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THE RELATIONSHIP BETWEEN EXECUTIVE GENDER DIVERSITY AND ENVIRONMENTAL INNOVATION AND THE MODERATING EFFECT OF SUSTAINABLE COMPENSATION POLICY: EVIDENCE FROM BRAZIL

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Introdução
Increasingly, there is a growing political and social awareness of the need to develop eco-innovations (Rhaiem & Doloreux, 2022). Environmental innovation is the production, exploitation, or assimilation of a product developed or adopted by the organization that results throughout its life cycle in reducing environmental risk (Kemp & Pearson, 2007). Gender diversity campaigns in top management teams are gaining momentum because the lack of executive gender diversity has ethical and financial implications for the company's stakeholders (Saeed, Baloch, et al., 2022).
Problema de Pesquisa e Objetivo
The objectives of this paper are to explore the effect of the executive gender diversity on environmental innovation and examine the moderating effect of sustainable compensation policy on this relationship
Fundamentação Teórica
Hambrick and Mason (1984) suggest that organizational outcomes reflect the cognitive bases and values of the organization's powerful actors. In other words, the characteristics of the top management team influence organizational outcomes (Hambrick, 2007). According to upper echelons theory, executive team members' heterogeneity and personal characteristics reflect their values and perceptions (C. Wu et al., 2019). Freeman (1984) defined stakeholders as any group or individual that can affect or is affected by an organization.
Metodologia
The final sample comprises 811 firm-year observations from unique 101 Brazilian firms from 2010-2020. We used Feasible Generalized Least Squares (FGLS) with the heteroscedasticity and panel-specific AR1 autocorrelation. FGLS method deals with heteroscedasticity and autocorrelation (Reed & Ye, 2011). FGLS estimation results in a more efficient estimator and more powerful tests than OLS (Hansen, 2007).
Análise dos Resultados
Our results suggest that executive gender diversity does not influence environmental innovation and that sustainable compensation policy strengthens the nexus of executive gender diversity and environmental innovation. These findings are consistent with stakeholder theory which indicate that companies with a sustainable compensation policy tend to serve stakeholder interests.
Conclusão
This study examined the impact of executive gender diversity for a sample of 101 Brazilian companies from 2010 to 2020. The study uses upper echelon and stakeholder theory, and the dependent variable of the study is the environmental innovation score from the Refinitiv database. As an independent variable, the study used the percentage of female executives and as a moderating variable the study used the presence of sustainable compensation policy. This study employed FGLS.
Referências Bibliográficas
Adu, D. A., Flynn, A., & Grey, C. (2022). Executive compensation and sustainable business practices: The moderating role of sustainability-based compensation. Business Strategy and the Environment, 31(3), 698–736. https://doi.org/https://doi.org/10.1002/bse.2913 Flammer, C., Hong, B., & Minor, D. (2019). Corporate governance and the rise of integrating corporate social responsibility criteria in executive compensation: Effectiveness and implications for firm outcomes. Strategic Management Journal, 40(7), 1097–1122. https://doi.org/10.1002/smj.3018.

Palavras Chave
Environmental Innovation, Executive Gender Diversity, Sustainable Compensation Policy

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1 INTRODUCTION

Increasingly, there is a growing political and social awareness of the need to develop eco-innovations (Rhaiem & Doloreux, 2022). Environmental innovation is the production, exploitation, or assimilation of a product developed or adopted by the organization that results throughout its life cycle in reducing environmental risk (Kemp & Pearson, 2007). In other words, environmental innovation is associated with products and processes that, besides adding value to the business, are determinants of environmental pollution (Mahmood et al., 2022). In this line, environmental innovation can promote quality economic growth and ensure ecological benefits (Yang et al., 2022). Thus, this innovation promotes renewable energy consumption, reduces the need for non-renewable energy, and makes the production process more efficient (Huang et al., 2022), and determinants such as executive gender diversity and sustainable compensation policy influence environmental innovation.

Gender diversity campaigns in top management teams are gaining momentum because the lack of executive gender diversity has ethical and financial implications for the company's stakeholders (Saeed, Baloch, et al., 2022). For example, gender diversity decreases the frequency and severity of accounting fraud (Cumming et al., 2015), reducing the propensity for firms to engage in fraud (Wang et al., 2022). Since it provides a variety of viewpoints and perspectives, gender diversity in top management helps achieve the firm's goals (Ali & Konrad, 2017). In principle, top management would only execute the strategy defined by the board of directors. However, in reality, top management has the power to choose the best way to meet the firm's strategic goals (Burkhardt et al., 2020). Executive gender diversity reduces firm risk-taking (Ozdemir & Erkmen, 2022), increases employee productivity (Luanglath et al., 2019), reduces firm litigation risk (Teodósio et al., 2021), and increases corporate innovation (Canil et al., 2021; J. Wu et al., 2022). In addition, gender diversity engages talent and expands networks, which improves the corporation's strategic decisions (Ali et al., 2014).

Given that the use of executive compensation linked to CSR is relatively new (Derchi et al., 2020), companies are gradually linking the compensation of their executive directors to sustainability aspects, including environmental goals (Winschel, 2021). For example, since 2008, Intel has linked 3% of annual employee bonuses to sustainability metrics (Ikram et al., 2019). Accordingly, it seems reasonable to integrate environmental and social aspects into executive compensation as a core corporate governance mechanism (Winschel & Stawinoga, 2019). In addition, companies use sustainable compensation policy to motivate executives to achieve environmental goals (Haque & Ntim, 2020).

Previous studies show the influence of executive gender diversity (Aabo & Giorici, 2022; Burkhardt et al., 2020; Gaio & Gonçalves, 2022; Galletta et al., 2022; Hyun et al., 2022; Jiang & Akbar, 2018; Pan et al., 2020; Saeed, Riaz, et al., 2022b; C. Wu et al., 2019; Zou et al., 2018) and sustainable compensation policy (Adu et al., 2022; Baraibar-Diez et al., 2019; Flammer et al., 2019; Gull et al., 2022; Haque, 2017; Haque & Ntim, 2020; Kara et al., 2022; Sarhan & Al-Najjar, 2022; Tsang et al., 2021) on environmental performance. However, to the best of our knowledge, no studies address the relationship between executive gender diversity and environmental innovation and the moderation of sustainable compensation policy in this relationship. Based on the discussion above, the objectives of this paper are to explore the effect of the executive gender diversity on environmental innovation and examine the moderating effect of sustainable compensation policy on this relationship.

The study has several contributions. First, In Brazil, it was only after 1990, with the market's opening, public policies to support technological innovation converged with scientific

policy (Jesus et al., 2022). Brazil's greenhouse gas emissions increased by 9.5 in 2020, while the rest of the world reduced almost 7% of global emissions due to the COVID-19 pandemic (SEEG, 2021). Brazil is one of the first countries to prepare for renewable energy by establishing tax measures to encourage resources and financing for renewable energy development and adopting the Pró-Álcool Program, Brazil's Biodiesel Development, and Use Initiative (Udeagha & Ngepah, 2022). In addition, Brazil is considered the leader of the biofuel industry and a model for other countries with great potential for soy biodiesel (Nikas et al., 2022). Thus, the study extends the knowledge of environmental innovation and remuneration structure. Second, the study contributes to stakeholder theory by indicating that in firms with sustainable compensation policies executive gender diversity influences environmental innovation. Third, the paper quantitatively examines the relationship between executive gender diversity and environmental innovation.

The remainder of this paper is structured as follows. The second section discusses the theory and literature review. Next, we discuss our research design and methodology, and the fourth section presents the empirical analyses of the study. Finally, we discuss the findings and make concluding remarks; we point out the research limitations and delineate the related future research directions.

2 LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1 Upper echelon theory

Hambrick and Mason (1984) suggest that organizational outcomes reflect the cognitive bases and values of the organization's powerful actors. In other words, the characteristics of the top management team influence organizational outcomes (Hambrick, 2007). According to upper echelons theory, executive team members' heterogeneity and personal characteristics reflect their values and perceptions (C. Wu et al., 2019). This theory suggests that the different demographic characteristics of top executives are likely to influence their decisions leading to different corporate strategies (Liu & Ji, 2022). Consequently, the theory proposes a direct relationship between top management team characteristics and organizational outcomes, such as corporate strategy (Yamak et al., 2013). Thus, a key aspect of the upper echelons theory is that top management team characteristics can predict corporate performance (Bassyouny et al., 2020; Plöckinger et al., 2016).

2.2 Stakeholder theory

The word "stakeholder" first appeared in an internal memo at the Stanford Research Institute, and this term indicated that management need not respond only to shareholders (Parmar et al., 2010). Freeman (1984) defined stakeholders as any group or individual that can affect or is affected by an organization. According to stakeholder theory, managers must pay attention to multiple stakeholders, such as the local community, competitors, and environmental lobbyists (Jones et al., 2017). These managers have obligations to stakeholders that include but go beyond shareholders. The firm's survival depends on how well it serves its stakeholders (Bouguerra et al., 2022). Stakeholder theory suggests that companies consist of networks of relationships between different stakeholders, the task of managers is to create value for stakeholders, most corporate decisions have ethical content, and companies have objectives beyond profit (Hörisch et al., 2020). Thus,

2.3 Hypotheses

Given that women are becoming increasingly prominent in the workplace (C. Wu et al., 2019), gender diversity is becoming a hot topic in financial institutions (Galletta et al., 2022). In executive leadership positions, women are more risk-averse and more committed to ethical

practices than men (Wang et al., 2022). Since women play a different role in society than men, they can play a different role in a company regarding environmental issues (Liao et al., 2015). Zou et al. (2018) suggest that altruistic preference leads female executives to engage in CSR. In addition, women have a stronger ethical stance toward environmental practices (Saeed, Riaz, et al., 2022b) and can support CSR to increase the firms' legitimacy (Nguyen & Thai, 2022).

Women in higher echelons can impact CSR practices since they have unique resources (Tichenor et al., 2022). According to the upper echelons theory, the characteristics of executives influence corporate decisions (Saeed, Riaz, et al., 2022b). This theory states that women managers enhance the collective experience with different points of view, which influences the organization's choices that impact CSR (Hyun et al., 2022). Saeed et al. (2022) suggest that female executives have a greater propensity to transfer their innate values and character to company decisions and tend to push their corporations to show concern for sustainability. In this line, women rely on their knowledge and experience to participate in corporate decisions (Jiang & Akbar, 2018). Thus, since female and male directors differ, these differences can affect corporate strategy in corporate social responsibility (Aabo & Giorici, 2022).

Women managers have closer relationships with stakeholders and a better understanding of their expectations, which leads to a higher propensity to meet the demands of the various stakeholders (Amorelli & García-Sánchez, 2021). Accordingly, when female executives perceive environmental pressure from firm stakeholders, they pay more attention to the firm's green innovation performance and adopt proactive environmental strategies (Pan et al., 2020). Gender diversity enables a firm to negotiate compromises between stakeholders with conflicting interests and balance the financial and non-financial goals (Liao et al., 2015). It is worth noting that gender diversity allows better assessment of stakeholder needs (Bear & Post, 2010). Female directors have different experiences and backgrounds than male directors, which allows for a different orientation toward stakeholders (Manita et al., 2018). These differences can translate into relevant points of view for the various stakeholders of the firms (Post & Byron, 2014).

Using a sample of 490 companies from China, India, and Pakistan between 2010 and 2017, Saeed et al. (2022) found that the top management team's gender diversity positively influences the adoption of environmental standards. Galletta et al. (2022) studied the impact of female managers on sustainability performance in the banking sector in 48 countries from 2011-2019. They found that female managers improve the level of social performance. However, the presence of women in the management of firms does not influence environmental performance. Using a sample of 86 French firms from 2006 to 2017, Burkhardt *et al.* (2020) suggest that firms with a higher proportion of women in top management are associated with greater environmental innovation. Gaio and Gonçalves (2022) found that the presence of women managers positively influences CSR based on 268 companies in 11 European countries from 2013 to 2019. Based on a sample of 496 female executives from 524 listed manufacturing companies in China, Pan et al. (2020) found that female executives inhibit unethical environmental behavior and encourage proactive environmental strategies.

Wu et al. (2019) found that female executives positively influence a corporation's philanthropic behavior in a sample of 1944 Chinese companies from 2014 to 2016. Using a sample of 3462 firms from Standard and Poor's Executive Compensation database (ExecuComp), Hyun et al. (2022) found that female participation on the executive team increases CSR ratings. Zou et al. (2018) studied the impact of female executives on corporate social responsibility from a sample of 12941 observations from Chinese companies between 2006 and 2014. They found that female executives are more likely to encourage CSR reporting. Jiang and Akbar (2018) suggest that female executives increased corporate environmental investment in a sample of 359 Chinese listed companies between 2008-2016. Based on a sample of 723 non-financial companies from 2014 to 2019, Aabo and Giorici (2022) found that female

CEOs positively influence ESG performance when the dataset is composed of information from the Bloomberg database. However, they found no significant relationship when the dataset contains information from the Refinitiv database. Mungai et al. (2020) studied the association between top management team gender diversity and environmental sustainability in 852 Kenyan companies in 2019. They found that gender diversity in top management teams positively affects the adoption of sustainability initiatives, such as ISO 14001 certification.

Tichenor et al. (2022) examined the impact of female leadership on corporate social responsibility practices in 1242 US companies from 2009 to 2015. They concluded that female executives do not influence CSR engagement. Using a sample of 836 companies from 16 developed countries, Caby et al. (2022) concluded that gender diversity of the top management team does not influence the companies' commitment to climate change management. From a sample of 17,032 observations from Chinese companies between 2011 to 2017, Lu et al. (2020) found that the presence of women on the top management team negatively influences CSR performance in Chinese companies. Therefore, based on the upper echelon and stakeholder theories, the following hypothesis is proposed:

Hypothesis 1: Executive gender diversity is positively associated with environmental innovation

2.4.1. Relationship between executive gender diversity and environmental innovation: Moderation by sustainable compensation policy

Executive compensation related to sustainability is based on the connection between environmental targets and variable compensation packages for executives (Velte, 2022a). In this line, the inclusion of a sustainable compensation policy enables the alignment of interests between shareholders and CEO (Winschel & Stawinoga, 2019). Focke (2022) suggests that sustainable compensation policies can mitigate informational asymmetry and short-term managerial problems. In addition, the incentive linked to CSR increases shareholder value (Hong et al., 2016).

Companies have sustainable compensation policy to meet stakeholder expectations for CSR engagement (Ikram et al., 2019). These policies can help companies expand their social function to meet stakeholder values and communicate their long-term strategies (Qin & Yang, 2022). Companies can link executive compensation to environmental goals in response to strong stakeholder pressure (Radu & Smaili, 2021). When the CEO's behavior is aligned with shareholder demands, the CEO is more interested in establishing CSR initiatives (Velte, 2020) For Velte (2022b), sustainability-related executive compensation enables an alignment of interests between management and stakeholders. Since executive compensation linked to CSR provides managers with incentives for long-term planning, it benefits shareholders and stakeholders (Li et al., 2019).

Using a sample of 379 observations from 494 companies in 13 European countries, covering a 15-year period (2002-2016), Haque and Ntim (2020) concluded that sustainable compensation policy positively influences token carbon performance. Baraibar-Diez et al. (2019) studied the impact of sustainable compensation policy on environmental, social, and governance (ESG) scores in a sample of listed companies from Spain, France, Germany, and the United Kingdom. The results suggest that sustainable compensation policies affect ESG scores, especially when companies have a corporate social responsibility committee. Kara et al. (2022) found that banks donate more to charities when CEO compensation is linked to social responsibility. Sarhan and Al-Najjar (2022) found that CSR-related compensation positively influences the CSR performance of non-financial companies listed in the FTSE350 index from 2002 to 2016. Tsang *et al.* (2021) suggest that integrating sustainability criteria into executive compensation is associated with greater innovation. Gull et al. (2022) suggested that sustainable

compensation policies positively influence waste management in 8,365 firm-year observations for the period 2002-2017 from 37 countries.

Using a sample of 4,533 firm-year observations from companies belonging to the Standard & Poor's 500 Index (S&P 500) between 2004 and 2013, Flammer et al. (2019) concluded that integrating CSR criteria into executive compensation positively influences green innovation. From a sample of 262 UK listed companies from 2009 to 2018, Adu *et al.* (2022) found that sustainability-based compensation improves greenhouse gas emissions reduction performance. Based on a sample 256 UK non-financial companies from 2002 to 2014, Haque (2017) found that compensation linked to ESG targets positively influences carbon reduction initiatives. Cavaco et al. (2020) suggest that in stakeholder-oriented companies, compensation tied to environmental targets positively influences sustainability performance. Therefore, based on the stakeholder theory, the following hypothesis is proposed:

Hypothesis 2: Sustainable compensation policy positively moderates the relationship between executive gender diversity and environmental innovation

3 METHODOLOGY

3.1 Data sources and sample selection

Data for the research has been retrieved from the Refinitiv database. ESG scores from Refinitiv cover more than 11800 companies worldwide, with the indices reviewed quarterly (Refinitiv, 2022c). The Refinitiv database has 350 analysts trained to collect ESG data, with one of the largest ESG collection operations in the world (Refinitiv, 2022c). These analysts have local language experience, operate in different parts of the world, and manually process over 630 ESG measures for each company (Refinitiv, 2022c). This process carefully standardizes the information and ensures it is comparable (Refinitiv, 2022c). In addition, this database has daily audit samples that check critical data points with weekly reports (Refinitiv, 2022c). Thus, the Refinitiv database provides a platform to comprehensively assess the environmental, social, and governance pillars (Orazalin & Mahmood, 2021).

Initially, the sample comprises 6402 firm-year observations from the Refinitiv database during 2010–2020. We removed 495 firm-year observations from financial firms because financial firms have particular characteristics in their accounting system (Zaid et al., 2019) with different regulatory and financial natures (Yousaf et al., 2022). Next, we excluded all firms with missing ESG data, which eliminated 5075 firm-year observations. Finally, we eliminated 21 firm-year observations from firms with missing financial data. Thus, the final sample comprises 811 firm-year observations from unique 101 Brazilian firms from 2010-2020. Table 1, Panel A provides details of this sample selection. Table 1, Panel B presents the distribution of firms across sectors, and Table 1, Panel C, displays the sample distribution by year.

Table 1

Sample selection and sample distribution by sector and year

Panel A: Sample selection		
Filtering process	Number of firms	Number of observations
Brazilian firms' observations in the period 2010 – 2020	582	6402
Less observations from financial firms	45	495
Less observations with missing values of ESG data	533	5075
Less observations with missing values of other financial data	7	21
Final sample	101	811
Panel B: Distribution by sector		
Sector	N	%
Communication Services	33	4.07
Consumer Discretionary	152	18.74

Consumer Staples	102	12.58
Energy	46	5.67
Health Care	48	5.92
Industrials	99	12.21
Information Technology	24	2.96
Materials	121	14.92
Real State	34	4.19
Utilities	152	18.74
Total	811	100
Panel B: Distribution by Year		
Year	N	%
2010	54	6.66
2011	59	7.27
2012	62	7.64
2013	68	8.38
2014	69	8.51
2015	70	8.63
2016	69	8.51
2017	75	9.25
2018	79	9.74
2019	101	12.45
2020	105	12.95
Total	811	100

Table 1, Panel B, shows the sample distribution based on the Global Industry Classification Sector (GICS) of the Refinitiv database. GICS is a classification standard used worldwide by thousands of market participants for portfolio and investment management and asset allocation research (Refinitiv, 2022b). This table shows that the consumer discretionary and utilities sectors are the most represented, with 18.74%, followed by the materials sector (14.92%), consumer staples (12, 58%), and industrials (12.21%). The least represented sector is information technology with only 2.96%. Table 1, Panel C, reports the sample distribution by year. It is worth noting that the number of observations gradually increases each year.

3.2 Dependent variable

Following previous research (Fiorillo et al., 2022; Kyaw, 2022; Russo et al., 2022; Wedari et al., 2022), this study uses environmental innovation scores received from the Refinitiv database as the dependent variable. The Refinitiv database processes numerous sources of publicly available information, such as annual reports, company websites, NGO websites, and CSR reports (Refinitiv, 2022c). The environmental innovation score "reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes, or eco-designed products" (Refinitiv, 2022a). This score encompasses a firm's input and output of activities related to mitigating environmental degradation or reducing carbon emissions (Kyaw, 2022). Unlike other CSR measures that only consider information voluntarily disclosed by companies, the environmental innovation score considers objective data, such as R&D spending leading to product innovation and green revenues (Fiorillo et al., 2022). It is worth noting that the environmental innovation scores range from 0 to 100. However, we scaled the environmental innovation scores by 100 to facilitate interpretation in the multivariate analysis.

3.3 Independent, moderating, and control variables

The executive gender diversity is our independent variable. Executive gender diversity is the percentage of female executive members (Arayssi et al., 2020; Kouki, 2021). The sustainable compensation policy is a dummy variable equal to 1 if the firm has an ESG-related

compensation policy, and 0 otherwise (Adu et al., 2022; Flammer et al., 2019; Tsang et al., 2021). See the variables description in Table 2.

Table 2
Variables description

Variable name	Variable name	Model name	Proxy
Dependent	Environmental innovation score	EIN	The innovation score reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes, or eco-designed products.
Independent	Executive gender diversity	EGD	Percentage of female executive members
Moderator	Sustainable compensation policies.	SCP	Dummy variable, assumes value 1 if the company has a sustainable compensation policy and 0 otherwise
Control	Board size	BSIZE	The total number of board members at the end of the fiscal year
Control	CEO duality	CEODUAL	Dummy variable that equals one if the CEO and chairman are the same person and zero otherwise
Control	Analyst coverage	ANCOV	Total number of analysts covering a company in a given year
Control	Profitability	ROA	Income after taxes for the fiscal period/Total assets
Control	Leverage	LEV	Total debt/Total assets
Control	Firm size	FSIZE	Natural logarithm of total assets

Control variables regarding environmental innovation were introduced to the regression model to decrease the likelihood of bias in the results. We include control variables at the board and company level that can affect environmental innovation. We included board size, CEO duality, and analyst coverage at the board level. Board size is the total number of board members. Larger boards can better direct management to engage in CSR activities (Jizi et al., 2014). These boards are more visible and enthusiastic about social reputation (Uyar et al., 2022). Thus, we expect a positive relationship between board size and environmental innovation. CEO duality is a dummy variable that equals 0 if the company operates simultaneously with the same person as CEO and chairman, and otherwise 0. Since it increases informational asymmetry between the CEO and the board and induces management entrenchment, CEO duality harms CSR practices (Dakhli, 2021). Accordingly, the CEO duality reduces the monitoring activity (Velte, 2021). Thus, we expect a negative relationship between CEO duality and environmental innovation. The analyst coverage variable is the total number of analysts covering a company in a given year. Firms with analyst coverage are more exposed to environmental issues; thus, less CSR engagement leads to stakeholder dissatisfaction (M. Hu et al., 2021). In addition, analyst coverage can reduce the informational asymmetry between managers and shareholders (Aguilera et al., 2015). Thus, we expect a positive relationship between analyst coverage and environmental innovation.

We included profitability, leverage, and firm size at the firm level. Profitability is the ratio between income after taxes for the fiscal period and total assets. Profitable companies are more able to engage in CSR activities (He et al., 2022) because these companies have more resources to manage the issue of sustainability (J. Hu et al., 2022). Moreover, profitable companies are more subject to external innovation pressures (Kyaw, 2022). Thus, we expect a positive relationship between profitability and environmental innovation. Leverage is the ratio between total debt and total assets. Since leveraged companies are more likely to direct their

resources to increase profit rather than invest in CSR activities (Hamed et al., 2022), they are less likely to invest in pro-environmental strategies (Saeed, Riaz, et al., 2022a). Thus, we expect a negative relationship between leverage and environmental innovation. Finally, firm size is the natural logarithm of total assets. Larger firms tend to be more visible (Hamed et al., 2022) and have more resources to invest in socially responsible activities (Borghesi et al., 2014). In addition, the scale of these companies allows investments in areas that would otherwise be detrimental to the company's performance (Barros et al., 2022). Thus, we expect a positive relationship between firm size and environmental innovation.

3.4 Empirical models

This study investigates the impact of executive gender diversity on environmental innovation and the moderating role of sustainable compensation policy in this relationship. We performed the Breusch-Pagan and White test for heteroscedasticity, Wooldridge autocorrelation test, and Pesaran test for cross-sectional dependence. The results of the Breusch-Pagan test (chi2 = 71.74; prob > chi2 = 0.000) and White test (chi2 = 162.42; prob > chi2 = 0.000) reveal the presence of heteroscedasticity. The results of the Wooldridge test (F-stat = 154.493; Prob > F = 0.000) indicate the presence of autocorrelation. The results of the Pesaran test (cd = 2.678, p = 0.000) suggest the existence of contemporaneous correlation. Thus, we used Feasible Generalized Least Squares (FGLS) with the heteroscedasticity and panel-specific AR1 autocorrelation. FGLS method deals with heteroscedasticity and autocorrelation (Reed & Ye, 2011). FGLS estimation results in a more efficient estimator and more powerful tests than OLS (Hansen, 2007). We employed the following equations using the FGLS method:

$$EIN_{i,t} = \beta_0 + \beta_1 EGD_{i,t} + \beta_2 SCP_{i,t} + \beta_3 BSIZE_{i,t} + \beta_4 CEODUAL_{i,t} + \beta_5 ANCOV_{i,t} + + \beta_6 ROA_{i,t} + \beta_7 LEV_{i,t} + \beta_8 FSIZE + \varepsilon_{i,t} \quad (1)$$

$$EIN_{i,t} = \beta_0 + \beta_1 EGD_{i,t} + \beta_2 SCP_{i,t} + \beta_3 EGD_{i,t} * SCP_{i,t} + \beta_4 BSIZE_{i,t} + \beta_5 CEODUAL_{i,t} + \beta_6 ANCOV_{i,t} + + \beta_7 ROA_{i,t} + \beta_8 LEV_{i,t} + \beta_9 FSIZE + \varepsilon_{i,t} \quad (2)$$

where, EIN is the environmental innovation. EGD is the percentage of female executive members. SCP is the dummy variable, assumes value 1 if the company has a sustainable compensation policy and 0 otherwise. BSIZE is the total number of board members at the end of the fiscal year. CEODUAL is the dummy variable that equals one if the CEO and chairman are the same person and zero otherwise. ANCOV is the total number of analysts covering a company in a given year. ROA is the ratio income after taxes for the fiscal period over total assets. Leverage is the total debt over total assets. FSIZE is the natural logarithm of total assets. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles. Furthermore, β_0 is the intercept and $\beta_1 \ldots \beta_n$ are the regression coefficients and ε_{it} is the remainder error term.

4 RESULTS

4.1 Descriptive statics

Table 3 reports the descriptive statistics for environmental innovation, executive gender diversity, sustainable compensation policy and control variables. The mean environmental innovation is 0.225, which is in line with previous studies (Albitar et al., 2022; Fiorillo et al., 2022). The standard deviation is 0.318, reflecting the different levels of environmental innovation of the firms, and the values range from 0 to 0.997.

Table 3

Descriptive statics

Variables	Mean	SD	Minimum	Maximum
EIN	0.225	0.318	0	0.997
EGD	8.129	9.995	0	50
SCP	0.194	0.396	0	1
BSIZE	9.909	3.883	1	28
CEODUAL	0.315	0.460	0	1
ANCOV	8.781	4.154	0	18
ROA	0.071	0.116	-1.788	0.643
LEV	0.344	0.196	0	1.928
FSIZE	22.293	1.275	17.019	26.512

We find that the percentage of female executives is 0.08129, which indicates the low presence of female executives. This result is similar to 0.05, 0.1075 and 0.133 reported by Arayssi and Jizi (2019), Román et al. (2021) and Kouki (2021). The results reveal that 19.4% of the companies have a sustainable compensation policy. This result is lower than 25.7%, 32.00% and 56.20% reported by Focke (2022), Haque and Ntim (2020) and Adu et al. (2022)**,** respectively. The standard deviation is 39.6% and the values range from 0 to 1.

4.2 Correlation analysis

Table 4 presents the Pearson correlation matrix. The results indicate that environmental innovation has significant positive linear with sustainable compensation policy, board size, profitability, leverage, and company size. On the other hand, environmental innovation has negative linear with executive gender diversity and CEO duality.

Table 4

Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
EIN	1.00								
EGD	-0.07*	1.00							
SCP	0.17*	0.09*	1.00						
BSIZE	0.28*	-0.04	0.07*	1.00					
CEODUAL	-0.08*	-0.03	-0.04	-0.17*	1.00				
ANCOV	0.04	-0.17	0.12	0.01	0.10*	1.00			
ROA	0.07*	-0.12*	0.10*	0.02	-0.02	0.35*	1.00		
LEV	0.08*	-0.02	0.01	0.03	0.03	-0.09*	0.015*	1.00	
FSIZE	0.27*	-0.19*	0.11*	0.41*	-0.09*	0.18*	0.08*	-0.02	1.00

* Symbolizes significance at 5%, respectively.

4.3 Multivariate analysis

Table 5 presents the results from estimating models (1) and (2) using the FGLS method. The results reveal a negative relationship between board-specific skills and systematic risk at the 5 percent level. The results reveal a nonsignificant relationship between executive gender diversity and environmental innovation. This suggests that executive gender diversity does not influence environmental innovation, and this result is consistent with (Caby et al., 2022; Tichenor et al., 2022). Thus, hypothesis 1 is not supported. This result contradicts upper echelon and stakeholder theories that postulate greater engagement in environmental activities of companies with executive gender diversity because it brings values and skills to the company and allows for better stakeholder relations. The low percentage of female executives may explain these results (Caby et al., 2022).

Table 5

Results

Dependent variable: Environmental innovation score				
Feasible Generalized Least Squares				
	Model 1		Model 2	
	Coefficient	p-value	Coefficient	p-value
EGD	0.001	0.928	0.001	0.510
SCP	0.042	0.001***	0.022	0.130
EGD * SCP			0.002	0.19**
BSIZE	0.001	0.471	0.001	0.515
CEODUAL	-0.002	0.768	-0.003	0.661
ANCOV	-0.001	0.315	-0.002	0.318
ROA	0.001	0.950	0.001	0.990
LEV	0.013	0.542	0.015	0.500
FSIZE	0.031	0.000***	0.030	0.000***
Constant	-0.666	0.000***	-0.651	0.000***
Observations	811		811	
Firms	101		101	
Wald chi2	156.59	0.000***	167.44	0.000***
Period	11		11	

Note: This table presents the result of estimating baseline equation using the FGLS estimation technique. All continuous variables are winsorized at the 1st and 99th percentiles and indicates statistical significance at 5% level. ***, **, * indicate statistical significance at 1%, 5%, and 10% level, respectively.

Our evidence indicates that a sustainable compensation policy positively moderates the relationship between executive gender diversity and environmental innovation. Thus, supporting hypothesis 2. These findings are consistent with stakeholder theory. Firms with sustainability-related executive compensation tend to be responsive to stakeholder concerns (Velte, 2022a), and these companies enhance corporate governance by addressing stakeholder interests (Qin & Yang, 2022). Thus, a sustainable compensation policy ensures the inclusion of stakeholder objectives in executive compensation (Velte, 2022b). Adu et al. (2022) suggest that sustainable compensation policies can be a tool that leads CEOs to engage in carbon reduction initiatives. Sustainability-related incentives can be effective in influencing managers to improve CSR performance (Wasiuzzaman et al., 2022)

5 CONCLUSIONS

This study examined the impact of executive gender diversity for a sample of 101 Brazilian companies from 2010 to 2020. The study uses upper echelon and stakeholder theory, and the dependent variable of the study is the environmental innovation score from the Refinitiv database. As an independent variable, the study used the percentage of female executives and as a moderating variable the study used the presence of sustainable compensation policy. This study employed FGLS;

Our results suggest that executive gender diversity does not influence environmental innovation and that sustainable compensation policy strengthens the nexus of executive gender diversity and environmental innovation. These findings are consistent with stakeholder theory which indicate that companies with a sustainable compensation policy tend to serve stakeholder interests.

The study has limitations. First, the study only considers the context of Brazil. In this sense, future studies could analyze the influence of executive gender diversity in other institutional contexts. Second, the study uses only quantitative metrics. In this sense, future studies could use qualitative metrics. Finally, the study does not insert macro institutional issues that could influence environmental innovation, such as political and cultural factors.

REFERENCES

Aabo, T., & Giorici, I. C. (2022). Do female CEOs matter for ESG scores? *Global Finance Journal*, 100722. https://doi.org/https://doi.org/10.1016/j.gfj.2022.100722

Adu, D. A., Flynn, A., & Grey, C. (2022). Executive compensation and sustainable business practices: The moderating role of sustainability-based compensation. *Business Strategy and the Environment*, *31*(3), 698–736. https://doi.org/https://doi.org/10.1002/bse.2913

Aguilera, R. V, Desender, K., Bednar, M. K., & Lee, J. H. (2015). Connecting the Dots: Bringing External Corporate Governance into the Corporate Governance Puzzle. *Academy of Management Annals*, *9*(1), 483–573. https://doi.org/10.5465/19416520.2015.1024503

Albitar, K., Borgi, H., Khan, M., & Zahra, A. (2022). Business environmental innovation and CO2 emissions: The moderating role of environmental governance. *Business Strategy and the Environment*, *n/a*(n/a). https://doi.org/https://doi.org/10.1002/bse.3232

Ali, M., & Konrad, A. M. (2017). Antecedents and consequences of diversity and equality management systems: The importance of gender diversity in the TMT and lower to middle management. *European Management Journal*, *35*(4), 440–453. https://doi.org/https://doi.org/10.1016/j.emj.2017.02.002

Ali, M., Ng, Y. L., & Kulik, C. T. (2014). Board Age and Gender Diversity: A Test of Competing Linear and Curvilinear Predictions. *Journal of Business Ethics*, *125*(3), 497–512. https://doi.org/10.1007/s10551-013-1930-9

Amorelli, M.-F., & García-Sánchez, I.-M. (2021). Trends in the dynamic evolution of board gender diversity and corporate social responsibility. *Corporate Social Responsibility and Environmental Management*, *28*(2), 537–554. https://doi.org/https://doi.org/10.1002/csr.2079

Arayssi, M., & Jizi, M. I. (2019). Does corporate governance spillover firm performance? A study of valuation of MENA companies. *Social Responsibility Journal*.

Arayssi, M., Jizi, M., & Tabaja, H. H. (2020). The impact of board composition on the level of ESG disclosures in GCC countries. *Sustainability Accounting, Management and Policy Journal*, *11*(1), 137–161. https://doi.org/10.1108/SAMPJ-05-2018-0136

Baraibar-Diez, E., Odriozola, M. D., & Fernández Sánchez, J. L. (2019). Sustainable compensation policies and its effect on environmental, social, and governance scores. *Corporate Social Responsibility and Environmental Management*, *26*(6), 1457–1472. https://doi.org/https://doi.org/10.1002/csr.1760

Barros, V., Verga Matos, P., Miranda Sarmento, J., & Rino Vieira, P. (2022). M&A activity as a driver for better ESG performance. *Technological Forecasting and Social Change*, *175*, 121338. https://doi.org/https://doi.org/10.1016/j.techfore.2021.121338

Bear, S., & Post, C. (2010). *The Impact of Board Diversity and Gender Composition on Corporate Social Responsibility and Firm Reputation*. 207–221. https://doi.org/10.1007/s10551-010-0505-2

Borghesi, R., Houston, J. F., & Naranjo, A. (2014). Corporate socially responsible investments: CEO altruism, reputation, and shareholder interests. *Journal of Corporate Finance*, *26*, 164–181. https://doi.org/https://doi.org/10.1016/j.jcorpfin.2014.03.008

Burkhardt, K., Nguyen, P., & Poincelot, E. (2020). Agents of change: Women in top management and corporate environmental performance. *Corporate Social Responsibility and Environmental Management*, *27*(4), 1591–1604. https://doi.org/https://doi.org/10.1002/csr.1907

Caby, J., Coron, C., & Ziane, Y. (2022). The Effect of Top Management Team Gender Diversity on Climate Change Management: An International Study. In *Sustainability* (Vol. 14, Issue 2). https://doi.org/10.3390/su14021032

Cavaco, S., Crifo, P., & Guidoux, A. (2020). Corporate Social Responsibility and Governance: The Role of Executive Compensation. *Industrial Relations: A Journal of Economy and*

Society, *59*(2), 240–274. https://doi.org/https://doi.org/10.1111/irel.12254
Cumming, D., Leung, T. Y., & Rui, O. (2015). Gender Diversity and Securities Fraud. *Academy of Management Journal*, *58*(5), 1572–1593. https://doi.org/10.5465/amj.2013.0750
Dakhli, A. (2021). Does financial performance moderate the relationship between board attributes and corporate social responsibility in French firms? *Journal of Global Responsibility*.
Derchi, G.-B., Zoni, L., & Dossi, A. (2020). Corporate Social Responsibility Performance, Incentives, and Learning Effects. *Journal of Business Ethics*. https://doi.org/10.1007/s10551-020-04556-8
Dias Angelo, F., Jose Chiappetta Jabbour, C., & Vasconcellos Galina, S. (2012). Environmental innovation: in search of a meaning. *World Journal of Entrepreneurship, Management and Sustainable Development*, *8*(2/3), 113–121. https://doi.org/10.1108/20425961211247734
Fiorillo, P., Meles, A., Mustilli, M., & Salerno, D. (2022). How does the financial market influence firms' Green innovation? The role of equity analysts. *Journal of International Financial Management & Accounting*, *n/a*(n/a). https://doi.org/https://doi.org/10.1111/jifm.12152
Flammer, C., Hong, B., & Minor, D. (2019). Corporate governance and the rise of integrating corporate social responsibility criteria in executive compensation: Effectiveness and implications for firm outcomes. *Strategic Management Journal*, *40*(7), 1097–1122. https://doi.org/10.1002/smj.3018
Focke, M. (2022). Do sustainable institutional investors influence senior executive compensation structures according to their preferences? Empirical evidence from Europe. *Corporate Social Responsibility and Environmental Management*, *n/a*(n/a). https://doi.org/https://doi.org/10.1002/csr.2257
Freeman, R. E. (1984). Stakeholder management: framework and philosophy. *Pitman, Mansfield, MA*.
Gaio, C., & Gonçalves, T. C. (2022). Gender Diversity on the Board and Firms’ Corporate Social Responsibility. In *International Journal of Financial Studies* (Vol. 10, Issue 1). https://doi.org/10.3390/ijfs10010015
Galletta, S., Mazzù, S., Naciti, V., & Vermiglio, C. (2022). Gender diversity and sustainability performance in the banking industry. *Corporate Social Responsibility and Environmental Management*, *29*(1), 161–174. https://doi.org/https://doi.org/10.1002/csr.2191
Gull, A. A., Atif, M., & Hussain, N. (2022). Board gender composition and waste management: Cross-country evidence. *The British Accounting Review*, 101097. https://doi.org/https://doi.org/10.1016/j.bar.2022.101097
Hambrick, D. C. (2007). *Upper echelons theory: An update*. Academy of Management Briarcliff Manor, NY 10510.
Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, *9*(2), 193–206.
Hamed, R. S., Al-Shattarat, B. K., Al-Shattarat, W. K., & Hussainey, K. (2022). The impact of introducing new regulations on the quality of CSR reporting: Evidence from the UK. *Journal of International Accounting, Auditing and Taxation*, *46*, 100444. https://doi.org/https://doi.org/10.1016/j.intaccaudtax.2021.100444
Hansen, C. B. (2007). Generalized least squares inference in panel and multilevel models with serial correlation and fixed effects. *Journal of Econometrics*, *140*(2), 670–694. https://doi.org/https://doi.org/10.1016/j.jeconom.2006.07.011
Haque, F. (2017). The effects of board characteristics and sustainable compensation policy on carbon performance of UK firms. *The British Accounting Review*, *49*(3), 347–364. https://doi.org/https://doi.org/10.1016/j.bar.2017.01.001
Haque, F., & Ntim, C. G. (2020). Executive Compensation, Sustainable Compensation Policy,

Carbon Performance and Market Value. *British Journal of Management*, *31*(3), 525–546. https://doi.org/https://doi.org/10.1111/1467-8551.12395
He, Z., Guo, B., Shi, Y., & Zhao, Y. (2022). Natural disasters and CSR: Evidence from China. *Pacific-Basin Finance Journal*, *73*, 101777. https://doi.org/https://doi.org/10.1016/j.pacfin.2022.101777
Hong, B., Li, Z., & Minor, D. (2016). Corporate Governance and Executive Compensation for Corporate Social Responsibility. *Journal of Business Ethics*, *136*(1), 199–213. https://doi.org/10.1007/s10551-015-2962-0
Hörisch, J., Schaltegger, S., & Freeman, R. E. (2020). Integrating stakeholder theory and sustainability accounting: A conceptual synthesis. *Journal of Cleaner Production*, *275*, 124097. https://doi.org/https://doi.org/10.1016/j.jclepro.2020.124097
Hu, J., Wu, H., & Ying, S. X. (2022). Environmental regulation, market forces, and corporate environmental responsibility: Evidence from the implementation of cleaner production standards in China. *Journal of Business Research*, *150*, 606–622. https://doi.org/https://doi.org/10.1016/j.jbusres.2022.06.049
Hu, M., Xiong, W., & Xu, C. (2021). Analyst coverage, corporate social responsibility, and firm value: Evidence from China. *Global Finance Journal*, *50*, 100671. https://doi.org/https://doi.org/10.1016/j.gfj.2021.100671
Huang, Y., Ahmad, M., Ali, S., & Kirikkaleli, D. (2022). Does eco-innovation promote cleaner energy? Analyzing the role of energy price and human capital. *Energy*, *239*, 122268. https://doi.org/https://doi.org/10.1016/j.energy.2021.122268
Hyun, S., Kim, J. M., Han, J., & Anderson, M. (2022). Female executive leadership and corporate social responsibility. *Accounting & Finance*, *62*(3), 3475–3511. https://doi.org/https://doi.org/10.1111/acfi.12894
Ikram, A., Li, Z. (Frank), & Minor, D. (2019). CSR-contingent executive compensation contracts. *Journal of Banking & Finance*, 105655. https://doi.org/https://doi.org/10.1016/j.jbankfin.2019.105655
Jesus, M. A. S., Aguiar Dutra, A. R. de, Cirani, C. B. S., Jesus, K. R. E., Neto, R. C. S., & Guerra, J. B. A. (2022). Eco-innovation assessment of biodigesters technology: an application in cassava processing industries in the south of Brazil, Parana state. *Clean Technologies and Environmental Policy*, *24*(3), 931–948. https://doi.org/10.1007/s10098-021-02232-7
Jiang, X., & Akbar, A. (2018). Does Increased Representation of Female Executives Improve Corporate Environmental Investment? Evidence from China. In *Sustainability* (Vol. 10, Issue 12). https://doi.org/10.3390/su10124750
Jizi, M. I., Salama, A., Dixon, R., & Stratling, R. (2014). Corporate Governance and Corporate Social Responsibility Disclosure: Evidence from the US Banking Sector. *Journal of Business Ethics*, *125*(4), 601–615. https://doi.org/10.1007/s10551-013-1929-2
Jones, T. M., Wicks, A. C., & Freeman, R. E. (2017). Stakeholder Theory: The State of the Art. In *The Blackwell Guide to Business Ethics* (pp. 17–37). https://doi.org/https://doi.org/10.1002/9781405164771.ch1
Kara, A., Nanteza, A., Ozkan, A., & Yildiz, Y. (2022). Board gender diversity and responsible banking during the COVID-19 pandemic. *Journal of Corporate Finance*, *74*, 102213. https://doi.org/https://doi.org/10.1016/j.jcorpfin.2022.102213
Kemp, R., & Pearson, P. (2007). Final report MEI project about measuring eco-innovation. *UM Merit, Maastricht*, *10*(2).
Kouki, A. (2021). Does gender diversity moderate the link between CEO dominance and CSR engagement? A two-step system GMM analysis of UK FTSE 100 companies. *Journal of Sustainable Finance & Investment*, 1–26. https://doi.org/10.1080/20430795.2021.1939644

Kyaw, K. (2022). Effect of policy uncertainty on environmental innovation. *Journal of Cleaner Production*, *363*, 132645. https://doi.org/https://doi.org/10.1016/j.jclepro.2022.132645
Li, Z., Minor, D. B., Wang, J., & Yu, C. (2019). A learning curve of the market: Chasing alpha of socially responsible firms. *Journal of Economic Dynamics and Control*, *109*, 103772. https://doi.org/https://doi.org/10.1016/j.jedc.2019.103772
Liao, L., Luo, L., & Tang, Q. (2015). Gender diversity, board independence, environmental committee and greenhouse gas disclosure. *The British Accounting Review*, *47*(4), 409–424. https://doi.org/https://doi.org/10.1016/j.bar.2014.01.002
Lingyan, M., Zhao, Z., Malik, H. A., Razzaq, A., An, H., & Hassan, M. (2022). Asymmetric impact of fiscal decentralization and environmental innovation on carbon emissions: Evidence from highly decentralized countries. *Energy & Environment*, *33*(4), 752–782. https://doi.org/10.1177/0958305X211018453
Liu, M., & Ji, D. (2022). An Overview of the Literature on Upper Echelons*. *Accounting Perspectives*, *21*(2), 331–386. https://doi.org/https://doi.org/10.1111/1911-3838.12288
Lu, Q., Chen, S., & Chen, P. (2020). The Relationship between Female Top Managers and Corporate Social Responsibility in China: The Moderating Role of the Marketization Level. In *Sustainability* (Vol. 12, Issue 18). https://doi.org/10.3390/su12187730
Luanglath, N., Ali, M., & Mohannak, K. (2019). Top management team gender diversity and productivity: the role of board gender diversity. *Equality, Diversity and Inclusion: An International Journal*, *38*(1), 71–86. https://doi.org/10.1108/EDI-04-2018-0067
Mahmood, N., Zhao, Y., Lou, Q., & Geng, J. (2022). Role of environmental regulations and eco-innovation in energy structure transition for green growth: Evidence from OECD. *Technological Forecasting and Social Change*, *183*, 121890. https://doi.org/https://doi.org/10.1016/j.techfore.2022.121890
Manita, R., Bruna, M. G., Dang, R., & Houanti, L. (2018). Board gender diversity and ESG disclosure: evidence from the USA. *Journal of Applied Accounting Research*.
Mungai, E. M., Ndiritu, S. W., & Rajwani, T. (2020). Raising the bar? Top management teams, gender diversity, and environmental sustainability. *Africa Journal of Management*, *6*(4), 269–294. https://doi.org/10.1080/23322373.2020.1830688
Nguyen, T. T. P., & Thai, H. M. (2022). Effects of female directors on gender diversity at lower organization levels and CSR performance: Evidence in Japan. *Global Finance Journal*, *53*, 100749. https://doi.org/https://doi.org/10.1016/j.gfj.2022.100749
Nikas, A., Koasidis, K., Köberle, A. C., Kourtesi, G., & Doukas, H. (2022). A comparative study of biodiesel in Brazil and Argentina: An integrated systems of innovation perspective. *Renewable and Sustainable Energy Reviews*, *156*, 112022. https://doi.org/https://doi.org/10.1016/j.rser.2021.112022
Orazalin, N., & Mahmood, M. (2021). Toward sustainable development: Board characteristics, country governance quality, and environmental performance. *Business Strategy and the Environment*. https://doi.org/https://doi.org/10.1002/bse.2820
Ozdemir, O., & Erkmen, E. (2022). Top management team gender diversity and firm risk-taking in the hospitality industry. *International Journal of Contemporary Hospitality Management*, *34*(5), 1739–1767. https://doi.org/10.1108/IJCHM-06-2021-0719
Pan, C., Guo, H., Jiang, Y., Wang, H., & Qi, W. (2020). The double effects of female executives' participation on corporate sustainable competitive advantage through unethical environmental behavior and proactive environmental strategy. *Business Strategy and the Environment*, *29*(6), 2324–2337. https://doi.org/https://doi.org/10.1002/bse.2505
Parmar, B. L., Freeman, R. E., Harrison, J. S., Wicks, A. C., Purnell, L., & de Colle, S. (2010). Stakeholder Theory: The State of the Art. *Academy of Management Annals*, *4*(1), 403–445. https://doi.org/10.5465/19416520.2010.495581
Plöckinger, M., Aschauer, E., Hiebl, M. R. W., & Rohatschek, R. (2016). The influence of

individual executives on corporate financial reporting: A review and outlook from the perspective of upper echelons theory. *Journal of Accounting Literature*, *37*(1), 55–75. https://doi.org/10.1016/j.acclit.2016.09.002

Post, C., & Byron, K. (2014). Women on Boards and Firm Financial Performance: A Meta-Analysis. *Academy of Management Journal*, *58*(5), 1546–1571. https://doi.org/10.5465/amj.2013.0319

Radu, C., & Smaili, N. (2021). Alignment Versus Monitoring: An Examination of the Effect of the CSR Committee and CSR-Linked Executive Compensation on CSR Performance. *Journal of Business Ethics*. https://doi.org/10.1007/s10551-021-04904-2

Reed, W. R., & Ye, H. (2011). Which panel data estimator should I use? *Applied Economics*, *43*(8), 985–1000. https://doi.org/https://doi.org/10.1080/00036840802600087

Refinitiv. (2022a). *Environmental, Social and Governance (ESG) Scores from Refinitiv*. https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf

Refinitiv. (2022b). *Global Industry Classification Standard (GICS)*. https://www.refinitiv.com/en/financial-data/reference-data/classifications/business-and-industry-classifications/global-industry-classification-standard-system

Refinitiv. (2022c). *Refinitiv ESG company scores*. https://www.refinitiv.com/en/sustainable-finance/esg-scores

Russo, S., Schimperna, F., Lombardi, R., & Ruggiero, P. (2022). Sustainability performance and social media: an explorative analysis. *Meditari Accountancy Research*, *30*(4), 1118–1140. https://doi.org/10.1108/MEDAR-03-2021-1227

Saeed, A., Baloch, M. S., & Riaz, H. (2022). Global Insights on TMT Gender Diversity in Controversial Industries: A Legitimacy Perspective. *Journal of Business Ethics*, *179*(3), 711–731. https://doi.org/10.1007/s10551-021-04849-6

Saeed, A., Riaz, H., Liedong, T. A., & Rajwani, T. (2022a). Does family matter? Ownership, motives and firms' environmental strategy. *Long Range Planning*, 102216. https://doi.org/https://doi.org/10.1016/j.lrp.2022.102216

Saeed, A., Riaz, H., Liedong, T. A., & Rajwani, T. (2022b). The impact of TMT gender diversity on corporate environmental strategy in emerging economies. *Journal of Business Research*, *141*, 536–551. https://doi.org/https://doi.org/10.1016/j.jbusres.2021.11.057

Sanni, M., & Verdolini, E. (2022). Eco-innovation and openness: Mapping the growth trajectories and the knowledge structure of open eco-innovation. *Sustainable Futures*, *4*, 100067. https://doi.org/https://doi.org/10.1016/j.sftr.2022.100067

Sarhan, A. A., & Al-Najjar, B. (2022). The influence of corporate governance and shareholding structure on corporate social responsibility: The key role of executive compensation. *International Journal of Finance & Economics*, *n/a*(n/a). https://doi.org/https://doi.org/10.1002/ijfe.2663

SEEG. (2021). *Análise das emissões brasileiras de Gases de Efeito Estufa e suas implicações para metas climáticas do Brasil – 1970 – 2020*. https://seeg-br.s3.amazonaws.com/Documentos Analiticos/SEEG_9/OC_03_relatorio_2021_FINAL.pdf

Teodósio, J., Vieira, E., & Madaleno, M. (2021). Gender diversity and corporate risk-taking: a literature review. *Managerial Finance*.

Tichenor, J., Green, A., West, J., & Croom, R. (2022). Moving beyond the business case for female leaders: A longitudinal panel study of the impact of female leadership on corporate social responsibility. *Business and Society Review*, *127*(3), 639–661. https://doi.org/https://doi.org/10.1111/basr.12287

Tsang, A., Wang, K. T., Liu, S., & Yu, L. (2021). Integrating corporate social responsibility criteria into executive compensation and firm innovation: International evidence. *Journal*

of Corporate Finance, *70*, 102070. https://doi.org/https://doi.org/10.1016/j.jcorpfin.2021.102070

Udeagha, M. C., & Ngepah, N. (2022). Striving towards environmental sustainability in the BRICS economies: the combined influence of fiscal decentralization and environmental innovation. *International Journal of Sustainable Development & World Ecology*, 1–15. https://doi.org/10.1080/13504509.2022.2123411

Uyar, A., Kuzey, C., & Karaman, A. S. (2022). ESG performance and CSR awards: Does consistency matter? *Finance Research Letters*, *50*, 103276. https://doi.org/https://doi.org/10.1016/j.frl.2022.103276

Velte, P. (2020). Does CEO power moderate the link between ESG performance and financial performance? *Management Research Review*, *43*(5), 497–520. https://doi.org/10.1108/MRR-04-2019-0182

Velte, P. (2021). Meta-analyses on Corporate Social Responsibility (CSR): a literature review. *Management Review Quarterly*, 1–49.

Velte, P. (2022a). Does sustainable board governance drive corporate social responsibility? A structured literature review on European archival research. *Journal of Global Responsibility*, *ahead-of-p*(ahead-of-print). https://doi.org/10.1108/JGR-05-2022-0044

Velte, P. (2022b). Does sustainable corporate governance have an impact on materiality disclosure quality in integrated reporting? International evidence. *Sustainable Development*, *n/a*(n/a). https://doi.org/https://doi.org/10.1002/sd.2333

Wasiuzzaman, S., Uyar, A., Kuzey, C., & Karaman, A. S. (2022). Corporate social responsibility: Is it a matter of slack financial resources or strategy or both? *Managerial and Decision Economics*, *43*(6), 2444–2466. https://doi.org/https://doi.org/10.1002/mde.3537

Wedari, L. K., Moradi-Motlagh, A., & Jubb, C. (2022). The moderating effect of innovation on the relationship between environmental and financial performance: Evidence from high emitters in Australia. *Business Strategy and the Environment*, *n/a*(n/a). https://doi.org/https://doi.org/10.1002/bse.3167

Winschel, J. (2021). Climate change policies and carbon-related CEO compensation systems: an exploratory study of European companies. *Journal of Global Responsibility*.

Winschel, J., & Stawinoga, M. (2019). Determinants and effects of sustainable CEO compensation: a structured literature review of empirical evidence. *Management Review Quarterly*, *69*(3), 265–328. https://doi.org/10.1007/s11301-019-00154-9

Wu, C., Guang, H., Xu, J., & Wang, S. (2019). The effects of female executives on corporate philanthropy in China. *Corporate Social Responsibility and Environmental Management*, *26*(3), 628–643. https://doi.org/https://doi.org/10.1002/csr.1708

Wu, J., Richard, O. C., Triana, M. del C., & Zhang, X. (2022). The performance impact of gender diversity in the top management team and board of directors: A multiteam systems approach. *Human Resource Management*, *61*(2), 157–180. https://doi.org/https://doi.org/10.1002/hrm.22086

Yang, S., Wang, W., Feng, D., & Lu, J. (2022). Impact of pilot environmental policy on urban eco-innovation. *Journal of Cleaner Production*, *341*, 130858. https://doi.org/https://doi.org/10.1016/j.jclepro.2022.130858

Yousaf, U. Bin, Ullah, I., Jiang, J., & Wang, M. (2022). The role of board capital in driving green innovation: Evidence from China. *Journal of Behavioral and Experimental Finance*, *35*, 100714. https://doi.org/https://doi.org/10.1016/j.jbef.2022.100714

Zaid, M. A. A., Wang, M., & Abuhijleh, S. T. F. (2019). The effect of corporate governance practices on corporate social responsibility disclosure. *Journal of Global Responsibility*.

Zou, Z., Wu, Y., Zhu, Q., & Yang, S. (2018). Do Female Executives Prioritize Corporate Social Responsibility? *Emerging Markets Finance and Trade*, *54*(13), 2965–2981.