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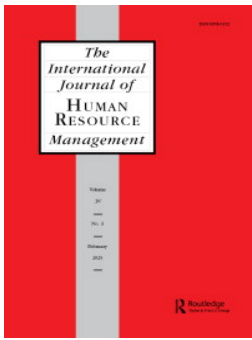
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Breaking down barriers: how board composition drives sustainability in GCC countries

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ABSTRACT

This study empirically examines the impact of board composition on firm sustainability within Gulf Cooperation Council (GCC) countries from 2017 to 2021. Using a sample of 135 non-financial, publicly listed GCC firms (364 firm-year observations), this article investigates the effects of gender diversity, board size, independence, skills, and the presence of sustainability committees on sustainability outcomes. Employing advanced econometric techniques—including panel regression, weighted regression models, quantile regression, Tobit, and logit analyses—to ensure robustness and address potential endogeneity, the study provides evidence of a significant positive effect of board gender diversity on sustainability. In contrast, other board characteristics do not consistently influence sustainability performance. These findings emphasise the unique role of female directors in promoting sustainable governance in the GCC, suggesting that increasing gender diversity may be a more effective strategy for corporate sustainability than focusing on other board factors. This article extends agency and resource dependence theories in the GCC context, offering practical insights for policymakers and managers in emerging markets. It highlights the importance of diverse boards in promoting sustainability and calls on policymakers to implement regulations encouraging board diversity for long-term corporate sustainability in the region—a call to action for a sustainable future.

KEYWORDS

Sustainability; board composition; board gender diversity; corporate governance; environmental management; GCC countries

Introduction

In recent years, firms globally have increasingly recognised the importance of embedding sustainability within their core business strategies. Sustainability involves balancing environmental, social, and economic

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dimensions to promote long-term business resilience and success. Firms adopt sustainable practices for various reasons, from enhancing shareholder value to addressing the rising expectations of diverse stakeholders (Ernst et al., 2022; Kraus et al., 2020). However, pursuing sustainability requires substantial resources and a solid commitment to responsible governance, particularly in developing economies where corporate governance frameworks are still evolving (Ferasso et al., 2020; Schneider & Clauß, 2020). Board diversity has emerged as a central focus in both management (Chen & Kao, 2022; Marinova et al., 2016; Mínguez-Vera & Martin, 2011; Tran et al., 2024) and finance research (Farag & Mallin, 2017; Raddant & Takahashi, 2022), with a specific emphasis on how gender diversity influences organisational performance. Although the value of female directors is increasingly recognised, many organisations continue to encounter obstacles in achieving gender diversity at the highest levels of leadership. Globally, women's representation in senior roles remains significantly lower than that of men (Gould et al., 2018).

The Gulf Cooperation Council (GCC) countries—comprising Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates—offer a distinctive context for examining sustainability and corporate governance. These economies, heavily reliant on natural resources, increasingly prioritise sustainability within their broader economic development frameworks, such as Saudi Vision 2030 and the UAE's Centennial 2071. Despite rapid economic growth, GCC countries face governance challenges, including limited investor protection and low levels of board diversity (Al-Malkawi et al., 2014). Given these obstacles, board composition—encompassing aspects such as gender diversity, board size, independence, skills, and the presence of sustainability committees—has emerged as a critical governance mechanism to strengthen firm sustainability. Research indicates that well-composed boards provide more vigorous oversight and improve decision-making, particularly concerning environmental and social governance (Al-Najjar & Salama, 2022; Goyal et al., 2023).

This study empirically investigates the role of board composition in driving sustainability outcomes within the unique context of GCC countries. Drawing on agency theory (Jensen & Meckling, 1976) and resource dependence theory (Pfeffer & Salancik, 1978), it examines how gender diversity and other board composition characteristics, including board size, independence, skills, and the presence of sustainability committees, influence companies' environmental management practices—such as emission reductions, environmental certifications, and broader sustainability initiatives. The primary objectives of this research are twofold: first, to analyse the impact of board composition on firm sustainability in the GCC; second, to explore how industry-specific factors, particularly within high-tech sectors, moderate the relationship between board

characteristics and sustainability outcomes. Through this dual focus, the study aims to provide valuable insights for academic researchers and policymakers.

This study aims to fill a significant gap in the literature by focusing on the understudied GCC region, notable for its rapid economic growth and evolving governance frameworks. The contribution of this article to the literature is threefold. First, it offers empirical insights into an emerging market context that has yet to be explored in governance and sustainability research. Second, the study's methodological contribution is significant, employing rigorous statistical methodologies and carefully specified models tailored to the idiosyncrasies of the underlying data. This approach includes a thorough quantification of the sensitivity of results to alternative model specifications, thereby enhancing the robustness and reliability of the findings. Third, by examining how specific aspects of board composition strengthen organisational commitment to sustainability, this research expands the discourse on effective governance and sustainable management practices. Unlike previous studies focusing on board diversity within developed markets (e.g. Mínguez-Vera & Martin, 2011), this study's investigation centres on the GCC, providing targeted insights into its unique governance dynamics.

Using a sample of 135 non-financial, publicly listed firms (364 firm-year observations) from GCC countries between 2017 and 2021 and employing advanced econometric techniques—including panel regression, weighted regression models, quantile regression, Tobit, and logit analyses—to ensure robustness and address potential endogeneity, this study finds a significant positive effect of board gender diversity on sustainability performance. In contrast, other board characteristics—such as board skills, board independence, board size, and the presence of sustainability committees—do not consistently or significantly impact sustainability outcomes across the models analysed, even within the high-tech industry. While gender diversity is particularly influential in high-tech settings, where female directors play a critical role in enhancing sustainability outcomes, traditional governance structures appear less effective in driving sustainability. Board skills demonstrate a positive influence on sustainability in some models, but this effect lacks robustness across different sustainability measures, suggesting that skilled directors may contribute to sustainability in specific contexts or under certain analytical frameworks.

The findings emphasise female directors' unique and substantial role in advancing sustainable governance within the GCC context. Increasing gender diversity may thus be a more effective strategy for promoting corporate sustainability than focusing solely on other board composition

factors. This potential impact of gender diversity on sustainability offers a promising pathway for fostering sustainable governance practices. These findings provide practical guidance for policymakers and business leaders within the GCC and other developing regions, adding actionable insights to the study's theoretical contributions.

The remainder of this article is organised as follows: Section 2 provides an overview of the GCC framework and discusses its relevance to sustainability and corporate governance. Section 3 presents the theoretical framework and develops the study's hypotheses. Section 4 describes the data and research methodology. Section 5 reports the analysis and empirical results, and Section 6 concludes the article with a discussion of the study's implications.

GCC framework and sustainability context

The GCC countries are characterised by rapid economic development, driven primarily by revenues from natural resources such as oil and gas (Al-Malkawi et al., 2014). Although this economic growth has transformed the region, it has also introduced substantial environmental and social challenges, prompting a shift towards sustainable development. In recent years, GCC governments have increasingly emphasised sustainability, embedding it within their long-term economic visions. For instance, Saudi Arabia's Vision 2030 outlines a comprehensive plan to reduce the kingdom's reliance on oil and transform its economy through diversification and sustainable development. As part of this initiative, Saudi Arabia has committed to green projects, including expanding renewable energy capacity and reducing carbon emissions through initiatives like the Saudi Green Initiative and the Middle East Green Initiative (Saudi Vision 2030).

Similarly, the UAE has made substantial progress in sustainability, with updated initiatives aligned with its National Agenda 2021. The UAE aims to establish itself as a global leader in sustainable development, primarily through its Centennial 2071 plan, which focuses on long-term environmental and economic sustainability. Additionally, under the Dubai Clean Energy Strategy (2015), the UAE targets generating 75% of its energy from clean sources by 2050. Reflecting this regional shift, GCC countries are increasingly investing in energy efficiency and renewable energy. For instance, the UAE has introduced energy efficiency labels on products like air conditioning units and lighting systems to reduce energy consumption (Sambidge, 2010). In Saudi Arabia, businesses are encouraged to adopt green building standards (Abraham, 2014), further promoting sustainability in infrastructure development across the region.

In addition to energy initiatives, GCC countries are implementing measures to reduce, reuse, and recycle waste while exploring alternative energy sources, such as biogas and non-recyclable plastics. Saudi Arabia has announced plans to build waste-to-energy plants (Zafar, 2021), and the UAE is similarly investing in waste-to-energy technology (Lucente, 2022). Water conservation has also become a regional priority, with investments in desalination, water reuse, and wastewater treatment facilities. For example, Abu Dhabi aims to cut water losses by half by 2030 (Freyberg, 2013). These initiatives reflect the region's growing commitment to sustainability and underscore the critical role of corporate governance and sustainable practices in achieving these ambitious environmental goals.

Despite strategic initiatives, the region continues to grapple with governance challenges. The composition and diversity of boards remain a pressing issue that requires ongoing attention and action. Male directors have historically dominated corporate governance in the GCC countries, with little female representation on boards (e.g. Al Hadi & AlAlwani, 2021; Al-Asfour & Khan, 2014; Jamali et al., 2005). This lack of gender diversity poses a barrier to the effective implementation of sustainability practices, as research has demonstrated that diverse boards contribute to more inclusive decision-making and improved governance outcomes (Adams & Ferreira, 2009; Al-Najjar & Salama, 2022).

Moreover, research suggests that gender diversity can enhance a company's Environmental, Social, and Governance (ESG) performance by fostering improved decision-making, essential for achieving sustainability goals (e.g. Saleh & Maigoshi, 2024). In the context of the GCC, increasing board gender diversity is vital for strengthening corporate governance mechanisms that support the broader objective of sustainable development. Gender-diverse boards are often better equipped to tackle complex ESG challenges, promoting the more effective integration of sustainability into corporate strategies (Bear et al., 2010; Tingbani et al., 2020).

This study contributes to the growing body of literature exploring the intersection of corporate governance, gender diversity, and sustainability in emerging markets. The GCC region's unique combination of economic wealth, resource dependency, and evolving governance frameworks provides a distinct context for this analysis (Al-Malkawi et al., 2014). By examining the link between board gender diversity and sustainability in the GCC, this research addresses a critical gap, offering insights into how governance reforms can drive sustainable business practices in resource-dependent economies. The study's potential to impact governance reforms and sustainable practices highlights its significance in shaping the future of corporate governance and sustainability in the GCC.

Furthermore, this study examines the critical role of gender diversity in the high-tech sector, which moderates the relationship between board gender diversity and sustainability. Although still developing in the GCC, the high-tech industry has become a central focus of economic diversification efforts, especially in the UAE and Saudi Arabia. Understanding the impact of female directors in this dynamic sector is essential for assessing the broader implications of gender diversity on sustainability. Addressing gender diversity in high-tech is increasingly urgent, as it will significantly influence the region's sustainability performance.

As boards of directors oversee firm performance, shareholders and stakeholders in GCC firms rely on them to monitor management's behaviour, minimising opportunism. Corporate boards serve as the first line of defence in reducing agency conflicts, lowering agency costs, and safeguarding stakeholder interests through rigorous oversight (Farooq et al., 2023). Research indicates that gender diversity significantly enhances governance quality, introducing fresh perspectives that improve decision-making, efficient oversight, and ethical standards (Adams & Ferreira, 2009; Terjesen et al., 2009). This is especially critical in GCC countries, where modernisation and economic diversification efforts depend on more robust governance mechanisms (PwC Middle East, 2023; World Bank, 2019).

Female directors positively impact management proficiency, especially in supervisory roles on the board (Baghdadi et al., 2023). Gender-diverse boards contribute to more responsible and sustainable decision-making, aligning with the GCC's sustainability goals. Diversity fosters innovation, encouraging broad engagement by incorporating varied viewpoints and experiences, which is essential for GCC economies transitioning from resource dependence to sustainable development. This diversity strengthens board independence, enhancing oversight, ethical governance, and alignment with stakeholder needs (Al-Najjar & Salama, 2022).

Theoretical framework and hypothesis development

This study's theoretical framework is grounded in two key foundations: agency theory and resource dependence theory (RDT). These theories provide the basis for examining the relationship between board composition—encompassing gender diversity, size, independence, skills, and the presence of sustainability committees—and sustainability performance. This framework is particularly relevant in the GCC context, where corporate governance is rapidly evolving. Building on prior research, such as Saleh and Mansour (2024), who applied these theories to investigate governance mechanisms influencing earnings management, this study extends the application of agency and resource dependence theories to explore

how specific board composition factors drive sustainability—a crucial goal in the GCC's corporate governance landscape. A discussion of this framework in greater detail when presenting the hypotheses.

Board gender diversity and sustainability performance (main hypothesis)

In GCC countries, corporate governance is shaped by unique structural factors, including concentrated family ownership and state involvement, making the board of directors essential for ensuring alignment between management actions, shareholder interests, and broader stakeholder priorities, particularly regarding sustainability initiatives (Galletta et al., 2021; Pearl Initiative, 2021; S&P Global, 2021).

According to agency theory, the separation between ownership (principals) and control (agents) can result in conflicts, especially in the GCC, where concentrated ownership and limited governance regulations amplify agency problems, making effective board oversight crucial (Eisenhardt, 1989; Fama, 1980; Fama & Jensen, 1983; Jensen & Meckling, 1976).

Board gender diversity is increasingly seen as beneficial, although female representation in GCC boards remains limited, with women holding 5.2% of board seats across GCC-listed firms and 9.9% in the UAE specifically (BoardEx, 2023; Heriot-Watt University, 2024). Evidence suggests female directors often prioritise ESG concerns, which are pivotal for firms aiming to enhance sustainability performance (Harjoto et al., 2015; Al-Najjar & Salama, 2022).

Although female board representation is low globally (Deloitte, 2024), including women on boards could strengthen corporate governance frameworks that align with the region's economic diversification and sustainable growth goals. The Saudi Vision 2030 and Qatar's National Vision 2030 illustrate regional efforts to enhance women's economic participation, with Saudi Arabia targeting a 30% female workforce by 2030 and mandating 20% female representation in its Shura Council since 2012.

This article applies agency and resource dependence theories. Resource Dependence Theory (RDT) asserts that a diverse board composition supplies organisations with critical resources, insights, and expertise, thereby enhancing their capacity to tackle complex issues such as sustainability (Pfeffer & Salancik, 1978). As sustainability is foundational to GCC economic strategies, female board members could substantially influence ESG initiatives (Saleh & Maigoshi, 2024). Agency theory further suggests that diverse boards, including women, reduce managerial opportunism and improve overall firm performance by providing more robust oversight (Adams & Ferreira, 2009; Jensen & Meckling, 1976).

Previous research highlights that female leaders bring distinct qualities, including social skills and empathy toward sustainability, making them

particularly effective advocates for long-term environmental objectives. Women often display greater risk aversion, positively influencing decision-making by favouring cautious, sustainable strategies (Eckel & Grossman, 2008; Fellner & Maciejovsky, 2007; Hao, 2019). They also excel at managing complex situations and fostering consensus. Female directors' ethical orientation further contributes to governance, with research indicating they are less prone to unethical conduct, enhancing board independence and moral standards (Adams & Funk, 2012; De Amicis & Falconieri, 2023). Farooq et al. (2023) support this by showing a significant negative relationship between female directors and investment inefficiency.

In addition, Do et al. (2023) found that board diversity improves responsiveness to stakeholder demands, mainly through allocating resources toward environmental performance—a priority for GCC countries pursuing sustainable development. Al-Najjar and Salama (2022) observe a positive association between diversity in board and executive roles and enhanced environmental outcomes, underscoring the impact of gender diversity on sustainable governance. Women's unique perspectives allow them to connect organisations with broader constituencies, advancing stakeholder trust and organisational legitimacy—key benefits in GCC economies seeking global investment and credibility (Carpenter & Westphal, 2001; Hillman & Dalziel, 2003).

Integrating agency theory with RDT illustrates that gender-diverse boards in the GCC can foster enhanced oversight and resource acquisition, which is essential for advancing sustainability initiatives. From the RDT perspective, women are strategically positioned to secure external resources through their diverse networks and collaborative skills. Additionally, their focus on long-term environmental and social outcomes supports the GCC's economic diversification aims, reinforcing the value of gender diversity in achieving regional sustainability ambitions. Considering these theoretical insights, this article proposes the following hypothesis:

H1: There is a positive association between board gender diversity and sustainability performance in GCC countries.

This hypothesis, rooted in agency and resource dependence theories, suggests that gender-diverse boards contribute to improved governance by enhancing oversight, ensuring resource acquisition, and fostering decisions that support long-term sustainability—all crucial elements for GCC firms aligned with the region's strategic objectives.

Additional hypotheses on board composition

To address the importance of other factors in board composition, additional governance elements: board skills, the presence of a sustainability

committee, board size, and board independence are included. These components serve as critical tools in corporate governance and contribute to sound governance practices. The primary hypothesis posits a positive association between these factors and sustainable performance. The specific, testable sub-hypotheses that constitute H2 are as follows:

Board Skills and Sustainability Performance: Board members' skills play a pivotal role in enhancing sustainability performance by providing critical oversight in the development, implementation, and monitoring of sustainability initiatives (Hillman & Dalziel, 2003). Al-Najjar and Salama (2022) find that board skills positively impact environmental performance, noting that directors with advanced education demonstrate higher involvement in environmental initiatives. By establishing sound policies and sustainable business practices, skilled board members promote values that foster organisational awareness of sustainability's long-term benefits (Homroy & Slechten, 2019). As stewards, these board members educate and motivate the organisation to cultivate a sustainability-orientated culture and reinforce accountability towards achieving sustainability objectives (Walls & Hoffman, 2013). Additionally, skilled boards are essential in evaluating sustainability outcomes and formulating long-term strategic plans that support sustainable operations. They ensure efficient resource allocation and integrate social, economic, and environmental considerations into decision-making processes (Iliev & Roth, 2023).

In the GCC, where sustainability is integral to national agendas like Saudi Vision 2030, board members' skills are particularly valuable. Skilled directors help GCC firms align with broader environmental and sustainability objectives, embedding ESG principles within corporate strategy. According to recent insights from the GCC Board Directors Institute, skilled directors are essential in managing stakeholder expectations and implementing ESG strategies, which are central to the region's economic diversification goals. Additionally, diverse boards—comprising directors with varied skills and perspectives—are better equipped to drive sustainability initiatives that align with regional priorities (GCC Board Directors Institute (GCC BDI), 2023). Accordingly, the following hypothesis is proposed:

H2a: Board skills are positively associated with sustainability performance in GCC countries.

This hypothesis posits that skilled board members contribute essential expertise and strategic insight required for effective sustainability governance. In GCC countries, where national development agendas emphasise environmental responsibility and resource efficiency, the presence of skilled board members is especially advantageous. Their capabilities in guiding ESG initiatives align closely with regional objectives, enhancing

organisational sustainability performance. This role is beneficial and critical, as these directors bring a depth of knowledge and accountability that supports firms in meeting local and global sustainability goals.

Sustainability Committees and Sustainability Performance: Boards often establish specialised committees—such as social, environmental, or sustainability committees—to strengthen their monitoring and oversight capacities, thereby enhancing stakeholder orientation and CSR engagement (Gull et al., 2023). From an agency theory perspective, sustainability committees bolster the board's monitoring function by focusing on sustainability oversight and aligning management actions with stakeholder interests in CSR and environmental responsibility. RDT further underlines their value, as these committees provide access to resources, networks, and expertise for addressing environmental challenges (Nuber & Velte, 2021). These committees guide the development, implementation, and monitoring of sustainable practices, promote sustainability values within the organisation, assess sustainability performance, develop strategic plans, and ensure efficient resource allocation, demonstrating practical management skills and a commitment to sustainability. According to Gull et al. (2023), CSR committees play a key role in reducing CSR decoupling—the gap between CSR commitments and actual practices—by aligning a firm's public sustainability statements with its internal operations. Similarly, Martinez-Ferrero and Garcia-Sánchez (2017) find that firms with large, independent boards and effective sustainability committees are more likely to produce verified sustainability reports.

This alignment is particularly relevant in GCC countries, where specialised committees can assist firms in achieving regional environmental goals and aligning with global sustainability standards, thereby supporting national visions for sustainable development. Arayssi et al. (2020) found that GCC companies with sustainability or governance committees exhibit greater engagement in ESG practices, underscoring the role of these specialised committees in aligning corporate actions with stakeholder expectations. Accordingly, the following hypothesis is proposed:

H2b: Sustainability committees are positively associated with sustainability performance in GCC countries.

This hypothesis posits that sustainability committees enhance the board's capacity to implement effective sustainability governance. In GCC countries, where environmental responsibility and alignment with global standards are increasingly prioritised, sustainability committees may play a critical role in advancing these objectives. By focusing specifically on sustainability oversight, such committees can help firms align corporate practices with regional environmental goals and international sustainability standards, thereby contributing to long-term sustainable development in the region.

Board Size and Sustainability Performance: This study considers board size a significant factor influencing the board's capacity to effectively supervise and manage sustainability performance. Building on previous research (e.g. Alsaifi et al., 2020; Baghdadi et al., 2023; Jizi et al., 2014), larger boards are frequently associated with enhanced governance capabilities due to their diverse resources and skill sets. Amorelli and García-Sánchez, (2020) contend that board composition plays a critical role in advancing CSR, while studies by Dalton et al. (1999) and Jizi et al. (2014) highlight that larger boards positively impact both financial and sustainability outcomes. Jizi et al. (2014) further suggest that larger boards facilitate greater management alignment with CSR initiatives, effectively communicating the firm's social performance to stakeholders. Larger boards promote diversity in decision-making, enhance stakeholder representation, and play a crucial role in responsibility allocation, which Almaqtari et al. (2023) identified as vital to board effectiveness.

According to RDT, larger boards offer essential resources, including legitimacy, advisory expertise, and strategic connections to other organisations, which are crucial for effective governance (Hillman & Dalziel, 2003). Consequently, larger boards enhance a firm's overall capabilities, knowledge, and access to external networks, strengthening their ability to monitor and effectively protect stakeholder interests.

In the GCC, where firms navigate complex governance structures and pursue ambitious sustainability objectives, larger boards with diverse expertise and resources are invaluable. Such boards provide essential insights and establish networks to guide firms towards effective CSR and environmental practices. By integrating diverse backgrounds and expertise, larger boards deepen the board's understanding of the firm's operational environment and strategic priorities (Payne et al., 2009).

Awad et al. (2023) find that larger boards in GCC companies bring diverse skills and resources, positively influencing firm value through enhanced governance, profitability, and strategic decision-making. They recommend that GCC firms consider increasing board size to strengthen corporate governance and drive profitability within an emerging market context. Similarly, Harun et al. (2020) found a positive association between board size and CSR disclosure among GCC Islamic banks, underscoring the need for robust governance mechanisms to support sustainable CSR practices that meet stakeholder expectations and promote long-term value. Based on these insights, the following hypothesis is proposed:

H2c: Larger boards are positively associated with sustainability performance in GCC countries.

This hypothesis draws on RDT, which posits that larger boards endow a firm with enhanced resources, legitimacy, and a broader representation of stakeholder interests. By integrating diverse perspectives and areas of expertise, larger boards are better positioned to support sustainability initiatives effectively, aligning with the GCC region's emphasis on sustainability objectives. These boards enhance a firm's access to critical resources and networks and strengthen its ability to engage in sustainable practices, meeting the demands of an evolving governance landscape focused on long-term environmental goals.

Board Independence and Sustainability Performance: According to agency theory, independent board directors reduce agency costs and enhance organisational performance through effective oversight and management accountability (Haque, 2017). Board independence is particularly relevant in GCC countries, where governance structures frequently reflect concentrated ownership, often controlled by family or state entities. The presence of independent directors strengthens accountability by aligning managerial actions with stakeholder interests, thereby reducing susceptibility to managerial influence and curbing behaviours that could undermine stakeholder goals (Lu et al., 2016). This increased oversight capacity allows independent directors to bring an objective perspective, enhancing decision-making and supporting a stronger focus on sustainability (Ames et al., 2018).

While insider representation may improve information flow, it can also reduce board independence, highlighting the importance of balancing these dynamics, as Payne et al., (2009) suggest. Krause and Semadeni (2014) further propose that higher levels of board independence improve a board's responsiveness to performance challenges, enhance managerial oversight, and lower the firm's cost of debt. Haque (2017) finds a positive correlation between board independence and carbon reduction initiatives, underscoring its role in promoting ecological sustainability. Similarly, Jizi et al. (2014) report that independent directors are positively associated with CSR disclosure, suggesting that board independence drives transparency and responsible practices.

In the GCC context, where firms increasingly aim to meet international standards for environmental responsibility, Arayssi et al. (2020) also found that higher board independence bolsters a firm's social responsibility image by facilitating ethical conduct. They concluded that independent boards effectively balance financial objectives with social responsibilities, supporting the hypothesis that board independence positively influences sustainability performance in GCC countries.

H2d: Board independence is positively associated with sustainability performance in GCC countries.

This hypothesis is grounded in agency theory, which posits that independent boards ensure management accountability, reduce agency costs, and support sustainability initiatives. In GCC countries, where corporate governance reforms increasingly emphasise transparency and environmental responsibility, board independence is likely to be pivotal in advancing sustainability goals. This underscores the importance of further research and highlights potential implications for corporate governance practices in the GCC.

Data and research design

Data

The sample includes all non-financial listed firms within GCC countries. Initially, approximately 600 firms were identified, from which all non-financial firms that provided the necessary information for the study period are selected. The final sample comprises 135 non-financial firms, distributed as follows: 38 firms from Qatar, 38 from Saudi Arabia, 34 from the UAE, 11 from Kuwait, 9 from Bahrain, and 5 from Oman, yielding around 364 firm-year observations from 2017 to 2021. This selection accounts for missing data and permits firms to enter and exit freely during the analysis period, ensuring comprehensive coverage of all qualifying non-financial firms. The study period began in 2017, marking the availability of corporate governance information. At the time of this research, 2021 was the latest year for published financial data in the Eikon database. The sample distribution is summarised in [Table 1-Panel A](#), with descriptive statistics in [Table 1-Panel B](#).

[Table 1-Panel B](#) presents descriptive statistics for the sample. The CSR-sustainability score, representing a firm's capability to integrate economic, social, and environmental considerations into daily decision-making, averages 0.25 with a maximum of 0.99, indicating a generally low emphasis on these activities across the sample. Similarly, the social pillar score, which reflects best management practices for social CSR activities, averages 0.22, with a peak value of 0.82, also suggesting limited support for social initiatives.

The statistics reveal that female directors constitute only 2% of board members on average, with a maximum representation of 0.4%, demonstrating low female representation. Additionally, 0.8% of board members

Table 1. Panel A – Sample selection.

Sample	
Number of public firms in GCC	854
Less financial related firms	252
Number of non-financial firms	602
Firm with no related information	467
Final Sample	135

Table 1. Panel B – Descriptive statistics.

Variable	Mean	Std. dev.	Min	Max
CSR-Sustainability score	0.255384	0.32322	0	0.992424
Social score	0.228372	0.201675	0.003402	0.823099
B.diversity	0.029222	0.064457	0	0.4
B.skills	0.008822	0.003228	0	0.01
Sustainability-comm	0.133824	3407132	0	1
B.indep	0.406985	0.273132	0	1
b.size	8.805479	2.323547	1	25
Beta	0.903649	0.471143	-0.3389	3.108985
ROE	0.055346	0.105069	-0.46682	0.846664
Size	21.9252	2.13515	16.40512	28.40237
Lev	0.22907	0.197548	0	0.784747

Note: Where sustainability score is measured as score to reflect firms approaches of communications for sustainability practices in their decision-making process, provided by Eikon database. Social score is available from Eikon to reflects firms' best management practices to generate trust and loyalty with different stakeholders including the society. B.diversity, measured as the percentage of female directors to the total number of directors; B.skills measured as the percentage of board members with academic and/or professional skills to the total number of directors; Sustainability-comm reflects if firms have sustainability committee within the board; B.indep measured as the percentage of non-executive directors to the total number of directors, B.size measured as the total number of directors; Beta, a measure for systematic risk, ROE measured as operating income divided by equity, firm size measured as the natural logarithm of total assets; Leverage it total debt to total assets ratio.

have professional or academic degrees, and 42% of members attend meetings regularly. Board independence averages 40%, while the typical board size is eight members. These findings highlight a need for improved governance practices in the GCC, particularly in increasing female representation and enhancing qualifications among board members. Further, the sample shows a market beta of 0.90, indicating moderate market risk and lower volatility relative to the market. Profitability and debt ratios are also modest, averaging 5% and 22%, respectively. Table 1-Panel C provides country-specific descriptive statistics, revealing consistently low CSR-sustainability and social pillar scores across GCC nations.

Table 2 presents the correlation matrix (Pearson correlations), showing no high bivariate correlations between the independent variables. This indicates that multicollinearity is not a concern in the regression models, ensuring robustness in the analysis.

Research design

The article employs various statistical techniques, with a time series-cross-sectional model as the primary baseline. This model accounts for firm-specific and time-related effects, allowing for a comprehensive panel data analysis. The main models are informed by previous studies on sustainability and environmental performance, particularly those examining the impact of gender diversity on sustainability outcomes (e.g. Al-Najjar & Salama, 2022) and studies on gender diversity published in human resource journals (e.g. Chen & Kao, 2022; Marinova et al., 2016; Mínguez-Vera & Martin, 2011). The specific models adopted in this study are as follows:

Table 1. Panel C – Descriptive statistics per country.

Variable	KSA				UAE				Qatar			
	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
CSR-Sustainability	0.290693	0.337802	0	0.982759	0.394903	0.326067	0	0.992424	0.151291	0.253893	0	0.882353
Social score	0.262391	0.212831	0.003402	0.754692	0.306757	0.208253	0.028636	0.823099	0.142327	0.128907	0.011733	0.49219
B.diversity	0.018744	0.050879	0	0.25	0.061552	0.079086	0	0.3	0.007632	0.027841	0	0.111111
B.skills	0.008182	0.003875	0	0.01	0.009403	0.002387	0	0.01	0.008889	0.003159	0	0.01
Sustainability-comm	0.417925	0.127995	0.142857	0.75	0.746344	0.202381	0	1	0.216641	0.221907	0	0.75
B.indep	0.252632	0.435669	0	1	0.088235	0.284475	0	1	0.084211	0.278437	0	1
b.size	9.481818	2.82106	1	25	8.343284	1.934944	5	13	8.59596	2.142472	3	13
Beta	0.949325	0.336518	0.296618	1.601255	0.824978	0.619065	-0.3389	3.108985	0.941015	0.477979	-0.06196	2.164084
ROE	0.096582	0.110682	-0.21871	0.640994	0.040763	0.120486	-0.46682	0.846664	0.036539	0.078251	-0.30262	0.289676
Size	23.18662	1.770434	20.02977	28.40237	22.01714	1.794374	18.93679	25.95398	22.19155	1.616634	18.8533	25.21702
Lev	0.254061	0.195587	0	0.777199	0.190338	0.16248	0	0.686702	0.229267	0.213019	0	0.784747
					Oman				Bahrain			
Variable	Kuwait				Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
CSR-Sustainability	0.317812	0.359726	0	0.961539	0.08631	0.237563	0	0.8125	0.155686	0.292181	0	0.95
Social score	0.272722	0.259418	0.004792	0.820093	0.110724	0.064901	0.052693	0.298213	0.228356	0.175842	0.055983	0.615065
B.diversity	0.0352	0.079436	0	0.4	0.041366	0.064592	0	0.222222	0.055556	0.10304	0	0.333333
B.skills	0.009333	0.002523	0	0.01	0.009524	0.002182	0	0.01	0.008261	0.003876	0	0.01
Sustainability-comm	0.221134	0.161379	0	0.5	0.601252	0.319159	0	1	0.363566	0.206335	0	0.8
B.indep	0.169231	0.377874	0	1	0	0	0	0	0.363566	0.206335	0	0.8
b.size	7.4	1.958664	5	13	9.47619	0.872872	9	12	0.025	0.158114	0	1
Beta	0.902015	0.367062	0.255782	1.584297	0.865378	0.248404	0.628912	1.105958	9.956522	0.928257	7	11
ROE	0.011094	0.102072	-0.39962	0.162161	0.066437	0.085794	-0.09445	0.230941	0.84574	0.435634	0.301652	1.445242
Size	19.11574	2.016706	16.40512	22.31486	20.42751	1.266787	19.08934	22.79859	0.074354	0.060232	-0.05934	0.286742
Lev	0.183936	0.202613	0	0.671679	0.29889	0.169985	0.000977	0.6087	0.303766	0.230798	0	0.68598

Table 2. Pearson correlation matrix.

	B.diversity	B.skills	Sustainability-comm	B.indep	B.size	Beta	ROE	Size	Lev
B.diversity	1								
B.skills	0.0683	1							
Sustainability-comm	0.1824	0.1019	1						
B.indep	0.0294***	0.0765	0.0224	1					
B.size	-0.064	-0.1545***	0.054	-0.0635	1				
Beta	0.1336**	-0.017	-0.0434	0.0436	-0.0855	1			
ROE	0.0557	-0.0719	0.0988***	0.087	0.0933	-0.118***	1		
Size	-0.0686	-0.0637	0.1657	0.0797***	0.1954**	0.0916***	0.2171***	1	
Lev	-0.0801	0.0765	-0.0058***	0.1151	-0.0052	0.1078***	0.0153	0.1119***	1

Note: variables are defined in the note of Table 1. ***, ** significant at 1% and 5% respectively.

$$\begin{aligned} \text{CSR – Sustainability}_{i,t} = & \beta_0 + \beta_1 \text{B.diversity}_{i,t} + \beta_2 \text{B.skills}_{i,t} \\ & + \beta_3 \text{sustainability comm}_{i,t} + \beta_4 \text{B.indep}_{i,t} + \beta_5 \text{B.size}_{i,t} \\ & + \beta_6 \text{firm – specific}_{i,t} + \varepsilon_{it} \end{aligned}$$

$$\begin{aligned} \text{Social pillar score}_{i,t} = & \beta_0 + \beta_1 \text{B.diversity}_{i,t} + \beta_2 \text{B.skills}_{i,t} \\ & + \beta_3 \text{sustainability comm}_{i,t} + \beta_4 \text{B.indep}_{i,t} + \beta_5 \text{B.size}_{i,t} \\ & + \beta_6 \text{firm – specific}_{i,t} + \varepsilon_{it} \end{aligned}$$

CSR-sustainability is quantified using a score from the Eikon database, which reflects each firm's approach to integrating sustainability practices into its decision-making processes. Additionally, the Eikon social pillar score evaluates top management practices to build trust and loyalty among various stakeholders, including society at large. The social pillar score include aspects related to: work force, human rights, community, and product responsibility This study investigates five independent variables to assess their influence on CSR-sustainability practices and social pillar scores among GCC firms. The primary independent variable, board gender diversity, is measured as the proportion of female directors. Additionally, the study examines board skills, measured as the percentage of directors with academic or professional qualifications; the presence of a sustainability committee within the board, representing a structured approach to sustainability oversight; board independence, calculated as the percentage of non-executive directors; and board size, represented by the total number of directors. Together, these independent variables offer a comprehensive understanding of how specific board characteristics contribute to sustainability performance in GCC firms.

Firm-related variables, including beta (a measure of systematic risk), return on equity (ROE, calculated as operating income divided by equity), and firm size (measured as the natural logarithm of total assets) are controlled for in the analysis. Previous research has raised concerns regarding reverse causality, a form of endogeneity that can lead to biased regression estimates (Roberts et al., 2013). To address this issue, prior studies have employed methods such as instrumental variables or two-stage least squares (2SLS) (Huang & Kisgen, 2013), as well as fixed-effect panel models to account for unobserved firm effects (Sila et al., 2016). In line with these approaches, the study employs a two-stage regression analysis with lagged values of board diversity, independence, and profitability as instruments to control for endogeneity in the baseline models. This method, recommended by Al-Najjar and Salama (2022) and Wintoki et al. (2012), is widely adopted for identifying valid instruments in the

examined relationships. The validity of the instruments was confirmed by the Sargan test, which showed no significant findings across any of the models.

To validate the results, the study employed multiple methods, including quantile regression analysis across a range of quantiles from 50 to 95. Given that the dependent variables are constrained between 0 and positive values, the study applies Tobit analysis to account for this truncation, thereby ensuring robust results.

Results

This section presents the regression analysis results, examining the relationship between board composition characteristics and sustainability performance among GCC companies. The analysis applies time-series and cross-sectional models, focusing on two main dependent variables: the CSR-sustainability score and the social pillar. As shown in Table 3, the findings indicate a positive association between the presence of female directors and sustainability performance, supporting the primary hypothesis (H1). This result aligns with prior research in environmental management and CSR, including studies by Al-Najjar and Salama (2022), Lu and Herremans (2019), Harjoto et al. (2015), and

Table 3. Regression analysis.

Variables	CSR-sustainability score				Social score			
	M1	M2	M3	M4	M5	M6	M7	M8
B.diversity	0.749* (0.419)	1.056** (0.411)	0.714* (0.419)	0.981** (0.414)	0.741** (0.300)	0.84*** (0.280)	0.741** (0.305)	0.83*** (0.288)
B.skills	13.69** (6.036)	15.95** (6.205)	12.54* (6.747)	13.57** (6.659)	3.714 (4.848)	5.384 (4.834)	3.724 (5.088)	5.042 (4.946)
Sustainability-comm	0.00475 (0.0688)	-0.0515 (0.0655)	-0.0014 (0.0711)	-0.0618 (0.0672)	-0.0110 (0.0467)	-0.0390 (0.0455)	-0.0125 (0.0478)	-0.0415 (0.0463)
B.indep	0.132 (0.109)	0.0877 (0.103)	0.132 (0.110)	0.0837 (0.104)	0.0704 (0.0683)	0.0558 (0.0680)	0.0696 (0.0687)	0.0551 (0.0680)
B.size	0.0106 (0.009)	0.00175 (0.00842)	0.0108 (0.0092)	0.00171 (0.00842)	-0.0004 (0.0058)	-0.00396 (0.0054)	-0.0004 (0.0058)	-0.00396 (0.0055)
Beta		-0.0778 (0.0571)		-0.0775 (0.0573)		0.0137 (0.0375)		0.0135 (0.0378)
ROE		0.456* (0.264)		0.467* (0.261)		0.247 (0.187)		0.249 (0.187)
Size		0.0417*** (0.0128)		0.0443*** (0.0129)		0.0205** (0.00840)		0.0208** (0.00841)
Lev		0.229* (0.137)		0.239* (0.138)		0.0530 (0.0789)		0.0542 (0.0793)
Constant	-0.0369 (0.116)	-0.903*** (0.296)	-0.00765 (0.127)	-0.901*** (0.299)	0.151* (0.0866)	-0.322 (0.200)	0.149* (0.0890)	-0.321 (0.202)
Observations	364	343	364	343	364	343	364	343
R-squared	0.067	0.210	0.070	0.218	0.079	0.168	0.081	0.169
year-dummies			Yes	Yes			Yes	Yes
Firm panel	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Note: variables are defined in the note of Table 1. ***, **, * are significant at 1%, 5%, and 10% respectively; numbers in brackets are robust standard errors.

Bear et al. (2010). This finding further reinforces agency and resource dependence theories (Adams & Ferreira, 2009; Eisenhardt, 1989; Fama, 1980; Fama & Jensen, 1983; Jensen & Meckling, 1976; Pfeffer & Salancik, 1978), while contributing to the literature on corporate governance in the GCC context (Jizi et al., 2022). In the GCC, where sustainability practices are increasingly crucial for attracting foreign investment and advancing economic diversification goals, female directors play a pivotal role in promoting socially responsible governance. This underscores the importance of GCC companies integrating diversity and sustainability, aligning with evolving regulatory expectations and global standards.

The analysis also reveals that firms with a higher proportion of board members holding academic or professional qualifications demonstrate improved sustainability performance (Models 1–4). This finding aligns with prior studies (Harjoto et al., 2015; Bear et al., 2010), which highlight the value of well-qualified board members in sustainability-related decision-making, thereby supporting hypothesis H2a. This result is consistent with the theoretical framework and underscores the importance of board expertise in developing regions such as the GCC, where this skill set is recognised as a governance asset that can strengthen strategic sustainability decisions. It also aligns with the recommendation of the GCC Board Directors Institute that boards comprising directors with varied skills and perspectives are well-positioned to promote sustainability initiatives aligned with regional priorities (GCC Board Directors Institute (GCC BDI), 2023). However, other board structure variables did not yield significant results, contradicting the associated sub-hypotheses. Finally, the findings suggest that larger, profitable firms and those with a higher dependency on debt in their capital structure tend to exhibit stronger sustainability performance.

Table 4 presents the results of the second set of models, employing two-stage least squares (2SLS) to address potential endogeneity issues by using a lag of governance-endogenous factors and a one-year lag of firm performance as instruments. The primary focus is to assess the robustness of the main independent variable, the presence of female directors on a company's board. The findings provide strong evidence that female directors effectively promote good governance and enhance sustainability performance, reinforcing the earlier results. Furthermore, the results indicate that board skills are positively associated with sustainability performance, as evidenced in Models 1 and 2. Lastly, larger firms tend to exhibit better sustainability performance compared to smaller firms. Overall, these findings support the main theoretical arguments within the GCC context.

Table 4. 2SLS-IV regression analysis.

Variables	CSR-sustainability score		Social score	
	M1	M2	M3	M4
B.diversity	1.623** (0.785)	1.556** (0.782)	1.685*** (0.516)	1.686*** (0.525)
B.skills	15.61** (6.748)	15.07** (6.935)	5.546 (4.718)	5.704 (4.771)
Sustainability-comm	-0.0693 (0.0849)	-0.0753 (0.0868)	-0.0448 (0.0559)	-0.0464 (0.0564)
B.indep	-0.0144 (0.130)	-0.0130 (0.131)	0.00331 (0.0776)	0.00167 (0.0781)
B.size	0.00282 (0.00852)	0.00273 (0.00852)	-0.00513 (0.00543)	-0.00506 (0.00540)
Beta	-0.122 (0.0759)	-0.120 (0.0763)	-0.0178 (0.0463)	-0.0180 (0.0464)
ROE	0.321 (0.305)	0.343 (0.305)	0.0828 (0.216)	0.0718 (0.218)
Size	0.0461*** (0.0144)	0.0466*** (0.0145)	0.0245*** (0.00932)	0.0244*** (0.00932)
Lev	0.214 (0.154)	0.215 (0.154)	-0.0141 (0.0901)	-0.0133 (0.0898)
Constant	-0.945*** (0.326)	-0.966*** (0.331)	-0.342 (0.216)	-0.349 (0.219)
Observations	213	213	213	213
R-squared	0.195	0.198	0.163	0.165
year-dummies		Yes		Yes
Firm-panel	Yes	Yes	Yes	Yes
Sargan test	1.560	1.526	2.197	2.122

Note: variables are defined in the note of Table 1. ***, **, and * are significant at 1%, 5%, and 10%, respectively; numbers in brackets are robust standard errors. Sargan test is not significant in all models, indicating the validity of the instruments.

To evaluate the findings further, the study conducts a quantile regression analysis at the 50th, 75th, and 95th quantiles of the dependent variables. Table 5 shows a robust positive relationship between the presence of female directors and firm sustainability performance across all quantiles, supporting H1. Additionally, limited evidence suggests that board skills positively and significantly impact sustainability performance, aligning with H2a (Model 1). These results are consistent with prior research in CSR and environmental management, including studies by Jain and Zaman (2020) and De Villiers et al. (2011). Interestingly, board independence has a negative and significant association with sustainability performance at the upper quantile (95th), yet it shows a positive association at the lower quantile (5th). This indicates a nuanced effect of board independence on sustainability, where the negative sign in the upper quantile contradicts the expectations and hypothesis, though the lower quantile findings support H2d, suggesting that independent directors may contribute expertise that improves strategic decisions in the GCC context. Finally, the analysis reveals that firm size, profitability, and leverage positively influence sustainability performance. Overall, these results underscore the strategic role of female directors in advancing sustainability within firms.

Table 5. Quantile regression analysis.

VARIABLES	CSR-Sustainability Score			Social Score		
	50	75	95	50	75	95
B.diversity	1.431*** (0.450)	1.697*** (0.517)	2.109*** (0.429)	1.052*** (0.228)	0.951*** (0.313)	1.202*** (0.431)
B.skills	10.28 (8.698)	23.41** (10.00)	12.60 (8.290)	4.980 (4.405)	5.441 (6.047)	0.621 (8.328)
Sustainability-comm	-0.0678 (0.0703)	-0.0959 (0.0809)	-0.00656 (0.0670)	-0.0429 (0.0356)	-0.0328 (0.0489)	0.0313 (0.0673)
B.indep	0.175* (0.103)	0.114 (0.124)	-0.175* (0.102)	0.104* (0.0544)	0.0371 (0.0747)	0.0367 (0.103)
B.size	0.00409 (0.0124)	0.00488 (0.0142)	0.028** (0.0118)	0.00249 (0.0062)	0.000850 (0.0086)	-0.020* (0.0118)
Beta	-0.102 (0.0695)	-0.0792 (0.0799)	-0.0967 (0.0662)	-0.00843 (0.0352)	0.0287 (0.0483)	0.0584 (0.0665)
ROE	0.227 (0.308)	0.984*** (0.354)	0.711** (0.294)	0.0828 (0.156)	0.403* (0.214)	0.626** (0.295)
Size	0.0311** (0.0140)	0.048*** (0.0161)	0.053*** (0.0134)	0.0132* (0.0071)	0.0302*** (0.00975)	0.0161 (0.0134)
Lev	0.116 (0.151)	0.380** (0.174)	0.329** (0.144)	0.0389 (0.0767)	0.0479 (0.105)	0.116 (0.145)
Constant	-0.698** (0.323)	-1.01*** (0.372)	-0.769** (0.308)	-0.259 (0.164)	-0.495** (0.225)	0.231 (0.309)
Observations	343	343	343	343	343	343
R-squared	0.1329	0.1821	0.1165	0.1112	0.1398	0.1210

Note variables are defined in the note of Table 1. ***, **, * are significant at 1%,5%, and 10% respectively; numbers in brackets are robust standard errors.

Further and robustness checks

Given that the dependent variables—CSR-sustainability and social scores—are non-negative and take values of zero or above, an additional robustness check is conducted using Tobit models, with results presented in Table 6. The Tobit model is particularly suitable for censored or truncated data, as it effectively captures observations that fall above a specified threshold (zero in this case), providing a more nuanced understanding of the relationships at play. The results reveal a significant positive relationship between female directors and sustainability performance, reinforcing the argument that female directors serve as effective monitoring mechanisms to promote firm sustainability. The results also show that board skills (Models 1–6) and board independence (Models 1–5 and 7) have an effect. The findings show how vital skilled directors are in making strategic decisions in the GCC, which supports hypothesis H2a. Finally, the analysis shows that firm size, leverage, and profitability are positively associated with sustainability performance, while firm risk is negatively associated, which aligns with previous studies.

To further validate the analysis, the dependent variable is examined in cases where it is dichotomous. Specifically, the study employed logistic regression (logit analysis) to explore these relationships further. Table 7 presents the results of the logit analysis, where the dependent variable is set to 1 if the CSR-sustainability score (social pillar score) exceeds the average score and 0 otherwise. The findings provide strong evidence

Table 6. Tobit analysis.

Variables	CSR-sustainability score							
	M1	M2	M3	M4	M5	M6	M7	M8
B.diversity	1.260*** (0.468)	1.799*** (0.451)	1.187** (0.472)	1.654*** (0.453)	0.741*** (0.160)	0.849*** (0.164)	0.741*** (0.162)	0.837*** (0.166)
B.skills	34.32*** (11.05)	35.47*** (10.21)	31.96*** (11.29)	31.16*** (10.40)	3.714 (3.206)	5.384* (3.168)	3.724 (3.316)	5.042 (3.280)
Sustainability-comm	0.0462 (0.0775)	-0.0626 (0.0722)	0.0339 (0.0782)	(0.0726)	-0.0110 (0.0258)	-0.0390 (0.0256)	-0.0125 (0.0261)	-0.0415 (0.0259)
B.indep	0.301*** (0.116)	0.235** (0.111)	0.297** (0.116)	0.222** (0.110)	0.0704* (0.0380)	0.0558 (0.0391)	0.0696* (0.0380)	0.0551 (0.0391)
B.size	0.00979 (0.0137)	-0.00593 (0.0133)	0.0101 (0.0137)	-0.00659 (0.0133)	-0.00040 (0.00446)	-0.00396 (0.00450)	-0.00042 (0.00445)	-0.00396 (0.00450)
Beta		-0.146** (0.0722)		-0.143** (0.0715)		0.0137 (0.0253)		0.0135 (0.0253)
ROE		0.813** (0.320)		0.848*** (0.324)		0.247** (0.112)		0.249** (0.113)
Size		0.0753*** (0.0153)		0.0806*** (0.0156)		0.0205*** (0.00511)		0.0208*** (0.00518)
Lev		0.386** (0.161)		0.403** (0.160)		0.0530 (0.0551)		0.0542 (0.0552)
Constant	-0.517*** (0.174)	-2.046*** (0.358)	-0.459** (0.183)	-2.053*** (0.358)	0.151*** (0.0535)	-0.322*** (0.118)	0.149*** (0.0571)	-0.321*** (0.118)
R-square	0.0529	0.1570	0.0550	0.1647	0.011	0.011	0.011	0.011
Observations	364	343	364	343	364	343	364	343
year-dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-panel	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note variables are defined in the note of Table 1. ***, **, * are significant at 1%, 5%, and 10% respectively; numbers in brackets are robust standard errors.

Table 7. Logit analysis.

Variables	CSR-sustainability score				Social score			
	M1	M2	M3	M4	M5	M6	M7	M8
B.diversity	5.289** (2.606)	8.428*** (3.220)	5.115* (2.616)	8.094** (3.269)	7.412*** (2.828)	10.13*** (3.095)	7.331*** (2.838)	9.911*** (3.130)
B.skills	100.8* (53.37)	139.7** (57.34)	96.31* (56.47)	127.1** (59.82)	17.33 (46.83)	30.67 (48.51)	13.06 (50.30)	21.81 (51.49)
Sustainability-comm	-0.135 (0.439)	-0.608 (0.439)	-0.169 (0.454)	-0.684 (0.448)	0.0711 (0.471)	-0.321 (0.506)	0.0559 (0.477)	-0.355 (0.508)
B.indep	1.092* (0.655)	0.826 (0.692)	1.079 (0.656)	0.804 (0.694)	0.961 (0.710)	0.923 (0.770)	0.970 (0.714)	0.925 (0.770)
B.size	0.0615 (0.0627)	-0.0195 (0.0733)	0.0633 (0.0627)	-0.0211 (0.0733)	0.0181 (0.0620)	-0.0364 (0.0669)	0.0181 (0.0614)	-0.0380 (0.0664)
Beta		-0.368 (0.455)		-0.356 (0.441)		-0.0547 (0.426)		-0.0597 (0.424)
ROE		5.926*** (2.028)		5.892*** (2.067)		2.126 (3.100)		2.252 (3.128)
Size		0.380*** (0.110)		0.407*** (0.114)		0.244* (0.128)		0.253* (0.130)
Lev		1.077 (0.930)		1.179 (0.941)		2.189** (1.055)		2.210** (1.058)
Constant	-2.57*** (0.943)	-11.01*** (2.711)	-2.368** (0.984)	-11.17*** (2.791)	-1.496* (0.837)	-7.213** (3.040)	-1.463* (0.885)	-7.254** (3.063)
R-square	0.0605	0.1933	0.0638	0.2011	0.0581	0.1385	0.0592	0.1406
Observations	364	343	364	343	364	343	364	343
year-dummies			Yes	Yes			Yes	Yes
Firm panel	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: variables are defined in the note of Table 1. ***, **, * are significant at 1%, 5%, and 10% respectively; numbers in brackets are robust standard errors.

supporting the primary hypothesis that board gender diversity positively influences firm sustainability. The results indicate that firms with more female directors are associated with improved sustainability outcomes, including a greater emphasis on ESG issues and a more responsible approach to managing the firm's societal and environmental impact, consistent with prior research.

Additionally, the study finds positive associations between board skills and independence and sustainability performance, supporting H2a and H2d within the GCC context. Firms with independent directors and board members with diverse skills and experiences contribute to more effective decision-making that supports firm sustainability. Lastly, the analysis reveals that firm size, leverage, and profitability positively impact sustainability performance.

Overall, this study's findings align with expectations and prior research, proving that promoting gender diversity on boards is crucial for enhancing sustainability performance and fostering effective decision-making and governance practices.

Moreover, the study re-estimates the models using weighted regression to examine the country effect in the regression analysis, with results presented in Table 8. The findings confirm a positive impact of board gender diversity on sustainability, consistent with the previous results and H1. Additionally, board skills show a similar positive effect on

Table 8. Further analysis: Weighted regression analysis.

Variables	REG		2SLS-IVREG		TOBIT	
	M1	M2	M3	M4	M5	M6
B.diversity	0.771* (0.472)	0.627** (0.303)	1.284 (0.888)	1.470** (0.591)	1.204* (0.745)	0.627** (0.299)
B.skills	20.54*** (5.021)	9.322** (3.949)	20.49*** (5.598)	9.237** (3.985)	48.13*** (12.99)	9.322** (3.896)
Sustainability-comm	0.00915 (0.0723)	-0.00590 (0.0507)	-0.00487 (0.0941)	-0.0200 (0.0592)	0.0242 (0.108)	-0.00590 (0.0500)
B.indep	0.146 (0.102)	0.0646 (0.0748)	0.0253 (0.130)	-0.000265 (0.0839)	0.379** (0.173)	0.0646 (0.0738)
B.size	0.00481 (0.00815)	-0.00470 (0.00500)	0.00789 (0.00781)	-0.00479 (0.00494)	0.00375 (0.0136)	-0.00470 (0.00493)
Beta	-0.0688 (0.0651)	-0.0152 (0.0457)	-0.119 (0.0922)	-0.0644 (0.0592)	-0.0942 (0.105)	-0.0152 (0.0451)
ROE	0.251 (0.314)	0.0452 (0.226)	0.132 (0.352)	-0.125 (0.251)	0.486 (0.526)	0.0452 (0.223)
Size	0.0516*** (0.0165)	0.0294** (0.0114)	0.0532*** (0.0189)	0.0317** (0.0128)	0.0881*** (0.0269)	0.0294*** (0.0113)
Lev	0.377** (0.160)	0.0419 (0.114)	0.333* (0.185)	-0.0251 (0.129)	0.677*** (0.261)	0.0419 (0.112)
Constant	-1.269*** (0.387)	-0.513* (0.261)	-1.249*** (0.441)	-0.477 (0.297)	-2.718*** (0.669)	-0.513** (0.257)
Observations	343	343	213	213	343	343
R-squared	0.245	0.149	0.236	0.137	0.199	0.01
Panel-effect	Yes	Yes	Yes	Yes	Yes	Yes
Sargan Test			2.66	1.07		

Note: variables are defined in the note of Table 1. ***, **, * are significant at 1%, 5%, and 10% respectively; numbers in brackets are robust standard errors.

sustainability, supporting H2a. Limited evidence suggests that independent directors positively influence sustainability performance, aligning with H2d.

The interaction effects between board gender diversity and other board characteristics, including board skills, board independence, and the presence of a sustainability committee, have also been examined. While the results for board diversity alone were positive and significant, the interaction effects were insignificant. Consequently, there is no support for any interactions between board gender diversity and other board-related factors. For the sake of parsimony, these models have not been reported.

Additionally, a categorical variable for gender diversity is added to the analysis, coded as 1 if gender diversity is less than 10%, 2 if it is between 10% and 30%, and 3 if it exceeds 30%. Table 9 presents the models, with categories 2 and 3 reported in the tables. The main variables of interest, Div-2 and Div-3, show positive associations across all models (except for Div-3 in Models 1 and 3), which is consistent with the previous study's findings.

Finally, the study is interested in examining the environmental performance among GCC firms to investigate the impact of female directors on environmental practices. Four measures are included to capture environmental performance and sustainability: the environmental score, which assesses a firm's efficiency in environmental management (sourced

Table 9. Gender categories analysis.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	M1	M2	M3	M4	M5	M6	M7	M8
Div-2	0.160* (0.0825)	0.237*** (0.0818)	0.155* (0.0832)	0.226*** (0.0834)	0.137** (0.0597)	0.170*** (0.0590)	0.137** (0.0612)	0.166*** (0.0608)
Div-3	0.137 (0.143)	0.296* (0.157)	0.127 (0.140)	0.281* (0.154)	0.198* (0.113)	0.288*** (0.0886)	0.200* (0.112)	0.286*** (0.0884)
B.skills	14.17** (5.785)	16.72*** (5.802)	13.11** (6.567)	14.47** (6.342)	4.007 (4.660)	5.947 (4.561)	4.062 (4.961)	5.633 (4.741)
Sustainability-comm	0.124 (0.110)	0.0735 (0.103)	0.123 (0.111)	0.0702 (0.104)	0.0709 (0.0696)	0.0510 (0.0682)	0.0700 (0.0701)	0.0501 (0.0683)
B.indep	0.0152 (0.0688)	-0.0420 (0.0639)	0.00977 (0.0712)	-0.0521 (0.0656)	-0.00395 (0.0459)	-0.0336 (0.0438)	-0.00532 (0.0471)	-0.0361 (0.0447)
B.size	0.0128 (0.00911)	0.00397 (0.00810)	0.0129 (0.00916)	0.00382 (0.00811)	0.000329 (0.00562)	-0.00361 (0.00517)	0.000318 (0.00565)	-0.00361 (0.00520)
Beta		-0.0820 (0.0550)		-0.0818 (0.0551)		0.00954 (0.0358)		0.00942 (0.0361)
ROE		0.493** (0.239)		0.500** (0.240)		0.282 (0.171)		0.280 (0.172)
Size		0.0433*** (0.0128)		0.0457*** (0.0130)		0.0230*** (0.00831)		0.0233*** (0.00835)
Lev		0.238* (0.135)		0.247* (0.136)		0.0391 (0.0793)		0.0407 (0.0795)
Constant	-0.0624 (0.109)	-0.970*** (0.292)	-0.0361 (0.122)	-0.966*** (0.295)	0.139* (0.0806)	-0.384* (0.194)	0.137 (0.0840)	-0.383* (0.196)
Observations	362	341	362	341	362	341	362	341
R-squared	0.078	0.236	0.080	0.243	0.091	0.199	0.093	0.200
year-dummies	no	no	yes	yes	no	no	yes;	yes

from the Eikon database), this score includes resource use, emissions, and innovation (such as green innovation and environmental R&D); the emission score, which reflects firms' effectiveness in reducing emissions (also from Eikon); ISO 14001 certification status; and the presence of environmental training programmes. Board gender diversity is expected to have a positive influence on environmental performance (e.g. Al-Najjar & Salama, 2022).

The results, reported in Table 10, indicate a positive association between board gender diversity and environmental performance across all models, consistent with the study's prior findings and previous studies (Al-Najjar & Salama, 2022). Increasing board gender diversity could improve GCC firms' environmental practices. Additionally, the study finds some evidence suggesting that board skills positively affect environmental practices, though the role of board independence yields mixed results in the GCC context. Finally, there is limited evidence to suggest that smaller boards are positively linked to implementing environmental management training in GCC firms, which could have implications for board structure and environmental training programmes.

The Role of High-Tech Industries within GCC: High-tech sectors, such as telecommunications and pharmaceuticals, are increasingly recognised

Table 10. Environmental performance models.

Variables	2SLS-IV		Tobit	Tobit	Logit	Logit
	Env score	2SLS-IV	Env score	Emission score	ISO14001	Env-mgt training
	M1	M2	M3	M4	M5	M6
B.diversity	7.466*** (2.037)	6.746*** (1.934)	0.518** (0.204)	0.951*** (0.274)	17.03* (9.722)	16.21* (9.019)
B.skills	1.378 (15.98)	5.643 (15.17)	6.968** (2.940)	7.116* (3.809)	79.78 (126.1)	63.21 (106.4)
Sustainability-comm	0.0428 (0.0705)	0.00406 (0.0669)	-0.00655 (0.0332)	-0.0289 (0.0451)	0.422 (1.322)	0.474 (1.074)
B.indep	-0.247** (0.117)	-0.239** (0.111)	0.0567 (0.0571)	0.0932 (0.0766)	8.391*** (2.293)	1.789 (3.347)
B.size	0.00536 (0.0110)	0.00688 (0.0105)	-0.00794 (0.00499)	0.00368 (0.00640)	0.0433 (0.149)	-0.543* (0.324)
Beta	-0.300*** (0.113)	-0.218** (0.108)	0.0346 (0.0509)	0.0482 (0.0653)	3.347* (1.830)	0.654 (2.019)
ROE	-0.391 (0.379)	-0.152 (0.359)	0.623*** (0.161)	0.637*** (0.209)	-3.287 (5.461)	4.800 (9.171)
Size	0.0567*** (0.0140)	0.0466*** (0.0132)	0.0543*** (0.0116)	0.0721*** (0.0154)	1.764*** (0.410)	2.858*** (1.049)
Lev	-0.0278 (0.146)	0.0186 (0.139)	-0.0414 (0.111)	0.00458 (0.144)	0.201 (3.506)	-1.028 (4.494)
Constant	-0.934*** (0.326)	-0.861*** (0.309)	-1.249*** (0.259)	-1.848*** (0.349)	-51.64*** (9.624)	-67.85*** (25.10)
Sargan Test	2.250	3.321				
Observations	213	213	343	343	343	339
year-dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of firms	130	130	130	130	130	130

Note: variables are defined in the note of Table 1. ***, **, * are significant at 1%, 5%, and 10% respectively; numbers in brackets are robust standard errors.

as pivotal in shaping sustainable CSR practices within the GCC. A dummy variable is included for these sectors to examine the influence of the industry context on CSR. The premise is that firms within high-tech industries may be more inclined towards CSR and sustainability initiatives, thereby enhancing their social performance. Additionally, the interaction effect between industry type and board gender diversity is explored, focusing on the potential role of female directors in driving social performance in high-tech sectors. The hypothesis is that female directors may have a more substantial impact on sustainability performance within these industries. A positive, statistically significant interaction effect would suggest female directors' active involvement in high-tech industries' social activities. Conversely, a negative or non-significant effect would imply a limited or no impact of industry context on the engagement of female directors in these activities.

Accordingly, the importance of examining how industry context and board gender diversity influence social responsibility outcomes within high-tech sectors is emphasised. This analysis seeks to enhance the existing literature by offering a deeper understanding of the complex interplay between industry dynamics, gender diversity, and CSR practices, particularly in high-tech industries.

The findings in [Table 11](#) reveal a positive and significant effect of high-tech industries on sustainability outcomes, indicating that firms in these sectors substantially impact sustainable practices within the GCC. Furthermore, the results confirm that female directors consistently positively and significantly influence sustainability outcomes, underscoring their crucial role in advancing sustainable practices (H1). However, the interaction effect between board gender diversity and high-tech industries was largely insignificant (except in Model 4), suggesting that female directors within high-tech sectors do not significantly alter the relationship between industry context and sustainability outcomes. In essence, the influence of high-tech industries on sustainability remains consistent regardless of board gender diversity. These findings offer valuable insights into the dynamics of high-tech sectors and the role of female directors in promoting sustainability in the GCC region.

Additionally, the high-tech variable and its interaction have been included in the environmental models, yielding similar results. Thus, the findings across both the sustainability index and environmental measures are confirmed as robust. For parsimony, these models are not reported.

Finally, further robustness checks have been conducted by substituting the gender diversity variable with a dummy variable indicating the presence of female directors and by introducing the Corporate Governance

Table 11. High-tech industry models.

Variables	2SLS-IV	2SLS-IV	Tobit	Tobit	Logit	Logit
	Sustainability	CSR	Sustainability	CSR	Sustainability	CSR
	M1	M2	M3	M4	M5	M6
B.diversity	1.024** (0.451)	0.880*** (0.308)	1.291 (0.823)	1.767*** (0.557)	1.770*** (0.459)	0.880*** (0.170)
B.skills	10.24 (6.490)	3.029 (4.616)	-39.94 (37.85)	-6.068 (21.53)	25.50** (10.14)	3.029 (3.221)
Sustainability-comm	-0.0592 (0.0679)	-0.0403 (0.0455)	-0.0546 (0.116)	-0.0353 (0.0604)	-0.0744 (0.0698)	-0.0403 (0.0252)
B.indep	0.0529 (0.101)	0.0370 (0.0670)	0.0352 (0.155)	-0.000269 (0.0870)	0.167 (0.106)	0.0370 (0.0383)
B.size	0.000267 (0.00796)	-0.00478 (0.00536)	-0.0111 (0.0132)	-0.00820 (0.00708)	-0.0101 (0.0129)	-0.00478 (0.00438)
High-tech	0.228** (0.0909)	0.138* (0.0730)	0.302** (0.123)	0.155* (0.0825)	0.392*** (0.0837)	0.138*** (0.0317)
Interaction	-0.640 (0.867)	-0.534 (0.759)	-0.649 (1.609)	-1.777* (0.974)	-1.455 (1.271)	-0.534 (0.491)
Beta	-0.0544 (0.0570)	0.0263 (0.0377)	-0.0871 (0.0927)	-0.00516 (0.0486)	-0.0984 (0.0701)	0.0263 (0.0250)
ROE	0.443* (0.236)	0.235 (0.174)	0.263 (0.297)	0.0499 (0.198)	0.819*** (0.313)	0.235** (0.110)
Size	0.0411*** (0.0137)	0.0189** (0.00866)	0.0402** (0.0188)	0.0202** (0.00974)	0.0751*** (0.0150)	0.0189*** (0.00506)
Lev	0.252* (0.139)	0.0618 (0.0800)	0.350 (0.218)	0.0114 (0.114)	0.432*** (0.155)	0.0618 (0.0537)
Constant	-0.818** (0.316)	-0.270 (0.207)	-0.437 (0.481)	-0.196 (0.275)	-1.903*** (0.346)	-0.270** (0.115)
Sargan test	1.563	2.201				
Observations	343	343	213	213	343	343
R-squared	0.268	0.215		0.189		
year-dummies						

Note variables are defined in the note of Table 1. ***, **, * are significant at 1%, 5%, and 10% respectively; numbers in brackets are robust standard errors.

(CG) index. The results, presented in Table 12, show that the main independent variables remain consistently positive and significant. This reinforces the previous findings and underscores the critical role of good governance practices in promoting sustainability.

Conclusion

This article investigates the relationship between board composition and sustainability within the unique context of developing countries, focusing specifically on the Gulf Cooperation Council (GCC) nations. By examining non-financial, publicly listed firms in the GCC from 2017 to 2021, the study gains valuable insights into female directors' critical role in fostering sustainable performance. The findings indicate that female directors significantly enhance sustainability outcomes, with board skills and board independence also exerting a positive impact. The results are robust across various econometric analyses, including quantile, Tobit, and logit methods. One key finding is that board gender diversity has a more pronounced effect on sustainability than other board characteristics, such

Table 12. Additional robust analysis (CG scores and diversity dummy).

Variables	CSR-sustainability score							
	M1	M2	M3	M4	M5	M6	M7	M8
B.diversity-dummy	0.181** (0.0762)	0.133** (0.0534)	0.251** (0.105)	0.256*** (0.0719)				
Governance score					0.00746*** (0.00100)	0.00477*** (0.000722)	0.00550** (0.00280)	0.00639*** (0.00188)
B.skills	15.97*** (6.106)	5.469 (4.766)	15.18** (6.746)	5.131 (4.659)				
Sustainability-comm	0.0713 (0.104)	0.0472 (0.0687)	-0.0345 (0.129)	-0.0161 (0.0785)				
B.indep	-0.0493 (0.0662)	-0.0371 (0.0461)	-0.0785 (0.0870)	-0.0542 (0.0585)				
B.size	0.000582 (0.00849)	-0.00489 (0.00557)	0.00184 (0.00864)	-0.00617 (0.00570)				
Beta	-0.0793 (0.0550)	0.0146 (0.0365)	-0.129* (0.0729)	-0.0241 (0.0453)	-0.0423 (0.0493)	0.0445 (0.0356)	-0.0440 (0.0788)	0.0778 (0.0541)
ROE	0.385 (0.275)	0.200 (0.191)	0.236 (0.322)	-0.000831 (0.234)	0.436* (0.237)	0.250 (0.173)	0.493* (0.285)	0.305 (0.231)
Size	0.0402*** (0.0128)	0.0191** (0.00855)	0.0447*** (0.0146)	0.0229** (0.00968)	0.0240** (0.0120)	0.00798 (0.00852)	0.0305* (0.0166)	0.00701 (0.0118)
Lev	0.237* (0.136)	0.0560 (0.0798)	0.227 (0.150)	-0.00120 (0.0885)	0.0319 (0.136)	-0.0862 (0.0830)	0.0823 (0.175)	-0.178* (0.102)
Constant	-0.853*** (0.297)	-0.280 (0.204)	-0.888*** (0.331)	-0.283 (0.224)	-0.617** (0.249)	-0.200 (0.173)	-0.712** (0.326)	-0.260 (0.233)
Observations	343	343	213	213	344	344	213	213
R-squared	0.213	0.161	0.201	0.141	0.368	0.322	0.330	0.303
year-country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

as skills, independence, or the presence of a sustainability committee. This suggests that gender diversity on boards is vital in driving sustainability outcomes. Additionally, evidence shows that board gender diversity positively correlates with several measures of environmental management practices. High-tech firms demonstrate a significant role in advancing sustainability within the GCC region.

These results have important empirical implications. For academics, they highlight a new context for exploring the association between board gender diversity and sustainability in developing countries, particularly the GCC. For policymakers, these findings offer insights into the potential benefits of encouraging greater female representation on corporate boards. Managers in the GCC may find value in implementing more proactive governance mechanisms. This study underscores the importance of promoting board diversity to enhance sustainable performance, marking a critical step towards embedding sustainable practices within emerging markets, including the GCC. Moreover, managers and policymakers in high-tech sectors should support female directors in engaging more actively with sustainability initiatives.

While the study's findings provide strong evidence for the positive impact of female directors on sustainability, other governance factors were found to be of less significance, leading to suggest the significant role of female directors in shaping governance decisions within the GCC context. Further research is warranted to understand other mechanisms underlying the link between board diversity—including nationality, culture, ethnicity diversity—and sustainability outcomes. Such research will provide a more comprehensive perspective on the impact of board structure on corporate sustainability within the GCC.

As with similar studies in this area, there are limitations, more aspects related to board diversity are needed as well as other governance mechanisms to help in understanding their effect on sustainability. Additionally, including companies from other developing markets in future studies could enable insightful comparisons across contexts, thereby enhancing the understanding of sustainability performance in developing economies.

Data statement

Data will be available upon request from the authors.

Disclosure statement

No potential competing interest was reported by the authors.

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