

## RESEARCH ARTICLE

# Board gender diversity and sustainability performance: Nordic evidence

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**Abstract**

This study investigates the relationship between board gender diversity and sustainability performance using a sample of 205 Nordic-listed firms across countries Denmark, Finland, Norway, and Sweden over the period 2002–2020. Drawing on gender social role theory and upper echelons theory, our results show a positive and significant association between board gender diversity and sustainability performance. Furthermore, the study extends the finding indicating that a “critical mass” of at least 30% of women on boards is required to have a significant effect on sustainability performance. The study also reveals that the association between board gender diversity and sustainability performance is more pronounced in the carbon-intensive industry subsample. Therefore, our study, amidst inconsistent board gender diversity and firm performance studies, suggests increasing the “critical mass” of women on boards to have a positive effect on sustainability performance.

**KEYWORDS**

board gender diversity, corporate governance, CSR, Nordic, sustainability performance

## 1 | INTRODUCTION

Paris Agreement 2015 raised concern toward sustainability by legally binding international treaty on climate change.<sup>1</sup> The same year, world leaders adopted the 17s Sustainable Development Goals (SDGs) as the 2030 Agenda for Sustainable Development.<sup>2</sup> Such global sustainability initiatives have impelled firms to embrace the sustainability of the people, planet, and society. This paper focuses on the intersection of two sustainability issues: sustainability performance and

gender equality, in the context of corporate sustainability, by examining whether board gender diversity is associated with improved sustainability performance.

In management literature, gender diversity is extensively studied in terms of board gender diversity which, in this study, we refer to understand the improved women proportion on corporate boards. The study of board gender diversity has been grasping the attention of both scholars and policymakers for the last two decades. Previous literature generally shows an association between board gender diversity and sustainability performance in other study contexts (Byron & Post, 2016; De Masi et al., 2021; Kyaw et al., 2017; Liu, 2018; Manita et al., 2018; Naciti, 2019; Provasi & Harasheh, 2021; Velte, 2016). However, studies using Nordic firm-level data to assess the possible association between board gender diversity and sustainability performance are virtually invisible. Thus, we do not have ample evidence to argue that board gender diversity is associated with sustainability performance irrespective of the study context. The consideration of the

<sup>1</sup>Paris Agreement was adopted by 196 Parties at COP 21 in Paris, on December 12, 2015 and entered into force on November 4, 2016. The main goal of the Agreement is to cut the greenhouse gas emission as soon as possible and limit the global warming to well below 2, preferably to 1.5°C, compared to pre-industrial levels. See, <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>.

<sup>2</sup>On January 1, 2016, the SDGs came into force officially that were adopted by world leaders in September 2015 at the UN Sustainable Development Summit. SDGs are not legally binding but governments are expected to take ownership and establish national frameworks for the achievement of the 17 SDGs. See, <https://www.un.org/sustainabledevelopment/>.

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Nordic context is necessary due to its unique characteristics and high stakeholder orientation.<sup>3</sup>

Nordic countries are considered pioneers in their emphasis on gender diversity. Norway was the first country globally to adopt a gender quota in 2003 which was mandated in 2006 requiring public limited companies to compose their boards of directors with at least 40% of each sex within 2 years (Seierstad & Opsahl, 2011). Today, Nordic board gender diversity is around 40% which is high compared to elsewhere in Europe.<sup>4</sup> On the other side, the welfare-states shaped traditions (Thomsen, 2016), and the model of “creating shared value” and stakeholder engagement (Strand et al., 2015) have the role of promoting stakeholder orientation in the Nordic. Such explicitly exercised stakeholder-oriented values across Nordic countries in the last decade contributed to positioning themselves as the global leaders in sustainability. For instance, the “Sustainable Development Report (SDG index) 2022” ranked four Nordic countries Finland, Denmark, Sweden, and Norway, respectively, in the top four positions among 193 UN member countries based on their overall performance on the SDGs or the percentage of SDG achievement.<sup>5</sup>

The study of stakeholder-oriented practices in the Nordic context has been a topic of interest to researchers across different fields. However, whether the higher board gender diversity is associated with improved sustainability practices is an overlooked area. One may argue that the higher stakeholder orientation in the Nordic region, in the first place, is the cause of Nordic firms having higher board gender diversity and sustainability performance. This assertion condemns the logic that women directors have higher concerns toward social-environmental or ethical issues as explained by gender-social role theory. Thus, whether the higher sustainability concerns of Nordic firms should be imputed to their stakeholder orientation or corporate boards with higher women representation, among others, also contribute to improving the sustainability performance in the Nordic is an empirical question.

The current paper, using the data from the Thomsen Reuters ASSET4 database, studied 205 Nordic publicly listed firms, consisting of countries Denmark, Finland, Norway, and Sweden. In the study, we employed gender social role theory and upper echelon theory to analyze the association between board gender diversity and sustainability performance. Our interpretation is that women have higher social and environmental concerns that are reflected in their leadership style. As a result, improved firms' sustainability performance can be attributed to women's social role and leadership. Empirically testing theories in the Nordic context, our study provides support to theories suggesting

that board gender diversity has a significant positive association with sustainability performance. Furthermore, we revealed that a “critical mass” of women directors on the corporate board is crucial to have a significant association with sustainability performance.

The current study has some important contributions. First, we contribute to the limited board gender diversity and sustainability performance literature. Specifically, by examining an association between board gender diversity and sustainability performance in a stakeholder-oriented context, we provide support for prior studies from elsewhere that showed board gender diversity is associated with sustainability performance. Second, our study extends the association between board gender diversity and sustainability performance, arguing that a “critical mass” of at least 30% of women on boards is essential to realize a significant performance effect, justifying the mandatory gender quota legislated by Nordic countries.

## 1.1 | Research context

The word Nordic, also used formally as the Council of Nordic Ministers, refers to the “north” to reflect both geographical and cultural combinations among those countries (Strand et al., 2015). Having identical political models that promote social welfare and equality, Nordic countries' high regard for women's representation in work is also accelerated by their institutional settings such as gender quotas, internationalization, and social trends (Gregorič et al., 2009).

The history of gender equality or gender diversity in Nordic goes back to the 1970s when the Nordic countries introduced policies to promote gender equality. In 2003, Norway considered a gender quota requiring the corporate boards to have at least 40% of gender diversity, and it was fully implemented for publicly listed companies in 2008. So, Norway became the first country in the world to adopt gender quotas. Iceland adopted similar quotas in 2010. Today, Norway and Iceland are the most gender-diverse board countries in the world. Following this, Sweden debated the corporate gender quotas bill in 2017. The corporate governance code 2016 in Finland required companies to report their board gender diversity initiatives. Denmark had a gender act enforced in 2013 encouraging companies to set gender diversity targets. These initiatives, legislation, and policies show a record-high rise in corporate gender diversity in Nordic countries over the past decade.<sup>6</sup> A study in 2005 across three Nordic countries showed that Nordic boards have 15% women, of which 24% in Norway, 16% in Sweden and 8% in Denmark (Gregorič et al., 2009). Today, Nordic boards have substantial women representation. The current study data shows that Nordic board gender diversity is about 35% in 2020 on which Norway, Sweden, Finland, and Denmark account for 35%, 30%, 25%, and 20%, respectively.

The Nordic governance system is acknowledged internationally lately (Thomsen, 2016) as the next supermodel.<sup>7</sup> The special

<sup>3</sup>Stakeholder-orientation refers to a high concern toward various stakeholders such as society, employees, suppliers, investors, government, media, etc. or sensitivity to their needs unlike shareholder-orientation where shareholders' value maximization is the focus. Prior studies extensively focused on shareholder-oriented contexts such as US, UK, Australia, or continental Europe which is different from the Nordic context. Nordic region is regarded distinct in its social welfare shaped traditions and these countries are consistently higher sustainability performers.

<sup>4</sup>See, <https://www.spencerstuart.com/research-and-insight/nordic-board-index/diversity>.

<sup>5</sup>The Sustainable Development Report (SDR), based on data and analyses produced by international organizations, civil society organizations, and research centers, reviews progress made each year on the Sustainable Development Goals since their adoption by the 193 UN Member States in 2015. See, <https://dashboards.sdgindex.org/rankings>.

<sup>6</sup>See, Nordic Council of Ministers (2016). All about business-Nordic women on boards and in leadership. <https://norden.diva-portal.org/smash/get/diva2:1045567/FULLTEXT03.pdf>.

<sup>7</sup>Economist (2013). The Nordic countries-The next supermodel. <https://www.economist.com/leaders/2013/02/02/the-next-supermodel>.

characteristics of the Nordic governance model are higher shareholder concentration, non-executive boards, employee representation, etc. (Kjærland et al., 2020). Thomsen (2016) also argued that concentrated ownership, two-tier board (supervisory and management boards) structure, employee representation, and low-powered managerial incentives (no room for transaction-based incentives/gains) are the Nordic welfare state-shaped governance characteristics.

The interest from management scholars to study the Nordic context has been from both micro (firm-level) and macro perspectives. At the macro level, the overall Nordic governance model has been studied using country-level data or insights. Thomsen (2016) discussed whether Nordic corporate governance characteristics explain the “Nordic model.” Strand et al. (2015) provided an overview of Nordic Corporate Social Responsibility (CSR). On the other hand, studies such as Gregorič et al. (2009), Oxelheim et al. (2013), Sjaafjell (2015), Dale-Olsen et al. (2013), Bøhren and Staubo (2016), Kjærland et al. (2020), etc. examined the association of corporate governance/gender diversity on financial performance at the firm-level. Yet, there is a vivid knowledge gap at the intersection between board gender diversity and sustainability performance at the firm level which is the focus of the current study.

The following section presents the theoretical framework and literature. In section three, we discuss the research method. Then, we report the study results and analysis in section four. The final section outlines the discussion and conclusion, including study implications and limitations at the end.

## 2 | THEORETICAL BACKGROUND

Before diving into the theoretical background and literature, it is important to define the notion of sustainability. The Brundtland commission's report states that sustainable development “meets the needs of the present without compromising the ability of future generations to meet their needs.”<sup>3</sup> Sustainable development or sustainability in strategy is often used interchangeably with CSR, however, the expression sustainability is gaining favor over CSR over time (Strand et al., 2015). There have been complexities when applying the term to business frameworks and practices, possibly, due to corporate sustainability is also argued for economic sustainability in addition to social and environmental Sustainability (Hourneaux Jr. et al., 2018) such as triple bottom line or “TBL” (Elkington, 2018). However, in his latest version, Elkington (2018) argued that the success or failure of sustainability goals must be measured by the overall well-being of people and the planet, stressing the importance of social and environmental outcomes over the economic outcome. Besides, social and environmental outcomes are subsequently related to financial performance in the long run (Sjaafjell, 2015). Thus, we use the term sustainability to refer to environmental, social, and governance (ESG) outcomes.<sup>8</sup>

<sup>8</sup>ESG performance is the term lately used in finance and governance literature. Although the current study focuses on the use of the term sustainability performance, the measurement used for the sustainability performance is ESG score from Thomson Reuters Refinitiv. The score measures firms' relative performance on ESG outcomes and the degree of transparency in reporting material data publicly. The score ranges between 0 and 100, indicating higher scored firms have better sustainability performance. See, <https://www.refinitiv.com/en/sustainable-finance/esg-scores>.

To understand why and how more women on boards are associated with higher sustainability performance, we draw two theories, namely the gender social role theory and the upper echelons theory. We draw gender social role theory to reflect gender-related attributes and social role expectations. Furthermore, we believe that linking the gender social roles to upper echelons is necessary to understand why women in leadership positions such as top management teams (TMT) and corporate boards are likely to articulate management or board decisions in consideration of social-environmental issues or ethical concerns.

According to gender social role theory, women are more communal and sensitive to environmental issues (Liu, 2018; Nadeem et al., 2020). So, they are likely to reflect a greater sense of ethics and concerns for social welfare (Atif et al., 2021; Burkhardt et al., 2020; Krishnan & Parsons, 2007). According to Hofstede (2001), the gender role expectation in society is reflected at the level of masculinity where men are expected to be assertive, tough, and achievement-oriented while women are expected to show modesty and focused on quality of life. Thus, the theory suggests that women care more about environmental and sustainability issues than their male peers. Drawing on the gender social role theory, Liu (2018) showed that firms with greater board gender diversity are less sued for environmental regulation violations, probably due to ethical performance shown by female directors. In this line, Nadeem et al. (2020) found a significant positive relationship between board gender diversity and environmental innovation. Similarly, Ben-Amar et al. (2015) also find evidence that the likelihood of voluntary climate change disclosure increases with the women percentage on boards. These studies ascribe better environmental performance to female directors' values and concerns to stakeholders.

Similarly, the upper echelons theory is used in several studies related to gender diversity and firm performance (Li et al., 2017; Nadeem et al., 2020; Ouni et al., 2020). According to the theory, TMT or leadership affects corporate performance through their interpretation of situations, a product of personal values, personality traits, and experiences (Ouni et al., 2020). Since own traits and psychological processes characterize women and men differently, that substantially impacts their decision-making processes (Li et al., 2017; Nadeem et al., 2020). So, the theory suggests that corporate boards with more women directors are more sensitive toward ethical behavior and environmental issues attributed to female gender roles. Shedding a light on the upper echelon theory, Li et al. (2017) found that a better environmental policy in a more gender-diverse board of directors is due to the increased sense of social responsibility and personal character of female directors. In this line, Nadeem et al. (2020) also supported this theory with evidence that showed female directors' concerns for the environment can be instrumental in generating environmental innovation in modern firms.

Studies on board gender diversity and sustainability performance is growing in the last decade. Generally, existing studies show a positive association between board gender diversity and sustainability performance (Byron & Post, 2016). Galletta et al. (2022) studied the impact of female directors and managers on sustainability



performance in the banking industry using a sample from 48 countries. They found that gender diversity in the banks increased financial, social, and environmental performance. In another study, Islam et al. (2022) employing a qualitative approach interviewed 19 board directors in Australia. The thematic analysis indicated that board gender diversity increases CSR investment leading to improve CSR performance. Using European data, Kyaw et al. (2017) showed that board gender diversity improves corporate environmental and social performance and that is persistent across industries. In Italy, Provasi and Harasheh (2021) investigated the effect of gender quotas on firm performance which showed an insignificant effect on financial performance while a significant positive effect on sustainability performance. However, another study from Italy by Cucari et al. (2018) indicated a negative association between board gender diversity and sustainability disclosure. Furthermore, Manita et al. (2018) studying S&P500 US firms found no significant relationship between board gender diversity and sustainability disclosure.

Several researchers have argued for the sizeable representation of women on boards to have a significant positive effect. They stress the “critical mass” theory (Kanter, 1977) that argues for the role of “dominants” and “tokens” groups in shaping interaction dynamics. If women on boards are used as “tokens” and boards are primarily the “old boys club”, such a symbolic board gender diversity cannot generate any noticeable effects. Studies have shown evidence that a certain percentage of women on boards is required to influence board decisions (Ben-Amar et al., 2015; Joecks et al., 2013). They examined the role of “critical mass” emphasizing that a board needs to reach a “critical mass” of women directors to have a positive effect on sustainability performance. However, there is a debate on the appropriate percentage of women directors required (Ben-Amar et al., 2015; De Masi et al., 2021; Kyaw et al., 2017; Manita et al., 2018; Nuber & Velte, 2021; Yarram & Adapa, 2021).

Some studies further explored the mechanism of the association between board gender diversity and sustainability performance. They found a significant or stronger association between board gender diversity and sustainability performance when firms are environmentally sensitive (Lu & Herremans, 2019; Nadeem et al., 2020), have less-growth opportunities (Burkhardt et al., 2020), less profitable (Nadeem et al., 2020), firm from emerging markets (Kyaw et al., 2017), and countries with stronger shareholder protection (Byron & Post, 2016).

In the Nordic context, limited studies are focusing on either the board gender diversity or firm performance. Gregorič et al. (2009) studied board diversity (internationalization, foreign directors, gender, etc.) in Norwegian, Danish and Swedish public firms at the country level from 2001 to 2007. They suggested that generally there is a positive effect of board diversity on firm performance. However, the positive effect disappeared when controlling the relevant variables. In this line, Marinova et al. (2015) studied Danish firms along with Dutch firms that showed no relationship between board gender diversity and firm performance. In a recent study, Eckbo et al. (2022) studied the valuation effect of the Norwegian board gender quota with no statistically significant results. The study concluded that quota

constraint imposed negligible costs on regulated firms in Norway, both in statistical and economical terms. Note that above mentioned Nordic studies with no significant results considered financial performance as the measure of firm performance. Apparently, the empirical question is whether board gender diversity is also insignificant for Nordic firms' sustainability performance. However, drawing upon both gender social role theory and upper echelons theory and the evidence found in other study contexts, we believe that board gender diversity should be associated with improved sustainability performance in the Nordic.

Therefore, we hypothesize that:

Board gender diversity is positively and significantly associated with sustainability performance.

### 3 | METHODOLOGY

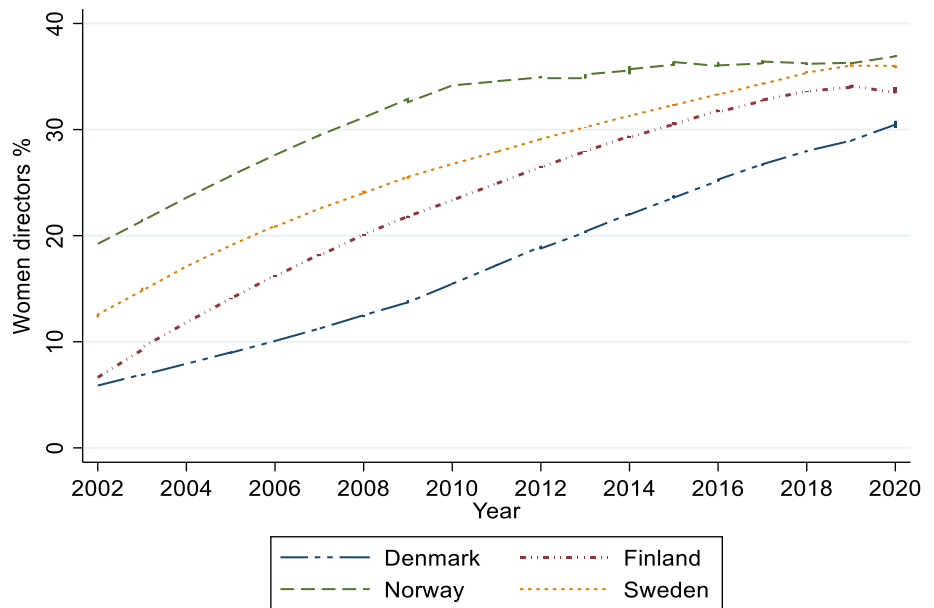
#### 3.1 | Data

We used board gender diversity and sustainability performance data from the Thomson Reuters ASSET4 database. Prior studies extensively used the ASSET4 database (Burkhardt et al., 2020; Galletta et al., 2022; Orazalin & Baydauletov, 2020; Ouni et al., 2020), Bloomberg database (Cucari et al., 2018; Manita et al., 2018), Systainalytics database (Lu & Herremans, 2019; Naciti, 2019), among others for ESG or sustainability measures. The database maps, analyzes, and verifies firms' public ESG disclosure such as corporate reports, websites, press releases, social media, etc. before assigning the ESG-related scores to large publicly listed companies across countries.

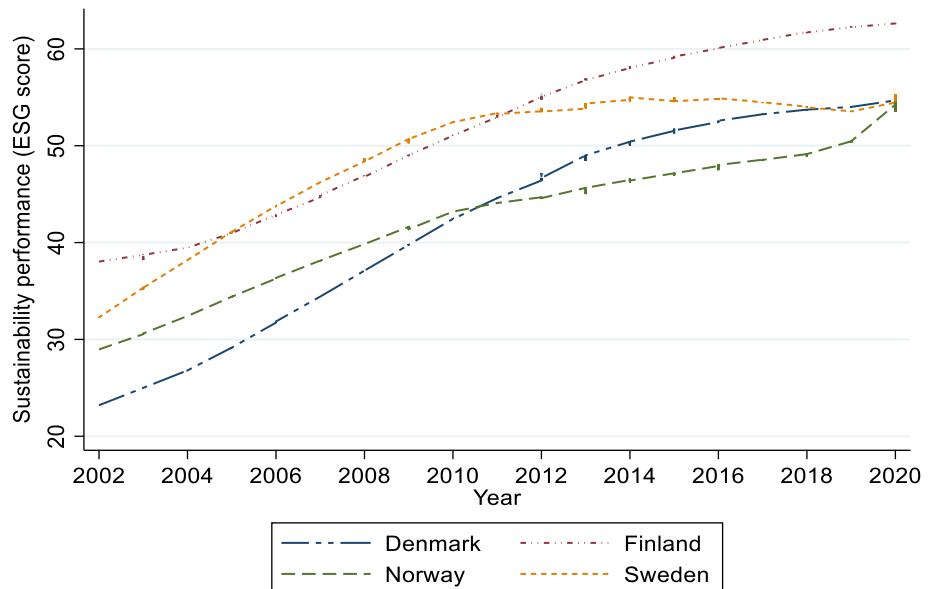
Our study covered four Nordic countries, namely, Denmark, Finland, Norway, and Sweden, due to data availability. At ASSET4, small number of firms' data is available for Iceland which also suffered from missing data in one or other baseline variables. Therefore, our study constituted four Nordic countries. Previous Nordic studies on board gender diversity also focused on one or more of these four countries (Gregorič et al., 2009; Huse & Grethe Solberg, 2006; Torchia et al., 2018). The sample included publicly listed 260 firms and 2302 firm-year observations of unbalanced panel data from 2002 to 2020. However, excluding observations with missing values for the accounting variables, the final number of firms consisted of 205 Nordic firms with 1648 firm-year observations. The firms were from diverse sectors such as energy, industrials, financials, healthcare, technology, basic materials, consumer cyclical, etc. The study sample accounted for 19% Danish, 23% Finnish, 17% Norwegian, and 41% Swedish firms. Thus, the sample seems to be balanced enough across Nordic countries given the number of publicly listed firms in each of these countries.

Figures 1 and 2 report the board gender diversity and sustainability performance data, respectively, during the study period for four Nordic countries. Figure 1 shows that Norway has the highest board gender diversity in Nordic throughout the study period while Denmark has the lowest board gender diversity than Norway, Sweden and Finland. However, there is a substantial rise in women's

**FIGURE 1** Board gender diversity in Nordic firms [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/csr.2432)]



**FIGURE 2** Sustainability performance in Nordic firms [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1002/csr.2432)]



representation on boards across Nordic countries that led to, on average, about 35% board gender diversity in 2020. Similarly, Figure 2 shows that Nordic firms have variations in sustainability performance. Finland seems to be a higher sustainability performer than its peers in the last decade. However, on average, all Nordic countries scored above 50 for ESG ASSET4 data in 2020. That shows that firms in Nordic countries are relatively good ESG performers and have above average degree of sustainability performance.

### 3.2 | Measures

The dependent variable Sustainability performance is measured by ESG score used by several prior studies (Cucari et al., 2018; Kyaw et al., 2017; Manita et al., 2018; Romano et al., 2020). ESG score is the weighted score

of firms' environmental, social and governance performance calculated by Thomson Reuters ASSET4 that is based on over 600 company-level ESG metrics and more than 500 data points.<sup>9</sup> Since it covers how a firm performs and communicates in three aspects: environmental-social-governance, the measurement is an extensive inclusion of firms' sustainability performance. For instance, the *Environmental* aspect includes the emission, resource use, and environmental innovation categories; the *Social* aspect includes human rights, community, workforce, and product responsibility categories; and the *Governance* aspect includes management, shareholders, and CSR strategy categories.

Similarly, as used in prior literature, board gender diversity is measured by the proportion of women on the boards (Boukattaya & Omri, 2021; Gallego-Sosa et al., 2020; Manita et al., 2018). In an

<sup>9</sup>See, <https://www.refinitiv.com/en/sustainable-finance/esg-scores>.

additional analysis, we also used alternative measures such as the number of women directors (Chen et al., 2015), above-industry average board gender diversity dummy, and dummies for “critical mass” (Ben-Amar et al., 2015; Birindelli et al., 2019).

In addition, following previous studies at the intersection of board gender diversity and firm performance, several control variables that

influence firm performance are used. We account for such control variables to mitigate the potentially confounding effects of governance and firm-specific characteristics that may affect firms' sustainability-related performance (Orazalin & Baydauletov, 2020). Thus, corporate governance variables such as board size (Atif et al., 2021; He & Jiang, 2019) and board independence (Atif et al., 2021; Manita et al., 2018) are controlled due to the possible effect of larger and independent boards. Similarly, we control firm-specific characteristics such as firm size (Atif et al., 2021; Naciti, 2019), firm age (Li et al., 2017), leverage (Atif et al., 2021; Lu & Herremans, 2019), block ownership (Liu, 2018), profitability (Naciti, 2019), tangibility (Chen et al., 2015), market-to-book (Ben-Amar et al., 2015; Nadeem et al., 2020), and analysts coverage (Chun & Shin, 2018). All the variables are defined in Table 1.

**TABLE 1** Variables definitions

Variable notations	Definitions
<i>Dependent variable:</i> ESGScore	ESG score scaled between 0 to 100 shows a firm's performance, effectiveness, and communication in the environment, social, and governance areas.
<i>Independent variables:</i> femaleprop	The proportion of female directors as a portion of the total board size.
<i>Control variables</i>	
Inboardsize	Natural logarithm of the total number of directors on a board.
indepdir	The ratio of independent directors on a board.
InTA	Natural logarithm of the total assets.
Infirmage	Natural logarithm of the total number of years since a firm issued its first IPO.
leverage	Total debt divided by total assets.
tangibility	The ratio of tangible assets divided by total assets.
loss	A binary variable indicating one if the firm occurred loss, and zero otherwise.
market-to-book	The ratio of the market value of equity to the book value of equity.
blockdum	A binary variable indicating one if firm has block-holding and zero otherwise.
Inanalysts	Natural logarithm of the total number of analysts following the firm.

### 3.3 | Model

$$\text{Sustainability performance}_{it} = \beta_0 + \beta_1 \text{Board Gender Diversity}_{it} + \sum \beta_j \text{Controls}_{it} + \gamma + \varepsilon_{it}$$

The equation stated is the baseline model where sustainability performance and board gender diversity are our dependent and independent variables, respectively. Besides, corporate governance and firm-specific control variables are used on the right-hand side of the equation. The model also accounts for fixed effects as shown by  $\gamma$  where time effects, industry (Global industry classification standard-GICS two-digits) effects, and firm effects are considered to account for time-variant and time-invariant effects.

The baseline model uses Pooled Ordinary Least Squares (OLS) Regression method to study the association between board gender diversity and sustainability performance accounting for potential confounding variables, time-variant, and invariant fixed effects. In addition, standard errors are clustered at the firm level due to the potentially firm-level clustered sampling design. To account for the endogeneity caused by reverse causality, we also used the Instrumental Variable-Two Stage Least Squares (IV-2SLS) regression method where two

Variable	Obs	Mean	Std. dev.	Min	Max
ESGScore	2302	49.645	20.272	2.3	92.138
femaleprop	2281	0.284	0.145	0	0.75
boardsize	2298	9.046	2.64	1	27
indepdir	2062	0.619	0.251	0	1
InTA	2160	23.197	1.679	18.173	27.174
firmage	2246	28.721	31.7	-13	115
leverage	2160	0.246	0.164	0	0.862
tangibilityratio	2153	0.254	0.23	0	0.996
loss	2302	0.086	0.28	0	1
market-to-book	2142	6.04	12.645	-0.094	133.374
blockdummy	2111	0.282	0.45	0	1
Number-of-analysts	2297	13.864	9.163	0	56

**TABLE 2** Descriptive statistics

Note: Please refer to Table 1 for the description of variables. The accounting variables are winsorized at 1% and 99% percentiles.

TABLE 3 Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) ESGScore	1.000											
(2) femaleprop	0.256*	1.000										
(3) Inboardsize	0.306*	-0.014	1.000									
(4) indepdir	0.218*	0.087*	-0.184*	1.000								
(5) lnTA	0.376*	0.147*	0.537*	-0.136*	1.000							
(6) Infirmage	0.293*	-0.043	0.277*	-0.042	0.382*	1.000						
(7) leverage	-0.082*	0.066*	-0.234*	0.043	-0.013	-0.180*	1.000					
(8) tangibilityratio	0.031	-0.093*	-0.047	-0.077*	-0.086*	0.064*	0.257*	1.000				
(9) loss	-0.115*	-0.020	-0.144*	-0.010	-0.184*	-0.075*	0.109*	0.151*	1.000			
(10) market-to-book	-0.094*	-0.036	-0.143*	0.000	-0.366*	-0.124*	0.050	0.051	0.032	1.000		
(11) blockdum	0.161*	0.159*	0.071*	0.032	0.086*	-0.012	0.007	-0.239*	-0.013	0.061*	1.000	
(12) lnanalysts	0.390*	-0.014	0.363*	0.001	0.412*	0.282*	-0.122*	0.116*	-0.103*	-0.064*	-0.057*	1.000

Note: Please refer to Table 1 for the description of variables. Table 2 shows Pearson's pairwise correlation coefficients between variables included in the baseline model. \* $p < 0.01$ .

TABLE 4 Relationship between board gender diversity and sustainability performance

Variables	(1) model1 ESGScore	(2) model2 ESGScore
femaleprop	16.0804*** (5.1031)	10.1183*** (3.7063)
Inboardsize	10.5583*** (3.2064)	-0.2399 (2.7207)
indepdir	14.4014*** (3.1752)	7.5094*** (2.3932)
lnTA	3.9179*** (0.9139)	3.0267* (1.5601)
Infirmage	1.4113* (0.7773)	2.3834 (2.0259)
leverage	-8.8747 (5.6105)	-0.7845 (4.7637)
tangibilityratio	2.5149 (4.4256)	-5.4815 (4.2684)
loss	-0.8559 (1.6551)	0.3484 (1.0849)
market-to-book	0.0861* (0.0513)	0.0785 (0.0709)
blockdum	2.8500** (1.3926)	2.7520*** (1.0445)
lnanalysts	5.4782*** (1.5251)	2.7121* (1.4924)
Constant	-95.9340*** (18.1940)	-38.3406 (36.2231)
Firm effects	No	Yes
Year effects	Yes	Yes
Industry effects	Yes	No
Country effects	Yes	No
YearXIndustry		Yes
YearXCountry		Yes
Observations	1648	1648
R-squared	0.593	0.696
Number of firms	205	205

Note: This table reports the baseline model where the association between dependent variable sustainability performance (*ESGScore*) and independent variable board gender diversity (*femaleprop*) is shown. Models 1 and 2 show Pooled OLS regression and Fixed-effects panel models, respectively. Standard errors are clustered at the firm level and shown in parentheses. \*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .

instruments such as *industry average board gender diversity* excluding the focus firm and *board gender diversity at the initial period* are used in line with prior studies (Bhandari & Javakhadze, 2017; Nadeem et al., 2020). Furthermore, the ignorance of the dynamic relationship may have serious concerns related to endogeneity. Following the literature (Boukattaya & Omri, 2021; Lu & Herremans, 2019; Naciti, 2019;

Nguyen et al., 2015), such unobserved heterogeneity is addressed using a two-step System Generalized Method of Moments (GMM).

## 4 | RESULTS AND ANALYSIS

### 4.1 | Descriptive statistics

Table 2 reports the summary of the descriptive statistics. The Nordic firms have, on average, an ESG score of 52.68 during the study period which is above the average score indicating that Nordic firms are

**TABLE 5** Endogeneity

Variables	(1) IV-2SLS ESGScore	(2) System-GMM ESGScore
femaleprop	17.8702** (8.8104)	7.7282** (3.1429)
Inboardsize	12.0032*** (1.5978)	−0.7418 (3.9067)
indepdir	15.0630*** (1.8773)	−2.1055 (5.2898)
InTA	3.9003*** (0.4352)	0.9703** (0.4324)
Infirmage	1.5950*** (0.3672)	−0.1763 (0.1745)
leverage	−8.6606*** (2.6187)	−5.3591*** (1.6377)
tangibilityratio	2.2177 (2.1405)	0.2842 (1.2093)
loss	−0.5879 (1.3466)	0.5974 (0.5584)
market-to-book	0.1045*** (0.0269)	0.0328* (0.0194)
blockdum	2.8001*** (0.7578)	1.1666*** (0.3912)
Inanalysts	5.2423*** (0.7328)	0.7163* (0.4292)
L.ESGScore		0.7483*** (0.0431)
L2.ESGScore		0.0649** (0.0264)
Constant	−98.4589*** (10.1156)	−11.7680* (6.6824)
Year effects		
Industry effects		
Country effects		
Observations	1506	1334
R-squared	0.597	

**TABLE 5** (Continued)

Variables	(1) IV-2SLS ESGScore	(2) System-GMM ESGScore
Kleibergen-Paap LM statistic	100.746	
p-Value	0	
Cragg-Donald F statistic	84.025	
Stock-Yogo test at 10%	19.93	
Hansen J statistic	3.506	35.76
p-Value	0.07	0.619
AR(1)		0
AR(2)		0.08
AR(3)		0.14

Note: This table reports the results for IV-2SLS regression and Dynamic panel-data two-step system GMM in models 1 and 2, respectively. In model 1, two instruments (*industry average women proportion on boards excluding the firm and women proportion at the initial period*) for the endogenous female proportion on boards variable are used. Both models' results show an association between board gender diversity (*femaleprop*) and sustainability performance (*ESGScore*). Robust and GMM Standard errors are shown in parentheses. \*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .

relatively better sustainability performers. The board gender diversity measured by female proportion on boards is 0.29, showing about 30% of board gender diversity in Nordic boards, on average. The female proportion range from 0 to 0.75. Similarly, on average, a Nordic board has about 27 directors, while 3 being the lowest and 27 being the highest number of board directors. There are about 63% of independent directors on boards. Furthermore, Nordic firms seem to be heterogeneous in terms of size, age, leverage, tangibility, market-to-book ratio, and so on.

Table 3 presents the correlation matrix between variables of interest including control variables. There is a significant (at a 1% level) and positive relationship between board gender diversity and sustainability performance, indicating a 0.26 Pearson pairwise correlation coefficient. This preliminary result supports the study hypothesis that there is a positive significant relationship between board gender diversity and sustainability performance. Since all other variables have a correlation coefficient below 0.60, there is no concern for multicollinearity. The variance inflation factor (VIF) test for multicollinearity also confirms that the variables used in the baseline model are not acute to the multicollinearity issue. The highest VIF is 2.04 and the Mean VIF is 1.29.

### 4.2 | Regression analysis

Table 4 reports the baseline model results using Pooled OLS regression and firm fixed effects. In Model 1, we find that there is a positive association between female proportion on boards and ESG score ( $\beta = 16.08$ ,  $p < 0.01$ ) taking into account several control variables, year, industry and country effects. Since our sample firms are



**TABLE 6** Test of critical mass

Variables	(1) model1 ESGScore	(2) model2 ESGScore	(3) model3 ESGScore	(4) model4 ESGScore
10%women	3.0483 (2.5370)			1.4511 (2.6257)
20%women		2.9695** (1.4473)		1.3925 (1.4477)
30%women			3.0334** (1.2998)	2.3790* (1.2683)
Inboardsize	10.5216*** (3.1779)	10.4707*** (3.2123)	10.5199*** (3.2013)	10.2706*** (3.1997)
indepdir	14.4876*** (3.1379)	14.3579*** (3.1467)	14.4198*** (3.1573)	14.2907*** (3.1645)
lnTA	3.8886*** (0.9504)	3.8856*** (0.9450)	3.8419*** (0.9359)	3.8291*** (0.9309)
Infirimage	1.2959 (0.7871)	1.3572* (0.7815)	1.3551* (0.7840)	1.3655* (0.7793)
leverage	-9.0411 (5.6260)	-9.2449 (5.6423)	-8.6955 (5.6641)	-8.9392 (5.6535)
tangibilityratio	1.1061 (4.6354)	1.4643 (4.5609)	1.8436 (4.6099)	2.0698 (4.4992)
loss	-1.2518 (1.6936)	-1.0208 (1.7286)	-0.9988 (1.6649)	-0.8508 (1.6785)
market-to-book	0.0761 (0.0522)	0.0814 (0.0517)	0.0821 (0.0519)	0.0809 (0.0520)
blockdum	2.8048** (1.3963)	2.7807** (1.3977)	2.9460** (1.3775)	2.8869** (1.3840)
Inanalysts	5.7228*** (1.5406)	5.6134*** (1.5271)	5.7772*** (1.5513)	5.7139*** (1.5431)
Constant	-95.1196*** (18.6061)	-93.9841*** (18.5506)	-93.6805*** (18.4620)	-93.7841*** (18.2708)
Year effects	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes
Observations	1654	1654	1654	1654
R-squared	0.587	0.589	0.590	0.591

Note: This table reports the OLS model results for the “critical mass” test where the association between board gender diversity (using three dummies) and sustainability performance (ESGScore) is shown. Models 1–3 show separate associations between 10%, 20%, and 30% of women on boards and ESGScore, respectively while Model 4 is the multivariate model. Standard errors are clustered at the firm level and shown in parentheses.

\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .

heterogenous, they can also have differences at the firm level that are time-invariant. Furthermore, industry and country-related time-variant differences might influence the association between women on boards and sustainability performance. Thus, accounting for such confounders, we run fixed-effects panel regression in Model 2. Results consistently show the positive and significant ( $\beta = 10.12$ ,  $p < 0.01$ ) relationship even after accounting for firm fixed effects, time-variant industry and country effects. Furthermore, results show that some of

our governance and firm-specific controls are significant, specifically, board independence, firm size, ownership, and analyst coverage.

### 4.3 | Endogeneity test

First, we address the endogenous relationship between board gender diversity and sustainability performance using IV-2SLS

**TABLE 7** Carbon-intensive versus carbon non-intensive industries

Variables	(1) Carbon-intensive ESGScore	(2) Carbon-non-intensive ESGScore
femaleprop	16.9299** (8.2801)	14.8816** (6.1494)
Inboardsize	12.9296*** (4.4138)	7.7491* (4.4159)
indepdir	16.0558*** (4.6929)	11.5185*** (4.1739)
lnTA	4.3632*** (1.4279)	3.0487*** (0.9715)
Infimage	1.2212 (1.3304)	1.6597* (0.9867)
leverage	-15.8444* (8.7846)	-4.6160 (6.9501)
tangibilityratio	6.3755 (6.0992)	3.4133 (5.8697)
loss	-0.3848 (2.5064)	-1.4730 (2.0505)
market-to-book	0.2176** (0.0903)	-0.0275 (0.0498)
blockdum	3.6822* (1.9006)	2.0701 (1.8855)
Inanalysts	6.1837*** (2.1271)	5.9468*** (1.9352)
Constant	-109.9486*** (28.5421)	-74.9641*** (19.7953)
Year effects	Yes	Yes
Industry effects	Yes	Yes
Country effects	Yes	Yes
Observations	813	835
R-squared	0.642	0.568

Note: This table reports the OLS model results for the subsample based on carbon-intensive (Model 1) and carbon-non-intensive (Model 2) industry categories. Both models show the association between board gender diversity (*femaleprop*) and sustainability performance (*ESGScore*). Standard errors are clustered at the firm level and shown in parentheses.

\*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ .

regression and dynamic panel-data estimation method. IV-2SLS is used to account for the reverse causality problem where we used two instruments that influence the women on boards but do not directly influence sustainability performance. A valid and strong instrument should have such features while finding such instruments is generally difficult. However, following studies such as Bhandari and Javakhadze (2017) and Nadeem et al. (2020), we used the *industry average board gender diversity* (excluding the focal firm) and *board gender diversity at the initial period* for the focal firm as two instruments for the endogenous board gender

diversity explanatory variable. In Table 5, we report statistics to support the use of our instruments. For instance, the under-identification test (LM statistic) shows the rejection of the null hypothesis. Cragg-Donald and Stock-Yogo tests also provide evidence that our instruments are not weak. In addition, we do not find support for the overidentification test of all instruments (Hansen J statistic) at least at 5% or below. However, our instruments are more motivated by theoretical interpretation and prior literature. Thus, we argue that firms in a cohort where its peers have a high proportion of women on boards are likely to employ higher women directors. In addition, the firm's initial level of women proportion on boards is the reference point whereby a firm is more likely to determine its women proportion on boards in the following years. It is also possible that peers' proportion of women on boards and the focal firm's initial level of women's proportion on boards have no direct effect on its sustainability performance. IV-2SLS regression result in Model 1 (Table 5) shows that the female proportion on boards is positively and significantly ( $\beta = 17.87$ ,  $p < 0.05$ ) related to ESG score, which is consistent with our baseline models.

Furthermore, we address the issue of the dynamic relationship between corporate governance and firm performance (Wintoki et al., 2012), employing the two-step System GMM method. Since the System GMM method allows us to use internal instruments available within the panel itself, use more than one period lagged dependent variable as explanatory variables, and consider lagged independent variables, it is more likely to give robust estimation accounting endogeneity issues. Dynamic system GMM estimation test in Model 2 (Table 5) shows that the ESG score is autocorrelated with a score from the previous 2 years which we used as explanatory variables (L.ESGScore and L2.ESGScore). So, the estimation result on the relationship between women on boards and sustainability performance is consistent ( $\beta = 7.73$ ,  $p < 0.05$ ) with our baseline models indicating that board gender diversity improves sustainability performance.

## 4.4 | Additional analysis

### 4.4.1 | Test of “critical mass”

We test the role of “critical mass” using three dummies for women on boards such as at least 10%women, at least 20%women, and at least 30%women directors. The baseline Pooled OLS Regression results in Table 6 show that “critical mass” is critical to improving firms' sustainability performance. For instance, we find at least 20% and at least 30% of women directors in Model 2 and Model 3, respectively, to be significantly associated with ESG scores while at least 10% of women on boards is not significant. However, Model 4, where we consider all three dummies in the same multivariate model, shows that at least 30% of women on boards are the “critical mass” and significantly ( $\beta = 2.38$ ,  $p < 0.10$ ) associated with sustainability performance.

#### 4.4.2 | Carbon-intensive versus carbon-non-intensive industries

The nature of the industry seems to affect the relationship between board gender diversity and sustainability performance. For example, environmentally sensitive (high impact on the environment) and non-sensitive (low impact on the environment) industries have different levels of environmental impact and concerns (Lu & Herremans, 2019; Nadeem et al., 2020). In this line, we employ the carbon-intensive and carbon non-intensive subsample based on the amount of carbon emission generated by the GICS sectors. Our data shows that energy, material, and industrials sectors are three major carbon emitters which we regard as carbon-intensive industries while others as carbon-non-intensive industries. The baseline Pooled OLS Regression in Table 7 result for subsamples analysis shows that board gender diversity is significant and positive for both groups of industry firms. However, the effect is stronger for carbon-intensive firms ( $\beta = 16.93$ ,  $p < 0.05$ ) than that for carbon-non-intensive firms ( $\beta = 14.88$ ,  $p < 0.05$ ).

#### 4.4.3 | Alternative measures

We perform further tests with our baseline OLS model. First, we examine the association between board gender diversity and sustainability performance using alternative measures for board gender diversity. We use “the number of women directors” and “above-industry-average board gender diversity dummy” as alternative measures. In unreported results, the study provides consistent baseline results even with our alternative measures of board gender diversity. Second, we use alternative measures for sustainability performance employing each pillar of the ESG score, i.e., environmental score, social score, and governance score. Our unreported results show that all three scores are significant and positively associated with board gender diversity while the governance score has a stronger relationship than others consistent with De Masi et al. (2021).

## 5 | DISCUSSION AND CONCLUSION

In this study, using firm-level data from 205 publically listed firms from four Nordic countries Denmark, Finland, Norway, and Sweden, we investigated the association between board gender diversity (proportion of women on boards) and sustainability performance (ESG score). Amidst two skepticism (1) studies showing an insignificant association between board gender diversity and financial performance in several Nordic samples, and (2) the possibility that high stakeholder orientation in the Nordic region might confound the positive association between board gender diversity and sustainability performance; we hypothesized, drawing on gender social role theory and upper echelons theory, that board gender diversity is positively and significantly associated with sustainability performance.

Our baseline Pooled OLS regression result, showing a positive and significant association between board gender diversity and sustainability performance, supported our hypothesis and agrees that gender social role theory and upper echelons theory explain how and why women on boards are associated with sustainability performance. The results are robust across endogeneity tests and additional analyses. Therefore, the current study provides supporting evidence that board gender diversity is significant and positively associated with non-financial-related performance, if not financial performance, which is in line with Torchia et al. (2018) who found a positive and significant effect of board gender diversity on organizational innovation in Norway. In another Norwegian study, Nielsen and Huse (2010) suggested that the ratio of women directors is positively associated with strategic control, indicating board effectiveness. Our study contributes to extending the finding of such prior studies taking into account sustainability (ESG) performance as the non-financial performance. Furthermore, our finding corroborates several existing studies (Boukattaya & Omri, 2021; Burkhardt et al., 2020; Kyaw et al., 2017; Lu & Herremans, 2019; Naveed et al., 2021) that found a positive effect of board gender diversity on sustainability/CSR performance in other study contexts. However, our finding is contrary to a few studies such as Cucari et al. (2018) who found a negative effect of Italian firms' gender diversity quota on sustainability disclosure. In addition, Manita et al. (2018) found an insignificant association between board gender diversity and sustainability performance for S&P500 US firms.

Our study explores that the “critical mass” of women on boards is necessary to have a significant association with sustainability performance which endorses the “critical mass” theory. With univariate models, we found that at least 20% and 30% of women on boards are significant while our multivariate model showed that a “critical mass” of at least 30% of women on boards is necessary to affect the sustainability performance. Existing studies have been inconsistent to suggest the appropriate “critical mass.” Ben-Amar et al. (2015) and Nuber and Velte (2021) found that the effect of women on climate change disclosure practices or carbon performance is positive if a critical mass of at least two women directors is reached. However, De Masi et al. (2021), Yarram and Adapa (2021), and Amorelli and García-Sánchez (2020) found that “critical mass” of at least three women on boards enhances the level of ESG disclosure/performance. In contrast, Kyaw et al. (2017) found a significant effect of at least one woman director suggesting that a “critical mass” of women on boards is not required to promote CSR. Furthermore, Manita et al. (2018) found an insignificant effect of “critical mass” to affect the ESG disclosure. Our study provides evidence that stresses 30% of women on boards to be the appropriate level of “critical mass” necessary to have a significant effect on sustainability performance. In this way, we contribute to this rare and inconclusive strand of literature.

In an additional analysis, our study reveals a stronger association between board gender diversity and sustainability performance in carbon-intensive firms as compared to non-intensive firms which is in line with Nadeem et al. (2020) and Lu and Herremans (2019). The possible reason might be firms with ESG risks exposure such as carbon-intensive industries invest more in sustainability when they have more



women on boards (Naveed et al., 2021). However, this is an empirical question also for future studies.

Therefore, our study examining the sustainability-related firm performance owing to board gender diversity contributes to this rare strand of literature using Nordic firm-level data. In the context of the prior inconsistent relationship between board gender diversity and financial performance, the current study finding explores the avenues that more women on boards might be beneficial for sustainability performance. This provides a management implication that board gender diversity as a resource should be deployed in such areas where women's leadership can play a significant role or impact. Study findings also have important policy implications that firms should increase women's representation in corporate boards due to its association with sustainability performance. However, a "critical mass" of at least 30% of women on boards is necessary to influence the board's policies and decisions related to sustainability performance. In this sense, the evidence supports the existence of the board gender diversity quota system in Nordic countries.

However, there are some contextual caveats. First, the current study focuses only on the Nordic region. So, we are not able to investigate whether the macro institutional context has a role to influence the association between board gender diversity and sustainability performance. If future researchers want to compare the Nordic context with some other institutional or governance contexts while investigating the relationship between board gender diversity and sustainability performance, studies could draw whether institutional context influences the results. Second, our measure of sustainability performance is an aggregate score which covers several categories of environment, social, and governance pillars such as emission reduction, workforce diversity and inclusion, community, management, human rights, environmental policies, and so on. Future research may employ more specific measures for sustainability performance, for example, CO<sub>2</sub> emission level, renewable energy use ratio, charity spending, etc. which can explore the effect of board gender diversity in more tangible ways. Third, this study is unable to test the subsamples based on industry, country, and year, due to the limited data observations available in each category. So, future studies can enlarge the data if they have accessibility to alternative data sources. Finally, future researchers might consider several other mechanisms such as CSR strategy, corporate culture, national culture, financial flexibility etc. that may moderate or mediate the relationship between board gender diversity and firm performance.

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