0112    0.0082    0.0518
ROA         0.0027    0.0028    0.0010    0.0007    0.0048
LNFSIZE     0.0021    0.0021    0.0010    0.0002    0.0039
LNBSIZE    -0.0653   -0.0648    0.0491   -0.1609    0.0333
LEV         0.0015    0.0013    0.0051   -0.0080    0.0120
BGD        -0.0360   -0.0363    0.0461   -0.1263    0.0559

******************** ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output: 95

Number of bootstraps for percentile bootstrap confidence intervals: 5000
```

Appendix B

```
********************* PROCESS for R Version 4.3.1 *********************

           Written by Andrew F. Hayes, Ph.D.  www.afhayes.com
   Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************

Model : 4
    Y : LOGRND
    X : INDDIRR
    M : ROA

Covariates:
       LNFSIZE LNBSIZE LEV BGD

Sample size: 1554

Custom seed: 654321

**************************************************************************
Outcome Variable: ROA

Model Summary:
          R       R-sq        MSE          F       df1       df2          p
     0.4408     0.1943  117.9630    74.6806    5.0000 1548.0000     0.0000

Model:
            coeff         se          t          p       LLCI       ULCI
constant   -0.9702     0.8061    -1.2035     0.2290    -2.5514     0.6110
INDDIRR   -13.1712     2.5868    -5.0917     0.0000   -18.2452    -8.0972
LNFSIZE     0.2290     0.0363     6.3026     0.0000     0.1577     0.3003
LNBSIZE     2.0194     0.4699     4.2974     0.0000     1.0977     2.9412
LEV        -4.1433     0.2305   -17.9784     0.0000    -4.5954    -3.6913
BGD        -0.1534     1.5325    -0.1001     0.9203    -3.1593     2.8526

Standardized coefficients:
            coeff
INDDIRR   -0.1246
LNFSIZE    0.1500
LNBSIZE    0.1093
LEV       -0.4155
BGD       -0.0023

**************************************************************************
```

```
Outcome Variable: LOGRND

Model Summary:
          R       R-sq        MSE          F        df1        df2          p
     0.2042     0.0417     0.1139    11.2176     6.0000 1547.0000     0.0000

Model:
             coeff         se          t          p       LLCI       ULCI
constant   -0.0238     0.0251    -0.9498     0.3423    -0.0730     0.0254
INDDIRR    -0.2200     0.0811    -2.7135     0.0067    -0.3790    -0.0610
ROA         0.0026     0.0008     3.3470     0.0008     0.0011     0.0042
LNFSIZE     0.0024     0.0011     2.0879     0.0370     0.0001     0.0046
LNBSIZE     0.0853     0.0147     5.8069     0.0000     0.0565     0.1141
LEV         0.0005     0.0079     0.0592     0.9528    -0.0150     0.0159
BGD        -0.0425     0.0476    -0.8915     0.3728    -0.1359     0.0510

Standardized coefficients:
            coeff
INDDIRR   -0.0731
ROA        0.0913
LNFSIZE    0.0552
LNBSIZE    0.1620
LEV        0.0018
BGD       -0.0227

************************ TOTAL EFFECT MODEL ***************************
Outcome Variable: LOGRND

Model Summary:
          R       R-sq        MSE          F        df1        df2          p
     0.1864     0.0348     0.1147    11.1472     5.0000 1548.0000     0.0000

Model:
             coeff         se          t          p       LLCI       ULCI
constant   -0.0264     0.0251    -1.0492     0.2943    -0.0757     0.0229
INDDIRR    -0.2548     0.0807    -3.1589     0.0016    -0.4130    -0.0966
LNFSIZE     0.0030     0.0011     2.6420     0.0083     0.0008     0.0052
LNBSIZE     0.0907     0.0147     6.1866     0.0000     0.0619     0.1194
LEV        -0.0105     0.0072    -1.4595     0.1446    -0.0246     0.0036
BGD        -0.0429     0.0478    -0.8970     0.3698    -0.1366     0.0509

Standardized coefficients:
            coeff
INDDIRR   -0.0846
LNFSIZE    0.0690
LNBSIZE    0.1723
LEV       -0.0370
BGD       -0.0229

**************************************************************************
Bootstrapping progress:
  |>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>| 100%

************ TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y ************

Total effect of X on Y:
     effect         se          t          p       LLCI       ULCI       c_cs
    -0.2548     0.0807    -3.1589     0.0016    -0.4130    -0.0966    -0.0846

Direct effect of X on Y:
     effect         se          t          p       LLCI       ULCI      c'_cs
    -0.2200     0.0811    -2.7135     0.0067    -0.3790    -0.0610    -0.0731

Indirect effect(s) of X on Y:
       Effect    BootSE  BootLLCI  BootULCI
ROA   -0.0348    0.0170   -0.0725   -0.0078
```

```
Completely standardized indirect effect(s) of X on Y:
       Effect    BootSE  BootLLCI  BootULCI
ROA   -0.0116    0.0055   -0.0235   -0.0026
********** BOOTSTRAP RESULTS FOR REGRESSION MODEL PARAMETERS **********

Outcome variable: ROA

             Coeff  BootMean    BootSE  BootLLCI  BootULCI
constant   -0.9702   -0.9570    0.6075   -2.1851    0.2067
INDDIRR   -13.1712  -13.3390    2.7867  -18.8794   -8.0429
LNFSIZE     0.2290    0.2313    0.0302    0.1741    0.2922
LNBSIZE     2.0194    2.0200    0.5441    0.9835    3.1104
LEV        -4.1433   -4.2140    0.9296   -6.1450   -2.4698
BGD        -0.1534   -0.2157    1.9949   -4.4158    3.4006
----------
Outcome variable: LOGRND

             Coeff  BootMean    BootSE  BootLLCI  BootULCI
constant   -0.0238   -0.0240    0.0191   -0.0600    0.0145
INDDIRR    -0.2200   -0.2199    0.0861   -0.3884   -0.0517
ROA         0.0026    0.0027    0.0010    0.0007    0.0047
LNFSIZE     0.0024    0.0024    0.0010    0.0004    0.0042
LNBSIZE     0.0853    0.0856    0.0149    0.0569    0.1146
LEV         0.0005    0.0003    0.0049   -0.0086    0.0106
BGD        -0.0425   -0.0426    0.0463   -0.1315    0.0495

******************** ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output: 95

Number of bootstraps for percentile bootstrap confidence intervals: 5000
```

Appendix C

```
********************* PROCESS for R Version 4.3.1 *********************

           Written by Andrew F. Hayes, Ph.D.  www.afhayes.com
   Documentation available in Hayes (2022). www.guilford.com/p/hayes3

***************************************************************************

Model : 4
    Y : LOGRND
    X : INDCOMM
    M : ROA

Covariates:
       LNFSIZE LNBSIZE LEV BGD

Sample size: 1554

Custom seed: 654321

***************************************************************************
Outcome Variable: ROA

Model Summary:
          R      R-sq       MSE         F       df1       df2         p
     0.4299    0.1848  119.3617   70.1777    5.0000 1548.0000    0.0000

Model:
             coeff        se         t         p      LLCI      ULCI
constant   -0.5946    0.8340   -0.7130    0.4759   -2.2305    1.0412
INDCOMM    -8.2205    3.0052   -2.7354    0.0063  -14.1153   -2.3258
LNFSIZE     0.2160    0.0366    5.9032    0.0000    0.1443    0.2878
LNBSIZE     2.2507    0.5825    3.8640    0.0001    1.1082    3.3933
LEV        -4.1394    0.2318  -17.8560    0.0000   -4.5941   -3.6847
```

```
BGD        -0.0025    1.5483   -0.0016    0.9987   -3.0395    3.0345

Standardized coefficients:
            coeff
INDCOMM   -0.0843
LNFSIZE    0.1415
LNBSIZE    0.1218
LEV       -0.4151
BGD       -0.0000

************************************************************************
Outcome Variable: LOGRND

Model Summary:
          R       R-sq        MSE          F        df1        df2          p
     0.2071     0.0429     0.1138    11.5546     6.0000 1547.0000     0.0000

Model:
             coeff         se          t          p       LLCI       ULCI
constant   -0.0078     0.0258    -0.3021     0.7626    -0.0583     0.0427
INDCOMM    -0.2838     0.0930    -3.0512     0.0023    -0.4663    -0.1014
ROA         0.0028     0.0008     3.5078     0.0005     0.0012     0.0043
LNFSIZE     0.0020     0.0011     1.7818     0.0750    -0.0002     0.0043
LNBSIZE     0.1073     0.0181     5.9380     0.0000     0.0719     0.1428
LEV         0.0009     0.0079     0.1195     0.9049    -0.0145     0.0164
BGD        -0.0324     0.0478    -0.6775     0.4982    -0.1262     0.0614

Standardized coefficients:
            coeff
INDCOMM   -0.1022
ROA        0.0983
LNFSIZE    0.0460
LNBSIZE    0.2038
LEV        0.0032
BGD       -0.0173

************************ TOTAL EFFECT MODEL ***************************
Outcome Variable: LOGRND

Model Summary:
          R       R-sq        MSE          F        df1        df2          p
     0.1878     0.0353     0.1146    11.3219     5.0000 1548.0000     0.0000

Model:
             coeff         se          t          p       LLCI       ULCI
constant   -0.0094     0.0258    -0.3644     0.7156    -0.0601     0.0413
INDCOMM    -0.3065     0.0931    -3.2905     0.0010    -0.4891    -0.1238
LNFSIZE     0.0026     0.0011     2.3195     0.0205     0.0004     0.0049
LNBSIZE     0.1135     0.0181     6.2882     0.0000     0.0781     0.1489
LEV        -0.0105     0.0072    -1.4554     0.1458    -0.0245     0.0036
BGD        -0.0324     0.0480    -0.6752     0.4997    -0.1265     0.0617

Standardized coefficients:
            coeff
INDCOMM   -0.1103
LNFSIZE    0.0598
LNBSIZE    0.2156
LEV       -0.0370
BGD       -0.0173

************************************************************************
Bootstrapping progress:
  |>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>| 100%

************ TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y ************
```

```
Total effect of X on Y:
     effect         se          t          p       LLCI       ULCI       c_cs
    -0.3065     0.0931    -3.2905     0.0010    -0.4891    -0.1238    -0.1103

Direct effect of X on Y:
     effect         se          t          p       LLCI       ULCI      c'_cs
    -0.2838     0.0930    -3.0512     0.0023    -0.4663    -0.1014    -0.1022

Indirect effect(s) of X on Y:
       Effect    BootSE  BootLLCI  BootULCI
ROA   -0.0226    0.0138   -0.0546   -0.0021

Completely standardized indirect effect(s) of X on Y:
       Effect    BootSE  BootLLCI  BootULCI
ROA   -0.0081    0.0049   -0.0197   -0.0008

********** BOOTSTRAP RESULTS FOR REGRESSION MODEL PARAMETERS **********

Outcome variable: ROA

             Coeff  BootMean    BootSE  BootLLCI  BootULCI
constant   -0.5946   -0.5733    0.6590   -1.8810    0.6722
INDCOMM    -8.2205   -8.3417    3.4487  -14.9437   -1.6339
LNFSIZE     0.2160    0.2184    0.0301    0.1612    0.2786
LNBSIZE     2.2507    2.2536    0.6303    1.0430    3.5004
LEV        -4.1394   -4.2118    0.9238   -6.1429   -2.4694
BGD        -0.0025   -0.0713    2.0519   -4.3675    3.6349
----------
Outcome variable: LOGRND

             Coeff  BootMean    BootSE  BootLLCI  BootULCI
constant   -0.0078   -0.0079    0.0191   -0.0440    0.0311
INDCOMM    -0.2838   -0.2857    0.1136   -0.5104   -0.0689
ROA         0.0028    0.0028    0.0010    0.0008    0.0048
LNFSIZE     0.0020    0.0020    0.0009    0.0002    0.0038
LNBSIZE     0.1073    0.1078    0.0217    0.0658    0.1513
LEV         0.0009    0.0007    0.0050   -0.0083    0.0110
BGD        -0.0324   -0.0325    0.0463   -0.1231    0.0598

******************** ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output: 95

Number of bootstraps for percentile bootstrap confidence intervals: 5000
```