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Original Research

Board Independence and Corporate Water Disclosure: The Role of Board Diversity

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Abstract

With the contemporary prevalence of global environmental issues, academic attention to companies' water responsibilities is increasing. Therefore, we investigate Forbes Global 2000 listed multinational corporations (MNCs) water disclosure via content analysis and empirically test the impact of board independence on corporate water disclosure and the moderating effect of board diversity. Our results show that board independence significantly promotes MNCs' water disclosure, the moderating effect of board gender diversity is positive, and the joint moderating effect of board diversity is also positive. This study emphasizes the importance of board independence and board diversity in enhancing a company's water responsibility and extends the application of stakeholder theory to the corporate water responsibility field. Moreover, suggestions for policymakers and MNCs to promote corporate water responsibility are provided.

Keywords: board independence, board diversity, decision-making, water disclosure, multinational corporations, stakeholder

Introduction

The influence of human activities on the environment, especially water-related crises, has attracted much attention from governments and non-governmental organizations (NGOs). After the Second World War, the emerging stability of political and economic situations significantly promoted economic activities and GDP growth worldwide. Meanwhile, these have also engendered climate-change-induced consequences, including extreme heat and weather events, sea level rise, low water availability, and increased distress migration [1]. In particular, people's livelihoods are affected by water-related issues. The Carbon Disclosure Project (CDP) reports that over 60% of freshwater resources are consumed by manufacturing-related sectors worldwide [2].

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Moreover, the United Nations World Water Assessment Programme (WWAP) report shows that over 80% of the world's wastewater is not treated before its release into the environment [3]. This led to 800,000 deaths from drinking-water-related issues in 2012, while 24,500 km^2 of marine ecosystems were affected by water pollution in 2017 [3], and there is expected to be a 56% gap between global water supply and demand by 2030 [4]. Therefore, the World Bank has called for concrete development actions [1], and water-related issues have also been noted in the 2030 Agenda for Sustainable Development. Regarding the private sector, the CDP has mentioned that additional attention to companies' water responsibility management and disclosure is needed [5].

In the past decade, academics have begun to focus on companies' water responsibility management and disclosure. Zhang and Tang (2019) argue that companies' water disclosure reflects water-related corporate practices in management, actions, and performance [6]. These practices can be directly affected by government regulations [7], requirements from NGOs [8], and public supervision (e.g., media) [9]. Therefore, companies adopt water disclosures in response to related stakeholders to help them understand how to implement water responsibility management [10]. Accordingly, an appropriate disclosure relieves stakeholder pressure [11] and enhances companies' understanding of the management of water-related risks, opportunities, and challenges [12].

However, government regulations are lacking to prevent companies' water pollution [3]. On the one hand, the world's water management mechanisms are mainly dominated by the related government bodies [13], but institutional rigidity normally inhibits the government from mitigating emerging water-related challenges [6]. This may make the government's water management mechanisms less resilient and unsustainable [13]. On the other hand, a lack of water disclosure standards for NGOs remains [5], and there is still a shortage of global collective synchronicity in water-related regulations [3]. These have caused water-related regulations to become more uncertain [14] and provided an opportunity for companies to adopt water disclosure to avoid coercive policies [15]. Therefore, Zhang and Tang (2019) suggest that a company's water responsibility management and disclosure remain self-disciplined, a scenario that depends on corporate governance (CG) [6].

Therefore, the literature argues how CG affects corporate environmental responsibility decision-making. Rao and Tilt (2016) argue that corporate environmental decision-making can be determined by board composition [16]. In particular, board members are responsible for management appointments (or removal), strategy setting, and operational monitoring during board debates [17]. These directly determine a company's strategy, policy, and system of operation [18]. The environment is considered a vulnerable stakeholder [19], requiring additional board attention on wider stakeholders' environmental demands to help the board detect environmental issues [20]. In doing so, the board must maximize the advantages of board members in enhancing its knowledge base [21, 22] and the concerns of shareholder demands [19, 23], especially in terms of the advantages deriving from its members' independence and diversity. This is because outside directors' divergent viewpoints can enhance board management supervision [24], strengthen decision-making [25, 26], and ensure that the company's actions comply with stakeholders' environmental expectations [27]. Meanwhile, board members' diversity can increase board concerns regarding stakeholder demands [20] and strategic efficiency [28]. This also enhances corporate environmental disclosure [20, 28, 29]. Thus, the existing literature has investigated the relationship between CG and corporate environment-related issues [23, 27, 30-33].

Considering corporate water practices as a key part of companies' environmental responsibility, stakeholders' water issue concerns and board-detecting abilities may be vital to promoting corporate water responsibility decision-making. Based on existing arguments, we believe that board independence is likely to enhance water responsibility decision-making and that board diversity can enhance the board's concerns for stakeholders and water decision-making efficiency, which may result in different corporate water disclosures. There may be a potential link between board independence, board diversity, and corporate water disclosure. However, to date, only a few such investigations have been conducted. Therefore, this study investigates Forbes Global 2000 listed multinational corporations' (MNCs) water disclosure via content analysis, theoretical discussions, and empirical tests on the impact of board independence on corporate water disclosure and the moderating effect of board diversity from the perspective of stakeholders. This can deepen our understanding of how board independence and board diversity can strengthen corporate water responsibility, and expand the application of stakeholder theory in a company's water responsibility field. Meanwhile, our study also provides suggestions for policymakers on encouraging companies to strengthen their water responsibility inclinations by adjusting the relevant policies and potential strategic approaches vis-à-vis corporate water responsibility enhancement. Next, we present the theoretical orientations and hypothesis development.

Theoretical Orientations

Stakeholder theory explains why a company should not only be concerned with shareholders' interests but also focus on other stakeholders who can influence it [34]. These stakeholders may include consumers, employees, suppliers, and even the environment, and there is an interdependency between the company and these stakeholders [29]. However, the influence of the

different stakeholders varies [35], and the company also treats the stakeholders differently [36]. This is because a company is usually concerned about the stakeholders that can be in its best interest [36], and the appeals of powerful stakeholder groups (e.g., consumers and employees) can attract the company's attention more easily than those of vulnerable groups (e.g., suppliers and environment) [19]. This leads to the company's environmental responsibility being driven by conflicting interests and power differences between stakeholders [37], and management evolves into stakeholder management issues [38], which could be influenced by the board.

A company's environment-related disclosure is the outcome of board decision-making [67], explained from the stakeholders' perspective. Rao and Tilt (2016) argue that a company's corporate social responsibility (CSR)-related decision-making is determined by board composition [16]. For instance, outside directors can represent the interests of a broader range of stakeholders [33], which may reduce information asymmetry between the company and stakeholder groups [39]. Furthermore, with an increasing number of board members, broader stakeholder group interests will be presented on the board [40], which can strengthen the link between the company and various stakeholder groups [33]. Meanwhile, gender differences can enhance female directors' attention to vulnerable stakeholders [19] and strengthen the board's ability to detect stakeholders' water issue concerns [20]. Previous studies have investigated the roles of board independence and board diversity in CSR [33, 41], environmental [42], and water disclosures [20] from the perspective of stakeholder theory.

Thus, stakeholder theory can explain the impact of board independence on corporate water disclosure and the moderating effect of board diversity.

Board Independence and MNCs' Water Disclosure

Outside directors may focus more on stakeholder concerns than internal members. The board comprises both inside and outside directors, and the difference between them is that outsiders are generally not directly linked to the company [33], which means that they are not directly involved in the business operations and are less affected by the CEO [39]. These indicate that outsiders are more likely to question managers' decisions than insiders [18], especially in managerial opportunism prevention. Meanwhile, the remuneration of outside directors is not related to corporate financial performance [32], which causes outsiders to be less economically driven [43] and more focused on long-term corporate sustainable development [44]. Consequently, compared to insiders, outsiders normally show a strong stakeholder orientation [45] and try their best to ensure that corporate practices align with public environmental expectations [27].

Board environmental responsibility decision-making is highly likely to be enhanced by board independence. Board independence reflects the proportion of outside directors to all board members [46]. Peng and Zhang (2022) argue that the divergent "voice" of outside directors is the key to improving board decision-making [23]. This is because the diverse knowledge and backgrounds provide varied viewpoints for the outside directors [46]. This not only strengthens board decision-making efficiency through better management supervision [27] but also enhances the board's understanding of the potential reputational risk that may be caused by corporate irresponsibility practices and the expectations of international organizations (e.g., GRI) [46]. Moreover, outside directors represent the interests of their regions and groups [25] and treat vulnerable stakeholders more equally than insiders [26]. This may lead to an improvement in the board's attention to various stakeholder demands. Therefore, with an increase in board independence, the company's interest conflict with stakeholders can be reduced [46], the link with stakeholders strengthened [47], and board decision-making can better consider wider stakeholders [48] and focus more on environmental sustainability [23].

Previous studies have also provided evidence of the role of board independence in corporate environmental responsibility [39, 33, 41, 46, 49]. Jizi (2017) empirically tests the impact of CG on UK companies' sustainability disclosures and determines the positive role of board independence in business ethics policies [39]. Fernández-Gago et al. (2018) investigate the data of Spanish-listed companies, and the results show that outside directors can promote CSR disclosure [46]. Correa-Garcia et al. (2020), using data from non-financial business groups in Latin America, find a positive relationship between outside directors and sustainability reporting [25]. Other evidence shows that board independence positively affects a company's transparency [49] and environmental performance [31].

Considering that a company's water issues are an important part of its environmental responsibility, we assume that board independence can also strengthen corporate water responsibility during the board's decision-making process. Thus, we propose the following hypothesis:

H1: There is a positive relationship between board independence and the water disclosure of MNCs.

Board Diversity

Board diversity can help companies to enhance their environmental decision-making. Previous studies argue that business team members normally base their perceptions of problems on their perspectives [50]. When a team has greater diversity, the perspectives of team conversations can widen, and the members' understanding can also deepen [51]. Regarding a board, diversity includes board members' ethnicity, gender, tenure, and others [28]. In particular, board gender

diversity could affect the board's concerns regarding stakeholders' demands [20, 52], and board members' tenures could impact their management monitoring effectiveness [53]. According to Rao and Tilt (2016), management supervision and board attention to stakeholders are crucial to board CSR decision-making improvement [16], which requires consideration of board gender and tenure diversity in corporate environmental responsibility studies.

In terms of gender diversity, female directors may enhance a board's ability to detect stakeholders' water-related concerns. The previous literature argues that traditional social identity can result in the unrelenting devaluation of females [54], which may cause them to show more care for others [55] and social orientation [56]. These characteristics generate a stronger benevolence [57] and ethical sense [55] in female directors than in male directors. In particular, female directors exhibit lower tolerance for corporate irresponsibility [58] and are more concerned about environmental issues [20] with the needs of stakeholders [19]. This may be integrated with the advice of female directors and diffused during board debates. Furthermore, with increased board gender diversity, board managerial supervision can be improved [59], and stakeholder interests can be ensured [57]. Consequently, the board's ability to detect stakeholders' water issues is enhanced [20].

Previous studies have investigated the role of board gender diversity in enhancing corporate environmental responsibility. Francoeur et al. (2019) indicate a positive relationship between board gender diversity and a company's environmental scores [19]. Nadeem (2020) investigates the influence of board gender diversity on a company's voluntary disclosure, and the results indicate a positive influence [60]. Moreover, other studies have shown that female directors positively affect corporate environment-related practices [29, 41, 61-63].

Considering the arguments and evidence stated above, and with arguments from Nadeem et al. (2020a) [29], Ibrahim et al. (2009)[55], and Peng et al. (2023) [20], we present the following hypothesis:

H2a: Board gender diversity positively moderates the relationship between board independence and MNCs' water disclosure.

Regarding tenure diversity, a link exists between board environmental decision-making and the heterogeneity of directors' tenures. Katmon et al. (2019) suggest that tenure reflects the time period of a director on a company's board [28]. As their tenure increases, the directors become more familiar with the company's strategies and policies [53]. This can provide an advantage for senior directors in monitoring the management process [64] and reduce misleading information disclosure [65]. Therefore, the relationship between the company and stakeholders is maintained [66], helping the board better understand the company's specific issues [67]. However, a longer tenure also causes directors to have a closer relationship with managers [53]. This may incline directors to avoid conflicts with managers during decision-making processes [53] and very likely maintain the status quo to remain in their "comfort zone" [28].

Conversely, even shorter tenures may cause directors to become unfamiliar with the company's regulations and processes [68]; however, they are not too close with managers [53]. By providing fresh viewpoints on the board [67], the advantages of senior directors in management process monitoring and stakeholder relationship maintenance may be reactivated [69]. Consequently, boards with heterogeneously tenured directors can normally generate better management supervision capabilities [67], a tied link with stakeholders [70], and more balanced CSR-related decision-making [16].

Existing studies have also confirmed the aforementioned arguments. Li and Wahid (2018) investigate the relationship between board tenure diversity and monitoring effectiveness, and they report that the relationship is positive [69]. Katmon et al. (2019) show that board tenure diversity positively affects a company's CSR disclosure quality [28]. Another study also shows a positive relationship between board tenure diversity and a company's social disclosure [41].

Considering the abovementioned, we draw the following hypothesis:

H2b: Board tenure diversity positively moderates the relationship between board independence and MNCs' water disclosure.

Material and Methods

Sample and Data

The sample sources for this study are 2019 Forbes Global 2000 listed MNCs (China, Japan, the UK, and the US) from the manufacturing sector. This is because these companies represent the largest global MNCs and are in the top four countries in Forbes regarding the number of firms listed. In addition, the same sample source has been used in previous CSR-related studies [30, 31, 41, 62, 71]. The sample selection process is stated as follows: based on China Industry Classification for National Economic Activities, 893 manufacturing MNCs are selected from the Forbes list. After excluding 629 samples from the non-manufacturing sector and 124 with missing data, 140 samples are obtained for the present study.

We followed Liu et al. (2021) [7] to select the sample's CSR or related reports as the data source for water disclosure. We also referenced Peng et al.'s (2023) [20] approach to select board- and firm-specific characteristics from the sample's related reports (fiscal years 2017-2018). To ensure the integrity of the corporate water disclosure data, we download the abovementioned reports from the official websites of the samples. The total amount of these qualitative data is more than 5.5 GB.

Variable Development and Model Specifications

Variable Development

For the independent variable, we use the proportion of outside directors to the total number of board directors to measure board independence (*IND*). This is the same as undertaken by Cui et al. (2020) [30], Hussain et al. (2018) [31], and Peng and Zhang (2022) [23].

For the dependent variable, we followed the approach of Peng et al. (2023) [20] to measure water disclosure (*WD*). This approach uses a content analysis method with a multigrade scoring system to measure the samples' CSR, ESG, and/or other related reports. Specifically, the measurement includes MNCs' water responsibility policies (or strategies) and their actual performance. In addition, the multigrade scoring system is combined with "0-2" and "0-4" perimeters, which have been used in existing environmental-related disclosure studies [30, 20]. To be specific, the water responsibility-related policies or strategy will adopt the "0-2" scoring system, and the "0-4" perimeter will be used for the feasible water practices (See Table 1 for further details). The formula is as follows:

$$WD = \sum_{i=1}^{9} \frac{X_i}{34} \times 100\%$$

To ensure the reliability of the measurement method and the results of this study, *WD* was measured by four coders, and an online tool (i.e., http://dfreelon.org/utils/recalfront/recal2) was applied to calculate Krippendorff's alpha for testing. The testing references the approach of Peng et al. (2023) [20], which includes 10% random results for the consistency testing of the coding system, 20% results (evaluated twice by different coders) for reliability, and a re-evaluation of the top 20% results after a one-month waiting period for stability. After calculating Krippendorff's alpha, the results of the abovementioned tests are above 0.80. These results meet the requirements suggested by previous studies [72, 73]. The total processing time for data collection (i.e., measurement and reliability checks) is approximately 500 hours.

Board gender diversity (*BGD*) and board tenure diversity (*BTD*) are adopted as moderator variables in this study. We used the ratio of female directors to the total number of board directors to measure *BGD*. This is similar to approaches used by Katmon et al. (2019) [28] and Peng et al. (2023)[20]. Moreover, we calculate the "Blau Index" [74] of *BTD* as the measurement, and this is similar to the approaches of related studies [28, 41, 67].

Regarding the control variables, previous studies suggest that a company's environmental responsibility is the outcome of the board's decision-making [23] and is influenced by available resources [28]. To be specific, Peng and Zhang (2022) argue that the knowledge and experience of board directors can affect board decision-making [23], and Hussain et al. (2018) suggest that board meeting frequency represents board diligence [31]. This leads to board size (*BS*) and board meeting frequency (*BM*), which determine a company's environmental performance [23, 31]. Moreover, CSR disclosure is affected by profitability (*ROA*) [31, 75], auditing quality

Table 1. Multigrade scoring system for MNCs' water disclosure.

<table>
<tr><th>Score</th><th>Explanation</th><th colspan="5">Content Examples*</th></tr>
<tr><td>0</td><td>No related information disclosure</td><td colspan="5">No related information disclosure</td></tr>
<tr><td>1</td><td>Briefly related information disclosure</td><td colspan="5">We commit to improving water management.</td></tr>
<tr><td>2</td><td>Detailed related information disclosure</td><td colspan="5">In 2018, we upgraded our water treatment system and a new water recycling system was installed, and the water safety training was also completed. These improved the operational efficiency of our water use. Moreover, we will continue to enhance the company's water management and review our water management for the supply chain.</td></tr>
<tr><td>3</td><td>Detailed related information disclosure + related quantitative performance data</td><td colspan="5">In 2018, we invested $1.2 million to upgrade our water treatment system and $2 million in a new water recycling system, and the water safety training was also completed 100%. These reduced approximately 2 million cubic meters of water usage. Moreover, the review of water management for the supply chain has been completed by 30%. The rest of the review will be continued.</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Detailed related information disclosure + related quantitative performance data + yearly comparison of the performance</td><td colspan="5">In 2018, our annual water usage was 8 million cubic meters, which is 20% lower than in 2017, and 50% lower than in 2016. For another project, an extra $1.2 million will be used to upgrade our water treatment system and $2 million for a new water recycling system. (See Table X for further details)
Table X: Water usage from 2014-2018 (million cubic meters)</td></tr>
<tr><td>2014</td><td>2015</td><td>2016</td><td>2017</td><td>2018</td></tr>
<tr><td>16</td><td>17</td><td>16</td><td>10</td><td>8</td></tr>
</table>

*Examples are hypothetical.

(*BIG4*) [76], debt-to-asset ratio (*DEBT*), and firm size (*SIZE*) [28]. Thus, *BS*, *BM*, *ROA*, *BIG4*, *DEBT*, and *SIZE* are selected as control variables in this study, and the measurements of these variables are based on previous studies [41, 23, 31]. Table 2 summarizes all the variables.

Model Specifications

The models for the empirical test in this study are the dependent, independent, moderator, and control variables. According to our hypothesis development, H1 is required to examine the impact of board independence on the water disclosure of MNCs. Therefore, we utilize the following equation:

$$WD = \beta_0 + \beta_1 IND + CONTROL + \varepsilon \quad (1)$$

Where *WD* refers to the MNCs' water disclosure, *IND* represents board independence, *CONTROL* represents control variables, and ε represents an idiosyncratic error.

To examine the moderating effect of board gender diversity (H2a) and board tenure diversity (H2b) on this relationship, the following equations are used:

$$WD = \beta_0 + \beta_1 IND + \beta_2 IND \times BGD + CONTROL + \varepsilon \quad (2)$$

In Equation (2), *BGD* refers to board gender diversity, and the remaining variables are the same as in Equation (1).

$$WD = \beta_0 + \beta_1 IND + \beta_2 IND \times BTD + CONTROL + \varepsilon \quad (3)$$

In Equation (3), *BTD* refers to board tenure diversity, and the remaining variables are the same as in Equations (1) and (2).

Finally, the 1% and 99% levels of winsorized tail reduction are applied for scientific objectivity improvement, and Stata is applied for the aforementioned empirical tests.

Results and Discussion

Descriptive Statistics and Correlation Analysis

Table 3 presents the descriptive statistics and Pearson's correlations of the variables. The table shows that the correlation coefficients between *IND* and *WD*, *BGD* and *WD*, *BTD* and *WD*, *BS* and *WD*, and *BIG4* and *WD* are all positive at the 1% significance level. The correlation coefficients between the other variables are positive (or negative), as shown in the table. Regarding the multicollinearity issue, except for the correlation coefficient between *IND* and *BGD* (0.62), all others are below 0.35. These results agree with the acceptable suggestions of Kutner et al. (2004)[77]. Moreover, this study calculates the variance inflation factors (VIFs) for the variables. The results show that the mean of the VIFs is 1.34, and the highest is 1.84, which indicates that our regression models are free of multicollinearity.

Multivariate Regression Results

Table 4 reports the regression results of this study. The impact of *IND* on *WD* (H1) is empirically tested in Model 2, and Models 3 and 4 are used to evaluate the moderating effect of *BGD* (H2a) and *BTD* (H2b), respectively. Furthermore, interaction plots of board diversity's moderating effect are also provided.

Table 2**.** Variable summary.

Name of variable	Mnemonics	Role	Measurement
Water disclosure of MNCs	*WD*	Dependent variabl	Measurement results of water disclosure
Board independence	*IND*	Independent variable	Outside directors to the total number of board directors
Board gender diversity	*BGD*	Moderator variable	Female directors to total directors on the board
Board tenure diversity	*BTD*	Moderator variable	Measurement results of "Blau Index" for directors' tenure
Board size	*BS*	Control variable	Total number of board directors
Board meeting	*BM*	Control variable	Total number of board meetings per year
Profitability	*ROA*	Control variable	Operating income to total assets
Auditing quality	*BIG4*	Control variable	Binary variable: value 1 for one of the four largest accounting firms is external auditor, otherwise 0.
Debt-to-asset ratio	*DEBT*	Control variable	Total liabilities to total assets
Firm size	*SIZE*	Control variable	Log of the company's total employees

*Examples are hypothetical.

Table 3. Variables statistics and Pearson correlation.

Variable	Mean	SD	VIFs	1	2	3	4	5	6	7	8	9	10
1. WD	16.52	6.71		1.00									
2. IND	0.58	0.24	1.77	0.32***	1.00								
3. BGD	0.17	0.13	1.84	0.28***	0.62***	1.00							
4. BTD	0.53	0.21	1.19	0.24***	0.22***	0.22**	1.00						
5. BS	10.76	2.26	1.27	0.25***	0.28***	0.34***	0.27***	1.00					
6. BM	10.11	5.14	1.14	0.04	-0.28***	-0.22***	-0.15*	-0.12	1.00				
7. ROA	0.07	0.07	1.18	0.09	0.21**	0.14	0.23***	0.09	-0.21**	1.00			
8. BIG4	0.86	0.34	1.22	0.31***	0.31***	0.31***	0.23***	0.28***	-0.02	0.1	1.00		
9. DEBT	0.61	0.17	1.25	-0.12	0.22***	0.32***	-0.05	0.12	-0.09	-0.17**	0.09	1.00	
10. SIZE	10.83	0.97	1.15	0.08	0.06	0.15*	0.02	0.23***	0.03	-0.13	0.18**	0.24***	1.00
Mean VIFs			1.34										

***, **, and * represent statistical significance at 1%, 5%, and 10%, respectively.

Board Independence and MNCs' Water Disclosure

Table 4 shows that the result for *IND* in Model 2 is positive at the 1% significance level. This indicates that the impact of board independence on MNCs' water disclosure is positive, similar to the findings of Fernández-Gago et al. (2018) [46] and Peng and Zhang (2022) [23]. Following previous arguments [16, 23, 46], this result indicates that outside directors' divergent viewpoints represent various stakeholders' interests and help the board realize the water issue demands of stakeholder groups. In addition, with the increasing numbers of outside directors, their "noise" could push board attention toward the company's water responsibility during board debates, which could effectively strengthen the water responsibility decision-making and enhance the relevant disclosure. These results are consistent with our expectations. Thus, H1 is supported.

Moderating Effect of Board Diversity

The result of the interaction term *IND×BGD* is positive in Model 3, with a 5% significance level. Meanwhile, Fig. 1 displays that the slope of the line for high-board gender diversity is steeper than that of low-board gender diversity. This finding indicates that board gender diversity positively moderates the relationship between board independence and the water disclosure of MNCs, which indirectly supports the findings [20, 29] and arguments [20, 29, 55] in previous studies. Based on previous arguments [20, 29, 57], this result demonstrates that female directors' characteristics of benevolence and ethical sensitivity can strengthen a board's ability to detect stakeholders' water responsibility demands during board decision-making. The positive role of board independence can be enhanced by increasing the number of females on the board. Specifically, decision-making can be promoted by a board that focuses on water responsibility and has the ability to detect stakeholders' water issue concerns. Consequently, MNCs' water disclosure capabilities are promoted. These results are consistent with our expectations. Thus, H2a is supported.

Meanwhile, the result of the interaction term *IND×BTD* is not significant in Model 4. According to Fig. 2, the slope of two lines (i.e., low- and high-board tenure diversity) is not much different. This finding indicates that board tenure diversity does not moderate the relationship between board independence and the water disclosure of MNCs. Similarly, Khan et al. (2019) find that the impact of board tenure diversity on Pakistani companies' CSR disclosures is insignificant [78]. Harjoto et al. (2015) show that the relationship between board tenure diversity and US companies' CSR strength is also insignificant [79]. This is inconsistent with the argument that board tenure diversity can enhance management supervision [67] and balance board CSR-related decision-making [16]. This finding

Table 4. Regression results.

VARIABLES	(1)	(2)	(3)	(4)	(5)
IND		0.95***	0.36	0.70*	0.57
		(3.47)	(0.82)	(1.91)	(1.58)
IND×BGD			1.96**		
			(2.03)		
IND×BTD				0.59	
				(1.05)	
IND×BGD×BTD					2.86*
					(1.91)
BS	0.43**	0.31*	0.26	0.29	0.27
	(2.22)	(1.74)	(1.43)	(1.60)	(1.50)
BM	0.06	0.14	0.15	0.15	0.15
	(0.64)	(1.35)	(1.52)	(1.42)	(1.51)
ROA	0.20	-0.12	-0.18	-0.20	-0.23
	(0.38)	(-0.24)	(-0.35)	(-0.40)	(-0.45)
BIG4	0.36***	0.26*	0.24*	0.25*	0.24*
	(2.75)	(1.851)	(1.69)	(1.77)	(1.71)
DEBT	-0.48**	-0.66***	-0.78***	-0.66***	-0.74***
	(-2.01)	(-2.82)	(-3.17)	(-2.71)	(-3.00)
SIZE	0.02	0.02	0.02	0.03	0.02
	(0.41)	(0.57)	(0.52)	(0.63)	(0.56)
Constant	1.32**	1.15*	1.49**	1.19*	1.38**
	(1.99)	(1.84)	(2.29)	(1.94)	(2.20)
F	3.38***	5.62***	5.09***	4.90***	4.96***
Root MSE	0.46	0.44	0.43	0.44	0.44
Observations	140	140	140	140	140
R-squared	0.16	0.23	0.25	0.23	0.24

***, **, and * represent statistical significance at 1%, 5%, and 10%, respectively.

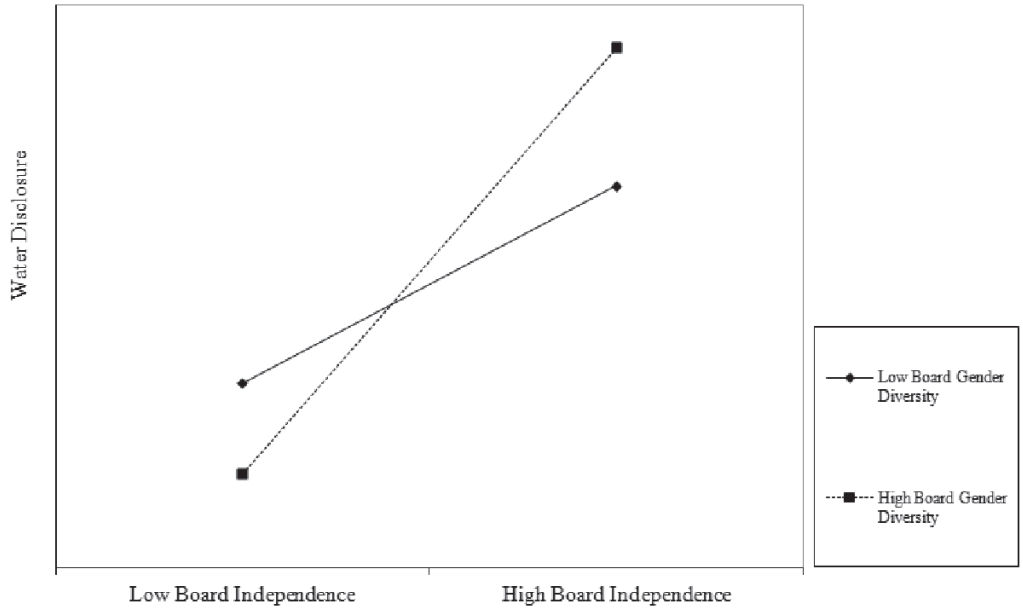

Fig. 1. Interaction plot for the moderating effect of BGD.

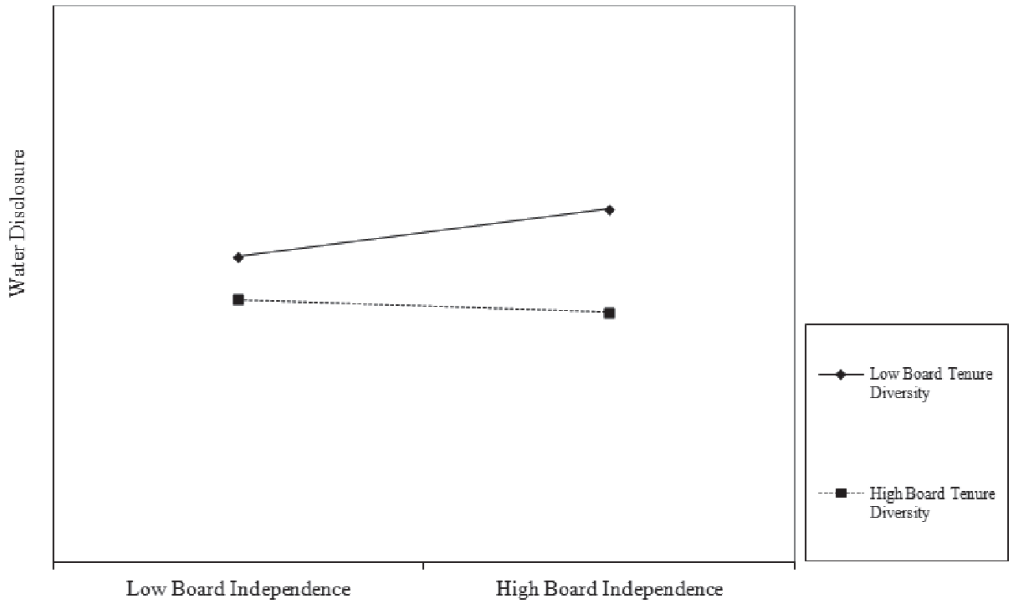

Fig. 2. Interaction plot for the moderating effect of BTD.

implies that the moderating effect of board tenure diversity is more complicated than expected. Thus, H2b is not supported.

We suspect that senior and junior directors may strengthen board water responsibility decision-making in different ways. Senior directors have a close relationship with managers [53], thereby increasing earnings management risk [69]. Meanwhile, senior directors' familiarity with the company's regulations [53] and specific issues [67] may be beneficial to decision-making efficiency. Consequently, decision-making regarding water responsibilities may be enhanced. For junior directors, decision-making can be improved by their fresh viewpoints [67]. However, a lack of understanding of a company's regulations and processes [68] may limit the positive role of junior directors in improving water responsibility decision-making. This may be the reason for this unexpected result, and additional analysis for board diversity is required.

Additional Analysis: The Joint Moderating Effect of Board Diversity

A joint moderating effect of board diversity may exist between board independence and MNCs' water disclosure. The hypothesis developments are based on existing arguments through a theoretical lens. Interestingly, the moderating effect of board tenure diversity is insignificant, which means that the role of board diversity is more complex than envisaged, and a deeper investigation is needed. Rao and Tilt (2016) assume that board CSR-related decision-making is a collective process that may be influenced by various board diversity characteristics [16]. This may be the key to unlocking the role of board diversity in board decision-making regarding water issues and explaining why the moderating effect is insignificant. Considering the argument of Rao and Tilt (2016) [16], an additional question can be proposed: Can MNCs' water responsibility decision-making be enhanced when an independent board with female directors' detection ability in stakeholders' water issue concerns and the heterogeneity of directors' tenure's better management monitoring and balanced water responsibility decision-making? In other words, does the joint moderating effect of board gender diversity and board tenure diversity exist between board independence and MNCs' water disclosure? To answer this question, we add an interaction term (*IND*×*BGD*×*BTD*) to Equation (1) and test the joint moderating effects of board diversity using the following equation:

$$WD = \beta_0 + \beta_1 IND + \beta_2 IND \times BGD \times BTD + CONTROL + \varepsilon \quad (4)$$

The results are reported in Table 4. As the table shows, the result for the interaction term *IND*×*BGD*×*BTD* is positive at the 10% significance level in Model 5. This indicates that the joint effect of board diversity (board gender diversity and board tenure diversity) positively moderates the relationship between board independence and the water disclosure of MNCs, which conforms to the argument of Rao and Tilt (2016) [16] and reveals that water responsibility decision-making can be enhanced when an independent board has higher board gender and board tenure diversity. This indicates that the positive role of directors' heterogeneous tenure (board tenure diversity) in board management monitoring enhances board water responsibility decision-making, but this only happens when the board has a sufficient ability to detect stakeholders' water responsibility concerns.

Table 5. Robustness tests.

VARIABLES	Test 1			Test 2		
	(1)	(2)	(3)	(4)	(5)	(6)
IND	1.61***	0.94*	1.10**	0.97***	0.40	0.60*
	(4.41)	(1.89)	(2.48)	(3.56)	(0.96)	(1.69)
IND×BGD		2.57**			1.85*	
		(2.32)			(1.97)	
IND×BGD×BTD			4.75**			2.73*
			(2.59)			(1.79)
BS	0.44**	0.36	0.36*	0.33*	0.27	0.28
	(2.02)	(1.65)	(1.68)	(1.80)	(1.50)	(1.57)
BM	0.16	0.18	0.19	0.15	0.16*	0.17*
	(1.39)	(1.58)	(1.63)	(1.50)	(1.67)	(1.69)
ROA	0.18	-0.11	-0.18			
	(0.24)	(-0.14)	(-0.24)			
ROE				-0.00	-0.00	-0.00
				(-0.89)	(-0.85)	(-0.89)
BIG4	0.25*	0.23	0.22	0.26*	0.23*	0.24*
	(1.74)	(1.57)	(1.53)	(1.83)	(1.67)	(1.68)
DEBT	-0.58*	-0.76**	-0.72**	-0.58***	-0.69***	-0.65***
	(-1.91)	(-2.41)	(-2.24)	(-2.62)	(-3.00)	(-2.79)
SIZE	0.01	0.01	0.01	0.02	0.02	0.03
	(0.24)	(0.18)	(0.26)	(0.60)	(0.56)	(0.61)
Constant	0.65	1.11	1.00	1.02*	1.35**	1.22**
	(0.93)	(1.51)	(1.43)	(1.68)	(2.14)	(2.01)
F	6.00***	6.67***	6.17***	4.56***	5.08***	4.89***
Root MSE	0.46	0.45	0.45	0.44	0.43	0.43
Observations	97	97	97	140	140	140
R-squared	0.29	0.32	0.32	0.24	0.25	0.25

***, **, and * represent statistical significance at 1%, 5%, and 10%, respectively.

This re-emphasizes the positive role of female directors in corporate water responsibility.

Robustness Tests

In this study, the approaches of excluding US samples and alternative measurements are applied to the robustness tests. First, we followed an approach from a previous study [80] to exclude US samples to ensure robustness. In doing so, we perform empirical tests without US samples using the same regression models (Robustness Test 1). Second, the existing literature suggests that profitability can be measured by either the return on equity (*ROE*) or *ROA* [81]. Thus, we substitute *ROA* with *ROE* for Robustness Test 2.

Table 5 presents the robustness test results. As the table shows, *IND* positively affects *WD* in Models 1 and 4, *IND×BGD* positively affects *WD* in Models 2 and 5, and the results for *IND×BGD×BTD* are also positive in Models 3 and 6. These results are similar to those in Table 4, which indicates that H1, H2a, and the additional analysis pass the robustness test.

Conclusions

With the contemporary prevalence of global environmental issues, academic attention to the water responsibilities of companies has been increasing. Previous literature suggests that board composition

is the key to improving a company's environmental responsibility [16], especially independence [46] and board diversity [57]. However, merely a few studies have investigated the impact of board independence on corporate water disclosure, as well as the role of board diversity. Therefore, this study uses stakeholder theory to discuss the above-stated relationship and empirically test the related hypotheses.

Our results show that board independence significantly promotes MNCs' water disclosure. The moderating effect of board gender diversity is positive, and the joint moderating effect of board diversity is also positive. These emphasize the importance of board independence in corporate water responsibility enhancement, indicating the positive role of female directors in promoting the board's ability to detect stakeholders' water-related concerns, and how board independence, board gender diversity, and heterogeneous tenure could jointly strengthen board water responsibility decision-making efficiency.

Meanwhile, our study also makes several contributions:

Theoretically, our results emphasize that board independence (i.e., outside directors' divergent viewpoints) is the key to improving the board's concerns about stakeholders' water responsibility demands during board debates and strengthening decision-making. This explains how board independence can enhance board stakeholder management of water concerns from the perspective of stakeholders, which extends the application of stakeholder theory in the corporate water disclosure field. An examination of the moderating effect of board diversity highlights that female directors' moral characteristics can promote the board's ability to detect stakeholders' water responsibility concerns. This closes the existing gap and deepens the understanding of how board diversity can influence board water responsibility decision-making. Finally, an additional analysis of the joint moderating effect of board diversity unlocks the mystery of the mixed results regarding the role of board tenure diversity in corporate environmental responsibility. This explains the joint effect of board gender and tenure diversity on corporate water responsibility decision-making. This again re-emphasizes the importance of female directors' abilities in water responsibility decision-making.

This study offers practical suggestions for policymakers and MNCs. Considering critical water crises, policymakers should realize the importance of outside directors in board water responsibility decision-making. We suggest policymakers adopt CG-related policies to increase a company's board independence and encourage the diffusion of outside directors' divergent viewpoints in board debates to strengthen corporate water-related concerns. Board diversity should also be considered when adjusting relevant policies. Currently, policies mainly focus on board independence, while there is less concern about diversity. However, this study proves the advantage of female directors in improving boards' ability to detect stakeholders' water issue demands and the joint effect of board diversity. Therefore, policymakers could encourage companies to increase their board gender ratios and tenure diversities and improve corporate water responsibility by enhancing the advantage of female directors and promoting management supervision from directors' heterogeneous tenures.

For MNCs, this study suggests that the company should realize that board water responsibility decision-making can be enhanced through board independence and diversity. Notably, MNCs should consider increasing board independence and encouraging outside directors to diffuse their divergent viewpoints during board debates. These could effectively improve the board's attention to wider stakeholder groups and enhance their water responsibility decision-making processes. Meanwhile, MNCs may also consider increasing the proportion of female directors on boards and glean their advantages in promoting corporate responsibility. Moreover, heterogeneous tenures are required for directors. Furthermore, MNCs could consider the advantages of senior and junior directors in familiar companies' operations and fresh viewpoints, and combine these with the positive role of outside and female directors to further strengthen corporate water responsibility.

Finally, the limitations of this study and directions for future research are discussed. Small and medium-sized enterprises (SMEs) are not considered in this study. However, SMEs are also responsible for global water crises. Thus, future research can focus on SMEs' water issues to provide suggestions for SMEs to promote water responsibility and offer suggestions to policymakers regarding relevant policy enhancements. Institutional factors are also related to a company's environmental responsibility, which means that additional institutional factors (e.g., national culture and mandatory regulation) should be considered in the research model. This may deepen our understanding of a company's water responsibility and inspire fresh research for management and CSR fields.

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Conflict of Interests

The authors declare no conflicts of interest.

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