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The interactive effect of environmental management team with board attributes on sustainability pillars: Evidence from Gulf Cooperation Council (GCC)

Mohammed Abusharbeh [a,*], Jalal Rajeh Hanaysha [b], Husni Samara [c]

[a] *Arab American University, Jenin, Palestine*
[b] *Skyline University College, Sharjah, United Arab Emirates*
[c] *Putra Business School, University Putra Malaysia, Malaysia*

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ABSTRACT

This study elucidates the moderating effect of environmental team on the nexus between board effectiveness and ESG performance, utilizing panel data from 89 non-financial listed firms in Gulf Cooperation Council (GCC) from 2018 to 2022. Thus, fixed effects model and Two Stages Least Square (2SLS) were used to address robustness findings and to detect endogeneity bias in our estimated models. The results reveal that board background skills and female directors are more likely to support board oversight toward sustainability pillars. We ascertain that the existence of environmental team positively strengthens the impact of gender diversity and board skills on ESG pillars. However, our findings affirm that board environmental team negatively moderates the relationship between CEO duality and ESG performance. Additionally, large-sized board and sustainability are adversely moderated by the board environmental committee. Overall, our research offers robust guidelines for regulatory bodies in GCC towards develop ESG regulations and to encourage firms to build a specialized team for promoting sustainability pillars.

Abbreviations

BA	Board attributes
BSIZE	Board size
BSKIL	Board skills
BIND	Board independence
BGEND	Board gender diversity
CEOD	CEO duality
GCC	Gulf cooperation council
EMT	Environmental management team
ESG	Environmental, Social, Governance
FSIZE	Firm size
GMM	Generalized methods of moment
LEV	Leverage
ROA	Return on assets

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* Corresponding author. Faculty of Business, Arab American University, Palestine.
E-mail addresses: Mohammed.abusharbeh@aaup.edu (M. Abusharbeh), Jalal.hanaysha@skylineuniversity.ac.ae (J.R. Hanaysha), pbs24104092@grad.putrabs.edu.my (H. Samara).

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(*continued*)

2SLS	Two stages least square
UET	Upper echelons theory

1. Introduction

Sustainability and environmental pillar have become significant instruments and tipping point for businesses to improve their performance and reputation. Large corporations in developed countries are likely to report their influence on the social and environmental behaviors of society. The environmental practices are motivated by the attention of firms and their stakeholder's interests. Thus, sustainability reporting, especially the environmental pillar is considered as one of the priorities for stakeholders in their investment decisions (Khan et al., 2016). Recently, most businesses have started to accredit sustainability pillars in their future plans to maximize their shareholders wealth (Almaqtari et al., 2024; Alsayegh et al., 2020).

Sustainability reporting has gained a lot of attention from practitioners and researchers because of value added for both economy and society (Taliento et al., 2019). Increasing in sustainability reporting is positively associated with financial performance and quality of disclosure and that motives the legitimacy of the firms (Khamis et al., 2025). Thus, the literature provides ample evidence to the significant importance of sustainability pillars for financial performance (Roffé & González, 2024), competitive advantage (Tarnovskaya, 2023), and economic expansion (Obiora et al., 2022). Undoubtedly, corporate sustainability reporting has become crucial for shareholders to gain and sustain more profits (Issa et al., 2021).

Board attributes are considered a significant factor for sustainability performance (Shaukat et al., 2016). Board of directors is a key mechanism of governance practices that set strategic plans to guide companies in sustainability development (Kuzey et al., 2023). However, sustainability and environmental issues are significant challenges for the board of directors (Hoang, et al., 2021). Shareholders periodically require transparency and accountability in corporate sustainability pillars (Disli et al., 2022). This effort makes it difficult for the board in response to stakeholders' expectations. Therefore, an environmentally qualified team is essential in navigating the complexity between sustainability reporting and board of directors (Moxen & Strachan, 2017). Indeed, sustainability team helps the board in increasing firms' legitimacy in the eyes of shareholders, regulators and stakeholders (Leleux & van der Kaaij, 2019). Their experience and communication skills enhance board effectiveness and overcome the sustainability challenges (Almaqtari et al., 2024). Thus, the research question is how environmental team moderates the nexus relationship between board attributes and sustainability performance in Gulf countries.

The capital market in gulf countries is empirically interesting for different reasons. First, the relationship between board attributes and sustainability reporting is unique and underdeveloped in Gulf countries. Second, GCC countries are the main petroleum exporting countries with a critical need of achieving sustainable development. They face profound environmental threats due to oil extraction and pollution. GCC countries control 20 % of oil and natural gas reserves worldwide (ElMassah & Hassanein, 2023). Third, these countries are facing challenges in the implementation of their sustainable strategies. Government budgets are generally limited in providing funds for green finance and technology. Therefore, it is worthily to overlook this side.

This paper aims to examine how environmental management team moderates the relationship between board effectiveness and sustainability performance for the listed firms in GCC countries. Therefore, this study contributes to the body knowledge of literature that emphasize on board level governance bundles and sustainability pillars by several ways. First, addressing the presence of environmental committee between board structure and sustainability contributes to bolstering the corporate legitimacy of GCC. Second, in the best of researcher's knowledge, this paper is considered a unique study that primarily examines the association between board attributes and sustainability moderated by the presence of specialized environmental team. This contribution is important because most of previous studies have primarily focused on developed countries and neglected emerging countries such as GCC. Thus, this investigation is critically needed. Third, our expected results would be fruitful for accounting literature, and in this sense, the quality of ESG performance is useful for reducing the information asymmetries and agency problem.

This research body is divided into the following sections. The literature review is presented in section 2, that exploring previous literature and formulating research hypotheses. Section 3 describes the methods and variables measurements. Section 4 analyzes the panel dataset and presents the findings. Section 5 discusses the results, while the conclusion and research implications are covered in section 6.

2. Literature review and hypotheses development

2.1. Theoretical foundation

Undoubtedly, sustainability has been a fiercely debated issue that investigated by several previous studies (Kheireddine et al., 2024). Sustainability issues have challenged corporate managers to pay great attention to social and environmental issues in response to stakeholder's interests and to maintain their corporate legitimacy. In this regard, sustainability has different aspects in theoretical foundation. It integrates environmental, social and governance practices. Thus, four relevant theories (agency, stakeholders, legitimacy, critical mass) primarily focused on sustainability and board attributes. In agent-shareholder relationship, stakeholders delegate responsibility to corporate directors in order to operate the company with expectation to achieve stakeholders' interests (Jensen & Meckling, 1976). Corporate directors are more likely to engage in sustainability pillars to hide corporate misconduct. Manager's

behavior is not aligned with stakeholders' interests, which in turn conflict of interests. Thus, board oversight reduces agency costs and enhances ESG performance. Al-Okaily et al. (2021) argued that companies can strengthen their accountability and transparency with their shareholders through fulfilling their obligations in achieving their sustainable goals.

In stakeholders' theory, Freeman (1984) posited that firms should achieve all stakeholders' interests. Therefore, boards are responsible not only to shareholders, but also to all parts involved by firms' activities. Boards with skilled, diverse and independent members are more likely to serve sustainability strategies, leading to benefit boarder sets of stakeholders (Gallego-Álvarez & Rodriguez-Dominguez, 2023). Moreover, Obeng et al. (2025) argued board with sustainability assurance has the potential to improve transparency of sustainability discourse and mitigate corporate greenwashing for relevant stakeholders.

As for legitimacy theory, Dowling and Pfeffer (1975) posited that individuals usually have intention to engage behavior through adopting company behavior toward environmental and social initiatives. In addition, Hu and Chen (2023) argued that sustainability considerations should be a part of company strategic goals in order to attain high credibility of ESG performance. Gerged et al. (2021) validated that a diverse and effective board can encourage ESG strategies to achieve legitimacy in the eyes of stakeholders.

In respect to critical mass theory, more female directors on board stronger influence on board decisions and policies (Kanter, 1977). This influence becomes more effective once critical mass is reached to over than 30 % of board is women, leading to useful shifts in corporate decisions (Dahlerup, 1988). In sustainability, Glass, and CookIngersoll (2015) argues that firms with more women leaders on board adopt stronger sustainability practices. Amorelli, and SánchezMaría (2020) validate that critical mass of female leaders leads to stronger stakeholders' engagement and sustainability reporting practices.

2.2. Board size (BSIZE)

Recent research found a significant positive association between board size and sustainability performance (Muazaroh, & Sari, 2025; Nicolo et al., 2025; Treepongkaruna et al., 2024). For instance, Amara and Ahmadi (2024) report larger boards can bring diverse experts substantially leading to more supportive ESG performance. They added that large board size requires expert members who can assist board oversight and environmental initiatives. Conversely, Arayssi et al. (2019) affirm that smaller boards are dynamic and efficient in accelerating the transparency and accountability of ESG disclosure. Additionally, Birindelli et al. (2018) revealed that small board has an effective role in supporting sustainability issues due to smoothly communicate with stakeholders.

In agency theory, large board size is less effective and inefficient with sustainability practices due to different stakeholders' interests (Disli et al., 2022). However, Najaf et al. (2024) underpin larger board with effective corporate governance mechanisms supports sustainability reporting, aligning with agency theory by reducing opportunistic behavior and information asymmetry. Hence, García et al. (2023) argue that larger board interacts with expert member can bring more board oversight and more supportive sustainability performance. Therefore, board of directors essentially need a specialized environmental team that focuses on alleviating the board effectiveness in ESG reporting. Based on the earlier discussion, the association between board size and sustainability pillars is complicated and needs an expert in environmental issues in order to moderate such relationship. Thus, we formulate the following hypothesis.

H1. The interaction between board size and environmental committee positively impacts sustainability pillars.

2.3. Board skills (BSKIL)

Board skills refer to collective knowledge and professional qualifications that board members bring to their company and significantly influence on decisions and corporate sustainability (Gerged et al., 2024). In this sense, Tjahjadi et al. (2021) argue that board in terms of skills and competences has positive effect on sustainability performance. Birindelli et al. (2018) add that the members of board should be elected based on their education, skills, and expertise. In this vein, resources dependence theory posited that skilled board brings executive external resources and networks necessary for ESG strategies (Pfeffer and Salancik, 1978). In this context, Furlotti et al. (2023) affirm that higher skilled board produces higher quality of ESG scores. Gerged et al. (2024) argue that skilled board with ESG committee positively affects ESG performance. Velte (2023) mention that the presence of ESG oriented members in the board significantly improves sustainability performance in Germany.

According to the agency theory, boards with specific skills can strengthen ESG oversight and hold managers accountable ESG risks (Zhu et al., 2024). Prior studies supported the importance of specialized environmental team along with skilled board for improving ESG disclosure (Ammer et al., 2020; Uyar et al., 2021). Thus, Almaqtari et al. (2024) validate the importance of board environmental committee in supporting the ESG issues. They argue that environmental team can strength the effect of skilled board on sustainability performance. Accordingly, we formulate the following hypothesis.

H2. The interaction between board skills and environmental committee positively impacts sustainability.

2.4. Board independence (BIND)

Boards are included external directors who have no affiliations with the company or its staff and are elected to the board to control managerial decision making (Fama & Jensen, 1983). Prior research acknowledged that higher percentage of non-affiliated directors in the boardroom can effectively board oversight and enhance ESG transparency and disclosure (Abbas et al., 2025; Al-Qudah & Houcine, 2024; Kamaludin et al., 2022).

An independent board provides useful information to their stakeholders in order to ensure that sustainability pillars take place in

high consistent and accountability (Kheireddine et al., 2020). This assertion provides valuable implications for supporting ESG activities and reporting. Independent directors serve as governance mechanisms and exert pressure on corporate directors to improve ESG contributions (Farza et al., 2022). In the same manner, stakeholder theory states that higher number of non-executive directors mitigates agency problems and reduces agency costs, leading to improve accountability and firm value maximization (Birindelli et al., 2018). Moreover, Liao et al. (2015) provide evidence that board with more independent directors along with environmental committee shows higher tendency to be ecologic transparent and moderates different stakeholders' perspective regarding ESG issues. Biswas et al. (2018) verify that the interaction between independent directors and board sustainability committee positively affects environmental performance in Australia. Furthermore, Almaqtari et al. (2024) suggest that the interaction between sustainability committee and board independence can positively affect ESG performance. Campanella et al., 2021 validate that environmental committee strengthens the positive effect of board independence on sustainability. Accordingly, the following hypothesis is formulated.

H3. The interaction between board independence and environmental team positively impacts sustainability.

2.5. Board gender (BGEND)

Another board attribute that positively influence on ESG performance is female participation on board. Women on board play crucial role in supporting sustainability issues despite the substantial cultural and personal differences between the females and males (Farza et al., 2022). Prior studies found that female directors are more likely to participate in sustainability issues compared to their males' counterparts (Dias et al., 2024; Kheireddine et al., 2020). De Masi et al. (2022) argue that board with female expert leader and altruistic behavior leads to proactive environmental strategies. Hence, most of the previous studies found that the women participation on board positively affect environmental activities (Alkayed et al., 2024; Dias et al., 2024; Disli et al., 2022; García-Meca et al., 2024).

In respect to agency theory, gender diversity on board mitigates conflicts of interests between executives and stakeholders by strengthening ESG accountability (Fernández-Méndez et al., 2025). Additionally, Velte (2023) revealed that female directors with ESG specialized committee reduce greenwashing, indicating enhanced board oversight aligned with agency theory. According to stakeholder theory, women directors tend to prioritize stakeholders' interests. Thus, Gavana et al. (2025) validated those female directors on board are often improve social and governance of ESG performance in accordance with the expectations of stakeholders. To reinforce the role of women on board in supporting corporate sustainability, Uyar et al. (2021) argued the existence of environmental team along with gender-diverse assists board in facilitating environmental accountability and reducing information asymmetry. Therefore, we argue that board environmental committee strengthens the positive effect of women directors on ESG performance. Thus, we posit the following hypothesis.

H4. The interaction between female directors and environmental team positively impacts sustainability.

2.6. CEO duality (CEOD)

Double position represents that the chair of board has the same position of the chief executive officer (García-Ramos & Díaz Díaz, 2020). Prior research revealed that CEOs' combined role negatively affect sustainability pillars (Zhu et al., 2024; Khemakhem et al., 2023). For instance, Bhat et al. (2023) argue that CEO dual role often reduces sustainability because of CEO power concertation, leading to diminishing the ESG performance. Similarly, Arayssi et al. (2019) affirm that CEO-chair position is less likely to support ESG reporting and consequently environmental issues. Hence, the nexus between CEO duality and ESG performance may stem from conflict of interests between managers and stakeholders, because of the power is concentrated by one person, reducing board oversight and increasing agency problem. In this case, the CEO duality weakens long-term sustainability and making board effectiveness crucial to align personal benefits (Cherian et al., 2020). However, other past research provided evidence to the positive association between CEO duality and ESG performance (Arici et al., 2024; Sepulveda-Nuñez et al., 2025). According to stewardship theory, CEOs with dual role may act a steward of company, making effective decisions that improves ESG performance (Aliahmadi, 2024). In addition, CEO power can get better access to external resources and enhances ESG practices (Remo-Diez et al., 2025).

CEO duality in sustainability yields stronger ESG performance when environmental team is established to translate CEO intention to transparency of sustainability performance (Aliahmadi, 2024). Such specialized team serves as board effectiveness, strengthening accountability and credibility of ESG under CEO duality as emphasized in agency theory. Thus, Oware et al. (2022) affirm that the board needs expert members who can induce executives to participate in ESG development and environmental practices. In the light of this discussion, we argue that the presence of the board environmental committee weakens the negative effect of CEO duality on ESG performance. Therefore, we posit the following hypothesis.

H5. The interaction between the dual role of CEO and environmental team positively impacts sustainability performance.

2.7. Environmental Management Team (EMT)

Recently, most large businesses appointed a qualified team in boardroom who are specialized in environmental activities. Board environmental team is defined as a specialized subcommittee of a company board of directors that overseeing the company environment issues, mitigating risks and implementing sustainability strategies (Garcia-Sanchez et al., 2022). Furthermore, Masud et al. (2018) argue that this committee is responsible in setting and implementing the environmental strategies of the company. Arayssi and Jizi (2023) underline that the presence of sustainability committee increases the level of ESG disclosure and reduces agency costs to

shareholders. Dixon-Fowler et al. (2017) found that environmental team has a direct positive impact on sustainability issues. Kumari et al. (2022) reported that the presence of sustainability team significantly motivates stakeholders to societal initiatives. Abdullah et al. (2024) argued sustainability committee creates positive image and good reputation for company. Garcia-Sanchez et al. (2022) provided evidence that the interaction between board attributes and environmental committee offers a powerful lens in shaping accountability of sustainability performance. Accordingly, we argue that corporation with higher level of ESG pillar requires highly expert and qualified environmental team. Thus, this study formulates the following hypothesis.

H6. Environmental management team positively affects sustainability pillars.

3. Methodology

3.1. Data and sample

This study utilizes panel data from Gulf cooperation council (Saudi Arabia, Qatar, Kuwait, Bahrain, Oman, United Arab Emirates) non-financial listed firms from 2018 to 2022. To ensure the validity of research data, we selected our sample based on the following criteria; (1) we excluded the financial sector due the differences in financial structure compared with other sectors; (2) non-financial firms that have been listed less than one year were excluded due to data unavailability; (3) the sample comprised 89 non-financial listed firms that operating in these countries and periodically disclose their ESG reports; (4) companies with missing values were omitted to ensure integrity and consistency of panel data through the estimated models. Therefore, we ultimately obtained 445 annual observations as our final sample. Hence, panel data were collected from Tomson reutter eikon database, which offered accessible data for sustainability reporting of corporations worldwide.

In terms of the data processing, we standardized the panel data that were strongly balanced in order to ensure consistency in data variables measurement. Therefore, we constructed panel data regression using fixed effects model to detect unobservable heteroscedastic at both firm and time levels. Additionally, to further analysis, we employed robustness test analysis using Two Stages Least Square to mitigate endogeneity issue (Wooldridge, 2016) and to check consistency of our regression results. Indeed, 2SLS used as instrumental variable to isolate the casual effect among the variables (Gujarati & Porter, 2009).

3.2. Variable's measurement

This research uses sustainability performance (ESG) as dependent variable that includes the environmental, social, and governance pillars (Al Amosh & Khatib, 2022; Alsayegh et al., 2020). Consequently, ESG pillars regressed by group of independent variables that represent board attributes as follows. First, board size (BSIZE) that measures the number of directors on the board (Erin et al., 2022). Hence, larger board may be associated with higher cost and less effective decision making (Kumari et al., 2022). Second, board skills (BSKIL) that represent collective knowledge and professions of board members (Almaqtari et al., 2024). Third, independent directors (BIND) measure the percentage of non-executive directors from total members in the board who induce transparency and accountability in the company (Khan et al., 2021). Fourth, women on board that measures the number of female directors divided by total board members (Abusharbeh et al., 2023). Fifth, CEO duality refers to duplication in position which the CEO holds the same position as chair of board (Wijethilake & Ekanayake, 2020).

Additionally, this study uses environmental management team (EMT) as moderating variable. EMT measures qualified environmental team who is responsible for setting and implementing environmental strategies in company (Almaqtari et al., 2024). Furthermore, this study uses variables; firm size (SIZE), leverage (LEV), and profitability (ROA) as control variables. In this sense, FSIZE measures the natural logarithm of firm total assets (Al-Qudah & Houcine, 2024). Leverage is measured by firm's total liabilities to total assets (Abu Khalaf, 2024), while ROA measures net profits to bank assets (Priharta & Gani, 2024). We used the aforementioned control variables to capture the impact of board attributes on sustainability pillars.

3.3. Model setting

To test the moderating effect of environmental team on nexus between board characteristics and sustainability pillars, we deploy fixed – effects panel econometric model in order to control for unobserved heterogeneity that may constant over the time (Wooldridge, 2010). Therefore, Hausman test was used to determine whether Fixed effects or random effects model is best out model in data analysis (Hausman, 1978).

To examine our research hypotheses, we use the following regression equation:

$$ESG_{it} = \alpha + \beta_1 \sum_{j=1}^{5} BA_{it} + \beta_6 \sum_{j=1}^{3} control_{it} + \mu_i + \eta_t + \epsilon_{it} \quad (1)$$

In this context, ESG_{it} denotes environmental, social and governance pillars. Following prior studies on board attributes and sustainability performance (Almaqtari et al., 2024; Bhat et al., 2023; Disli et al., 2022). $\sum_{j=1}^{5} BA_{it}$ represents board attributes including; board size (BSIZE), board skills (BSKIL), board gender (BGEND), CEO duality (CEOD) as independent variables. $\sum_{j=1}^{3} control_{it}$ denotes to the selected control variables including; firm size (FSIZE), leverage (LEV), and return on assets (ROA). This study also controls for industry fixed effects μ_{it} and year fixed time effects η_t and ϵ_{it} refers to error term. By rewriting the aforementioned equation, we formulate the

direct effect model as follows:

$$ESG_{it} = \alpha + \beta_1 (BSIZE_{it}) + \beta_2 (BSKIL_{it}) + \beta_3 (BIND_{it}) + \beta_4 (BGEND_{it}) + \beta_5 (CEOD_{it}) + \beta_6 (FSIZE_{it}) + \beta_7 (LEV_{it}) + \beta_8 (ROA_{it}) + \beta_9 (EMT_{it}) + \mu_i + \eta_t + \epsilon_{it} \quad (2)$$

Consequently, the interactive effect of EMT with BA on ESG (H_1, H_2, H_3, H_4, H_5, and H_6) could be formulated by the following simultaneous moderation effect equation:

$$ESG_{it} = \alpha + \beta_1 (BSIZE_{it}) + \beta_2 (BSKIL_{it}) + \beta_3 (BIND_{it}) + \beta_4 BGEND_{it} + \beta_5 (CEOD_{it}) + \beta_6 (FSIZE_{it}) + \beta_7 (LEV_{it}) + \beta_8 (ROA_{it}) + \beta_9 (EMT_{it}) + \beta_{10} (BSIZE_{it} * EMT_{it}) + \beta_{11} (BSKIL_{it} * EMT_{it}) + \beta_{12} (BIND_{it} * EMT_{it}) + \beta_{13} (BGENDR_{it} * EMT_{it}) + \beta_{14} (CEOD_{it} * EMT_{it}) + \mu_i + \eta_t + \epsilon_{it} \quad (3)$$

In this paper, environmental team (EMT) plays two roles. Firstly, we tested its direct effect on ESG performance by taking into consideration the effect of Board Attributes (BA) and control variables as formulated in equation (2). In second step, we consider EMT as moderator variable between board attributes and sustainability performance as formulated in equation (3). The interaction effect (BA*EMT) was developed to determine how the environmental team strengths/weakness the influence of board attributes on sustainability pillars.

Consequently, we employed Two-Stages Least Squares (2SLS) as instrumental variables (IVs) for robustness check in order to resolve if regressors are endogenous or correlated with error term. In this case, this approach is appropriate compared to other methods such as GMM estimator due to several reasons. First, 2SLS is more efficient in absence of heteroscedastic case. Second. It is proper for moderate sample size (Wooldridge, 2016). These assumptions are suitable for our panel data set.

4. Empirical results

4.1. Descriptive statistics

The sample of GCC listed firms displays considerable variability in sustainability reporting over the period 2018 to 2022. Table 1 shows that some companies in GCC disclose ESG pillars with a minimum score of 3.6 %, maximum score of 87.6 % and an average score of 34.7 %. This implies only 34.7 % of the firms disclose sustainability reporting to their stakeholders and the public. The result displays that board structure has an average board size of 9.2 members in a boardroom with a mean value of 2.99 % women directors which is relatively low. Interestingly, 82.2 % of board members have managerial skills in accounting, finance, and environmental activities and 42.3 % independent board directors. Further, CEO with dual role accounts for 7.8 % of the boards in GCC countries. The results also show that 32.4 % of our sample (445 observation value) have sustainability team or committee. Therefore, a higher EMT score indicates better corporate environmental practice. In Table 1, we use Variance Inflation Factor (VIF) to check multi-co-linearity problems among explanatory variables. The result shows that all values of VIF were lower than the standard of 5. Thus, we can conclude that there was no co-linearity issue within our estimated model.

4.2. Pearson correlation analysis

The pairwise correlation matrix in Table 2 shows the correlation between explanatory variables and sustainability performance. The results reveal that correlation coefficients among research were relatively small. The correlation value between ESG and gender diversity (BGEND) is significant and positive (correlation 0.229, $p > 0.05$) suggesting initial support of direct effect of BGEND on ESG, while the correlation between ESG score and environmental team (EMT) is positive (correlation 0.323, $p > 0.001$), providing potential moderating effect between board attributes and ESG score. As for co-linearity, Table 2 reports that most correlation coefficients of independent variables are less than 0.60, with highest negative correlation between BSKIL and CEO duality (correlation −0.389, $p > 0.001$). Thus, the correlation matrix verifies that our data variables are not influenced by multi-co-linearity issue.

Table 1
Descriptive statistics and collinearity test.

Variables	N*T	Mean	St.D	Min	Max	VIF
ESG score	445	0.347	0.198	0.036	0.876	–
BSIZE	445	9.210	0.019	3	19	1.10
BSKIL	445	0.822	0.382	0	1	1.24
BIND	445	0.423	0.259	0	100	1.09
BGEND	445	0.029	0.048	0	0.222	1.15
CEOD	445	0.078	0.269	0	1	1.22
FSIZE	445	10.25	0.957	7.66	12.39	1.16
LEV	445	0.642	0.241	0.240	0.840	1.34
ROA	445	0.043	0.067	−0.525	0.446	1.35
EMT	445	0.323	0.468	0	1	1.02

Note (s); VIF indicates variance inflation factor; N*T refers to total observation; St.D stands for standard deviation.

Table 2
The matrix of correlations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) ESG	1								
(2) BSIZE	0.054	1							
(3) BSKIL	0.074	−0.146**	1						
(4) BIND	0.082	−0.059	0.126**	1					
(5) BGEND	0.229*	0.086	0.079	0.183**	1				
(6) CEOD	0.003	0.053	−0.389**	0.072	−0.072	1			
(7) FSIZE	0.426**	0.204**	−0.118	−0.041	0.031	0.109*	1		
(8) LEV	0.203**	0.191**	−0.135**	−0.071	−0.106*	0.129**	0.259**	1	
(9) ROA	0.029	0.041	0.040	−0.025	0.289**	−0.102*	0.042	−0.401**	1
(10) EMT	0.323**	0.035	−0.031	0.015	0.032	0.029	0.136**	−0.215**	0.038

Note (s); * and ** denote to significant level at 5 % and 1 %, respectively.

4.3. *Regression analysis*

The fixed effects results in Table 3 show the direct effect of board attributes on ESG along with control variables in model 1. Here, the result displays that BSIZE is positive and statistically not significant ($\beta_1 = 0.161$, $p < 0.05$). This result indicates that large board size will not influence ESG pillars. This finding conflicts with prior studies suggesting that larger board size can improve sustainability performance (Muazaroh, & Sari, 2025). However, the beta coefficient of BSKIL is positive and statically significant ($\beta_2 = 3.52$, $p > 0.05$). This concludes that a higher percentage of board members with high experience and managerial skills contributes to higher performance of ESG. This result is consistent with recent prior studies arguing that board with skilled members can assist the company in sustainability practices (Zhu et al., 2024). In contrast, board independence is positive and statically in significant effect ($\beta_3 = 0.038$, $p < 0.05$). This indicates that presence of independent directors on the board will not improve the ESG performance. This result provides ample evidence that BIND will not help firms in readiness for providing transparent sustainability reporting in GCC. This finding is contrary with previous works concluding that board independence can effectively enhance ESG transparency (Abbas et al., 2025). The beta coefficient of female on board is positive and statistically significant ($\beta_4 = 2.54$, $p > 0.05$). This implies that women are more likely to support social and environmental strategies in GCC countries. This finding is supported by previous works who validate that the importance of female directors in encouraging sustainability issues (Dias et al., 2024). The coefficient effect of CEO duality is positive and in significant effect on ESG ($\beta_5 = 1.079$, $p < 0.05$), indicating that CEOs with double position are not interested environmental or social activities. This argument is inconsistent with previous studies which find that CEO duality diminishes the ESG performance (Bhat et al., 2023). In respect to control variables, firm size (SIZE) is positive and significantly affect ESG performance ($\beta_6 = 8.88$, $p > 0.01$), implying that firms with large size have better contribution in sustainability pillars. This result is aligned with previous studies, suggesting larger firms tend to have more interest in sustainability reporting (Al-Qudah & Houcine, 2024). However, leverage and profitable firms are not significant with ESG performance in GCC.

Interestingly, model 2 displays that environmental team is positive and statically significant effect on ESG performance ($\beta_9 = 5.12$, $p > 0.01$). This indicates that environmental team with board decisions lead to improve sustainability performance. This result is

Table 3
The results of Panel data estimates.

Variable	Model 1	Model 2	Model 3
Constant	−63.59** (0.000)	−56.08** (0.000)	−69.14** (0.000)
BSIZE	0.161 (0.586)	0.098 (0.739)	0.393 (0.253)
BSKIL	3.52* (0.020)	3.68* (0.014)	5.26** (0.002)
BIND	0.038 (0.158)	0.034 (0.207)	0.025 (0.301)
BGEND	0.254* (0.042)	0.269* (0.030)	0.284* (0.042)
CEOD	1.079 (0.587)	0.560 (0.777)	2.49 (0.301)
FSIZE	8.88** (0.000)	8.01** (0.000)	9.35** (0.000)
LEV	1.209 (0.772)	1.944 (0.635)	−3.990 (0.411)
ROA	−0.108 (0.251)	−0.109 (0.244)	−0.169 (0.093)
EMT		5.12** (0.000)	18.62** (0.000)
BSIZE * EMT			−0.722 (0.237)
BSKIL * EMT			0.000 Omitted
BIND * EMT			−7.38* (0.011)
BGEND * EMT			−0.552* (0.037)
CEOD * EMT			−4.35 (0.195)
Fixed effects model	No	Yes	Yes
Hausman test	9.94 (0.267)	17.72* (0.038)	25.59* (0.012)
R-squared	0.222	0.248	0.221
Prob (F - value)	(0.000)	(0.000)	(0.000)

Note (1); *p > 0.05; and **p > 0.01; the p-value is between parentheses.

similar with findings by prior studies such as Arayssi and Jizi (2023) and Kumari et al. (2022), who affirm that environmental team is positively related to sustainability pillars. Similarly, the results in model 2 are consistent with the earlier findings in the estimated model 1.

Table 3 shows the results of moderation effect in model 3. The interaction term BSIZE*EMT between board size and environmental team is positive and statically in significant affect ESG pillars ($\beta_{10} = 0.393$, $p < 0.05$). This result is inconsistent with our hypothesis that says EMT moderates the relationship between board size and sustainability, violating the interactive effect of board size and EMT on ESG pillars. The finding reveals that environmental team is positive and statically effects the association between board skills and sustainability ($\beta_{11} = 5.26$, $p > 0.05$). This result supports our hypothesis which states EMT moderates the association between BSKIL and ESG pillars, suggesting that EMT strengthens the relationship board skills and sustainability performance. This study further finds that estimated coefficient (BIND*EMT) is positive and statically insignificant ($\beta_{12} = 0.025$, $p < 0.05$). This result is conflict with the hypothesis argues that EMT moderates the association between BIND and sustainability pillars. The interactive effect between the women directors and EMT on ESG pillars is negative and significant ($\beta_{13} = -0.552$, $p < 0.05$). This result indicates that EMT negatively moderates the relationship between women directors and sustainability performance. However, the beta coefficient of interactive effect of the term (CEOD*EMT) is positive and statically insignificant ($\beta_{14} = 2.49$, $p < 0.05$). This result is contrary with our hypothesis that says EMT moderates the relationship between double position and sustainability. This means that EMT inefficiently affects the joint relationship between CEO duality and sustainability performance.

4.4. *Robustness test*

We believe that endogeneity issues might exist in our estimated models because of reverse causality or autocorrelation. Thus, the interactive effect of EMT and board attributes are not clear whether or not they better predict sustainability performance or vice versa. To resolve this issue, we employed Two Stages Least Square (2SLS) in order to ascertain the robustness of our findings. The results of instrumental variables approach (2SLS) are presented in Table 4. Thus, the results from 2SLS are reported in model 1, 2, and 3. The finding shows consistency in the direct effect of board attributes, EMT, and control variables on ESG performance compared with earlier findings by fixed effects models. In contrast, some different results in moderation effect model are found attributed to the endogeneity bias. Firstly, the interactive effect between BSIZE and EMT is negative and statically significant, indicating that the moderating effect of EMT weakness the relationship between board size and ESG pillars. Secondly, the interaction effect of CEOD and EMT is negative and significantly affects ESG performance, suggesting that the moderating role of EMT supports the negative of CEO duality on ESG. Thirdly, the interaction between board gender and EMT positively affects sustainability performance.

5. Discussion

This study focused primarily on examining the moderating effect of environmental team on nexus between board characteristics and ESG pillars in GCC context. Panel data regression and instrumental variables approach (2SLS) were used to detect endogeneity and to robust the research results. The findings established that board knowledge and skills have a direct positive effect on sustainability performance. Additional support can be observed by earlier studies (Gerged et al., 2024; Tjahjadi et al., 2021) which validated such relationship. Therefore, higher skilled board members allow companies to create innovative green programs for promoting environmental performance. Furthermore, Furlotti et al. (2023) contend that board with skilled members has the ability to provide transparent ESG reporting to their stakeholders. This finding supports the resources dependency theory which posited that higher board skills strengths the company capabilities and commitments to sustainability pillars.

Table 4
The results of instrumental variables approach (2SLS).

Variable	Model 1	Model 2	Model 3
Constant	−59.90** (0.000)	−55.89** (0.000)	−61.67** (0.000)
BSIZE	−0.562 (0.175)	−0.595 (0.131)	0.098 (0.822)
BSKIL	5.41* (0.018)	5.64** (0.009)	8.51** (0.001)
BIND	−0.039 (0.201)	0.037 (0.221)	0.043 (0.141)
BGEND	0.851** (0.000)	0.839** (0.000)	0.404* (0.041)
CEOD	−0.225 (0.944)	−0.517 (0.866)	−5.110 (0.174)
FSIZE	8.10** (0.000)	7.31** (0.000)	6.91** (0.000)
LEV	12.32** (0.001)	13.60** (0.000)	15.86** (0.000)
ROA	0.034 (0.798)	0.031 (0.806)	0.097 (0.439)
EMT		11.19** (0.000)	36.75** (0.000)
BSIZE * EMT			−2.62** (0.003)
BSKIL * EMT			0.000 Omitted
BIND * EMT			−4.49 (0.309)
BGEND * EMT			1.19** (0.000)
CEOD * EMT			−13.49* (0.029)
R-squared	0.264	0.337	0.376
Prob (F-value)	(0.000)	(0.000)	(0.000)

Note (1); *p > 0.05; and **p > 0.01; the p-value is between parentheses.

The results also revealed that board diversity positively affects ESG performance, suggesting that women participation on boardroom are more likely to engage in sustainability initiatives than men. Thus, previous studies supported that board gender diversity has positive association with ESG reporting (Garcia-Meca et al., 2024; Alkayed et al., 2024). This result could be interpreted to those women are more interests than men in environmental and social issues because of their altruistic behavior and moreover, depends on female leadership type is more prone to support stakeholders' interests. Additional support can be noticed by study of De Masi et al. (2022) who affirmed that female on board increases attention of stakeholders towards sustainability issues which leads to reduce information asymmetry and mitigates ESG risks.

As for moderating role of environmental team, the result found that the interaction between EMT and board size has negative effect on sustainability in GCC context, indicating that the presence of environmental committee negatively moderates the relationship between board size and ESG performance. This result is inconsistent with empirical findings by Muazaroh, and Sari (2025), Treepongkaruna et al. (2024), Nicolo et al. (2023) and Disli et al. (2022) which verified the critical role of environmental team in board oversight and prioritize sustainability activities to satisfy different needs of stakeholders. Hence, this finding is validated by the agency theory which posited that large board size is less effective in supporting sustainability reporting. It could be explained to different perspectives between board members and environmental team regarding the feasibility of sustainability issues for stakeholders' interests. Indeed, high-power concentration with few directors that have similar perspectives toward sustainability issues may lead the board to less likely participate in ESG pillars.

The interaction effect between EMT and board skills positively affect ESG pillars. This indicates that a board with managerial skills along with the presence of EMT positively contributes in enhancing sustainability pillars. This result supported by Almaqtari et al. (2024), who validated the moderating positive effect of environmental team between board skills and sustainability issues. Additional support by Uyar et al. (2021) who added that the interaction between board skilled members and environmental committee yields a significant benefit to corporate sustainability including the reduced in information asymmetry, and quality of reporting. Hence, this finding verified the core of dependance resources theory which posited skilled board serve as a key mechanism to secure external resources and reduce environmental dependence.

The findings underlined that the interaction between EMT and non-affiliated directors insignificantly affect ESG performance, suggesting that the presence of independent directors is not influence on board decisions regarding the sustainability issues. This result is conflict with prior studies (Almaqtari et al., 2024; Khan et al., 2021) who supported the idea that independent directors play a positive role in supporting sustainability performance. This result could be interpreted due to the concentration power of CEO in making decisions regarding sustainability issues.

Next, the study revealed that the interactive effect of EMT strengths the positive effect of board gender diversity on ESG reporting, suggesting that a higher proportion of female directors in boardroom along with presence of EMT lead to enhance the transparency of sustainability reporting. This result is aligned with prior works of Garcia-Meca et al. (2024) and Uyar et al. (2021) who affirmed that board with female directors positively contributes in improving the sustainability pillars. To remain sustainable, shareholders should support the inclusion of female directors on corporate board in order to achieve different stakeholders' interests (Fernández-Méndez et al., 2025). This result is supported by critical mass theory which posited that a threshold of women directors is critically useful for enhancing ESG performance (Hassan et al., 2025).

Finally, the study found that environmental team negatively moderates the relationship between CEO duality and sustainability pillars, implying that CEOs with double positions are less likely to participate in sustainability issues when interacted with board environmental team. This result can be attributed to the power of CEO in making decisions regarding to sustainability contributions. Thus, this finding is supported by past research (Bhat et al., 2023; Khemakhem et al., 2023; Zhu et al., 2024) who argued that CEOs dual role is less effective in supporting corporate sustainability and verified by agency theory. However, this result is contradicted with those findings by Arici et al. (2024) and Sepulveda-Nuñez et al. (2025) who affirmed that CEO duality can provide several benefits regarding to sustainability including steward the company toward sustainable development and get better excess external resources that reinforce ESG practices.

6. Conclusion and policy implications

6.1. Conclusion

This study provides comprehensive empirical evidence on how board environmental team moderates the relationship between board attributes and sustainability pillars. By analyzing data from 89 non-listed firms in GCC from 2018 to 2023. The findings reveal that board attributes such as board skills and female directors have direct positive effect on sustainability in GCC context. In contrast, the other board attributes; board size, independent directors, and CEO duality don't have significant effect on ESG performance. Interestingly, the environmental team has a direct positive effect on sustainability pillars. Moreover, the moderating analysis indicates that EMT moderates the relationship between various attributes of board including BSIZE, CEOD, and female directors. The interaction between board EMT and BSIZE negatively affects sustainability performance. Additionally, EMT adversely moderates the relationship between dual role of CEO and ESG performance. In contrast, EMT strengthens the positive effect of female leaders on sustainability disclosure. Therefore, these findings are verified the core values of agency, dependence resources and critical mass theories.

6.2. Policy implications

The findings of this paper offer several theoretical implications to the stand of literature aiming to leverage environmental team

role for board effectiveness and sustainability performance. First, highlighting the role of board environmental team is imperative, particularly in emerging markets such as GCC. Specialized experts in ESG initiatives can help in integration between board oversight and sustainability pillars. Therefore, policymakers should focus on ensuring the accountability of ESG issues to mitigate conflicts of interest and to achieve sustainability goals aligned with long term stakeholders' interests. Second, strengthening the role of the environmental team is critical for promoting proactive sustainable strategies and maintaining social legitimacy, leading to improving company image and reputation. Third, board environmental committee can exert a real impact on corporate decisions, particularly in the presence of female directors on board. Top management should consider both the presence and composition of environmental team matter in achieving sustainability outcomes.

Practically, this research provides various implications for policy makers and regulators in GCC context. Firstly, this paper affirmed that board diversity favorably influences sustainability performance. It offers insights into gender diversity and women who have been appointed on board. Thus, the elected women may bring diverse views and values that change the ideological mindset with board regarding to the importance of sustainability issues for companies (De Masi et al., 2022). Secondly, listed firms in GCC are motivated to consider the ESG pillars in their strategic goals by integrating sustainability dimensions into their corporate goals. Therefore, managers in GCC should also be aware of ISO 14001 as an effective management tool for promoting sustainability practices. This instrument can bring benefits to companies including compliance with environmental regulations, improved sustainability reporting, and reinforced stakeholders trust (Kheireddine et al., 2024). Thirdly, an interesting implication of this research is that the presence of board environmental team in a firm that makes GCC firms more sustainable. Thus, this result opens the door for reconsidering the roles and responsibilities of sustainability committee whether it is created for authentic motive to execute sustainability activities or just only the matter of firm's image and reputation.

6.3. Future research

While this research provides valuable findings, it has certain limitations that should be acknowledged as an avenue for future research. First, this study is focused on GCC, which have unique economic and different regulatory attributes regarding sustainability pillars. Therefore, the findings may be not directly generalizable to other markets. Comparative study across different institutional settings or countries could improve the understanding of how the presence of environmental team moderate's nexus between board effectiveness and ESG practices under different market conditions. Second, future research could examine validity of psychological theories such as Upper Echelons Theory (UET) in order to examine how executives' attributes shape sustainability decisions and their behaviors toward ESG issues.

Declaration of competing interest

The authors declare that they have no conflict of interest.

Data availability

Data will be made available on request.

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