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Female chief financial officers (CFOs) and environmental decoupling. The moderating impact of sustainability board committees

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Abstract

This study analyses the link between chief financial officer (CFO) gender and environmental decoupling. Moreover, the moderator effect of sustainability board committees is tested. Based on upper echelons theory, a sample of listed firms headquartered in the European Union (2312 firm-year observations) from the business years 2017–22 is used. In line with the theoretical framework and based on correlation and regression analyses, CFO gender is significantly and negatively linked with environmental decoupling. The existence of sustainability board committees strengthens this relationship. The results are robust to various robustness tests and endogeneity checks. This study contributes to the increasing research activity on the influence of corporate governance on environmental decoupling. Future research should analyze specific environmental decoupling dimensions and the impact of other CFO characteristics (e.g., expertise) on environmental decoupling. Regarding the stakeholder concerns on corporate environmental decoupling in recent years, firms should increase the quality of their environmental reports to build up increased stakeholder relations. To the best of our knowledge, this is the first empirical study on the relationship between CFO gender and corporate environmental decoupling. Moreover, the moderator effect of sustainability board committees is included as an innovative complementary driver.

KEYWORDS

CFO gender, corporate governance, corporate social responsibility, environmental decoupling, sustainability board committee, upper echelons theory

1 | INTRODUCTION

During the last decade, an increased number of studies stressed a positive impact of top management attributes on corporate social responsibility (CSR) performance and reporting (e.g., Bhaskar et al., 2023). In particular, the influence of chief executive officers (CEOs) on CSR has been analyzed due to their major impact on CSR-

related decisions and activities (based on meta-analytic results: Bhaskar et al., 2023). Among others, previous studies found a positive impact of CEO gender and CSR variables (e.g., Aabo & Giorici, 2023). However, the impact of chief financial officers (CFOs) on CSR was rather neglected yet (Guo et al., 2021; Khalid et al., 2022; Sun & Rakhman, 2013). We only recognized three studies on the impact of CFO dimensions on CSR yet. Sun and Rakhman (2013) used a sample

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of S&P 500 firms from 2005 and found that CFO tenure is positively related to CSR, while CFO's education (Master's of Business Administration degree) or accounting expertise (certified public accountant designation) did not contribute to CSR. Guo et al. (2021) stressed that CFOs with accounting expertise disclose more CSR issues in their 10-K reports. Based on a Chinese setting, Khalid et al. (2022) found a positive effect of CFO foreign and professional experience on CSR assurance, while CFO's academic experience was insignificant.

From a traditional perspective, CFOs were only responsible for financial reports and related performance figures. Voluntary CSR reports were often prepared by other departments, for example, marketing, or outsourced to external consulting firms. Because of the financial crisis of 2008–09, stakeholders and regulators demand an increased awareness of CSR strategies and an increased quality of CSR reports. An adequate quality of sustainability reports can only be achieved if CFOs represent powerful “watchdogs” for financial and CSR reports, and for communicating the financial and CSR efforts to external stakeholders (Guo et al., 2021; Khalid et al., 2022; Sun & Rakhman, 2013). Thus, stakeholder trust on CSR will be higher if CFOs as significant leaders feel responsible for firms' financial and CSR functions. For example, top managers are likely to include CSR aspects in their decision-making, if the impact of CSR risks, for example, climate risks, on financial performance will be quantified in business reporting. Analyses on the link between CSR and financial performance in line with the business case argument for CSR should be a major content of the extended job profile of CFOs, highlighting our aim to analyze the link between CFOs and CSR activities.

This analysis contributes to the prior research on the link between top management and CSR as follows. As a contribution to previous studies, we analyze the effect of female CFOs on environmental decoupling as the difference between external environmental efforts (reporting/“talk”) and internal environmental actions (performance/“walk”) (Sauerwald & Su, 2019; Velte, 2023a; Walker & Wan, 2012). To the best of our knowledge, we present the first study on this relationship. Based on upper echelons theory (Hambrick & Mason, 1984), environmental decoupling is linked with information asymmetries and conflicts of interest between executive directors and related stakeholders. Environmental decoupling can be mainly classified as a form of self-impression management or greenwashing (GREEN) behavior. Recent practices of environmental decoupling within environmental reports have been widely criticized (Mahoney et al., 2013). Female CFOs as a sustainable corporate governance tool should decrease environmental decoupling in line with stakeholders' demands.

In view of the major impact of CFOs on business processes and reporting, we assume that CFO gender and environmental decoupling are negatively connected in our chosen sample of EU listed firms. We are also interested in the moderating effect of sustainability board committees as a possible complementary mechanism to female CFOs. We contribute to previous research and assume that the negative effect of CFO gender on environmental decoupling will be an important goal of the EU Green Deal Project. Based on a sample of listed firms headquartered in a EU member state (2312 firm-years

observations) for the business years 2017–22, we find that female CFOs have a negative influence on environmental decoupling and that sustainability board committees strengthen this link. Our results remain constant after several robustness tests and endogeneity checks. The results have implications for business practice, regulators, and research, based on future challenges on sustainable corporate governance and environmental reporting within EU member states. The interactions between female CFOs and sustainability board committees should be recognized in future discussions to decrease the probability of environmental decoupling.

In the following, we motivate our empirical focus on the European capital market. As a reaction to the financial crisis of 2008–09, big public interest entities (PIEs) must prepare a non-financial declaration in line with the EU Non-Financial Reporting Directive (NFRD) starting with the business year 2017. There are clear empirical indications of a low decision usefulness of the NFRD both from a cross-country perspective and related to specific EU member states (e.g., in Italy) and heterogeneous market reactions (Velte, 2022). That is why the European Commission (EC) has implemented an ambitious EU Green Deal project to reach climate neutral economy by 2050. As a milestone of the Green Deal project, the EU Taxonomy Regulation 2020 classifies whether business activities relate to six environmental goals (climate change mitigation; climate change adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, and protection and restoration of biodiversity and ecosystems). Three environmental key performance indicators must be disclosed in the non-financial declaration since the business year 2021. According to the new EU Directive on Corporate Sustainability Reporting (CSRD) of 2022, both listed firms and big non-listed corporations must prepare a full sustainability report. Finally, another recent EU Directive stipulates listed corporations to include fixed gender quotas in their boards of directors. These regulations demonstrate that sustainability reporting with a focus on environmental issues will be the core elements of the EU Green Deal project and these increased challenges are directly linked to the job profile of CEOs. Consequently, empirical research on top management teams and environmental issues based on the EU capital market is most relevant. These regulatory initiatives also pressure the CFO to combine financial and CSR aspects in an integrated report. Integrated reporting is a voluntary reporting concept where sustainability and financial reports are presented in an integrated way. This concept gets more important from an international perspective (e.g., based on the International Sustainability Standards Board (ISSB)), as the ISSB is the new global standard setter for sustainability reporting for listing firms with a focus on climate reporting. The regulatory pressure on top managers to establish a successful sustainability transformation is extremely high for the European capital market, leading to increased responsibilities of CFOs toward environmental reporting.

With this, we highlight the agenda of our study. First, we present an upper echelons theoretical foundation, a short literature review on the link between female CFOs, sustainability board committees, and environmental decoupling and then the main hypotheses. The data and methodology of the empirical analysis will include the sample

selection, the main variables, and our regression models. We will then focus on the results from the correlation, regression, robustness, endogeneity, and channel analyses. Conclusions with implications and limitations of the study will follow.

2 | THEORETICAL FRAMEWORK, LITERATURE REVIEW, AND HYPOTHESES

2.1 | The influence of CFO gender on environmental decoupling

The major relevance of top management teams, especially the CEO and CFO, can be motivated by the upper echelons theory (Hambrick & Mason, 1984). Upper echelons theory represents a management theory and assumes that business actors' behavior is bounded rational. Decision-making of the CFO will be mainly influenced by cognitive characteristics and individual values. As the measurement of psychological influencing factors is difficult in business practice, Hambrick and Mason (1984) recommended to primarily rely on demographic factors, for example, gender. Thus, upper echelons theory can greatly explain the link between CFO gender and environmental decoupling. The influence of CFOs on business reporting is intensive within a top management team and the firm to influence CSR efforts significantly. Upper echelons theory assumes that group-related determinants within the board of directors are not relevant, but the central role of the CFO may be the crucial factor in establishing a decreased amount of environmental decoupling. Upper echelons characteristics have a major impact on strategic choices, for example, product innovation, and on firm performance (Hambrick & Mason, 1984). As product innovation and CSR activities have many interrelations, upper echelons theory can explain a direct influence of CFO gender (as a demographic upper echelons characteristic) on environmental decoupling (as strategic choices). Hambrick and Mason (1984) also stresses that managerial discretion and executive job demands moderate this impact. As environmental reports and related performance proxies relate to management discretion, this illustrates the massive impact of CFOs on decoupling decisions, for example, to reduce the optimistic tone of environmental disclosure.

Stakeholders fear environmental decoupling as the information value of environmental reports is low and an opportunistic management behavior is realistic (Gull et al., 2024; Gull et al., 2023b; Gull et al., 2023c). Female CFOs will include the demands of a broad range of stakeholders in the environmental report and related performance metrics. Literature assumes that female executives are more sympathetic, care about the different stakeholders and create/maintain a balance between shareholders and other stakeholders (Bhaskar et al., 2023). Thus, female CFOs are more interested in CSR outputs and have more concerns about potential environmental decoupling practices. We already mentioned that prior European sustainability regulations pressure CFOs to be more responsible for the preparation of environmental reports and related performance figures. This

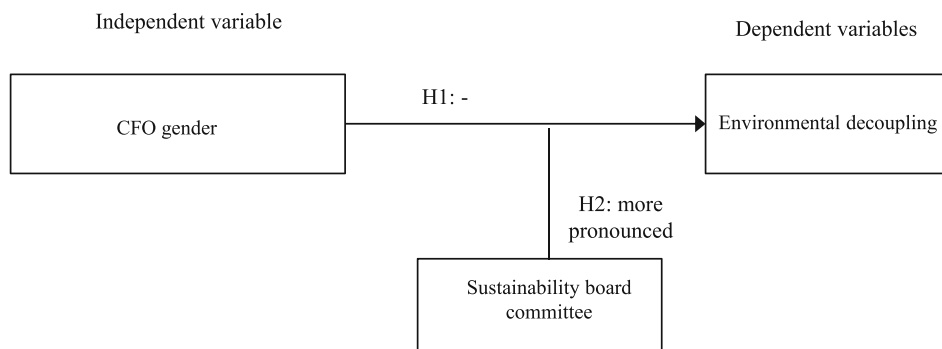
especially relates to the NFRD and the new CSRD, shifting from voluntary to mandatory sustainability reports. As the legislator stipulates the connectivity between environmental risks and financial risks in the report, we assume that female CFOs will decrease the gap between environmental reporting and performance in line with stakeholder preferences as they mainly influence the quality of environmental disclosure. For example, if environmental performance is quite low, CFOs will reduce the optimistic tone in environmental reports to draw a more balanced and realistic picture of the current environmental situation for different stakeholder groups. Moreover, CFOs should be more active in linking environmental and financial performance measures to increase the awareness of the full top management team. Without a precise interaction between environmental and financial information, there is a lower probability that executive directors will use environmental information for strategic decisions and environmental transformation processes.

From an empirical view, various studies have analyzed the impact of female board members on CSR performance and reporting during the last decade. Meta-analyses and literature reviews on this topic have stressed a positive relationship (e.g., Byron & Post, 2016). This also related to European settings (Velte, 2023b), indicating a positive influence of female directors on environmental performance (Bhuiyan et al., 2021; Garcia Martin & Herrero, 2020; Orazalin & Mahmood, 2021). There are also tendencies for this relationship in specific (former) EU regimes, such as France (Burkhardt et al., 2020; Galia et al., 2015) and the United Kingdom (Taurigana et al., 2017).

Moreover, researchers have analyzed the influence of board and individual top management team attributes on CSR decoupling. Female board members decrease CSR decoupling in cross-country studies (Eliwa et al., 2023) and in the USA (Gull et al., 2024; Gull et al., 2023b). While few studies relied on CEO proxies, for example, CEO narcissism (Al-Shammari et al., 2019), CEO power (Shahab et al., 2022), CEO positions (Marquis & Qian, 2014), and CEO overconfidence (Sauerwald & Su, 2019), indicating a significant impact on CSR decoupling, the position of a CFO was not recognized yet. We only identified three studies on the impact of CFO attributes on CSR outputs. First, Sun and Rakhman (2013) used a sample of S&P 500 firms from 2005 and found that CFO tenure and CSR are positively related, while CFO's education (Master of Business Administration degree) or accounting expertise (certified public accountant) did not contribute to CSR. Second, Guo et al. (2021) stressed that CFOs with accounting expertise disclose more CSR issues in their 10-K reports in the USA. Third, based on a Chinese setting, Khalid et al. (2022) found a positive effect of CFO foreign and professional experience on CSR assurance, while CFO's academic experience was insignificant.

Thus, in line with upper echelons theory and previous research, we assume that female CFOs are negatively related to corporate environmental decoupling (H1):

H1. *CFO gender is negatively associated with corporate environmental decoupling.*

**FIGURE 1** Research framework.

2.2 | Sustainability board committees as a moderator of the link between CFO gender and environmental decoupling

As the top management team's composition is of crucial importance in achieving solid CSR outputs, and CFOs might not be appropriate in monitoring CSR strategies without any support, a shift to other board members is useful based on upper echelons theory (Hambrick & Mason, 1984). As the existence of sustainability board committees is voluntary in most countries, the main goal of these committees is to support the executive directors and the other board members in CSR consulting and/or monitoring. Sustainability board committees engage in environmental reporting and promote active environmental CSR strategies, which should relate to lower environmental decoupling (Biswas et al., 2018; Dixon-Fowler et al., 2017; Velte & Stawinoga, 2020). Thus, we assume a complementary relationship between CFOs and sustainability board committees, while they have different job profiles. There is a great trend of the implementation of these committees as part of the top management team in European firms (Garcia Martin & Herrero, 2020). CFOs should have a close interaction with sustainability board committees as sustainability strategies will be prepared and discussed with the CEO or a chief sustainability officer (CSO). If ambitious environmental activities are prepared and discussed in the sustainability committee, CFOs should reflect the influence on environmental reports and related performance figures to a greater extend. Based on upper echelons, sustainability committees as part of the top management team influence strategic choices (= environmental strategies) and firm value (= environmental performance). As environmental decoupling contrasts stakeholder preferences, they have a negative influence on the degree of environmental decoupling in line with CFO gender.

The link between sustainability board committees and CSR outputs also represents an attractive empirical research topic during the last decade (e.g., Dixon-Fowler et al., 2017; Helfaya & Moussa, 2017). The majority found a positive influence of sustainability board committees on CSR. This result was stated in cross-country designs (Baraibar-Diez & Odriozola, 2019; Birindelli et al., 2018) and in specific regimes as the USA (Burke et al., 2019; based on CSR strengths) and Australia (Biswas et al., 2018). Positive results were also related to environmental performance on a European cross-country level (Bhuiyan et al., 2021; Garcia Martin & Herrero, 2020; Orazalin &

Mahmood, 2021; Velte, 2020), in Turkey (Kilic & Kuzey, 2019), the USA (Dixon-Fowler et al., 2017; Walls et al., 2012), the UK (Konadu, 2017; Liao et al., 2015), and in Spain (Cancela et al., 2020).

Based on upper echelons theory and previous research, we assume a significant moderator effect of sustainability board committees as states in H2:

H2. Sustainability board committees strengthen the negative link between CFO gender and corporate environmental decoupling.

Figure 1 Summarizes our research framework.

3 | DATA AND METHODOLOGY

3.1 | Sample selection

The original dataset consists of listed firms headquartered in an EU member state with available data in the Refinitiv and BoardEX databases for the business years 2017–22. We focus on the EU capital market in view of the unique setting of the environmental regulations during recent years. As already stressed, the EU Commission has initiated several sustainability regulations during recent years with a major impact on environmental reporting/performance and the job profile of CFOs. These regulations are directly linked to firms with a headquarter in an EU member state. The business year 2017 is our starting point due to the first year of mandatory implementation of the EU NFRD. According to the NFRD, big PIEs must prepare a non-financial declaration on environmental and social topics. Before the business year 2017, full sustainability disclosure was voluntary. As already mentioned, we assume major regulatory pressures on CFOs to be responsible for the preparation of sustainability reports and to link sustainability information with financial data. The significant corporate sustainability reforms of the EU Green Deal project (e.g., Taxonomy Regulative, CSRD), which started in 2019, can be classified as a major catalyst for successful sustainability transformation processes. The business year 2022 is our final year, as we aim to collect an adequate number of firm data and stress the major missings of observations for the year 2023. The UK is also included in our sample as a former EU member state. Primary data was obtained from the Refinitiv and

BoardEX databases. Financial services firms are excluded due to their specific capital structure and regulatory requirements. Additionally, missing (non-)financial datapoints lead to a decrease in firm-year observations. We winsorize all continuous variables at the bottom 1% and top 99% levels to remove the potential impact of outliers. Our final sample is based on 2312 firm-year observations.

3.2 | Dependent variables

Three major categories of CSR decoupling proxies can be found in previous studies. First, many researchers relied on Hawn and Ioannou (2016) and measures CSR decoupling as the difference between external CSR actions and internal CSR actions, based on external CSR database (e.g., Refinitiv). Second, other researchers measured the difference between CSR reporting, based on content analyses, and CSR performance, based on external CSR databases. Both manual and automated content analyses are popular in this context. Third, some studies included two external CSRS databases to measure the gap between CSR reporting (e.g., Bloomberg) and CSR performance (Refinitiv). As we did not have any access to sustainability reporting databases (second method) and to the Bloomberg terminal (third method), we referred to the first method. The choice can also be justified as the reliance on the classification by Hawn and Ioannou (2016) represents the most prominent method in comparison to the others.

Recent research (Hawn & Ioannou, 2016; Shahab et al., 2022) dominantly classifies CSR decoupling as the difference between external and internal CSR actions using data from the Refinitiv database (formerly known as Assets 4). In line with Hawn and Ioannou (2016), we operationalize environmental decoupling (GAP) as the gap between external and internal environmental actions. In more detail, environmental decoupling is the absolute difference between current external and 1-year lagged internal actions scaled by the logged total assets (Hawn & Ioannou, 2016; Shahab et al., 2022). Internal environmental actions refer to six dummy variables, based on the (non) existence of policies on environmental supply chain management, renewable energy use, policy energy efficiency, water technologies, policy emissions, and policy water efficiency. External environmental actions relate to six dummy variables, based on the (non) existence of the disclosure on reduction (targets) due to toxic chemicals, staff transportation impact, (e-)waste, voc, nox, and sox emissions as well as the existence of green buildings.

As robustness tests, two more proxies such as GREEN and brownwashing (BROWN) were implemented to analyze whether CFO gender influences GREEN or BROWN. BROWN (GREEN) is the negative (positive) gap between current external and lagged internal environmental actions scaled by the logged total assets.

3.3 | Independent and moderator variables

CFO gender is our independent variable (dummy variable) and classifies whether the CFO is a woman or not (CFO_gender). CFO positions

and related sex are included in the BoardEx database. The basic moderator variable was taken from the Refinitiv database. sustainability board committee (SBC) is a dummy variable that equals 1 if the company has implemented a sustainability board committee or not. As robustness tests, we also measure the moderating impact of the size of the sustainability board committee, assuming an increased effectiveness of this committee (SBC_S). This modified moderator variable was taken from the BoardEX database.

3.4 | Control variables

We included several control variables commonly used in previous studies on related topics (e.g., Gull et al., 2024; Gull et al., 2023b). Referring to fundamental firm characteristics, prior research has included firm size, financial performance, leverage (LEV), R&D expenses, and firm age as control variables (Gull et al., 2024). Based on the business case argument for sustainability, corporate financial conditions should have a major impact on environmental decoupling. Firm size (SIZE) as the natural logarithm of total assets is related to economics of scale or scope, which may be relevant for competitive aspects (Gull et al., 2024). We assume a positive influence on GAP. Financial performance is assumed to be positively related with GAP. We included return on assets (ROA) (Gull et al., 2024) and LEV to control for financial stability of the firm. R&D expenses (R&D) represents a major proxy of corporate innovation with risky outputs, thus a positive impact on GAP may be also realistic.

Upper echelons theory (Hambrick & Mason, 1984) assumes that board effectiveness as a monitoring tool will decrease the extent of GAP. It will motivate executive directors to decrease or prevent environmental decoupling as opportunistic management behavior. As corporate governance variables should have a negative impact on GAP, we first included board independence (BOARDIN) in line with previous studies (Gull et al., 2024). BOARDIN is the ratio of independent directors on the board as reported. Second, board size (BOARDS) refers to the logarithm of amount of board directors. We also included the percentage of shares held by public investors (FREE_FLOAT) as external corporate governance mechanism and assumed a negative impact on GAP. As individual corporate governance proxies, we recognized the age (CFO_age) and the tenure (CFO_tenure) of the CFO as well as the CEO duality model (CEOD) and CEO gender (CEO_gender), assuming a negative impact on GAP. Included variables are included in Table 1.

3.5 | Regression models

We are interested in the relationship between CFO gender and environmental decoupling as well as the moderation effect of sustainability board committees. Our main regression models recognize whether (lagged) CFO_gender has a negative impact on GAP and whether his link is moderated by SBC. We applied these specifications (Equations (1) and (2)) to test H1 and H2:

TABLE 1 Variables of the study.

Panel A: Dependent variables	
GAP	Difference between external environmental actions and internal environmental actions, based on Hawn and Ioannou (2016) and Refinitiv (see also Appendix)
GREEN (as robustness test)	The positive gap between external environmental actions and internal environmental actions, based on Hawn and Ioannou (2016) and Refinitiv
BROWN (as robustness test)	The positive gap between internal environmental actions and external environmental actions, based on Hawn and Ioannou (2016) and Refinitiv
Panel B: Independent variable	
CFO_gend	A dummy variable coded 1 if the CFO is female and 0 otherwise, obtained from BoardEX
Panel C: Control variables	
SBC (also moderator variable)	A dummy variable coded 1 if the firm has implemented a sustainability board committee and 0 otherwise, obtained from Refinitiv
SIZE	Firm size = natural logarithm of total assets obtained from Refinitiv
ROA	Return on assets = (Net income before preferred dividends + ((Interest expense on debt-interest capitalized) * (1-Tax rate)))/Average of last year's and current year's total asset obtained from Refinitiv
LEV	Leverage = Long-term debt scaled by total assets obtained from Refinitiv
R&D	(Research and Development Expense) / (Net Sales or Revenues) obtained from Refinitiv
BOARDIN	Board independence = (Independent board members) / (Total number of board members) obtained from Refinitiv.
BOARDS	Board size = natural logarithm of the amount of directors on the board obtained from Refinitiv
FREE_FLOAT	Free float as a percentage of shares outstanding obtained from Refinitiv
CFO_age	A dummy variable coded 1 if the CFO is older than the mean of the sample, obtained from BoardEX
CFO_tenure	A dummy variable coded 1 if the tenure of the CFO is higher than the mean of the sample, obtained from BoardEX
CEOD	A dummy variable coded 1, if the CEO is also the board chair, obtained from Refinitiv
CEO_gend	A dummy variable coded 1, if the CEO is female, obtained from BoardEX

Abbreviations: BROWN, brownwashing; CEO, chief executive officers; CEOD, CEO duality model; CFO, chief financial officer; GREEN, greenwashing; ROA, return on assets.

$$\begin{aligned}
 \text{GAP}_{it+1} = & \alpha + \beta_1 \text{CFO_gend}_{it} + \beta_2 \text{SBC}_{it} \\
 & + \beta_3 \text{SIZE}_{it} + \beta_4 \text{ROA}_{it} + \beta_5 \text{LEV}_{it} \\
 & + \beta_6 \text{R\&D}_{it} + \beta_7 \text{BOARDIN}_{it} + \beta_8 \text{BOARDS}_{it} \\
 & + \beta_9 \text{FREE_FLOAT}_{it} + \beta_{10} \text{CFO_age}_{it} \\
 & + \beta_{11} \text{CFO_tenure}_{it} + \beta_{12} \text{CEOD}_{it} \\
 & + \beta_{13} \text{CEO_gend}_{it} + e_{it}.
 \end{aligned} \quad (1)$$

$$\begin{aligned}
 \text{GAP}_{it+1} = & \alpha + \beta_1 \text{CFO_gend}_{it} + \beta_2 \text{SBC}_{it} \\
 & + \beta_3 \text{SBC}_{it} * \text{CFO_gend}_{it} + \beta_4 \text{SIZE}_{it} \\
 & + \beta_5 \text{ROA}_{it} + \beta_6 \text{LEV}_{it} + \beta_7 \text{R\&D}_{it} \\
 & + \beta_8 \text{BOARDIN}_{it} + \beta_9 \text{BOARDS}_{it} \\
 & + \beta_{10} \text{FREE_FLOAT}_{it} + \beta_{11} \text{CFO_age}_{it} \\
 & + \beta_{12} \text{CFO_tenure}_{it} + \beta_{13} \text{CEOD}_{it} \\
 & + \beta_{14} \text{CEO_gend}_{it} + e_{it}.
 \end{aligned} \quad (2)$$

Panel data regressions based on significant Lagrange multiplier tests, F-tests for overall significance, and Hausman tests are conducted. Panel data regressions are superior in comparison to classical OLS regressions due to endogeneity concerns. In detail, we included country fixed effects, industry fixed effects based on two-digit SIC codes, and year fixed effects. This procedure is common in related archival research. GAP was forwarded by one year to model a possible

causal relationship and mitigate potential endogeneity concerns due to reverse causality. Consequently, we provide robust regression results. We estimated Equations (1) and (2) using fixed effects panel regressions with robust standard errors adjusted for heteroscedasticity.

4 | RESEARCH RESULTS

4.1 | Descriptive statistics

Table 2 provides an overview of the descriptive statistics for the dependent variable, independent variable, and control variables. On average, female CFOs are of low relevance in our sample with a mean of around 14%. The mean (median) score of GAP in our sample is −1.07 (−0.96). Many included firms have implemented a sustainability board committee with a mean of 73%. Interestingly, a low mean (13%) of female CEOs can be stressed.

4.2 | Correlation results

Table 3 presents the Pearson correlation matrix for the dependent, independent, and control variables. As supposed, CFO_gend is

TABLE 2 Descriptive statistics.

Variable	N	Mean	Median	SD	Min	Max
Panel A: dependent variables						
GAP	2312	−1.07	−0.96	1.24	−4.24	2.09
Panel B: independent variable						
CFO_gend	2312	0.14	0	0.21	0	1
Panel C: control variables						
SBC (also moderator)	2312	0.73	1	0.21	0	1
SIZE	2312	12.43	11.42	1.76	7.45	15.21
ROA	2312	5.23	5.65	9.86	−2.24	34.13
LEV	2312	0.21	0.25	0.42	0.23	0.75
R&D	2312	0.17	0.25	0.21	0	0.54
BOARDIN	2312	0.44	0.34	11.21	0	1
BOARDS	2312	8.73	10	4.12	3	21
FREE_FLOAT	2312	0.46	0.67	0.31	0	1
CFO_age	2312	0.32	1	0.3	0	1
CEO_tenure	2312	0.23	0	0.2	0	1
CEOD	2312	0.34	1	0.2	0	1
CEO_gend	2312	0.13	0	0.14	0	1

Abbreviations: BOARDIN, board independence; BOARDS, board size; CEO, chief executive officers; CEOD, CEO duality model; CFO, chief financial officer; LEV, leverage; ROA, return on assets; SBC, sustainability board committees.

negatively significantly correlated with GAP. This result is in line with prior research on related topics (e.g., Guo et al., 2021; Khalid et al., 2022; Sun & Rakhman, 2013). In line with our prior assumptions, we also find that SBC is negatively related with GAP as well. We calculated variance inflation factors (VIFs) to test for multicollinearity. In our data, no VIF is higher than 2.7, and thus multicollinearity should not be realistic. Most of our included variables show the assumed positive versus negative impact on GAP. However, some relationships did not show any significant correlation.

4.3 | Regression results

The results of the multivariate regression analysis are explained in Table 4. Model 1 includes the link between CFO_gend and GAP and Model 2 includes the moderator variable (CFO_gend*SBC). We note that CFO_gend is negatively significantly related with GAP. Thus, H1 is supported. Regarding model 2, we find that the significant negative link between CFO_gend and GAP is more pronounced by SBC. Thus, H2 is supported. The degree of R^2 is satisfactory.

These basic regression results are in line with prior empirical research and the theoretical framework. Upper echelons theory assumes that female CFOs and sustainability board committees will decrease corporate environmental decoupling due to increased sensitivity of and influence on environmental reporting and performance (Hambrick & Mason, 1984). The decreased level of environmental decoupling will be linked with increased stakeholder trust and higher firm reputation. Female CFOs and sustainability board committees represent complementary corporate governance tools in promoting

environmental activities. Our results are also in line with prior empirical studies, which assume a positive impact of CFO attributes on CSR performance and reporting (e.g., Guo et al., 2021; Khalid et al., 2022; Sun & Rakhman, 2013).

4.4 | Robustness tests, endogeneity checks and channel analysis

We conducted several robustness checks to test the sensitivity of our regressions. Table 5 gives a summary of the results of our robustness checks. First, we ran regressions regarding the impact of CFO_gend on overall CSR decoupling (CSRDE; model 3) and related moderator analysis (model 4); we found similar results in line with environmental decoupling. Second, we used SBC size (SBC_S) as a variation of our moderator, analyzed the effect on the link between CFO_gend and GAP (model 5), conducted the moderator analysis (model 6), and found similar results compared with our basic regressions. We also measured the disaggregated influence of female CFOs on corporate GREEN and BROWN practices (models 7 and 8). Both GREEN and BROWN can be classified as opportunistic behavior of executives, which contrasts information demands of stakeholders. Stakeholders expect a sound and realistic description of the sustainability strategies and achievements of the company. If the firm conducts an over-reporting (GREEN) or an under-reporting (BROWN), stakeholders cannot analyze corporate environmental activities in a right manner. Thus, in line with upper echelons theory, we assume that CFO gender will negatively impact BROWN and GREEN behavior. Their aim should be a more balanced development of internal and external environmental

TABLE 3 Pearson correlation matrix.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) GAP	1	-	-	-	-	-	-	-	-	-	-	-	-	-
(2) CFO_gender	-0.42**	1	-	-	-	-	-	-	-	-	-	-	-	-
(3) SBC	-0.31**	0.43**	1	-	-	-	-	-	-	-	-	-	-	-
(4) SIZE	0.23**	0.21**	0.31*	1	-	-	-	-	-	-	-	-	-	-
(5) ROA	0.33**	0.32*	0.21**	0.53**	1	-	-	-	-	-	-	-	-	-
(6) LEV	0.22***	0.21*	0.32**	0.21**	-0.21**	1	-	-	-	-	-	-	-	-
(7) R&D	0.32***	0.01*	0.12*	0.12*	0.25**	-0.41**	1	-	-	-	-	-	-	-
(8) BOARDIN	-0.22*	0.32*	0.34**	0.42**	0.32**	-0.21*	0.24*	1	-	-	-	-	-	-
(9) BOARDS	-0.27**	0.21**	0.21**	0.21**	0.14**	0.12	0.34*	0.23**	1	-	-	-	-	-
(10) FREE_FLOAT	-0.22*	0.01	0.12*	0.13*	0.04	-0.01**	0.11**	0.31*	0.21*	1	-	-	-	-
(11) CFO_age	-0.21***	0.01*	0.43*	0.22**	0.21*	0.05	0.04	0.03	0.12**	0.04*	1	-	-	-
(12) CFO_tenure	-0.32	0.31**	0.32*	0.14*	0.32*	0.12	0.21	0.13**	0.04	0.11*	0.22**	1	-	-
(13) CEOD	-0.32	0.01*	0.22**	0.01	0.03	0.03	0.34*	0.43*	0.22**	0.21	0.05	0.11**	1	-
(14) CEO_gender	-0.33**	0.31**	0.21**	0.21	0.05	0.12	0.01	0.11*	0.11**	0.12	0.12	0.21*	0.12*	1

Note: This table represents the correlation coefficients between independent, dependent, and control variables for the whole sample. The variables are defined in Table 1.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Abbreviations: BOARDIN, board independence; BOARDS, board size; CEO, chief executive officers; CEOD, CEO duality model; LEV, leverage; ROA, return on assets; SBC, sustainability board committee.

TABLE 4 Regression analyses.

Variables	Model 1 (GAP)	Model 2 (moderator)
CFO_gender	−0.03** (0.032)	−0.06** (0.036)
SBC	−0.07** (0.043)	−0.05** (0.041)
CFO_gender* SBC	-	−0.02*** (0.021)
SIZE	2.32** (0.038)	2.44** (0.031)
ROA	0.43** (0.039)	0.49** (0.043)
LEV	0.23** (0.041)	0.28** (0.043)
R&D	0.24** (0.035)	0.21** (0.040)
BOARDIN	−1.32** (0.031)	−1.42** (0.037)
BOARDS	−2.54* (0.065)	−2.43* (0.063)
FREE_FLOAT	−0.23 (0.212)	−0.21 (0.243)
CFO_age	−0.12** (0.044)	−0.15** (0.041)
CFO_tenure	−0.21** (0.031)	−0.20** (0.031)
CEOD	0.12 (0.212)	0.19 (0.202)
CEO_gend	−0.23** (0.034)	−0.21** (0.42)
CONSTANT	−1.54** (1.542)	−1.67** (1.345)
Observations	2312	2312
R ² (adj.)	0.211	0.225
Industry FE	YES	YES
Country FE	YES	YES
Year FE	YES	YES

Note: This table presents results from panel regressions of female CFOs (CFO_gender) on corporate environmental decoupling (GAP) (model 1), interaction of sustainability board committees (SBC) and controls for the whole sample. Total variables are explained in Table 1. Robust and clustered (by firm) standard errors are reported in parentheses. The *p* values are two-tailed. The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Abbreviations: BOARDIN, board independence; BOARDS, board size; CEO, chief executive officers; CEOD, CEO duality model; CFO, chief financial officer; LEV, leverage; ROA, return on assets.

actions. We found significant negative results for both dimensions of environmental decoupling in line with upper echelons theory.

Empirical research on the influence of corporate governance on environmental outputs is confronted with endogeneity concerns (e.g., Wintoki et al., 2012). Self-selection bias and reverse causality are the two major endogeneity concerns in this context (Wintoki et al., 2012). Propensity score matching (PSM) and the Heckman two-step estimation are highly recommended for endogeneity checks. As the selection of female CFOs is a voluntary management decision, we address potential self-selection bias as follows. First, the PSM approach is recognized in this study. PSM partials out selection bias by creating a control group. Using a set of firm characteristics in a probit regression, this technique pairs every firm in the treatment group with a statistical twin firm from a large set of non-participant firms to form the control group. These statistical twins can be used for comparison to examine the treatment effects. We recognized the industry averages of our CFO variables and build a dummy for each predictor based on the cut-off value of the industry average (e.g., Shahab et al., 2022). The first stage of the PSM approach is a probit model that uses CFO proxies as dependent variables, and variables that determine CFO_gender and GAP as regressors (board and firm-specific variables), utilizing the nearest neighbor matching technique with a 1% radius matching approach. We then re-estimate our model for the matched sample (see Table 6). The results are in line with our baseline results that CFO gender has a negative impact on environmental decoupling.

Second, to minimize sample bias and correct sample-induced endogeneity, the Heckman two-step estimation approach is used. In the first step, we run a probit regression to predict the conditional distribution of the treatments with a set of covariates that capture the relevant attributes. Normally, all control variables and moderators are used for this purpose. The second step refers to the addition of the

TABLE 5 Robustness checks.

Variables	Model 3 (CSR_GAP)	Model 4 (CSR_GAP; moderator)	Model 5 (CSR_GAP; SBC_S)	Model 6 (CSR_GAP; SBC_S as moderator)	Model 7 (GREEN)	Model 8 (BROWN)
CFO_gender	−0.04** (0.041)	−0.06** (0.039)	−0.07** (0.038)	−0.05** (0.040)	−0.02** (0.034)	−0.03** (0.039)
CFO_gender*SBC	-	−0.032*** (0.013)	-	-	-	-
CFO_gender*SBC_S	-	-	-	−0.034*** (0.014)	-	-
Controls	YES	YES	YES	YES	YES	YES
Observations	2312	2312	2312	2312	2312	2312
R ² (adj.)	0.221	0.235	0.221	0.204	0.212	0.242
Industry FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Note: This table presents results from panel regressions of female CFOs (CFO_gender) on CSR decoupling (CSR_GAP) (model 3), interaction of CFO_gender and sustainability board committees (SBC) (model 4), size of the sustainability board committee (SBC_S) (models 5–6), on greenwashing (GREEN) (model 7), and brownwashing (BROWN) (model 8). Controls are not tabulated. Total variables are explained in Table 1. Robust and clustered (by firm) standard errors are reported in parentheses. The *p* values are two-tailed. The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Abbreviation: CFO, chief financial officer.

TABLE 6 Endogeneity tests.

Variables	Model 9 propensity score matching (PSM)	Model 10 Heckman 2 stage approach (second stage regression)	Model 11 2SLS/IV (second stage regression)
CFO_gender	−0.05** (0.040)	−0.07** (0.035)	−0.04** (0.037)
Controls	YES	YES	YES
Inverse mills ratio (IMR)	–	−183.09 (−0.31)	–
Observations	2312	2312	2312
R ² (adj.)	0.221	0.235	0.214
Industry FE	YES	YES	YES
Country FE	YES	YES	YES
Year FE	YES	YES	YES

Note: This table presents results from propensity score matching (PSM) of female CFOs (CFO_gender) on CSR decoupling (CSR_GAP) (model 9), second stage regressions of the Heckman 2 stage approach (model 10), and two-stage-least squares (2SLS)/instrumental variable (IV) (model 11). Controls are not tabulated. Total variables are explained in Table 1. Robust and clustered (by firm) standard errors are reported in parentheses. The *p* values are two-tailed. The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Abbreviation: CFO, chief financial officer.

resulting inverse mills ratio (IMR) to the final model. We first create dummy variables for CFO variables based on the cut-off value of the industry average. The first stage is a probit model using CFO dummies as the dependent variables and board and firm-specific variables as controls. The estimated parameters are recognized to measure the IMR, which is then implemented as an additional explanatory variable in the second stage estimation. Table 6 includes the coefficient estimates from the second-stage regression. The results are in line with our baseline regressions. Thus, our endogeneity checks provide some hints that selection bias is not assumed to be a dominant problem in our study.

In line with sample selection bias, two stage least squares (2SLS)/instrumental variables (IV) and difference-in-difference approaches are key endogeneity checks for reverse causality issues. As our time frame is rather short, we are not able to conduct a proper difference-in-difference design. Instead, we include 2SLS/IV regressions. As a first step, we regress the endogenous variable on all chosen instruments, which have previously undergone relevance and exogeneity checks, and obtain the residual for the endogenous variable. As a second step, we replace the endogenous variable with the corresponding residual and regress the dependent variable (environmental decoupling) on it. We decided to use BOARDS as an instrumental variable in line with prior research (Nuber & Velte, 2021). BOARDS represents a corporate governance variable that should be a significant positive association with the appointment of female directors (Campbell & Minguez-Vera, 2008). An increased BOARDS normally relates to increased firm size, and it is linked with an increased probability to engage female directors, because stakeholder pressure will be higher in these firms. They expect an adequate representation of female directors, which is also relates to the executive level. We also assume an increased probability of female CFOs in view of stakeholder pressure and increased resources of the firm. While most firm variables are not completely exogenous, BOARDS is relatively constant over time and is far less influence by firm performance than over

corporate governance attributes (Nuber & Velte, 2021). While BOARDS is linked with CFO gender, we do not expect a major impact on environmental decoupling, fulfilling the criteria of instrumental variables. Post-estimation analysis confirmed the strength and relevance of our instrument. The results of the second stage shown in Table 6 are in line with our main regressions. The second-stage coefficients for CFO_gend were negative and statistically significant to GAP.

Next, the question arises which channels could be realistic concerning the influence of female CFOs on environmental decoupling. We already mentioned that the traditional role of CFOs relates to financial reporting and related financial performance. The extended job profile of CFOs to ensure a decision useful environmental reporting requests a careful integration of financial and sustainability information and a higher degree of quantification of environmental activities. The top management team and related stakeholders need key performance indicators for their decision-making, especially based on environmental aspects. A negative influence of female CFOs on environmental decoupling also requires an adequate quality of financial statements in view of the major interrelations between financial and environmental information. In detail, the EU Taxonomy Regulation stipulates to report the ratio of green revenues, capital expenditures (CAPEX) and operating expenditures (OPEX) as part of the sustainability report. These key performance indicators are subcategories of the financial statement (income statement) and can be classified as major components of earnings management. If the degree of earnings management via revenues, CAPEX, and OPEX is high, the information value of the environmental components of the performance indicators is limited. We assume that female CFOs will decrease the extent of earnings management in the income statement as a first step, which will lead to decreased environmental decoupling as a second step. Stakeholders expect a sound financial and environmental reporting, which should be explicitly addressed by the CFO. Thus, we measure the impact of female CFOs on the degree of earnings management as an inverse variable of financial reporting and

TABLE 7 Channel analysis.

Variables	Model 12 (ACC)	Model 13 (REM)
CFO_gender	−0.47** (0.029)	−0.59** (0.025)
CONTROLS	YES	YES
CONSTANT	−2.54** (1.398)	−2.87** (1.214)
Observations	2245	2242
R ² (adj.)	0.203	0.212
Industry FE	YES	YES
Country FE	YES	YES
Year FE	YES	YES

Note: This table presents results from panel regressions of female CFOs (CFO_gender) on accruals-based earnings management (ACC) (model 12), real earnings management (REM) (model 13) and controls for the whole sample. Robust and clustered (by firm) standard errors are reported in parentheses. The *p* values are two-tailed. The symbols ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Abbreviation: CFO, chief financial officer.

assume a negative impact in this channel analysis. We include two proxies of earnings management, which are dominantly used in prior archival research on related topic. First, to address accruals-based earnings management, we used the accruals model by Kothari et al. (2005) (ACC). Second, to include real earnings management (REM), we focus on three basic factors (Roychowdhury, 2006), which are also recognized: abnormal levels of operating cash flows, abnormal production costs, and abnormal discretionary expenses. Regression results on the influence of CFO_gend on ACC and REM are stated in Table 7. In line with our assumptions, female CFOs are negatively related with both measures of earnings management, leading to an increased financial reporting quality. This should lead to reduced environmental decoupling to increase the connectivity between financial statements and environmental information and to realize an increased quality of environmental reports.

5 | SUMMARY

5.1 | Conclusions

This study focused on the influence of CFO gender on corporate environmental decoupling. Moreover, we included sustainability board committees and measured the moderator effect on this relationship. It is assumed that CFO gender and sustainability board committees are complementary sustainable corporate governance factors. As empirical-quantitative research on corporate environmental decoupling just started, we present the first analysis on this relationship. Upper echelons theory assumes that female CFOs relate to higher corporate environmental sensitivity and therefore will reduce the extent of environmental decoupling (Hambrick & Mason, 1984). Environmental decoupling as the mismatch between environmental reporting and performance should lead to negative firm reputation if stakeholders get aware of these management policies (Gull

et al., 2024; Gull et al., 2023b; Gull, Hussain, Khan, Khan, & Saeed, 2023).

Due to the major influence of CFOs on financial and sustainability reporting and related performance figures, we highlighted a contribution to previous analyses, especially regarding the European capital market. Based on massive corporate sustainability regulations during recent years, there is a great need to conduct empirical studies for the EU member states. We referred to listed firms headquartered in an EU member state covering the business years 2017–22 (2312 firm-year observations). We conducted several regression analyses and found that CFO gender has a significant and negative effect on environmental decoupling. This negative relationship is more pronounced by the existence of sustainability board committees. Thus, the two sustainable board mechanisms decrease corporate environmental decoupling as strategic choices in line with upper echelons theory (Hambrick & Mason, 1984). Our regression results are robust after conducting several robustness tests, (size of sustainability board committees, subcategories of decoupling), endogeneity checks (PSM, Heckman 2 stage approach, and 2SLS/IV), and channel analysis. Moreover, the results are in line with upper echelons theory and prior studies, which found a positive link between CFO attributes and CSR outputs (e.g., Guo et al., 2021; Khalid et al., 2022; Sun & Rakhman, 2013).

In the following, we highlight some implications for researchers, regulators, and business practice to promote the negative link between sustainable boards and environmental decoupling practices.

5.2 | Managerial implications

Top managers, board of directors and stakeholders should find effective tools to decrease or prevent environmental decoupling. Significant intrinsic and extrinsic motivations of executive directors should be promoted to substantially integrate CSR missions, strategies, and related processes. In line with board gender diversity, it is important to select female directors for powerful top management positions, for example, the board chair, the CEO or the CFO. Successful diversity management requests the inclusion of proper gender diversity concepts into the overall corporate strategy and related environmental management processes. As both corporate governance reports and sustainability reports relate to diversity management, this stresses the connectivity between the two topics. As a major job profile of the CFO, firms should prepare an integrated financial and sustainability report to stress the major implications of gender diversity on overall firm valuation.

5.3 | Regulatory implications

From a regulatory perspective, the EU standard setter should continue with future regulations to promote sustainable board composition. Listed firms should implement specific sustainable board characteristics, such as a critical mass of female directors, sustainability-related



management compensation schemes, or sustainability board committees. The EU Commission implemented a new Directive on mandatory gender quotas on boards of directors in 2022. The EU Corporate Sustainability Due Diligence Directive (CSDDD) of 2024 includes a mandatory implementation of a climate neutrality strategy and major due diligence duties regarding the sustainable value chain. However, sustainability-related board expertise and compensation are not mandatory in the EU member states in contrast to financial and industry expertise of audit committees for PIEs. Without mandatory sustainability expertise in the board of directors, there remains a major risk of GREEN and information overload in environmental reports.

Moreover, the EU Commission should implement future regulations to prevent corporate environmental decoupling. The new CSRD and the related European Sustainability Reporting Standards (ESRS) lead to a massive increase of environmental information. However, a great volume of managerial discretion relies on the firm-specific materiality analysis, based on the ESRS. Thus, a higher quantity of environmental information does not automatically lead to increased decision usefulness of the reports. As sustainability reports will be externally audited in the future, a new EU assurance standard on environmental disclosure must be implemented soon.

5.4 | Research implications

From a research perspective, future researchers are invited to analyze the influence of sustainable corporate governance attributes on corporate environmental decoupling in more detail. First, other top management positions and other demographic or behavioral characteristics could be recognized, for example, female CSOs, foreign CEOs, or CFOs with sustainability expertise. As we only included gender as a demographic characteristic in our study, future research should explicitly analyze CFO education and background skills, for example, environmental and social expertise. As board reporting on expertise is not mandatory in most countries, analyses of the voluntary presentation of CVs of the respective top management team members are crucial. We assume that many CFOs still have a financial and/or accounting background, lacking adequate knowledge on environmental issues, for example, climate change. Second, moderator or mediator analyses on other sustainable board attributes, for example, audit committee members with environmental skills or environmental-related executive compensation, should be conducted. Third, the effects of EU regulations, for example, the NFRD, the EU Taxonomy Regulation 2020, or the CSRD should be analyzed for evidence-based regulations. Fourth, as we only relied on one method to measure CSR decoupling, which has some limitations (e.g., Velte, 2023a), future studies should include more environmental decoupling variables for robustness checks, based on different databases and methods. As the reliance on the classification by Hawn and Ioannou (2016) was criticized, there should be a future focus on automated text analyses of environmental reports to create individual environmental reporting and performance measures, which are more independent from external databases. As the EU plans to establish a European Single Access

Point (ESAP) by 2027, where all sustainability reports will be included in a tagging format, we assume an increased research activity on automated text analyses, based on AI (e.g., python) in the following years. Some studies have already measured tone management in CSR reports, based on AI, and compared it with CSR performance as an alternative measure of CSR decoupling (Sauerwald & Su, 2019).

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APPENDIX A: Environmental decoupling measure

External environmental actions	Internal environmental actions
Green Buildings: Does the company report about environmentally friendly or green sites or offices?	Environmental supply chain management: Does the company use environmental criteria (ISO 14000, energy consumption, etc.) in the selection process of its suppliers or sourcing partners?
Toxic chemicals reduction: Does the company report on initiatives to reduce, reuse, substitute or phase out toxic chemicals or substances?	Renewable Energy Use: Does the company make use of renewable energy?
Staff transportation impact reduction: Does the company report on initiatives to reduce the environmental impact of transportation used for its staff?	Policy Energy Efficiency: Does the company have a policy to improve its energy efficiency?
E-Waste reduction: Does the company report on initiatives to recycle, reduce, reuse, substitute, treat or phase out e-waste?	Water technologies: Does the company develop products or technologies that are used for water treatment, purification or that improve water use efficiency?
Waste reduction initiatives: Does the company report on initiatives to recycle, reduce, reuse, substitute, treat or phase out total waste?	Policy Emissions: Does the company have a policy to improve emission reduction?
Voc emissions reduction: Does the company report on initiatives to reduce, substitute, or phase out volatile organic compounds (VOC)?	Policy water efficiency: Does the company have a policy to improve its water efficiency?
Nox and Sox emissions reduction score: Does the company report on initiatives to reduce, reuse, recycle, substitute, or phase out SOx (sulfur oxides) or NOx (nitrogen oxides) emissions?	