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Submitted 07-10-2021. Approved 01-20-2023

Evaluated through a double-blind review process. Associate Editor *ad hoc*: Aldo Musacchio

Reviewers: Marina Amado Bahia Gama, Fundação Getulio Vargas, Escola de Administração de Empresas de São Paulo, São Paulo, SP, Brazil. One of the reviewers did not authorize the disclosure of their identity and review report.

Peer review report: the peer review report is available at this URL

Original version | DOI: http://dx.doi.org/10.1590/S0034-759020230402

BOARD ATTRIBUTES AND ENVIRONMENTAL DISCLOSURE: WHAT IS THE NEXUS IN LIBERAL ECONOMIES?

Atributos do Conselho e Divulgação Ambiental: Qual é o nexo nas economias liberais?

Atributos de la junta y divulgación ambiental: ¿Cuál es el nexo en las economías liberales?

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ABSTRACT

Our study investigates the impact of the board of directors' attributes on companies' environmental disclosure. The sample comprised 1,037 companies from Australia, Canada, Ireland, New Zealand, the United Kingdom, and the United States between 2015 and 2018. The results reveal that the percentage of independent auditors, board size, and the presence of the sustainability committee positively influence environmental disclosure. Our findings show that greater diversity on the board is an important factor for companies to disclose more information on their emissions. We conclude that companies should pay greater attention to the characteristics of their boards of directors, as this determines their engagement in environmental issues. This research presents an environmental disclosure index that is less susceptible to greenwashing. The results also bring contributions to the resource dependence theory and agency theory.

Keywords: corporate governance, environmental disclosure, corporate social responsibility, liberal economies, board attributes.

RESUMO

Nosso estudo tem como objetivo investigar qual é o impacto dos atributos do conselho de diretores na divulgação ambiental das empresas. A amostra foi composta por 1.037 empresas da Austrália, Canadá, Irlanda, Nova Zelândia, Reino Unido e Estados Unidos, entre 2015 e 2018. Os resultados revelam que a porcentagem de auditores independentes, o tamanho do conselho e a presença do comitê de sustentabilidade influenciam positivamente a divulgação ambiental. Nossos achados mostram que maior diversidade no conselho é um fator importante para que as empresas divulguem mais informações de suas emissões. Nós concluímos que as empresas devem dar maior atenção às características de seus conselhos de diretores, porque isso determina o engajamento das empresas às questões ambientais. Esta pesquisa apresenta um índice de divulgação ambiental menos suscetível a greenwashing. Os resultados também trazem contribuições para a Teoria da Dependência de Recursos e Teoria da Agência.

Palavras-chave: *governança corporativa, divulgação ambiental, responsabilidade social corporativa, economias liberais, atributos do conselho.*

RESUMEN

Nuestro estudio tiene como objetivo investigar el impacto de las juntas en la divulgación ambiental de las empresas. La muestra estuvo compuesta por 1.037 empresas de Australia, Canadá, Irlanda, Nueva Zelanda, Reino Unido y Estados Unidos, entre 2015 y 2018 Los resultados revelan que el porcentaje de auditores independientes, el tamaño del directorio y la presencia del comité de sustentabilidad influyen positivamente en la divulgación ambiental. Nuestros hallazgos muestran que una mayor diversidad en la junta es un factor importante para que las empresas divulguen más información sobre sus emisiones. Concluimos que las empresas deben prestar la mayor atención a las características de sus consejos de administración, ya que esto determina el compromiso de las empresas con los temas ambientales. Esta investigación presenta un índice de divulgación ambiental que es menos susceptible al lavado verde. Los resultados también traen contribuciones a la Teoría de la Dependencia de los Recursos y la Teoría de la Agencia.

Palavras clave: *gobierno corporativo, divulgación ambiental, responsabilidad social corporativa, economías liberales, atributos del consejo de administración.*

INTRODUCTION

Companies have increased environmental disclosure in their official reports to legitimize their actions and establish a commitment to sustainable development (El-Bassiouny & El-Bassiouny, 2018). Thus, some studies have analyzed which factors influence companies' levels of environmental disclosure (Galego-Álvarez et al., 2014; García-Meca et al., 2015; Miras-Rodríguez et al., 2018), concluding that one of the most relevant factors for understanding environmental disclosure is corporate governance (CG), since the board of directors actively make decisions about the company's environmental policies (Post et al., 2011).

Corporate governance mechanisms are a broader concept, including ownership structure, executive compensation, shareholder rights, and board attributes. Within these mechanisms, the board of directors has a fundamental role in monitoring environmental risks, making decisions on environmental policies, encouraging companies to adopt more sustainable practices, and disclosing their environmental actions to stakeholders with greater transparency (Schiehll & Kolahgar, 2021; Schiehll & Martins, 2016). Considering the importance of the board of directors' structure for the implementation of corporate environmental policies, this study aims to answer the research question: What is the impact of the board of directors' attributes on companies' environmental disclosure? Our study is centered on liberal economies, which have similar characteristics. Thus, we control some external mechanisms of corporate governance, which are similar in these countries. Our study investigates the timeframe from 2015 (when 193 UN member countries signed the Global Compact for Sustainable Development) to 2018 (the most recent data available at the time of data collection).

The study addresses liberal economies because, historically, they have companies with a high level of disclosure of financial information and corporate governance (Martínez-Ferrero & García-Sánchez, 2017). In addition, Australia, Canada, Ireland, New Zealand, the United Kingdom, and the United States have similar institutional characteristics. These countries adopt the common law legal system, present a competitive market based on demand and supply, and have low state intervention in the economy and strong investor protection (Pinheiro et al., 2022; Witt et al., 2018).

Furthermore, in these economies, the capital markets are financed by different investors, requiring the company to have governance mechanisms to ensure shareholder rights (Martins et al., 2020). According to Ioannou and Serafeim (2012), if companies from liberal economies fail on their boards of directors, they may be penalized by the capital market. However, the study by Pucheta-Martínez et al. (2019) showed that companies based in liberal economies tend to have less environmental disclosure since the style of corporate governance in these countries is oriented toward bringing value to investors, which includes greater transparency in financial reporting rather than in corporate social responsibility (CSR) reports. Investigating the environmental disclosure of companies headquartered in countries that historically privilege financial disclosure can bring important contributions to the CSR and CG literature.

The findings support the resource dependence theory and agency theory. Board attributes can be considered a key resource for companies to achieve greater environmental disclosure. Furthermore, introducing independent members can support the agency theory, which considers that external members can reduce the conflict between agent and principal. Therefore, a better combination of the organization's independent and internal members can be important for companies to achieve a greater environmental reputation with their stakeholders.

In this research, we present new empirical evidence on how board attributes relate to environmental disclosure. Although some previous studies (Furlotti et al., 2019; Jizi, 2017; Nadeem et al., 2020) have shown that the presence of more women on the board can encourage voluntary disclosure, our findings have indicated that the presence of more women may only be more important in the GHG emissions disclosure. From a practical point of view, this study seeks a more precise explanation of how the board of directors' attributes can be used to promote CSR.

LITERATURE REVIEW

Board Attributes and Theoretical Model

From the resource dependence theory (RDT) perspective, the board of directors is a company's resource to manage the external environment – its dependencies and uncertainties. According to Haynes and Hillman (2010), boards with different professional experiences and a variety of knowledge (Board Capital Breadth) will be more willing to consider different perspectives, which leads the organization to strategic change and competitive advantage. Taking the board as a human resource, it must deal with external stakeholders in the search for critical external resources. According to Oliveira et al. (2016), one of the board's roles is to help companies manage their businesses fairly for all stakeholders.

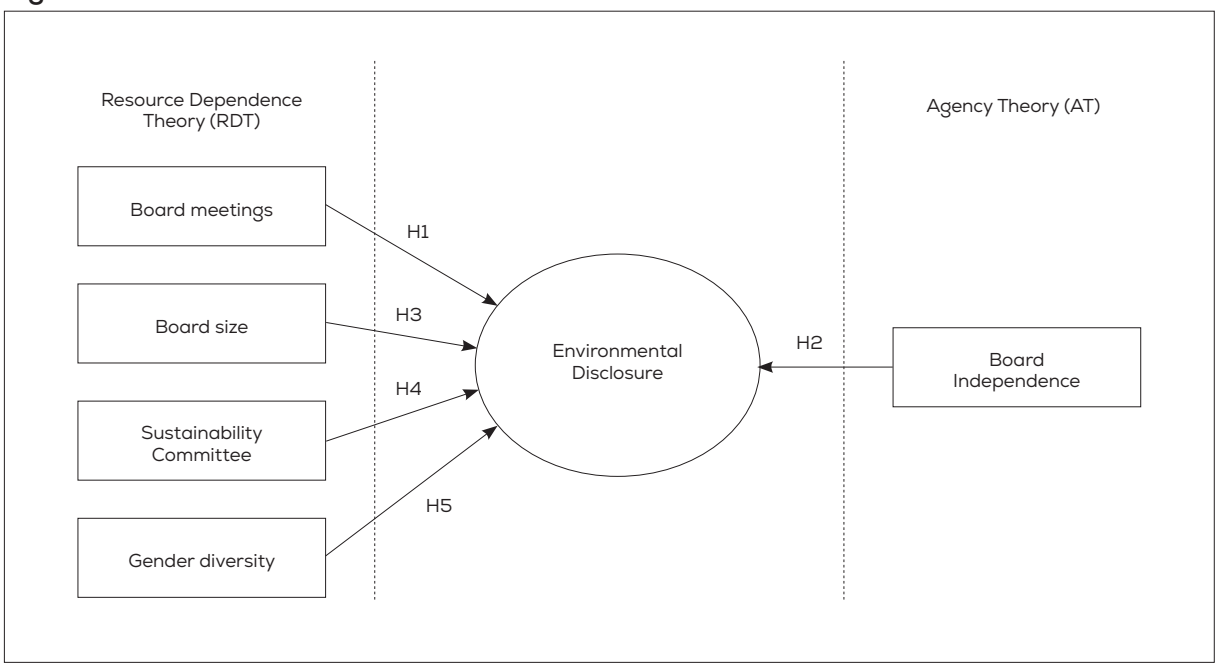
The boards of directors are a resource responsible for the proper functioning of the company since they determine the rules and functions for the executive directors, effect their hiring and dismissal, authorize the proposals of the strategic managers, determine the long-term business objectives, monitor the financial performance, and define performance policies, including corporate social responsibility actions (Schiehll et al., 2018). Therefore, the boards' attributes, such as number of meetings, board size, presence of a sustainability committee, and gender diversity, can contribute to companies having a greater engagement in environmental disclosure.

On the other hand, from an agency theory (AT) perspective, independent board members are considered experts in maintaining a good reputation and corporate image (Fama & Jensen, 1983). Based on this assumption, independent board members can effectively monitor the interests of both shareholders and stakeholders. According to Hussain et al. (2018), external directors bring more transparency and objectivity to the board because they are less subjected to pressures from managers and shareholders than internal directors.

In addition, independent directors monitor the quality of the information contained in financial and CSR reports since managers may have their own interests, generating controversial information for stakeholders (Vafeas, 2000). According to the study by Fama and Jensen (1983), strategic decision-making considers broader organizational interests when non-executive directors are on the board. This is in opposition to the decision-making perspective aimed solely at investors.

From the perspective of RDT and AT, in this paper, we investigate the effect of board attributes on environmental disclosure. Figure 1 presents the theoretical model.

Figure 1. Theoretical model



Source: Elaborated by the authors.

Our model presents five research hypotheses, each related to an attribute of the board of directors. Based on previous studies, we expect a positive effect for all these relationships.

Hypothesis development

Board meetings are an appropriate way to communicate corporate responsibilities and advance sustainable development goals (Ahmad et al., 2017). The high frequency of meetings allows directors to improve supervision of the company's operations. Meetings allow board members to share information and points of view, guaranteeing the objectives of all parties interested in the company's actions (Pucheta-Martínez & Chiva-Ortells, 2018). Therefore, more board meetings may lead to greater transparency and business communication (Birindelli et al., 2018) and improve financial performance and effectiveness in corporate decisions (Ji et al., 2020). Some studies have pointed out the positive impact of the number of board meetings on CSR disclosure (Odoemelam & Okafor, 2018; Yusoff et al., 2019). Thus, we developed the following hypothesis:

H1: The number of board meetings positively influences environmental disclosure.

Internal directors tend to pay more attention to short-term economic goals, while external directors have a broader view, including environmental issues (Ahmad et al., 2017). A company with external board members shows appreciation for the stakeholders' interests. Previous studies (Hussain et al., 2018; Jizi et al., 2014) have tried to find relationships between the presence of independent directors and CSR disclosure, showing a positive influence of the presence of independent directors on CSR disclosure (Fallah & Mojarrad, 2019; Koprowski et al., 2021; Odoemelam & Okafor, 2018). Thus, we develop the following hypothesis:

H2: A higher percentage of independent directors positively influences environmental *disclosure*.

The size of the board refers to the number of board members. Larger boards probably have different points of view, aiding in decision-making that considers multiple perspectives (Husted & Sousa-Filho, 2019). In addition, a larger board of directors has a greater diversity of experiences and increased representation of minority stakeholders (Bae et al., 2018). However, from the agency theory perspective, a greater board induces less ideal monitoring and control in corporate governance (Hussain et al., 2018). Several studies have shown a positive impact of a larger board of directors in the dissemination of sustainability (Husted & Sousa-Filho, 2019; Liao et al., 2018; Martínez-Ferrero & García-Sánchez, 2017). Thus, we develop the following hypothesis:

H3: Board size has a positive influence on environmental disclosure.

Moreover, another resource of the board structure used in recent research is the presence of a sustainability committee or corporate social responsibility committee. A sustainability committee indicates that the board of directors is committed to sustainable development (Hussain et al., 2018). Establishing a sustainability committee improves corporate governance, leading to better financial performance for the firm and corporate transparency (Orazalin, 2020). Previous studies have shown a positive influence of a corporate social responsibility committee on environmental disclosure (Adel et al., 2019; Arena et al., 2015). The presence of a sustainability committee tends to encourage companies to have better socio-environmental performance. Thus, we develop the following hypothesis:

H4: The presence of a sustainability committee positively influences environmental disclosure.

A combination of capacities, experiences, and gender diversity is essential for the board of directors to exercise its role effectively in favor of sustainable development. More women on the board of directors are likely to bring an additional independent view, which improves the quality of business decisions (García-Sánchez et al., 2019). Thus, the greater participation

of women on the board influences decision-making in the company, contributing to the increase in corporate social responsibility policies (Fernandez-Feijoo et al., 2014). Women make different decisions than men regarding environmental issues (Liao et al., 2015), as they are more sensitive and consider multiple parties when making their corporate choices (Terjesen et al., 2009). Previous literature has found a positive impact of a larger female representation on the board in socio-environmental disclosure (Furlotti et al., 2019; Jizi, 2017). Thus, we develop the following hypothesis:

H5: Gender diversity on the board of directors positively influences environmental disclosure.

As can be seen, previous studies relate the board of directors' attributes to CSR. Therefore, our study presents a new approach, finding the effects of attributes on environmental disclosure.

METHODOLOGY

Data

The study population comprised all publicly traded companies from Australia, Canada, Ireland, New Zealand, the United Kingdom, and the United States present in the Thomson Reuters Eikon® database. The sample consisted of 1,037 companies from with available corporate governance data. We analyzed 4 years: from 2015 to 2018. Table 1 shows the distribution of companies by sector and by country.

Table 1. Sample distribution by activity sector and countries

Economic sector name/ Country	AUS	CAN	IRE	NZE	UK	USA	Number of firms
Communication	4	8	0	2	13	29	56
Consumer discretionary	18	13	5	1	40	100	177
Consumer staples	6	10	4	0	21	41	82
Energy	3	22	1	0	7	22	55
Financial	13	24	3	0	30	60	130
Health care	6	2	4	1	6	54	73
Industrials	10	18	3	0	54	92	177
Materials	18	37	5	0	23	43	126
Real Estate	0	0	0	0	3	7	10
Technology	1	7	3	0	10	84	105
Utilities	5	8	0	2	6	25	46
Total	84	149	28	6	213	557	1037

Source: Elaborated by the authors.

According to Table 1, the sample is divided into 11 industries. Firms in the industrial and consumer discretionary sectors represent 17.06%, followed by the financial and materials sectors at 12.53% and 12.15%, respectively. The sector with the lowest representation was real estate at 1%. As can be seen, the country with the highest representation is the United States, with 53.71%, followed by the United Kingdom, with 20.54%. In contrast, New Zealand represents only 0.57%.

Measurement of variables

The data collection followed the methodology of Gamerschlag et al. (2011). They claim that environmental disclosure can be measured through eight pillars. Thus, Thomson Reuters Eikon® environmental indicators were grouped, resulting in the environmental index. The dependent variable of this study is environmental disclosure. This disclosure was calculated through the sum of each of the 25 indicators analyzed. If a company discloses the 25 indicators, it has a maximum performance of 25 points. In building this index, we used objective indicators, trying to avoid greenwashing. Table 2 shows how the environmental index was built.

Table 2. Indicators collected to measure environmental disclosure index

Pillars of environmental disclosure	Description
Recycled	Waste Recycled Total
	Waste Recycled to Total Waste Score
Energy consumption	Energy Efficiency Initiatives
	Energy Use Total
	Renewable Energy Use
Biodiversity	Biodiversity Impact Reduction
	Biodiversity Restoration Protection
Emissions	CO2 Equivalents Emission Total
	NOx Emissions
	SOx Emissions
	Ozone-Depleting Substances

Continue

Table 2. Indicators collected to measure environmental disclosure index — Concludes

Pillars of environmental disclosure	Description
Effluents and Water	Water Discharged
	Water Pollutant Emissions
	Water Recycled
	Water Withdrawal Total
	Water Technologies
Waste	Waste Total
	Non-Hazardous Waste
	Hazardous Waste Reduction
Spills	Recent Spills and Pollution Controversies
	Accidental Spills
Environmental Impacts	Environmental Resource Impact Controversies
	Land Environmental Impact Reduction
	Toxic Chemicals or Substances Reduction
	Environmental Products

Source: Elaborated by the authors.

The study's independent variables are the attributes of the board – number of board meetings, board independence, board size, sustainability committee, and gender diversity. These attributes were selected because they are important in determining environmental policies, as shown in previous studies (Shahbaz et al., 2020; Shaukat et al., 2016). We adopted the GRI guidelines, Return on Assets, firm size, and industry as control variables. As countries are in different geographic locations, the country effect has also been used as a control variable. Table 3 shows each of the variables used in the study and how they are measured.

Table 3. Variables used in the analysis

Variable	Description	Previous studies
ENVINDEX	Environmental Disclosure: This variable ranges from 0 (less environmental disclosure by the company) to 25 (greater disclosure of environmental issues by the company).	This index was created based on Gamerschlag et al. (2011).
BMEET	Board meetings: Number of meetings held by the board per year.	Birindelli et al. (2018); Ji et al., (2020); Yusoff et al. (2019)
BINDP	Board Independence: Percentage of independent auditors on the board of directors	Endo (2020); Fallah and Mojarrad (2019); Hussain et al. (2018)
BSIZE	Board size: Total number of directors on the board of directors.	Bae et al. (2018); Husted and Sousa-Filho (2019); Olthuis and Oever (2020)
SUSCM	Sustainability Committee: Presence of a sustainability committee (1), absence of a sustainability committee (0).	Adel et al. (2019); Burke et al. (2019); Orazalin (2020)
GENDI	Gender diversity: Percentage of women on the board over the total number of members on the board of directors	Furlotti et al. (2019); Jizi (2017); Nadeem et al. (2020)
GRI	Adoption of GRI guidelines: it takes the value 1 if the company publishes a CSR report following the GRI guidelines and 0, otherwise.	Fuente et al. (2017); Kuzey and Uyar (2017); Torelli et al. (2020)
ROA	Return on Assets: Net Income / Total Assets	Bae et al. (2018); Frías-Aceituno et al. (2013); Husted and Sousa-Filho (2019)
FIRMSIZE	Firm Size: This variable is measured by: number of employees/10000.	Adel et al. (2019); Huang (2013)
SECTOR	High Impact Sector: it takes the value 1 if the company operates in an industry with strong and direct environmental impact and 0, otherwise.	Gallego-Álvarez and Pucheta-Martínez (2020); Odoemelam and Okafor (2018); Torelli et al. (2020)
AUSTRALIA	Dummy variable: 1 = if the firm is in Australia; 0 = Otherwise.	---
CANADA	Dummy variable: 1 = if the firm is in Canada; 0 = Otherwise.	---
IRELAND	Dummy variable: 1 = if the firm is in Ireland; 0 = Otherwise.	---
NEWZEALAND	Dummy variable: 1 = if the firm is in New Zealand; 0 = Otherwise.	---
UK	Dummy variable: 1 = if the firm is in the United Kingdom; 0 = Otherwise.	---
USA	Dummy variable: 1 = if the firm is in the United States; 0 = Otherwise.	---

Source: Elaborated by the authors.

Research model

The data were submitted to descriptive statistics to obtain the measures of central tendency and the measures of dispersion of the sample. Before applying the panel regression technique, the following tests were performed: variance inflation factor (VIF) and tolerance to measure the collinearity between the predictors, Shapiro-Francia W test for normality, and Breusch-Pagan test to accept or reject the hypothesis of heteroscedasticity. We applied the Durbin-Watson test to test for endogeneity, which showed no endogenous regressors in our models. In this study, panel data analysis was used. Panel data analysis allows the observation of the longitudinal behavior of companies over a period. In addition, this technique reduces collinearity problems between variables and heteroscedasticity between observations (Fávero, 2013). Thus, we have the following equation:

$$Disclosure_{it} = \beta_0 + \beta_1 BMEET_{it} + \beta_2 BINDP_{it} + \beta_3 BSIZE_{it} + \beta_4 SUSCM_{it} + \beta_5 GENDI_t + \beta_6 GRI_{it} + \beta_7 ROA_{it} + \beta_8 FirmSize_{it} + \beta_9 Sector_{it} + \beta_9 Australia_{it} + \beta_{10} Canada_{it} + \beta_{11} Ireland_{it} + \beta_{12} NewZealand_{it} + \beta_{13} UK_{it} + \beta_{14} USA_{it} + \mu_i + \varepsilon_{it}$$

where disclosure is the dependent variable for environmental disclosure, β_0 is the constant and β_1 to β_{14} are the coefficients to be estimated, i = company, t = year (with fixed effects), μ represents the constant and unobservable characteristics of companies potentially related to environmental disclosure (unobservable heterogeneity), and ε is the error term. The data were analyzed using Stata® software, version 13.

ANALYSIS OF RESULTS

Descriptive statistics and bivariate correlations

Table 4 reports the main descriptive statistics for the variables analyzed.

Table 4. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max	Shapiro-Francia W test
ENVINDEX	3966	12.88	2.78	10	24	0.92
BMEET	3966	8.77	3.77	1	48	0.87
BINDP	3966	98.88	6.77	0	100	0.92
BSIZE	3966	10.14	2.65	1	22	0.99

Continue

Table 4. Descriptive statistics

Concludes

Variable	Obs.	Mean	Std. Dev.	Min	Max	Shapiro-Francia W test
SUSCM	3966	0.59	0.49	0	1	1.00
GENDI	3966	13.57	9.87	0	60	0.99
GRI	3966	0.28	0.45	0	1	1.00
ROA	3087	0.07	0.06	-0.5	0.41	0.90
FIRMSIZE	3966	3.87	9.53	0.09	220	0.31
SECTOR	3966	0.21	0.41	0	1	1.00
AUSTRALIA	3966	0.07	0.26	0	1	1.00
CANADA	3966	0.14	0.34	0	1	1.00
IRELAND	3966	0.02	0.15	0	1	1.00
NEWZEALAND	3966	0.00	0.07	0	1	1.00
UK	3966	0.20	0.40	0	1	1.00
USA	3966	0.54	0.49	0	1	1.00

Source: Elaborated by the authors.

Regarding the dependent variable, companies in our sample disclosed, on average, 12.88 items out of 25. The company with the least environmental transparency disclosed 10 items of the environmental index, while the company with the greatest transparency disclosed 24 items. The number of board meetings is, on average, 8.7 per year. The sample has companies with only one meeting and companies with 48 meetings. Regarding the percentage of independent directors, the data reveal that, in general, companies tend to have a higher percentage of independent directors. For the size of the board, they count, on average, with 10 board members. In addition, the companies in the sample tend to have a sustainability committee on their boards. Regarding gender diversity, the data show that, on average, councils have 13.57% of female representation, having councils with no participation of women and others with 60%.

Regarding the control variables, we found that, on average, companies do not adopt the GRI disclosure guidelines. Return on assets averages 0.07, and firm size averages 3.87. In relation to the industry sector, our sample is underrepresented for sectors with high environmental impact, for example, energy, materials, and utilities. The country variable confirms that the United States has the largest representation in the sample. On the other hand, New Zealand has the smallest representation.

Table 5 presents the analysis of the correlation coefficients between the variables of the proposed model to identify possible collinearities.

Table 5. Correlation matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) ENVINDEX	1.00														
(2) BMEET	0.05***	1.00													
(3) BINDP	0.05***	-0.05***	1.00												
(4) BSIZE	0.20***	-0.05	0.09***	1.00											
(5) SUSCM	0.42***	0.12***	0.03***	0.21***	1.00										
(6) GENDI	0.13***	0.04***	0.09***	0.25***	0.21***	1.00									
(7) GRI	0.63***	0.06***	0.05***	0.25***	0.43***	0.20***	1.00								
(8) ROA	0.02	-0.20***	-0.01	-0.15***	-0.08***	-0.02	-0.02	1.00							
(9) FIRMSIZE	0.06***	-0.03**	0.03	0.20***	0.12***	0.14***	0.16***	0.01	1.00						
(10) SECTOR	0.27***	0.03*	-0.02	-0.05***	0.15***	-0.11***	0.18***	-0.09***	-0.12***	1.00					
(11) AUSTRALIA	0.01	0.22***	-0.31***	-0.23***	-0.01	-0.01	0.01	0.01	-0.06***	0.06***	1.00				
(12) CANADA	-0.01	0.08***	0.05***	0.07***	0.09***	-0.08***	0.01	-0.09***	-0.08***	0.22***	-0.11***	1.00			
(13) IRELAND	0.01	0.02	-0.01	0.01	-0.03*	-0.03***	0.02	0.03*	0.01	-0.00	-0.04***	-0.06***	1.00		
(14) NEWZEALAND	-0.03	0.05***	-0.11***	-0.07***	0.01	0.03***	-0.01	-0.00	-0.02*	0.02	-0.02	-0.02*	-0.01	1.00	
(15) UK	0.09***	0.05***	-0.01	-0.15***	0.17***	-0.09***	-0.03**	0.02	-0.04***	-0.06***	-0.14***	-0.20***	-0.08***	-0.03***	1.00
(16) USA	-0.07***	-0.23***	0.16***	0.20***	-0.19***	0.14***	0.00	0.02	0.12***	-0.14***	-0.31***	-0.44***	-0.17***	-0.08***	-0.55***

***p<0.01. **p<0.05. *p<0.10.

Source: Elaborated by the authors.

Although Table 5 shows some significant correlations, the coefficients were lower than 0.8. We verified the presence of a moderate correlation only between the environmental index and the adoption of the GRI guidelines. This provides external validity for the environmental index. Despite this, and with the VIF values presented below, we can conclude that multicollinearity is not an issue in our models.

Multivariate data analysis

To test the hypotheses developed, we operationalized eight models. First, we segregated the environmental index into eight parts – the eight pillars of environmental disclosure. Except for biodiversity, each pillar was taken as a dependent variable (D.V) in a model. Most companies did not have an extensive disclosure in this environmental pillar, which influenced our tests because when operationalizing the model, the variables were omitted. In Model 8, we present the results for the environmental index. Table 6 shows the results of the multivariate analysis.

Table 6. Multivariate analysis results

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	D.V.: Recycled	D.V.: Energy Consumption	D.V.: Emissions	D.V.: Effluents and Water	D.V.: Waste	D.V.: Spills	D.V.: Environmental Impacts	D.V.: Environmental Index
Variable	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
BMEET	0.000	0.006	-0.002	0.000	0.002	-0.000	-0.000	-0.001
BINDP	0.001	0.001	0.001	0.001	0.003**	0.003*	0.000	0.011*
BSIZE	0.009*	0.001	0.007***	0.025***	0.010**	0.007*	0.007***	0.063***
SUSCM	0.410***	0.259***	0.019*	0.063**	0.376***	0.090***	0.008	1.013***
GENDI	0.001	0.000	0.009*	0.000	-0.000	-0.001	-0.000	0.000
GRI	0.640***	0.415***	0.215***	0.668***	0.826***	0.641***	0.075***	3.189***
ROA	0.315	0.126	0.231***	1.487***	0.566***	0.929***	0.132***	3.504***
FIRMSIZE	-0.005***	-0.000	-0.000**	-0.002***	-0.004***	-0.001	-0.000*	-0.013***
SECTOR	-0.221***	-0.003	0.291***	0.637***	0.040	0.171***	0.106***	1.138***
Obs.	3085	3085	3085	3085	3085	3085	3085	3085
Effect	Random	Random	Random	Random	Random	Random	Random	Random
R^2overall:	0.2530	0.3211	0.2888	0.3200	0.3606	0.2391	0.1193	0.4563
R^2 between	0.8153	0.7026	0.3557	0.7405	0.8256	0.7031	0.5275	0.8244
VIF	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16
Breusch-Pagan test	463.38***	55.61***	1605.65***	1973.08***	248.79***	1088.61***	3818.12***	762.31***
Durbin-Watson test	No endogenous	No endogenous	No endogenous	No endogenous	No endogenous	No endogenous	No endogenous	No endogenous
Wald x^2 test	1041.67***	1454.40***	1248.54***	1447.03***	1734.02***	966.38***	416.64***	2580.93***
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hausman test	Prob>chi2 =0.999	Prob>chi2 =0.984	Prob>chi2 =0.997	Prob>chi2 =0.998	Prob>chi2 =0.996	Prob>chi2 =0.999	Prob>chi2 =0.883	Prob>chi2 =0.992

***p<0.01. **p<0.05. *p<0.10.

Source: Elaborated by the authors

In a general analysis of the models, we can confirm that the R has acceptable values, according to Fávero (2013). Through the VIF operationalized with the variables of each model, we confirmed the absence of multicollinearity since the variables have VIF values less than 10. The results confirm that the models have no heteroscedasticity since Prob> chi² <0.05 (Miniaoui et al., 2019). The Durbin-Watson and GMM robustness tests were applied and confirmed that the regressions were not endogenous.

In Model 5, Model 6, and Model 8, board independence was significant. This means that a greater proportion of independent directors positively impact the disclosure of information about waste, spills, and environmental disclosure. The board size positively impacts information on recycled materials, emissions, effluent and water emissions, waste, spills, environmental impacts, and environmental disclosure. The results show that the presence of a sustainability committee within the board is essential for companies to disclose environmental information. Gender diversity positively affected greenhouse gas emissions (Model 3). In other words, the presence of more women on the board positively influences companies to disclose more information about their emissions. For the control variables, the results show that adopting GRI guidelines, the return on assets, and the industry sector positively affect environmental disclosure. On the other hand, company size does not influence environmental disclosure.

As a further analysis, we operationalized models that control countries' effects, considering that companies are based in different geographic regions. Table 7 shows the results.

Table 7. Further analysis. Country's effect on environmental disclosure

	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Variable	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
AUSTRALIA	0.228					
CANADA		-0.747***				
IRELAND			0.398			
NEWZEALAND				-1.067**		
UK					0.844***	
USA						-0.320***
BMEET	-0.005	0.002	-0.002	-0.000	-0.001	-0.010
BINDP	0.014**	0.013**	0.011*	0.009*	0.010*	0.015***
BSIZE	0.069***	0.073***	0.062***	0.060***	0.077***	0.073***
SUSCM	1.017***	1.058***	1.017***	1.017***	0.818***	0.927***
GENDI	0.000	-0.001	0.000	0.001	0.003	0.002
GRI	3.180***	3.165***	3.185***	3.185***	3.228***	3.200***
ROA	3.482***	3.356***	3.471***	3.498***	3.380***	3.464***

Continue

Table 7. Further analysis. Country's effect on environmental disclosure — Concludes

	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Variable	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**
FIRMSIZE	-0.013***	-0.014***	-0.013***	-0.013***	-0.012***	-0.012***
SECTOR	1.134***	1.245***	1.142***	1.144***	1.196***	1.110***
Obs.	3085	3085	3085	3085	3085	3085
Effect	Random	Random	Random	Random	Random	Random
R^2 overall:	0.4567	0.4624	0.4567	0.4572	0.4679	0.4587
R^2 between	0.8242	0.8057	0.8290	0.8278	0.8327	0.8368
VIF	1.21	1.16	1.15	1.15	1.17	1.19
Breusch-Pagan test	755.62***	785.09***	755.76***	753.89***	763.20***	749.88***
Durbin-Watson test	No endogenous	No endogenous	No endogenous	No endogenous	No endogenous	No endogenous
Wald x^2 test	2584.42***	2644.16***	2584.18***	2589.38***	2702.60***	2605.08***
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Hausman test	Prob>chi2=0.996	Prob>chi2=0.996	Prob>chi2=0.996	Prob>chi2=0.997	Prob>chi2=0.999	Prob>chi2=0.998

***p<0.01. **p<0.05. *p<0.10.

Source: Elaborated by the authors.

The results confirm the signs obtained in the previous models, demonstrating stable findings. Companies based in Canada, New Zealand, and the United States tend to have less environmental disclosure. This finding is interesting since the United States has great environmental biodiversity. In contrast, when companies are headquartered in the UK, they are more proactive in environmental disclosure.

Discussion

Overall, our findings indicate that a stronger board is a significant driver of environmental disclosure. Our results show that a greater number of independent board members have a positive impact on environmental disclosure, which is in line with previous research (Endo, 2020; Fallah & Mojarrad, 2019; Hussain et al., 2018). Independent directors have no personal interests in the company and help to monitor management and control agency costs, resulting in less asymmetry of environmental information between directors and stakeholders. Information asymmetry is reduced through environmental disclosure, helping to maintain the company's reputation.

Results show that the board size (an organizational resource from an RDT perspective) positively affects environmental disclosure. Larger boards have a greater background diversity,

which leads to including environmental issues on the board meetings' agenda. Bae et al. (2018) believe that larger boards tend to be more concerned with meeting the expectations of all stakeholders, considering not only economic decisions but also socio-environmental issues. These results converge with other previous findings (Husted & Sousa-Filho, 2019; Liao et al., 2018; Martínez-Ferrero & García-Sánchez, 2017).

The increase in the number of board members is followed by an increase in the board's effectiveness due to the different professional backgrounds and experiences of the directors (Martínez-Ferrero & García-Meca, 2020; Martínez-Ferrero & García-Sánchez, 2017). Larger boards have more experience concerning environmental communication strategies, enabling a more sophisticated CSR report. Based on the RDT, larger boards have greater availability of knowledge and resources to make connections with external pressures.

We also found that the presence of a sustainability committee is an explanatory factor for the level of environmental disclosure of companies. The data show that companies with sustainability committees carry out more detailed environmental disclosure. Companies that create a committee to plan and monitor sustainability actions tend to have greater responsibility for natural resources and the community (Sidhoum & Serra, 2018). They are more likely to disclose environmental information in their reports to legitimize their actions and reduce political/agency costs. Given that environmental committees are not mandatory, companies implementing them may have greater recognition of the importance of sustainable development (Dixon-Fowler et al., 2017).

The presence of a sustainability committee means that the company is committed to environmental transparency. Previous research has also found a positive influence of the sustainability committee on environmental disclosure (Adel et al., 2019; Arena et al., 2015). The existence of such an internal monitoring mechanism can be a resource to manage stakeholder uncertainties in relation to the company.

The results indicate a positive impact of board gender diversity on emissions disclosure, corroborating previous studies (Furlotti et al., 2019; Jizi, 2017; Nadeem et al., 2020) that argue that women can enrich discussions by bringing different points of view and supporting corporate decisions on environmental issues. Women bring different backgrounds, which can be a resource for managing stakeholders (external environment). More diverse boards of directors demonstrate greater independence (Shahbaz et al., 2020), which reduces opportunistic behavior and minimizes informational asymmetry.

Companies that publish environmental reports following the GRI guidelines present more environmental information than those that do not use this framework. Firms that do not follow the GRI are likely to select and report only favorable information, failing to include issues such as atmospheric emissions and negative impacts on the community (Vigneau et al., 2015). The data also confirms several previous studies by showing that the greater a company's profitability, the greater its concern with environmental disclosure. Large companies have more stakeholders and resources to invest in sustainability reports and actions (Garcia-Sanchez et al., 2016).

The findings also demonstrate that the location affects environmental disclosure even if the sample belongs to countries with similar institutional characteristics. In the UK, a legal framework encourages companies to disclose environmental information (Additionally, the UK was the first country to support "The Prince's Accounting for Sustainability Project" (A4S), which aims to make sustainable decision-making business as usual. The CDP (Carbon Disclosure Project) was also born in the UK, encouraging companies to disclose their carbon emissions. This can contribute to institutions such as the government and business organizations putting pressure on British companies to disclose environmental information.

The board of directors' attributes are important mechanisms for companies to achieve greater environmental performance. Therefore, managers must be aware that when designing a board, they must consider the mix between internal and external directors and establish committees that can support sustainable development. Balancing internal and external directors can be a valuable resource in avoiding agency problems. Furthermore, organizations should invest resources in reporting authentic efforts in relation to environmental disclosure, avoiding creating misleading impressions of their performance. Environmental disclosure can be a company's response to stakeholder pressures, being a resource to reduce agency costs. Therefore, this type of disclosure cannot be merely a symbolic strategy. Researchers should strive to build environmental indices that are less susceptible to greenwashing.

CONCLUSION AND IMPLICATIONS

The research investigated the impact of the board of directors' attributes on companies' environmental disclosure. This paper reinforces the importance of the board of directors' attributes in the engagement of companies in environmental disclosure. We confirm Hypothesis 2, 3, and 4 and partially Hypothesis 5.

These results contribute academically to the studies that work the nexus between board attributes and environmental disclosure, reducing the research gap of previous studies and bringing new evidence to the field. The theoretical implication of the findings is that board independence, board size, sustainability committee, and gender diversity work in favor of shareholders and stakeholders, confirming the assumptions of RDT and AT. Previous studies have mostly addressed the relationship between governance and environmental disclosure in a theoretical way (Jain & Jamali, 2016), requiring more empirical evidence.

The evidence found reinforces that the board of directors is an important resource and a response to companies' external challenges. From an RDT perspective, executives can respond to stakeholder interests with environmental disclosure, which reduces uncertainty and dependency. Organizations are open systems that depend on critical resources (such as the board) for superior environmental performance. Greater environmental disclosure can facilitate access to financial and human resources, for example. Furthermore, from AT's perspective, the introduction of external directors can help protect not only the interests of shareholders but also those of other stakeholders.

Additionally, the results can assist managers in making business decisions. The study showed the importance of the board of directors (a valuable organizational resource) for decisions on corporate social responsibility. Thus, companies must consider that the composition of the board is responsible for the environmental performance of companies since it has a large role in the planning and monitoring of strategic CSR policies. The findings support the adoption of the GRI guidelines in environmental reporting as a tool for greater environmental transparency. The results also imply that corporate governance mechanisms help companies achieve their sustainability goals and obtain legitimacy with stakeholders. Therefore, an efficient board allows for greater monitoring of corporate behavior, promotes environmental transparency, and reduces investor insecurity in company operations.

Organizations must understand how environmental disclosure creates value for their shareholders. Governments must provide regulations encouraging greater environmental performance and reduce greenwashing in corporate reporting.

Although this study investigated the impact of the board attributes on environmental disclosure, the results are limited to large companies from liberal economies. Thus, the results cannot be generalized to all companies in the countries. In addition, the findings are limited to companies that disclose environmental information and that are included in the Thomson Reuters Eikon® database. Another limitation is the board attributes chosen, which were based on previous studies. Other endogenous (academic background and age of directors) and exogenous (presence of the audit committee) attributes can be selected in future studies.

These limitations represent directions for future studies on the nexus between board attributes and environmental disclosure. Future studies may analyze other corporate governance mechanisms, such as ownership structure, executive compensation, and shareholder rights. Also, studies can expand the analyzed time frame, considering the legal aspects of the countries and comparing environmental disclosure before and after the SDG goals. They can investigate other clusters of countries, such as emerging and Asian economies. Finally, through qualitative research, new explanatory variables for environmental disclosure can emerge, as they can investigate companies of various sizes, not just the leading companies in each country.

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ACKNOWLEDGMENT

The research received financial support from the Ministerio de Ciencia e Innovación (Ministry of Science and Innovation of Spain), Contract PID2020-113498RA-C22 (IRENE), the Junta de Castilla y León and the European Regional Development Fund, through Contract CLU-2019-03 (Unidade de Excellence in Economic Management for Sustainability), the Ministerio de Ciencia e Innovación, through the Contract PID2020-114797GB-I00 (SODEFGOC), and the Instituto Universitario Multidisciplinar de Empresa (IME) at the Universidade de Salamanca.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

AUTHORS' CONTRIBUTIONS

Alan Bandeira Pinheiro: Conceptualization, data curation, formal analysis; Investigation; Methodology; Visualization; Writing – original draft; Writing – proofreading and editing.
Marcelle Colares Oliveira: Acquisition of financing; Investigation; Methodology; Project administration; Resources; Software; Supervision.
George Alberto de Freitas: Data Curation, Formal Analysis, Validation; Visualization; Writing – original draft; Writing – proofreading and editing.
María Belén Lozano García: Acquisition of financing; Project administration; Resources; Software; Supervision; Validation; Visualization.

ERRATUM

In the article "Board attributes and environmental disclosure: What is the nexus in liberal economies?", published in RAE-Revista de Administração de Empresas, 63(4), 2022, e2021-0446. DOI: http://dx.doi.org/10.1590/S0034-759020230402, e-mail and institutional affiliation of the George Alberto de Freitas.

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