Thunderbird International Business Review

WILEY

RESEARCH ARTICLE OPEN ACCESS

Board Gender Diversity and Sustainable Innovation in Emerging Market Multinational Enterprises: Do Country-Level Institutions Matter?

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Received: 30 November 2024 | **Revised:** 10 July 2025 | **Accepted:** 23 July 2025

ABSTRACT

There is little research attention on the antecedents of sustainable innovation (SI) in emerging market multinational enterprises (EMNEs). This study, therefore, considers the effect of board gender diversity on SI in EMNEs. We combine upper echelons and institutional theories to examine the influence of board gender diversity and country-level institutional factors on SI. Our analysis of a 10-year (2013–2022) panel data of EMNEs from 19 countries reveals a positive effect of board gender diversity on SI. Our study also reveals that country-level institutional factors such as governance effectiveness, control of corruption, and gender parity index moderate the positive association between board gender diversity and SI. Our study contributes to the literature on SI by providing insights on how board gender diversity and institutional quality enhance investments in SI. The managerial implications of our research are discussed.

1 | Introduction

As nations seek to achieve the United Nations Sustainable Development Goals (UN-SDGs) by the year 2030, the issue of sustainability has gained prominence among researchers, business managers, and policymakers. Central to this discussion is the pivotal role companies can play in addressing today's challenges while protecting the environment and the interests of future generations (Hernandez-Vivanco et al. 2018). The growing awareness that economic actions of firms have impacts on the environment, climate change, and future generations has led to increased pressure on firms to adopt sustainable initiatives (Cillo et al. 2019; Delmas and Pekovic 2018). The demand from firms' stakeholders to implement sustainable approaches and the growing influence of sustainability considerations in consumer purchase decisions ensure that sustainability performance is a key determinant of competitiveness today (García-Granero et al. 2018; Zaman et al. 2024). Thus, to succeed in current business environments that are highly competitive, firms must not only be innovative but also strive to address the concerns of stakeholders. Conforming to this thinking, there is a burgeoning research interest in sustainable innovation (Cillo et al. 2019; Hernandez-Vivanco et al. 2018; Boons et al. 2013).

Sustainable innovation (SI) is the introduction of innovations in products, processes, organization, and marketing that minimize environmental costs and burdens (García-Granero et al. 2018; Delmas and Pekovic 2018). It is a future-oriented approach to innovation that incorporates environmental, social, and economic considerations (Cillo et al. 2019). This viewpoint suggests that, aside from creating financial returns for firms, innovation should generate social and environmental benefits for it to be sustainable. Consequently, researchers have suggested that the competitive advantage of firms can be guaranteed when their economic actions are predicated on sustainable business models (Fuentes-Fuentes et al. 2023; Delmas and Pekovic 2018).

However, despite the potential benefits of SI in enhancing competitive advantage for firms, SI requires a huge amount of resources, and the uncertainty about its success may deter managers, who may often favor short-term profit maximization, from embracing SI initiatives (Nadeem et al. 2020). In such circumstances, Zaman et al. (2024) note that those in upper echelons, notably the board of directors, who are placed at the zenith of the firm can override managerial discretion over SI implementation. This is because corporate boards have the duty to set strategic direction for the firm (Adams et al. 2023), including decisions relating to SI activities. Notwithstanding, the ability of corporate boards to function optimally may be constrained by their composition (Attah-Boakye et al. 2020; Nadeem et al. 2020). This realization has sparked research interest in uncovering the influence of board diversity on organizational outcomes (e.g., Bouchmel et al. 2022; Post and Byron 2015).

There is sufficient empirical evidence indicating that gender-diverse boards can contribute to corporate innovation and other emerging forms of innovation (Adams et al. 2023; An et al. 2021; Attah-Boakye et al. 2020; Griffin et al. 2021). While other studies have specifically focused on the role of board gender diversity on SI (Nadeem et al. 2020; Zaman et al. 2024), much of this research has concentrated on advanced countries to the neglect of emerging markets. As a result, the factors influencing SI in emerging markets have remained unexplored. Adams and his colleagues captured this succinctly in their special issue call on understanding sustainable innovation in emerging markets. We note that this omission in the literature is problematic, given that Boons et al. (2013) opined that emerging markets have their unique sustainability challenges that require context-specific SI initiatives to tackle. Hargadon (2015) expressed a similar view and cautioned against the adoption of a one-size-fits-all approach to SI. This indicates that SI initiatives in advanced economies may not be effective in emerging markets. Hence, there is a need to understand the peculiarities of SI in emerging markets. We address this gap by examining the effect of board gender diversity on SI by utilizing a unique panel data set of 179 emerging market multinational enterprises (EMNEs) from 19 countries.

Therefore, this paper seeks answers to two research questions: what is the relationship between board gender diversity and SI? And do country-level institutions make a difference in this relationship? To address these questions, we carefully weave together two theoretical frameworks—the upper echelons theory (Hambrick and Mason 1984) and institutional theory (DiMaggio and Powell 1983; North 1990). In doing so, we argue that female board members bring different ideas, experiences, education, expertise, and values which can influence the adoption of SI, and at the same time, board members operate in an external institutional environment that can either enhance or constrain the adoption of SI (Adams et al. 2023; Attah-Boakye et al. 2020; DiMaggio and Powell 1983; Hambrick 2007; Hambrick and Mason 1984; Nadeem et al. 2020; North 1990; Zaman et al. 2024). The inclusion of women on corporate boards and their influence on firm outcomes such as SI are determined by the institutional context (Griffin et al. 2021; Nguyen et al. 2021). Although research suggests that female directors are generally eco-friendly (Nadeem et al. 2020), female board members operating in strong institutional environments characterized by high governance effectiveness, control of corruption, and gender parity will have more incentive to influence the adoption of SI (Adams et al. 2023; Attah-Boakye et al. 2020). Therefore, we contend that these institutional features will strengthen the link between board gender diversity and SI.

This study contributes to the literature by uncovering the effect of board gender on SI and how the institutional environment influences female board members' adoption of SI within the context of EMNEs. Our study is significant and timely because MNEs accumulate high carbon footprints as they perform value chain activities in multiple countries, and there are calls for them to champion global sustainability by tailoring their innovations to UN-SDGs (Peerally et al. 2022; Zhao et al. 2024). Therefore, understanding the factors influencing SI in EMNEs is a step in the right direction.

The rest of the paper is structured as follows. The next section is on the theoretical background with a focus on SI, upper echelons theory, and institutional theory, after which the hypotheses are developed. Next is the methodology, followed by results and discussion, while the conclusions, theoretical contributions, and managerial implications are discussed. Finally, the limitations of the research are highlighted, and suggestions for future research are stated.

2 | Theoretical Background

2.1 | Sustainable Innovation

Sustainable innovation (SI) is an emerging concept that has gained research attention in recent years (Afeltra et al. 2023; Degler et al. 2021; Zaman et al. 2024). Yet, the concept is difficult to define because it has been used interchangeably with other related concepts such as "eco-innovation", "environmental innovation", "eco-friendly innovation", and 'ecological innovation' in the literature (Boons et al. 2013; Delmas and Pekovic 2018; García-Granero et al. 2018; Zaman et al. 2024). Despite this controversy about labeling, several scholars indicate that SI and eco-innovation are synonymous concepts (*see* Boons et al. 2013; Boons and McMeekin 2019; Delmas and Pekovic 2018). Accordingly, SI is defined as "innovation that improves sustainability performance, where such performance includes ecological, economic, and social criteria" (Boons et al. 2013, 2). The objective of SI is to integrate environmental, social, and economic factors in the practices and outcomes of organizations (Adams et al. 2016; Hautamäki and Oksanen 2016; Rattalino 2018). It requires organizations to intentionally change their values, products, processes, marketing, and practices to create environmental value and economic returns (Adams et al. 2016). According to Hautamäki and Oksanen (2016), SI seeks to address wicked societal problems while considering long-term impacts on future generations.

The measurement of SI remains one of the fundamental and challenging issues in SI research (Guimarães et al. 2024). Although researchers have developed several approaches to address this concern, there is no consensus on how SI should be measured. For instance, Calik (2024) developed and validated

a scale on sustainable product innovation that is suitable for manufacturing firms. Baxter and Chipulu (2023) developed a scale for measuring sustainability-oriented innovation that can be applicable to a wide range of organizations. Typically, these scales incorporate the triple bottom line by measuring SI across environmental, social, and economic dimensions. Meanwhile, García-Granero et al. (2018) classified firm-level indicators of SI into product, process, organizational, and marketing innovations and noted that many measures of SI fail to incorporate all these indicators. Due to the complexity of measuring SI, other scholars have used SI indicators within datasets to measure SI (Nadeem et al. 2020; Zaman et al. 2024). One such reliable measure of SI is the Thomson Refinitiv sustainable innovation score, which measures the capacity of a firm to introduce innovations that reduce environmental costs and burdens for its customers (Refinitiv 2022). This measure of SI has been validated extensively in previous studies (e.g., Nadeem et al. 2020; Zaman et al. 2024; Zaman et al. 2021) and is therefore adopted for this study.

Given that SI involves a long-term financial commitment to succeed, the decision to implement SI initiatives rests with the board of directors (Zaman et al. 2024). As a result, researchers have sought to understand how various corporate governance mechanisms can influence the adoption of SI (e.g., Nadeem et al. 2020; Zaman et al. 2024). While several studies have established a positive association between female board representation and SI (Nadeem et al. 2020), most of these research efforts have largely focused on advanced economies. There is a need to examine how this relationship unfolds in the context of emerging markets because female board representation is limited in many emerging markets as a result of weak institutional mechanisms and cultural norms that promote gender prejudices, resulting in limited educational and economic opportunities for women (Attah-Boakye et al. 2020). We extend the existing corpus of research to emerging markets by examining the role of board gender diversity on SI in emerging market multinational enterprises.

2.2 | Upper Echelon Theory

The upper echelon theory (UET) suggests that the thought process and decisions of boards are influenced by their personal attributes, such as experiences, education, expertise, exposure, and values (Hambrick and Mason 1984; Hambrick 2007). The theory asserts that the strategic decisions and overall performance of firms are a reflection of the demographic and psychological traits of top executives (Herman and Smith 2015; Hiebl 2014; Tao et al. 2013). UET has been applied in previous studies to understand how gender diversity influences different types of innovation (Adams et al. 2023; Attah-Boakye et al. 2020; Zaman et al. 2024). Zaman et al. (2024) argued and found support that the background of directors, such as their age, cultural orientation, gender, and other attributes can determine the adoption of eco-innovation. Adams et al. (2023) suggest that boards with female representation can promote coupled open innovation in emerging market multinational corporations, while Attah-Boakye et al. (2020) found that women on boards can influence firms' investment in research and development and corporate innovation.

The UET is a suitable framework for understanding the effect of board gender diversity on SI because strategic decisions such as the implementation of SI initiatives are at the discretion of the board. Moreover, the board of directors can support SI adoption by linking organizations with external resources, motivating employees, and monitoring its implementation (Nadeem et al. 2020; Zaman et al. 2024). Kim et al. (2015) observed that the upper echelon can exert pressure on the initiation and implementation of projects that are strategically important. This implies that boards that find SI appealing will ensure its adoption and integration into organizational products, practices, and processes. Furthermore, since female board members have a long-term orientation, they are bound to favor SI initiatives because of the long-term nature of SI (Nadeem et al. 2020; Zaman et al. 2024).

As Adams et al. (2023) note, upper echelons can influence firms' strategic decisions through board strategy involvement and board monitoring. Boards can support the adoption of SI by engaging in strategy development. They can also offer advice to top management teams responsible for SI implementation across the organization. Research evidence suggests that boards that are demographically and structurally diverse can share diverse perspectives, leading to the adoption of sustainable practices such as SI (Zaman et al. 2024). Moreover, boards with dedicated sustainability committees are more likely to adopt sustainable initiatives (Orazalin 2020). Aside from strategy involvement, boards can play a crucial role in monitoring the successful implementation of SI (Nadeem et al. 2020; Zaman et al. 2024). This suggests that board composition is a key factor in SI adoption.

2.3 | Institutional Theory

Apart from UET, this study is anchored on institutional theory because the behavior and actions of firms are a reflection of the institutional environment in which they operate. Institutions are social structures that exert pressure on firms by encouraging or constraining certain behavior (DiMaggio and Powell 1983). To gain acceptance and support, organizations take actions to align themselves with the norms, values, and expectations of their institutional environment (Zucker 1987). This behavior is crucial for organizations to ensure their survival and success within their social and regulatory contexts (David et al. 2019; Zucker 1987). The influence of the institutions on innovation has been well documented in the scholarly literature (e.g., Fakhimi and Miremadi 2022; Obobisa et al. 2022; Qi et al. 2021). Hence, this study adopts institutional theory to provide insights into the influence of country-level institutional factors on the adoption of SI. Specifically, we examine the moderating effects of external institutions, namely, governance effectiveness, control of corruption, and gender parity index (GPI), on the adoption of SI practices. It is noteworthy to state that institutional theory aligns seamlessly with UET because the composition of boards is a function of the institutional environment and the degree to which those in upper echelons influence firm decisions is also a reflection of the institutional context (Fernández-Temprano and Tejerina-Gaite 2020; Filatotchev et al. 2013; Griffin et al. 2021; Neville et al. 2019; Wang 2021). Against this backdrop, we follow the paths of Adams et al. (2023) and Attah-Boakye et al. (2020)

to combine institutional theory and UET to enable us to gain a better understanding of the antecedents of SI.

3 | Hypotheses Development

3.1 | Board Gender Diversity and SI

Board gender diversity is perhaps the most studied form of boardroom diversity. So important is the issue of gender diversity that some countries have enacted various legislations to promote the inclusion of more women on corporate boards (Belaounia et al. 2020; Chandler 2016; Terjesen et al. 2013). Compared to their male counterparts, female board members bring unique perspectives, experiences, and leadership styles on corporate boards (Galia et al. 2015). Because of the wide range of ideas and perspectives offered by female directors, studies have shown that board gender diversity can improve innovation (An et al. 2021; Galia and Zenou 2012; Griffin et al. 2021). Griffin et al. (2021) provided international evidence of how board gender diversity influences corporate innovation. They found in their study of 45 countries that companies with higher board gender diversity recorded a greater number of patents, novel patents, and achieved greater efficiency in innovation. Torchia et al. (2011) found in their study of 317 Norwegian firms that boards with at least three women achieved higher levels of innovation. Moreover, Galia and Zenou (2012) studied French firms and reported a positive effect of board gender diversity on corporate innovation. Recently, Attah-Boakye et al. (2020) utilized a panel data of 483 multinational corporations operating in emerging markets and found a positive impact of board gender diversity on corporate innovation. Similar findings have been reported in the relationship between board gender diversity and other forms of innovation. For instance, Adams et al. (2023) found a positive relationship between female board representation and coupled open innovation in their sample of 183 emerging market multinational enterprises. They further found a moderating effect of institutional quality on this relationship. This suggests that while board gender diversity can promote innovation, the institutional context also matters.

Turning our attention to SI—a variant of innovation that seeks to address environmental and social concerns, Nadeem et al. (2020) posed an interesting question as to whether women are eco-friendly. They further provided empirical evidence to confirm that board gender diversity contributes to environmental innovation and that the relationship is more pronounced in industries that are environmentally sensitive. Nadeem et al. (2017) also provided evidence in their study of Australian listed firms to demonstrate that corporate sustainability practices increased as female board representation increased. This indicates that the more women are involved in the boardroom, the more firms can adopt sustainable practices. Board gender diversity can contribute to SI because women in the upper echelon have a higher propensity to manage risks (Abou-El-Sood 2021; Belaounia et al. 2020) and are known to possess the moral compass to make fair decisions (Bart and McQueen 2013). They are also more committed to environmental and social concerns and are often disposed to consider diverse interests of stakeholders in decision-making (Nadeem et al. 2020; Öberg 2021; Smulowitz and Smulowitz 2024), in addition to being long-term oriented (Attah-Boakye et al. 2020). Indeed, the role of women in corporate governance goes beyond mere stereotypes as women often earn the right educational qualifications to sit on corporate boards and are often more subjected to public scrutiny than men (Giannetti and Wang 2020).

Since SI requires providing sustainable solutions that meet the needs of multiple stakeholders with competing interests, women on boards, by their very characteristic, may influence its adoption. Using a large dataset of firms in 54 countries, Bazel-Shoham et al. (2024) found that female board representation had a positive link with innovation for sustainability. Lakhal et al. (2024) also found that board gender diversity influenced both corporate and green innovation in French-listed firms. Similarly, Isa and Bensalem (2023) found that the relationship between board gender diversity and eco-friendly innovation was mediated by corporate social responsibility. Moreno-Ureba et al. (2022) found a positive association between gender board diversity and green innovation, with this relationship stronger in firms with at least three female directors. Naveed et al. (2023) found a positive relationship between gender board diversity and corporate green innovation in Chinese firms, and the relationship was further moderated by company-level institutional factors. Overall, the findings of these studies suggest that boards with female representation pay more attention to SI. Based on the preceding arguments and findings from previous studies, we state the following hypothesis.

H1. *There is a positive effect of board gender diversity on SI.*

3.2 | The Moderating Effect of Country-Level Institutions

We argue that the positive effect of board gender diversity on SI is moderated by country-level institutional factors for three reasons. First, the participation of women on corporate boards is influenced by the institutional environment (Terjesen and Singh 2008). Griffin et al. (2021) noted that board gender diversity is more pronounced in contexts with fewer gender gaps and more female participation in the labor market. Second, the influence of female board members on firm outcomes is determined by institutional contexts where diverse experiences are valued and leveraged (Adams et al. 2023). Empirical evidence suggests that female board members are more effective in countries with gender equality (Belaounia et al. 2020). Third, there is rich literature suggesting that firms' investment in innovation, including sustainability-related innovation, is a function of the institutional environment (Alam et al. 2019; Attah-Boakye et al. 2020; Kellard et al. 2023). As a result, there is a need to examine whether institutional factors moderate the relationship between board gender diversity and SI.

Firms operate in environments where institutions set the rules of the game (North 1990). Consequently, organizational actions and behaviors are constrained or encouraged by formal and informal institutional arrangements (DiMaggio and Powell 1983; North 1990). Formal institutions are written rules and regulations enacted by constituted authority to constrain the behavior of individuals and firms, while informal ones are norms and values that are embedded in the cultural ideology (Zenger

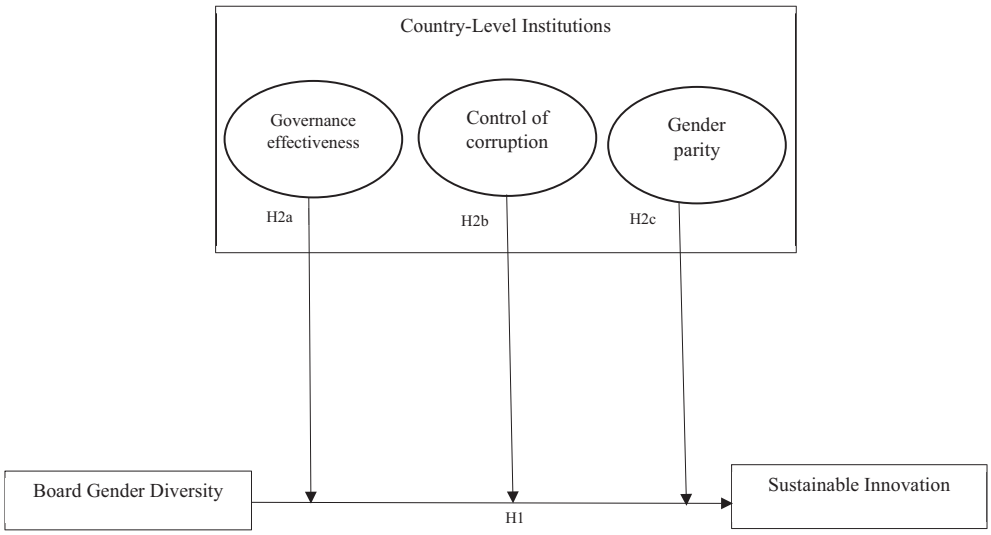

FIGURE 1 | Conceptual model.

et al. 2000). Differences in institutional environments entail that firm behaviors that are acceptable in one institutional context may be disapproved in another environment (Bahoo et al. 2023; Ikyanyon et al. 2020; Scott 2014). Thus, to cope with the demands of institutions, firms adopt legitimacy-seeking actions in order to survive (Meyer and Rowan 1977). Given that SI is encouraged in many institutional contexts through environmental regulations (Kellard et al. 2023), we expect institutions, represented by institutional factors such as governance effectiveness, control of corruption, and gender parity index, to encourage gender-diverse boards to adopt SI. This is because female board members influence firm outcomes in institutional environments that encourage their participation. For instance, Post and Byron's (2015) meta-analysis of 140 studies revealed that women on boards influence firm performance in contexts with high shareholder protection and gender parity. The latter is defined as the degree to which women and men have the same opportunities for economic participation, educational attainment, and political empowerment (Adams et al. 2023).

Several studies have examined the moderating effect of institutional quality on the relationship between board gender diversity and firm outcomes. Nguyen et al. (2021) and Hoch and Seyberth (2022) found that the effect of board gender diversity on firm performance was moderated by institutional quality. Additionally, Attah-Boakye et al. (2020) and Adams et al. (2023) in separate studies found that the institutional factors included in this study moderated the positive effect of female board representation on corporate innovation and coupled open innovation, respectively. We extend these previous studies by examining the moderating effect of institutional quality on the relationship between board gender diversity and SI. We argue that since SI requires a huge financial investment, firms operating in contexts with high institutional quality will be encouraged to adopt its implementation (Kellard et al. 2023). Such environments will also encourage female board members to make a case for the adoption of SI since female directors are usually eco-friendly (Nadeem et al. 2020). Thus, the preceding arguments and results of previous studies have given us the impetus to state the following hypotheses.

H2a. *Governance effectiveness moderates the positive effect of board gender diversity on SI.*

H2b. *Control of corruption moderates the positive effect of board gender diversity on SI.*

H2c. *Gender parity index moderates the positive effect of board gender diversity on SI.*

Figure 1 presents the conceptual model indicating the relationship among the variables in the study. Next, we discuss the methodology.

4 | Methodology

4.1 | Data and Sample

The data for this study were obtained from multiple sources. Specifically, firm-level data on board gender diversity and SI were obtained from the Thomson Eikon Refinitiv database for 10 years (2013–2022). The data from this database is reliable and have been used in several previous studies. Data on country-level institutional factors—control of corruption, governance effectiveness, and gender parity index—were obtained from the World Bank's Worldwide Governance Indicators. The corresponding 10-year data for these indicators are included in our analysis to serve as moderating factors.

This research is focused on emerging market multinational enterprises (EMNEs). Therefore, it is important to define EMNEs in this study. Multinational enterprises (MNEs) are firms that have headquarters in one country and operate in one or more other country (or countries) through a network of subsidiaries and affiliates (Rugman and Collinson 2009). Thus, since our study is focused on EMNEs, the MNEs in our sample are those that are headquartered in emerging markets. While definitions of emerging markets are many and varied, emerging markets are economies that are witnessing rapid growth and industrialization and are increasingly integrated into the global economy.

We adopt the IMF classification of emerging markets to include EMNEs in our sample. Accordingly, the sample for this study comprises 179 EMNEs extracted from the Thomson Eikon Refinitiv database.

4.2 | Measures

4.2.1 | Independent Variable

The independent variable in this study is board gender diversity. To measure this variable, we followed the examples of Adams et al. (2023) and Attah-Boakye et al. (2020) to measure the percentage of females on the board as a proxy for board gender diversity.

4.2.2 | Dependent Variable

To measure SI, we utilized the Thomson Eikon Refinitiv score of SI. The SI score recorded in the database has been used with success in previous studies (e.g., Nadeem et al. 2020; Zaman et al. 2024; Zaman et al. 2021). The Thomson Eikon Refinitiv sustainable innovation score "reflects a company's capacity to reduce the environmental costs and burdens for its customers, and thereby creating new market opportunities through new/improvement in environmental technologies and processes or eco-designed products or processes" (Refinitiv 2022; Zaman et al. 2021, 6). According to Refinitiv (2022), this score is derived from a percentile rank scoring methodology ranging from 0 to 100. A high score demonstrates a firm's commitment to SI.

4.2.3 | Moderating Variables

The moderating variables for this study are country-level institutional factors comprising governance effectiveness, control of corruption, and gender parity index. Previous studies have shown that the effect of board gender diversity on firm outcomes is moderated by external institutions (Adams et al. 2023; Attah-Boakye et al. 2020; Post and Byron 2015). Due to their high growth rate, emerging markets offer fertile grounds for investment, but at the same time, these economies present high investment risks due to their weak, incoherent, and loosely coupled institutions (Adams et al. 2023). Therefore, understanding corporate governance mechanisms and the role of country-level institutions in fostering SI in these markets is crucial. Therefore, we examine the moderating role of these institutions on the relationship between board gender diversity and SI.

4.2.4 | Control Variables

To enhance a robust analysis, we controlled for size; measured by the number of employees, environmental expenditure, return on assets, return on equity, combined environmental, social, and governance (ESG) score, total revenue, return on assets (ROA), return on equity (ROE), board size, and board independence. These variables have been controlled in previous studies on board gender diversity and innovation (Adams et al. 2023; Attah-Boakye et al. 2020; Nadeem et al. 2020; Zaman et al. 2024). For instance, Zaman et al. (2024) argued that firms with high ESG scores demonstrate a high commitment to the environment and are more likely to implement SI initiatives.

The variables in the study and their source are described in Table 1.

4.3 | Model Specification

Guided by our hypotheses, we are particularly interested in examining the relationship between board gender diversity and SI. This relationship is articulated in the following models. Implicitly, the relationship is given as:

$$\begin{aligned} SI_{i,t} = {} & \alpha_0 + \beta_1 BGDiv_{i,t} + \beta_2 FSize_{i,t} + \beta_3 EnvExp_{i,t} \\ & + \beta_4 ROA_{i,t} + \beta_5 ROE_{i,t} + \beta_6 ESG_{i,t} \\ & + \beta_7 TR_{i,t} + \beta_8 BSize_{i,t} + \beta_9 BInd_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

We included the control variables of firm size (FSize), environmental expenditure (EnvExp), return on assets (ROA), return on equity (ROE), combined environmental, social, and governance (ESG) score, total revenue (TR), board size (BSize), and board independence (BInd) in both models.

To enable us to test for the country-level effect of governance effectiveness (GovEff), control of corruption (CoC), and gender parity index (GPI) on SI through interaction with board gender diversity and SI, respectively, Equation (1) becomes:

$$\begin{aligned} SI_{i,t} = {} & \alpha_0 + \beta_1 BGDiv * GovEff_{i,t} + \beta_2 BGDiv * CoC_{i,t} \\ & + \beta_3 BGDiv * GPI_{i,t} + \beta_4 FSize_{i,t} + \beta_5 EnvExp_{i,t} \\ & + \beta_6 ROA_{i,t} + \beta_7 ROE_{i,t} + \beta_8 ESG_{i,t} + \beta_9 TR_{i,t} \\ & + \beta_{10} BSize_{i,t} + \beta_{11} BInd_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

From the equations, α_0 is the intercept of the model, β_1 to β_{11} are coefficients of the regressors, and ε is the error terms, all for firm i at time t.

The two-step system Generalized Method of Moments (GMM) econometric technique was used for estimating parameters in the models. The GMM, introduced by Hansen (1982), is an econometric technique well-suited for dynamic panel data models, especially when dealing with endogeneity, individual-specific effects, and small time dimensions (t) with large cross-sections (n). It utilizes internal instruments like lagged variables and can be made robust to heteroskedasticity and serial correlation, unlike traditional fixed or random effects models. The system GMM, developed by Arellano and Bover (1995), laid the groundwork for combining level equations with differenced equations to improve instrument validity. Blundell and Bond (1998) further introduced lagged differences as instruments for levels (in addition to lagged levels as instruments for differences), which improve efficiency and reduce finite-sample bias. These qualities provide the basis for our choice of the two-step system GMM technique in this study over other panel data estimation techniques.

TABLE 1 | Definition of variables.

Variable	Definition	Source of data
Sustainable innovation	Innovations in products, process, organization, and marketing that seeks to lessen environmental costs and burdens. It is measured using Thomson Eikon Refinitiv sustainable innovation score This is a score ranging from 0 to 100 which reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new/improvements in environmental technologies and processes or eco-designed products or processes	Thomson Eikon Refinitiv
Board gender diversity	Percentage of females on the board	Thomson Eikon Refinitiv
Control of corruption	World Bank indicator which measures the extent to which public power is exercised for private gain (percentile rank among all countries, which ranges from (lowest) zero to (highest) 100 rank)	World Bank Indicators
Governance effectiveness	The index varies from 0 to 100 and measures the quality of the civil service, public services, and the degree of independence of these from political pressures	World Bank Indicators
Gender parity index	This is a socio-economic composite index that measures if women and men have the same opportunities for economic participation, educational attainment, health and survival, and political empowerment. A GPI between 0.97 and 1.03 indicates parity between women and men. GPI below 0.97 indicates a disparity in favor of males	World Bank Indicators
Firm size	Measured by the number of employees	Thomson Eikon Refinitiv
Board size	The total number of board members at the end of the fiscal year	Thomson Eikon Refinitiv
Environmental expenditure	Total environmental expenditure for the fiscal year	Thomson Eikon Refinitiv
Return on assets	This is calculated by dividing a company's net income prior to financing costs by total assets	Thomson Eikon Refinitiv
Return on equity	This is a profitability ratio calculated by dividing a company's net income by total equity of common shares	Thomson Eikon Refinitiv
ESG score	This is an overall company score based on the reported information in the environmental, social and corporate governance pillars (ESG Score) with an ESG Controversies overlay	Thomson Eikon Refinitiv
Total revenue	Total earnings for the fiscal year	Thomson Eikon Refinitiv
Board independence	Percentage of independent board members reported by the company	Thomson Eikon Refinitiv

5 | Results and Discussion

The sample characteristics in Table 2 give an overview of the countries studied and the number of firms considered in each country. There are 1790 observations (or data points) for each variable from the 19 emerging economies. China, India, South Africa, Brazil, and Russia (members of BRICS) have the highest number of MNEs, signifying the global influence of this emerging market bloc. The descriptive statistics for variables in a dataset are presented in Table 3. For instance, the mean SI score is 37.86, with a standard deviation of 33.81. The scores range from a minimum of 0 to a maximum of 99.40, indicating considerable variability in SI among the observations. The mean score of Return on Assets is 0.0619 (or 6.19%), with a standard deviation of 0.0647. The values range from −0.1073 (indicating a loss) to 0.3443 (or 34.43%), showing that some firms are more profitable than others, while some may be operating at a loss.

It is observed from the Pearson correlation coefficient in Table 4 that, at a 5% significance level, SI is positively related to board diversity (BGDIV) with a coefficient of 0.083. The interactions of board gender diversity and institutional quality indicators (BGDIV × COC, BGDIV × GOVEFF, and BGDIV × GPI) show positive correlations with SI with corresponding values of 0.230, 0.151, and 0.079, respectively. Apart from firm size (FSIZE) that negatively relates to SI (−0.107), all other firm-level (i.e., the control) variables are seen to have a positive association with SI. This shows the covariance (or joint movement) of SI and these variables in the same direction. This correlation

result has helped avoid the suspicion of a spurious relationship between SI and its determinants and paved the way for further analysis.

TABLE 2 | Sample characteristics.

S/No	Country	Number of MNEs
1	Argentina	6
2	Brazil	14
3	Chile	3
4	China	31
5	Colombia	5
6	Egypt	4
7	Hungary	4
8	India	21
9	Indonesia	4
10	Malaysia	7
11	Mexico	10
12	Philippines	5
13	Poland	6
14	Russia	12
15	Saudi Arabia	6
16	South Africa	16
17	Thailand	8
18	Turkey	9
19	United Arab Emirates	8
Total		179

5.1 | There Is a Positive Effect of Board Gender Diversity on SI

The results of Model 1 of the 2–system GMM (which was tested at only the firm level) in Table 5 reveal a positive and significant effect of board gender diversity on SI ($\beta = 0.466$, $\rho < 0.05$). This means that a 46.6% improvement in SI is attributed to changes in board gender diversity. This finding supports our conceptual model, suggesting that having more women directors can positively influence SI initiatives in firms, which means that Hypothesis H1 in this study is accepted. Our result is consistent with other previous studies which argue that female board members bring diverse perspectives, unique experiences, and creativity to corporate boards, which can drive innovation (Adams et al. 2023; Attah-Boakye et al. 2020; Galia and Zenou 2012; Griffin et al. 2021; Torchia et al. 2011). Moreover, this finding also agrees with the views of scholars who believe that female directors have a tendency to manage risks better and are more concerned with the environment (Belaounia et al. 2020). Besides, female board members have been known to consider the diverse needs of multiple stakeholders in decision-making (Öberg 2021; Smulowitz and Smulowitz 2024). This implies that having more women on corporate boards can promote innovations that seek to reduce environmental burdens (Nadeem et al. 2020; Zaman et al. 2024). Thus, our study extends existing literature by demonstrating, within the context of 179 EMNEs from 19 countries, that SI can be improved when more women are appointed to corporate boards. This implies that legislations enacted by various countries to have more women on boards (see Chandler 2016; Terjesen et al. 2013) are a step in the right direction, since female board members can influence board decisions that can lead to the attainment of UN-SDGs.

5.2 | Country-Level Institutional Factors Moderate the Positive Effect of Board Gender Diversity on SI

Since the behavior of a firm is influenced by its institutional environment, we envisage that the extent to which female directors

TABLE 3 | Descriptive statistics.

Variables	Observations	Mean	Std. dev.	Minimum	Maximum
SI	1790	37.86417	33.80918	0	99.39516
BGDIV	1790	53.20014	27.24697	7.142857	99.31507
ROA	1790	0.061887	0.064661	−0.1073	0.3443
ROE	1790	0.193911	0.245826	−0.8502	2.3624
FSIZE	1790	31994.9	50254.83	38	355,900
ESG	1790	60.31042	19.16632	3.396853	94.16203
BSIZE	1790	11.57468	4.021688	5	26
BIND	1790	51.43622	29.44723	1.315789	99.6
TR	1790	3.17E+09	4.15E+09	11,197,119	2.81E+10
BGDIV × COC	1790	2845.518	1968.989	183.0191	9366.682
BGDIV × GOVEFF	1790	3280.263	1965.395	371.5842	9831.933
BGDIV × GPI	1790	52.76063	27.26174	6.994072	104.1508

TABLE 4 | Correlation matrix.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) SI	1												
(2) BGDIV	0.083*	1											
(3) ROA	0.113*	−0.052*	1										
(4) ROE	0.093*	0.049	0.452*	1									
(5) FSIZE	−0.107*	0.125*	−0.100*	0.087*	1								
(6) BIND	0.095*	0.075*	−0.142*	−0.080*	−0.020	1							
(7) BSIZE	0.077*	−0.088*	0.029	−0.131*	−0.129*	−0.069*	1						
(8) ENVEX	0.996*	0.076*	0.103*	0.099*	−0.105*	0.093*	0.079*	1					
(9) ESG	0.560*	0.038	0.145*	0.034	−0.219*	0.165*	0.016	0.554*	1				
(10) TR	0.047	−0.066*	0.061*	0.075*	−0.055	−0.144*	−0.004	0.030	−0.009	1			
(11) BGDIV × COC	0.230*	0.814*	−0.115*	−0.002	0.098*	0.212*	−0.119*	0.228*	0.129	−0.022	1		
(12) BGDIV × GOVEFF	0.151*	0.896*	−0.098*	−0.011	0.058*	0.180*	−0.060*	0.147*	0.089*	−0.041	0.950*	1	
(13) BGDIV × GPI	0.079*	0.998*	−0.050*	0.052*	0.116*	0.082*	−0.085*	0.071*	0.037	−0.065*	0.811*	0.901*	1

Note: The variables are as earlier defined and BGDIV × COC, BGDIV × GOVEFF, and BGDIV × GPI represent the interaction between board gender diversity and institutional factors (control of corruption, government effectiveness, and gender parity index). The asterisks (*) indicate statistical significance at a 95% confidence level ($p < 0.05$), meaning the correlation is unlikely to have occurred by chance.

TABLE 5 | Summary of GMM result.

Variable	Coefficient (1)	Coefficient (2)
BGDIV	0.466* (0.084)	0.917** (0.022)
FSIZE	−0.346 (0.271)	2.40E-14 (0.193)
ENVEX	1.000** (0.014)	1.000** (0.012)
ROA	−0.273 (0.335)	−0.494** (0.019)
ROE	−0.856 (0.687)	−0.016 (0.019)
ESG	0.808* (0.016)	0.317** (0.034)
TR	−0.237 (0.149)	−0.258** (0.081)
BSIZE	−0.219* (0.084)	0.029 (0.631)
BIND	−0.408** (0.008)	−0.510** (0.011)
BGDIV×COC		0.361* (0.638)
BGDIV×GOVEFF		0.117* (0.599)
BGDIV×GPI		0.944** (0.023)
Constant	3.503** (0.217)	1.124** (1.056)
Observations	1250	1250
J-statistic	318945.1	432768.3
F-statistic	95727.00 (0.0000)	27121.51 (0.0000)
AR(1)	−2.654 (0.008)	−3.360 (0.020)
AR(2)	−1.783696 (0.075)	−1.783696 (0.059)

Note: (1) provides the effects of firm-level factors on SI while (2) is the moderation effects of country-level institutional factors on SI. Values in parentheses are standard errors; **and * statistical significance at 1% ($p<0.01$) and 5% ($p<0.05$) respectively.

can influence the adoption of SI among EMNEs will depend on the institutional environment. Therefore, we examined the moderating effect of governance effectiveness, control of corruption, and gender parity on the relationship between board gender diversity and SI. Although previous studies have found a moderating effect of these variables on the relationship between female board representation and corporate innovation (Attah-Boakye et al. 2020) and coupled open innovation (Adams et al. 2023), we are not aware of any study examining this relationship on SI. Thus, we extend previous studies by testing the moderating effect of these country-level institutional factors on the relationship between board gender diversity and SI. The findings are presented in the subsequent sections.

5.2.1 | Governance Effectiveness Moderates the Positive Effect of Board Gender Diversity on SI

Considering the moderating effect of government effectiveness on the relationship between board gender diversity and SI, the estimate from our model 2 in Table 5 indicates that the interaction of board gender diversity and governance effectiveness significantly and positively ($\beta=0.117$, $\rho<0.05$) improves SI among EMNEs. This finding supports Hypothesis H2a and implies that good governance at the national level is a necessary condition for female board members to promote SI in EMNEs. This is consistent with Afrifa et al. (2020) who argued that effective governance at the national level results in a reduction in CO_2 emissions. This indicates that firms operating in environments with governance effectiveness pay more attention to environmental issues. Hence, women on boards in such contexts are more likely to promote SI activities. Therefore, to promote SI initiatives, emerging markets must embrace good governance. Indeed, Ngobo and Fouda (2012) argued that good governance reduces uncertainty and transaction costs, which results in favorable outcomes for firms. This indicates that good governance creates a conducive environment for firms to thrive. Our results have found support for this assertion by showing a positive moderation effect of governance effectiveness on the relationship between board gender diversity and SI. Overall, the result is consistent with Attah-Boakye et al. (2020), who found that governance effectiveness moderated the relationship between board gender diversity and corporate innovation. Similarly, this finding aligns with Adams et al. (2023), who reported a moderation effect of governance effectiveness on the relationship between female board representation and coupled open innovation in EMNEs. They argued that countries with strong institutions tend to have a higher GPI and are more inclined to appoint women to upper echelons. We extend these studies by showing evidence of how governance effectiveness moderates the positive effect of board gender diversity on SI based on a sample of 179 EMNEs from 19 countries.

5.2.2 | Control of Corruption Moderates the Positive Effect of Board Gender Diversity on SI

The result in model 2 (Table 5) indicates that the effect of board gender diversity on SI is significantly positively moderated by control of corruption ($\beta=0.361$, $\rho<0.05$). This finding supports Hypothesis H2b. The result corroborates the findings of Wahid (2019), as well as Capezio and Mavisakalyan (2016), which report that increased female board representation is associated with reduced corruption. Also, Cumming et al. (2015) suggest that board gender diversity reduces both the frequency and severity of securities fraud. Moreover, Lee et al. (2020) and Ellis et al. (2020) argue that corruption has a negative effect on corporate innovation. On the flipside, control of corruption has a positive effect on innovation, as our findings have shown. This implies that having more female board members not only results in reduced corruption but also improves SI initiatives.

Our finding is consistent with those of Adams et al. (2023) and Attah-Boakye et al. (2020), who found a moderation effect of control of corruption on the relationship between women on corporate boards and coupled open innovation and corporate innovation, respectively.

5.2.3 | Gender Parity Index Moderates the Positive Effect of Board Gender Diversity on SI

The result from the estimate of our model with the moderating effect of the gender parity index (GPI) on the relationship between board gender diversity and SI (see Table 5) reveals a positive and significant effect ($\beta = 0.944$, $\rho < 0.01$). This finding supports Hypothesis H2c. Our finding suggests that providing women with access to education and elevating them to upper echelons is necessary for SI in emerging economies. This is consistent with Adams et al. (2023), who found a moderation effect of GPI on the relationship between female board representation and coupled open innovation. We extend their work to SI in 179 EMNEs in 19 countries. Our finding also corroborates with Griffin et al. 2021, who observed that board gender diversity is more evident in environments characterized by narrower gender gaps and increased female labor market engagement. Similarly, Belaounia et al. (2020) argued that female board members exhibit greater effectiveness in nations characterized by gender equality. Thus, this finding indicates that emerging markets that seek to improve SI and achieve UN-SDGs must eliminate gender biases and give women the opportunity to contribute to decision making at the highest level.

5.3 | Test of Robustness

Aside from the cross-section fixed (first differences) effects used in the model to control for unobserved heterogeneity across the entities and the *J*-statistic of 318,945 (with a *p*-value of 0.0000) which suggests that the model's instruments used in GMM are valid, the Wald test (represented by the *F*-statistics) was carried out with the results indicating a joint significance of the regressors.

For more robustness, our models (with only firm-level factors and that with country-level interactive factors) were subjected to the Variance Inflation Factors (VIF) check, which measures the extent of multicollinearity, or correlation, among the independent variables in a regression model. Based on the rule of thumb that a VIF value above 10 suggests a high level of multicollinearity, which can cause problems in estimating the coefficients reliably, all our models performed well on this test, having no VIF value greater than 10.

Furthermore, the models were subjected to the widely used Arellano and Bond estimators—AR(1) and AR(2)—for dynamic panel data models to test for serial correlation. With the Arellano-Bond test for AR(1) typically not necessarily being problematic for the system 2-step GMM model, the emphasis is on AR(2). The result of this shows that our models are equally free from autocorrelation problems and, importantly, the absence of second-order serial correlation.

These model diagnostics indicate that the models are rightly specified and the models' estimators (specifically the Arellano-Bond

TABLE 6 | Quantile regression result.

Variables	10th Qt	20th Qt	30th Qt	40th Qt	50th Qt	60th Qt	70th Qt	80th Qt	90th Qt
BGDIV	0.062	0.358	0.194	1.213*	0.364	0.033	0.903***	0.403***	0.075***
	(0.401)	(0.358)	(5.58)	(0.120)	(0.251)	(0.484)	(0.221)	(0.084)	(0.317)
BIND	0.445*	0.250*	1.047	0.998*	0.952	0.104	1.104***	0.311***	0.043***
	(0.057)	(0.073)	(0.153)	(0.078)	(0.450)	(0.553)	(0.086)	(0.121)	(0.036)
BSIZE	−0.487	0.509	0.686	0.514	0.627	0.721	0.723***	0.733***	0.821***
	(0.188)	(0.115)	(0.619)	(0.344)	(0.188)	(0.155)	(0.759)	(0.619)	(0.458)
ENVEX	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***	1.000***
	(0.452)	(0.276)	(0.243)	(0.129)	(0.178)	(0.221)	(0.167)	(0.136)	(0.101)
ESG	0.272	0.102	1.702	0.826**	0.614	0.796	0.342	0.760	0.337
	(0.237)	(0.129)	(0.589)	(0.423)	(0.106)	(0.129)	(0.271)	(0.221)	(0.163)
TR	0.128	0.724	0.283	0.140	0.106	0.577	0.247	0.283	0.566
	(0.972)	(0.912)	(0.427)	(0.208)	(0.316)	(0.376)	(0.778)	(0.635)	(0.470)
ROE	−0.373	−0.111	−0.445	−0.362	0.712	0.208	0.000	0.416	−0.540
	(0.369)	(0.251)	(0.839)	(0.640)	(0.223)	(0.462)	(1.102)	(0.833)	(0.616)
FSIZE	0.209***	0.867	0.577**	0.477***	0.273	0.158	0.835	0.278	0.165
	(0.610)	(0.137)	(0.286)	(0.164)	(0.281)	(0.316)	(0.511)	(0.417)	(0.308)
ROA	−0.266	−0.736	−0.151	−0.436	−0.172	−0.453	−0.274	−0.146	−0.216
	(1.100)	(0.444)	(0.384)	(0.189)	(0.169)	(0.197)	(0.373)	(0.304)	(0.225)
C	−1.850**	−0.474	−2.883	−1.971**	−1.493	−1.350	−0.876	−1.946	−4.378
	(0.385)	(0.505)	(0.219)	(0.946)	(0.204)	(0.216)	(0.254)	(0.207)	(0.154)

Note: ***, **, and * are statistical significance at 1% ($p < 0.01$), 5% ($p < 0.05$), and 10% ($p < 0.1$) respectively.

ones) are consistent and reliable, thus with valid policy implications. Additionally, the quantile regression analysis (see Table 6) was employed to further examine the impact of our independent variables. The quantile process estimates a regression model at various quantiles, providing insights into how the relationship between the dependent variable and independent variables changes across different quantiles of the dependent variable.

From the result in Table 6, the coefficient of board gender diversity is statistically significant at the 0.7, 0.8, and 0.9 quantiles ($p < 0.05$), suggesting that board gender diversity has a stronger impact on SI in higher quantiles. Similarly, board independence is statistically significant at 10% at lower quantiles but more significant (at 1%) in higher quantiles (0.7, 0.8, and 0.9), indicating its increasing relevance in the upper quantiles of the distribution. The effect of board size also becomes significant at higher quantiles (0.7, 0.8, and 0.9), implying that size matters more in higher quantiles. Environmental expenditure is highly significant across all quantiles ($p = 0.0000$), indicating a consistent and strong effect on SI throughout the distribution. The ESG variable is only significant at the 0.4 quantile. Firm size is significant in lower quantiles (0.1, 0.3, 0.4) but not in others. Total revenue (TR), return on equity (ROE), and return on assets (ROA) show no significant relationship across the quantiles.

6 | Conclusions, Theoretical Contributions, and Managerial Implications

6.1 | Conclusions

This study aimed to examine the relationship between board gender diversity and SI, as well as to examine whether country-level institutional factors such as governance effectiveness, control of corruption, and gender parity index moderate this relationship. Based on a 10-year panel data of EMNEs from 19 countries, we conclude that board gender diversity positively contributes to SI. This is because women bring diverse experiences, ideas, and creativity to corporate boards which influence the adoption and implementation of SI initiatives in firms. Female board members are more concerned about the environment and therefore are more likely to make decisions that positively affect the environment, such as driving SI. Besides, women on boards are also more likely to consider the interests of diverse stakeholders in decision-making. Since SI involves multiple stakeholders who often have conflicting interests, female board members are more likely to promote SI. It is therefore evident that female board members of directors have the qualities that make them the ideal candidates to promote SI activities.

Nevertheless, given that firms operate in different institutional contexts which can have a profound influence on their behavior, the effectiveness of female board members of directors in driving SI is also influenced by the institutional environment. In particular, gender-diverse boards operating in institutional contexts characterized by government effectiveness, control of corruption, and a high gender parity index can have more influence on SI activities. Good governance creates a conducive atmosphere for gender-diverse boards to make decisions relating to SI by reducing uncertainty and transaction costs. Indeed, governance effectiveness results in better firm outcomes, including SI. At the same time, institutional contexts with control of corruption stimulate gender-diverse boards to positively influence SI. This is because female board members are less corrupt compared to their male counterparts, while corruption stifles innovation. This indicates that SI activities increase in environments with less corruption. Thus, control of corruption positively moderates the relationship between board gender diversity and SI. Moreover, gender-diverse boards influence SI when GPI is high. This suggests that as more women are given opportunities to acquire education and are promoted to upper echelons, the more they are able to influence SI initiatives in firms. To sum up, this study concludes that board gender diversity positively affects SI, and this relationship is amplified by institutional quality as represented by governance effectiveness, control of corruption, and the gender parity index.

6.2 | Theoretical Contributions

This study has made significant theoretical contributions that warrant highlighting. First, by examining the effect of board gender diversity on SI in EMNEs, we extend previous studies on the effect of board gender diversity on various forms of innovation (e.g., An et al. 2021; Adams et al. 2023; Attah-Boakye et al. 2020; Belaounia et al. 2020; Galia and Zenou 2012; Griffin et al. 2021; Nadeem et al. 2020; Torchia et al. 2011). We provide further evidence that board gender diversity positively enhances SI based on a 10-year panel data set of EMNEs in 19 countries. Our study is unique and adds to UET because previous studies on board gender diversity and SI have focused mostly on advanced countries to the neglect of emerging countries. Our focus on emerging countries is significant given that emerging markets operate under institutional contexts that differ from those of developed economies. Thus, this study provides unique insights into how board gender diversity serves as an important antecedent of SI in the context of emerging markets. Second, we examined the role of country-level institutional factors on the relationship between board gender diversity and SI in EMNEs. While previous studies have examined the effect of board gender diversity on SI (Nadeem et al. 2020), our study is the first to account for the role of the institutional context in this relationship. We extend the work of Attah-Boakye et al. (2020) and Adams et al. (2023) in their studies of corporate innovation and coupled open innovation, respectively. Our approach represents a significant contribution to theory as our study demonstrates that while board gender diversity contributes to SI, the relationship depends on institutional contexts that promote good governance, control of corruption, and gender parity index.

6.3 | Managerial Implications

The findings from this research have significant implications for managers, investors, and policy makers in emerging markets. The research has established a positive effect of board gender diversity on SI. This implies that firms that promote more women to upper echelons will reap the benefits of improved SI. Therefore, EMNEs seeking to improve their SI and reduce CO_2 emissions have to pay more attention to elevating more women to corporate boards. The findings from this study also imply that the legislation enacted in advanced countries to have more

women on corporate boards is necessary for emerging markets. Hence, policy makers in emerging markets will do well by enacting legislation to mandatorily include a certain percentage of women on corporate boards. However, while legislation to have more female representation on corporate boards is important, EMNEs should consider appointing female directors as a strategic imperative rather than solely for reasons of affirmative action. This is because our study has shown that women on corporate boards bring their diverse perspectives and creativity to influence SI, which is important for the competitiveness and long-term survival of firms.

Additionally, the findings from this research suggest that institutional quality amplifies the positive relationship between board gender diversity and SI. Based on this finding, emerging markets must strengthen their institutions to provide a conducive environment for firms to thrive, as this will lead to more attention to innovations that will reduce environmental burdens. The presence of strong and stable institutions will result in economic growth and facilitate the attainment of the UN-SDGs. This means focusing on providing good governance at the national level. Indeed, governance effectiveness cascades down to improved firm outcomes because it provides certainty and a reduction in transaction costs, which are necessary to stimulate SI in firms. More so, studies have shown that governance effectiveness and GPI move in the same direction. In contexts where good governance is provided, women have more opportunities, including appointments on corporate boards where they can influence SI decisions.

Furthermore, the finding that control of corruption moderates the positive effect of board gender diversity on SI has significant practical implications. First, corruption stifles innovation, while control of corruption accelerates innovation, and women on boards are found to be less corrupt. Therefore, EMNEs should focus on having more women on their corporate boards in order to reduce the probability of fraud. This will not only drive SI but will also create a positive image for EMNEs, which can attract investors, boost corporate performance, and enhance the long-term viability of the firm. Moreover, since GPI moderates the positive effect of board gender diversity on SI, there is a need for emerging markets to create more opportunities for women in education and provide a conducive environment for them to contribute their skills and experiences. This may mean moving away from gender prejudices that exist in many emerging markets and embracing the reality that women have a lot to offer to nation-building and sustainable development. In this sense, the human resources of EMNEs should recruit more women to top management teams (TMTs) to enable them to bring diverse perspectives and ideas to firm decisions. If more women occupy TMTs, the combination with female board members will further boost SI activities in EMNEs.

Finally, as EMNEs are part of global value chains, their carbon footprints are obviously high. Therefore, instead of being part of the global sustainability challenge, EMNEs can distinguish themselves by demonstrating that they can, indeed, be solutions to the problem. The latter can be achieved by investing heavily in SI activities. As our study has demonstrated, the key to achieving SI is by constituting gender-diverse boards that can champion such initiatives. We believe the recommendations provided in this paper, if implemented, will enable emerging markets to keep up with the target of achieving UN-SDGs by the year 2030.

7 | Limitations and Suggestions for Future Research

As with every piece of research, our study is not without limitations. Access to data has been identified as one of the challenges of conducting research in emerging economies (e.g., Adams et al. 2023), and our study is no exception. While we used the percentage of women on corporate boards as a proxy for board gender diversity, as done by previous researchers such as Adams et al. (2023) and Attah-Boakye et al. (2020), we could not obtain data on the actual number of women on corporate boards in each firm. Nor were we able to obtain data that distinguished executive board members from non-executive ones. However, we addressed this by dividing our data into quantiles and re-examining the effect of board gender diversity on SI, and this is consistent with the work of others who faced a similar situation (e.g., Adams et al. 2023).

Relatedly, while we conducted our study based on a 10-year panel data of EMNEs from 19 countries, we do not claim to study all EMNEs. Instead, our study was based on data availability as we obtained our firm-level data from the Thomson Eikon Refinitiv database. Therefore, there might be EMNEs from our identified emerging markets that do not feature in the database. Besides, we based our identification of emerging markets strictly on the IMF's designation of emerging markets. We understand that the definition of emerging markets is varied, and different classifications feature different countries. With this limitation in mind, we caution against the generalization of the findings from this research beyond our sample.

Finally, we examined only the effect of board gender diversity and neglected other aspects of board diversity, as well as aspects of board structure. This creates the opportunity for future researchers to extend our study by examining other aspects of demographic diversity, such as cultural and age diversity on SI. Moreover, future researchers can focus on the effect of board structure (board size, board compensation, frequency of board meetings, etc.) on SI. Lastly, there is room to extend this work to cover the effect of SI on firm outcomes in EMNEs.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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