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Linkage Corporate Governance to Sustainability Performance: The Mediating Role of Gender Equality in Emerging Economies

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Abstract

Purpose

The purpose of this study is to investigate the impact of corporate governance (CG) on sustainability performance (SP) as well as the mediating role of gender equality (GE) in emerging economies especially Pakistan. Pakistan's economy facing some problems such as unemployment, poverty, pollution, deforestation, and access to clean water related to Sustainable Development Goals (SDGs).

Design/Methodology/approach

Critical mass theory (CMT) and Social role theory (SRT) are used in this study. Secondary data was collected from the annual reports of 88 non-financial firms listed on the Pakistan Stock Exchange (PSX) between 2016 and 2022. SP was measured using the Global Reporting Initiative (GRI) standards, formulated by the United Nations' SDGs for 2030. The generalized method of moments (GMM) model is used to check the relationship between these variables. For

robustness, the Blau index method is used to calculate the GE.

Findings

The results show that GE fully mediates the link between CG and SP, with significant positive impacts revealed for board size (BS), board meeting frequency (BM), audit committee size (ACS), audit committee meeting frequency (ACM), and audit quality (AQ). Robustness tests confirm these findings, confirming the stability and reliability of GE's mediating role in increasing CG's influence on SP.

Originality/value

According to researchers' knowledge, this is the pioneer study that investigates the mediating role of GE between CG and SP. The study also used CMT and SRT which is most important for gender management (GM) and used the Shannon index to calculate GE on board.

Keywords: Gender Equality, Corporate Governance, Sustainable Development Goals, Sustainability Performance, United Nations

1. Introduction

SP emerged as an important concept for organizations seeking to balance economic, social, and environmental challenges in today's global economy (Kwarteng *et al.*, 2023^[28]; Mehboob & Zaidi, 2023; Anser *et al.*, 2024)^[6]. However, obtaining high SP is still difficult due to complex problems including resource limitations, legal pressures, and social responsibility requirements (Tjahjadi *et al.*, 2021; Naeem *et al.*, 2024)^[49, 33]. These are major problems in the SDGs, which seek to address global difficulties such as climate change, poverty, and inequality. CG plays a critical role in overcoming these challenges by advising businesses to efficiently implement sustainable practices (García Martín *et al.*, 2020)^[21]. CG frameworks can increase an organization's commitment to long-term outcomes by promoting transparent decision-making, advocating ethical behaviors, and prioritizing gender equality on boards. The relationship between them not only enhances SP but also speeds up organizations toward meeting more goals related to the 2030 Agenda of UN 2030.

Hussain *et al.* (2018)^[26] showed that CG structures have a major influence on SP, although developing countries often face inefficiencies in these structures, limiting their long-term development. Effective governance frameworks are critical for improving sustainable CG practices, as prominent firms' failures such as Steinhoff and Enron reveal (Windsor, 2024)^[55].

Although CG is acknowledged for its role in promoting sustainability, empirical evidence on its effectiveness in achieving SP goals remains scarce, underscoring the need to investigate how different governance structures affect SP outcomes (Hussain *et al.*, 2018)^[26]. Board committees (BC) are responsible for incorporating SP attributes into their regular reports, and board and audit committee (AC) members play essential roles in providing SP-related benefits to stakeholders (Maama *et al.*, 2021)^[29]. However, there are significant gaps between CG frameworks and SP goals, with previous studies focusing primarily on the relationship between CG and firm performance (FP) (Wahba, 2015; Pereira *et al.*, 2018)^[52, 36], while empirical research into specific CG components, such as BC, on SP aspects, remains limited. Gender diversity (GD) and equality in boardrooms act as mediators in the relationship between CG and SP, similar to the SDGs' Goal 5 goal. Despite advances in women's rights, actual GE remains unattainable (Tsalis *et al.*, 2020)^[50], and research highlights the importance of women in leadership roles, particularly in high-stakes decision-making contexts (Gümüşay *et al.*, 2020)^[24]. Diverse boards help to improve decision-making and CG by supporting effective monitoring and fostering strategic insights. GD promotes an inclusive environment that improves interactions among BC, AC, and SP aspects. Diverse boards are linked to improved risk management, financial reporting, and the incorporation of SP elements into business strategies, while stakeholder expectations for ethical standards emphasize the importance of board diversity.

This study is important for Pakistan, which is dealing with a slew of economic, social, and environmental issues that are limiting long-term progress. Pakistan's route to sustainability is impeded by continuing difficulties such as energy shortages, high unemployment rates, poverty, environmental degradation, and limited access to critical services (Chams & García-Blandón, 2019)^[13]. These issues have slowed economic growth while also exacerbating inequality and environmental stress, making achieving the SDGs more difficult. One of the most significant challenges is the country's reliance on inefficient energy systems, which has resulted in frequent blackouts, hindering productivity and negatively affecting industries (Asongu *et al.*, 2018)^[7]. Furthermore, environmental concerns such as deforestation and pollution continue to put a strain on Pakistan's natural resources, limiting efforts to promote sustainable practices. This study's emphasis on CG and its ability to generate SP suggests a possible way to tackle these difficulties and this study also aims to find ways for Pakistan's corporate sector to contribute significantly to sustainable development by analyzing how good governance structures, particularly those that promote GE on corporate boards, improve sustainable business practices (Juju *et al.*, 2020)^[27]. Strengthening CG with an emphasis on social and environmental responsibilities could help Pakistan address several of its issues, including boosting efficient energy use, lowering emissions, and increasing accountability in resource management. The findings of this study provide useful insights into how CG changes could empower firms to better align with SDG targets, resulting in a beneficial effect on the economy and society as a whole.

The contributions of this study are based on CMT and SRT. CMT and SRT suggest that the presence of women on the board can progress managerial performance and, as an

effect, impact managerial policymaking, particularly related to SP (Alhossini *et al.*, 2021)^[4]. One characteristic that is thought to develop BC efficacy is the presence of equal opportunities for all genders. This study proposes to advance our understanding of sustainability in several ways, taking into account the acknowledged limitations of earlier sustainability studies. Firstly, it contributes to knowledge by offering updated findings on CG and SP relationships. This study includes AC and SP relationships that haven't been thoroughly examined in other studies on sustainable practices. Secondly, the study looks into how GE is a mediator in the relationship between CG and SP. Thirdly, this study incorporates all three dimensions of SP, earlier studies investigate the relationship between CG and SP overall. Fourthly, the study aims to recover the generalizability of results by developing a complete SP measure based on GRI indications using a content analysis method. Fifthly, this study used CMT and SRT theories. These theories were ignored by earlier studies. Sixthly, the Shannon index and value index method are used to calculate the ratio of GE. Lastly, the GMM method is used in this study. This method is suitable for this study.

The remaining paper is organized as follows: Theoretical background is presented in section 2, while section 3 presents a literature review. Section 4 consists of the methodology. The empirical results are presented in section 5, and robustness is presented in section 6 while the conclusions are presented in section 7.

2. Theoretical Background

Different studies (Hussain *et al.*, 2018^[26]; Gradazi *et al.*, 2020) used different theories (Agency theory, stakeholder theory), but in this study, we used two theories CMT and SRT. These theories highlight the importance of GD in shaping CG structures that support SP and suggest that achieving critical mass and embracing diverse social roles can help organizations to effectively integrate sustainability into their strategic goal

2.1 Critical Mass Theory

CMT, which was developed in the context of social movements and group dynamics, proposes that the participation of minority members on the board is required and pivotal to launch meaningful impact and change (Pinheiro *et al.*, 2024)^[39]. CG commonly employs this concept to examine the impact of GD on boards, arguing that a minimum number of women on boards is required for them to have a meaningful influence on decision-making processes (Ahmad *et al.*, 2024)^[2]. When women reach this critical mass on boards, they can develop firms' goals toward more inclusive and sustainable practices, which correspond with stakeholder interests in environmental, social, and governance (ESG) criteria (Yadav & Prashar, 2023)^[56]. This threshold effect enables female board members to actively participate in decision-making, particularly on sustainability issues. Organizations with a significant number of female directors have more thorough sustainability strategies, exhibiting a commitment to long-term value creation and responsible corporate behavior (Smulowitz & Smulowitz, 2024)^[45].

CMT is essential in the context of SP because the inclusion of women on the board provides a diversified perspective that drives a focus on ethical, social, and environmental issues (Elaigwu *et al.*, 2024)^[15]. A board with at least three women has been demonstrated to be more inclined to

question established corporate practices and push for sustainable ones. This transformative influence is critical for SP because it helps firms conform to global sustainability standards and adapt to increased expectations of socially responsible behavior. As a result, CMT emphasizes the importance of significant female representation on boards, arguing that a critical mass can amplify women's influence, fostering a governance structure that prioritizes sustainability and positions companies to outperform on sustainability metrics.

2.2 Social Role Theory

SRT, which investigates how men and women are socialized into various roles and duties, offers useful insights regarding the relationship between GD on boards and SP. According to Qianhui (2023) [41], SRT asserts that women are frequently socialized to prioritize communal ideals like caring for others, long-term thinking, and well-being over immediate benefits. These ideals are consistent with sustainability concepts that prioritize environmental care, ethical corporate practices, and social responsibility. As a result, female board members naturally advocate for policies and tactics that prioritize the SDGs while also advancing long-term environmental and social goals. Research has found that companies with a larger proportion of women on their boards have more progressive environmental policies and frequently contribute viewpoints that support sustainability-focused efforts (Zaccone, 2023) [59].

SRT believes that increasing GD on boards enhances SP by offering perspectives that prioritize long-term business responsibility (Hawkins, 2023). Women in leadership positions may prioritize ethical decision-making, openness, and accountability, all of which are essential for sustainable practices. Furthermore, studies show that female directors frequently advocate for enhanced stakeholder engagement and community involvement, resulting in a deeper commitment to sustainability projects. Gender-diverse boards can help corporations fulfill their sustainability targets and improve their reputations by fostering a corporate culture that prioritizes social and environmental responsibility, resulting in more sustainable outcomes. SRT thus provides a theoretical foundation for explaining why female presence on boards may drive SP, as the communal and ethical perspective typically attributed to women is consistent with sustainability goals.

3. Hypotheses Development

3.1 Corporate Governance and Sustainability Performance

CG mechanisms, including BS, BM, and CEOD have been extensively researched for their potential impact on SP while ACS, ACMs, and AQ have less investigated relationship with SP. Effective governance structures are critical in promoting sustainable business practices because they provide oversight, and accountability, and align corporate actions with long-term environmental, social, and economic goals (Awalluddin *et al.*, 2024) [8]. The size of the board has frequently been linked to SP, with larger boards combining a greater range of knowledge and viewpoints, potentially contributing to more comprehensive sustainability activities (Aguilera *et al.*, 2021) [1]. Regular BMs are also connected to improved SP since frequent interaction allows directors to actively monitor progress toward sustainability targets and respond to new hazards.

However, results on the optimal board composition and meeting frequency have been varied, demanding additional research into these governance elements.

CEOD created controversy in the CG literature. Peterlin *et al.* (2015) [37] claim that CEOD improves decision-making efficiency by consolidating leadership, however, Farooq *et al.* (2023) argue that it undermines board independence and accountability, resulting in poorer SP. Studies based on SRT imply that dividing the roles can improve SP by creating a balanced governance structure that accommodates multiple opinions, enabling a more inclusive approach to decision-making (Bhat *et al.*, 2024) [10]. Furthermore, CMT proposes that a critical mass of gender-diverse board members may offset the possible dominance of CEOs in dual roles, resulting in more morally sound and sustainability-oriented initiatives. As a result, understanding how CEOs connect with sustainability objectives is a key focus in CG research.

The role of AC, its size, meetings, and AQ, has also arisen as a focus of attention in the context of SP, as these features are critical to maintaining transparency and accountability in corporate reporting. A properly sized committee is thought to provide effective supervision, whereas regular meetings allow committee members to handle any sustainability-related issues proactively. SP is strengthened further by ensuring that a company's sustainability statements and disclosures are accurate and reliable, hence increasing stakeholder trust. Despite these potential benefits, there has been little investigation into how AC traits affect SP, particularly when contrasted to more frequently studied CG dimensions like BS and CEOD. CMT findings suggest that AC with a critical number of female members could improve SP by prioritizing transparency and accountability. Furthermore, SRT suggests that gender-diverse ACs are more likely to advocate for ethical reporting and rigorous risk assessments, which are critical components of effective SP measures.

Despite these contributions, the literature still contains gaps. Most studies (Disli *et al.*, 2022; Githaiga & Kosgei, 2023; Naciti, 2019) [14, 23, 32] have concentrated on BS, BMs, and CEOD, ignoring the effects of ACS, meeting frequency, and AQ in impacting SP. Furthermore, the extant literature has mostly been done in wealthy nations (Qaderi *et al.*, 2022; Wang, 2017) [40, 53], with conflicting findings across regions, limiting their applicability to developing economies such as Pakistan. Few studies have explicitly examined CG via the lenses of CMT and SRT to investigate how AC features affect SP. Addressing these gaps would provide a more thorough understanding of how various governance methods affect SP while also contributing to the existing corpus of research on CG and sustainability. Based on the above arguments we formulated these hypotheses.

H1a: Board size has a significant impact on sustainability performance.

H1b: Board meetings have a significant impact on the performance of sustainability.

H1c: CEO duality affects sustainability performance.

H1d: Audit committee size has influences on the sustainability performance.

H1e: Audit committee meetings affect the sustainability performance.

H1f: Audit Quality affects the sustainability performance.

3.2 Corporate Governance and Gender Equality

CG mechanisms have been extensively researched for their impact on board dynamics and decision-making processes. BS has a considerable impact on GE; larger boards are more likely to have diverse members since there are more jobs available and a broader range of skills and viewpoints are required. Yao (2023)^[57] contends that when a critical mass of women serve on larger boards, the board culture can transition toward more collaborative and inclusive decision-making. This inclusion is related to increased attention to ethical practices, corporate social responsibility, and environmental projects, as women are often more aware of these concerns than men. Another crucial governance instrument is BMs, which enhance communication and strategic alignment by allowing female members' opinions to impact significant debates (Tilbury & Sealy, 2023)^[48]. CEO has sparked controversy in CG due to its impact on responsibility and supervision (Thompson & Alleyne, 2023)^[47]. CEO can reduce the board's independence, thereby suffocating different perspectives, especially those of female board members who are underrepresented or lack a supportive governance structure. However, SRT implies that women on boards approach this power structure differently, resulting in a more balanced power dynamic that promotes accountability and ethical governance (Thelma *et al.*, 2024)^[46]. This influence is consistent with sustainability aims, as female board members are more likely to emphasize social and environmental goals, validating SRT's view of women as advocates for communal values.

AC structures, such as committee size, meeting frequency, and AQ, all play an important role in increasing GE on boards. Larger Advisory Committees that meet regularly can provide additional possibilities for women to engage in and contribute to essential governance activities like as risk management, compliance, and ethics. El-Deeb and Mohamed (2024)^[16] have shown that gender-diverse ACs are more careful in overseeing financial reporting and internal controls, which improves overall audit quality and governance effectiveness. It is a pilot research focusing on CG factors and GE. Previous research focused on CG and other variables but was unable to address GE. This work intends to contribute to knowledge by using CMT and SRT to investigate how CG structures affect GE on Pakistani boards. Thus based on the above arguments we hypothesized it as follows.

H2a: Board size has a significant effect on gender equality.

H2b: Board meetings affect gender equality.

H2c: CEO duality has significant influences on gender equality.

H2d: Audit committee size has a significant effect on gender equality.

H2e: Audit committee meetings have a significant effect on gender equality.

H2f: Audit committee quality has a significant effect on gender equality.

3.3 Gender Equality and Sustainability Performance

GE on corporate boards has been increasingly connected to higher SP in a variety of businesses and geographies. According to research, gender-diverse boards are more likely to implement complete sustainability practices such as environmentally sensitive policies, transparent governance

structures, and stakeholder-focused strategies (Mazumder, 2024)^[31]. According to CMT, having a critical number of women in leadership roles increases their aggregate power, allowing them to effectively advocate for long-term projects that might otherwise be missed (Ely *et al.*, 2011)^[18]. When women reach this level on boards, they provide various perspectives that can help a company shift its focus from short-term financial benefits to long-term, socially responsible goals. Furthermore, studies have shown that boards with a critical mass of female directors are more accountable and prioritize ethical issues, both of which are important components of SP. SRT also sheds light on how gender equality influences SP, noting that women's community orientation frequently coincides with sustainability ideals (Marano *et al.*, 2022)^[30]. Women in leadership positions are more likely to emphasize ethical governance, transparency, and stakeholder involvement, all of which are essential for accomplishing sustainability goals. Gender-diverse boards are more likely to prioritize decisions that examine the long-term effects on society and the environment, as female directors usually offer principles founded on social responsibility and community welfare.

Despite these findings, there is a considerable research gap in understanding how GE on boards affects SP in emerging economies, where socioeconomic and cultural dynamics differ dramatically from those in Western countries. The purpose of this study is to pioneer an investigation into CRT and SRT inside Pakistani corporate boards, analyzing how GE affects SP in this particular socio-cultural and economic milieu. This model and connection study will provide useful insights into the function of CG in meeting sustainability goals in emerging markets, laying the groundwork for future research in comparable contexts. Based on all of this, we proposed the following hypothesis.

H3: Gender equality has impacts on sustainability performance.

3.4 Mediating Role of Gender Diversity

Research has increasingly emphasized GE in boards to improve the outcomes. Women in leadership positions have unique insights that help encourage a more holistic approach to sustainability. According to CMT, reaching a certain level of female representation on boards enables women to wield significant power, resulting in better ethical and sustainable decision-making (Brito *et al.*, 2024)^[12]. This is especially important in CG environments, where female directors, once in sufficient numbers, push for policies that address environmental and social issues, which are crucial components of sustainability. SRT strengthens the idea that women on boards can serve as go-betweens for CG and SP. Women are frequently socialized into communal roles that promote ethical considerations, community welfare, and environmental stewardship values, which are strongly related to sustainability concepts. As a result, female directors may push for corporate social responsibility policies, building a business culture that supports SP. Galbreath (2011) discovered that boards with a larger female representation pursue sustainability initiatives more rigorously. Ben-Amar *et al.* (2017)^[9] focused on developed nations and found that gender-diverse boards have a beneficial impact on SP. However, while this study emphasizes the relevance of GE in boardrooms, there is still a significant gap in knowing how this relationship works in

developing economies. This is the pioneer study conducted on the mediating role of GE between CG and SP in the context of Pakistan. Based on the preceding arguments, we proposed the following hypothesis.

H4: Gender equality mediates the relationship between governance mechanisms and sustainability performance.

3.5 Conceptual Framework

The conceptual framework of this which is proposed as the basis of literature is given below.

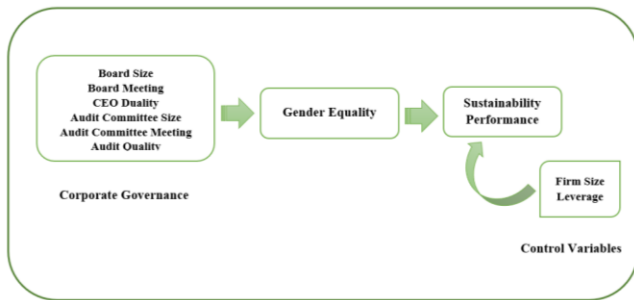


Fig I: Conceptual Framework

Section 4 covers research methods, which include population and sample size, variable measurement, model specification, and so on.

4. Methodology

4.1 Data

Secondary data is collected from annual reports of 88 non-financial firms listed at PSX from the study period from 2016 to 2022. SP is measured using GRI standards, and the study uses the GMM model to check the direct and indirect effects of CG on SP. Robustness tests are shown using alternative measures of GD, such as Blau indices.

4.2 Model Specification

The study used a GMM model. The system GMM estimator is an excellent statistical tool for dealing with heterogeneity, endogeneity, and estimate bias (Ullah *et al.*, 2018) [51]. To address these endogeneity issues, the system GMM technique includes internal instruments that are derived from the dependent variables' lagged values (Ullah *et al.*, 2018; Blundell & Bond, 2000) [51, 11]. Furthermore, the GMM model offers a method of minimizing excessive data losses. We used the system GMM model to check our models for endogeneity and reverse causality concerns.

To investigate the impact of CG on SP has been measured through the following model:

$$SP_{it} = \beta_0 + \beta_1 SP_{it-1} + \beta_2 BS_{it} + \beta_3 BM_{it} + \beta_4 CEOD_{it} + \beta_5 ACS_{it} + \beta_6 ACM_{it} + \beta_7 AQ_{it} + \beta_8 FS_{it} + \beta_9 Lev_{it} + \epsilon_{it} \quad (1)$$

To investigate the impact of CG on GE has been measured through the following model:

$$GE_{it} = \beta_0 + \beta_1 GE_{it-1} + \beta_2 BS_{it} + \beta_3 BM_{it} + \beta_4 CEOD_{it} + \beta_5 ACS_{it} + \beta_6 ACM_{it} + \beta_7 AQ_{it} + \beta_8 FS_{it} + \beta_9 Lev_{it} + \epsilon_{it} \quad (2)$$

To investigate the impact of GE on SP has been measured through the following model:

$$SP_{it} = \beta_0 + \beta_1 SP_{it-1} + \beta_2 GE_{it} + \beta_3 FS_{it} + \beta_4 Lev_{it} + \epsilon_{it} \quad (3)$$

The mediating role of GE between CG and SP has been measured through the following model:

$$SP_{it} = \beta_0 + \beta_1 SP_{it-1} + \beta_2 BS_{it} + \beta_3 BM_{it} + \beta_4 CEOD_{it} + \beta_5 ACS_{it} + \beta_6 ACM_{it} + \beta_7 AQ_{it} + \beta_8 GE_{it} + \beta_9 FS_{it} + \beta_{10} LEV_{it} + \epsilon_{it} \quad (4)$$

Where;

SP_{it} = Sustainability Performance of firm i at time t

SP_{it-1} = Lagged Sustainability Performance of firm i at time t

BS_{it} = Board Size of firm i at time t

BM_{it} = Board Meetings of firm i at time t

$CEOD_{it}$ = CEO Duality of firm i at time t

ACS_{it} = Audit committee size of firm i at time t

ACM_{it} = Audit committee meetings of firm i at time t

AQ_{it} = Audit quality of firm i at time t

GE_{it} = Gender Equality of firm i at time t

GE_{it-1} = Lagged Gender Equality of firm i at time t

FS_{it} = Size of firm i at time t

Lev_{it} = Leverage of firm i at time t

ϵ_{it} = error term.

4.3 Measurement of variables

The measurement of variables is given below in detail.

4.3.1 Measurement of Dependent Variable

We measure SP through content analysis of reports of GRI 39 dimensions (8 for economic, 17 for environmental, and 14 for social). Content analysis systematically reviews numerous reports (Elo *et al.*, 2014) [17] to see how firms implement and report on their sustainability projects. This research frequently focuses on major themes revealing an organization's commitment to sustainability. SP is measured in dummy form. If the indicator is mentioned then assign otherwise 0, after this, we created the index of these indicators by using this formula:

Index = No of items disclosed / Total item on an indicator

This measurement is aligned with Alam and Tariq (2023) [3], and Phan *et al.* (2020) [38].

4.3.2 Measurement of Independent Variables

BS is measured through the total number of directors on the board and BM through total meetings in a year while CEOD is measured through binary form if duality exists, assign 1 number; otherwise, assign 0 (Farooq & Ahmad, 2023; Farooq *et al.*, 2023; Naeem, 2023) [19, 20, 34]. ACS is measured through the total number of members of the committee, ACM is calculated through the total number of meetings of the committee in the year while AQ is measured through if the firm is audited by Big 4 audit firms then assign 1 otherwise 0 (Noor *et al.*, 2022) [35].

4.3.3 Measurement of Mediator

The mediator GE is measured through this formula. The Shannon index, a usually used diversity measure, accounts for both the number of women and men on the board and their relative proportions (Shannon, 2018) [44]. The formula for the Shannon index is: $H = -\sum_{i=1}^n p_i \ln(p_i)$

Where p_i is the proportion of board members of gender i .

4.3.4 Measurement of Control Variables

Some control variables have been added to the regression model to increase its quality. The model contained FS as a control variable, which was calculated as the natural logarithm of total assets. According to this viewpoint, businesses with higher log or assets are anticipated to

produce higher performance than lower assets firms. Finally, Lev is calculated by dividing the total debt by the total assets of the firm. The measurements of these control variables are consistent with (Farooq & Ahmad, 2023; Farooq *et al.*, 2023; Naeem, 2023; Ali *et al.*, 2022) [19, 20, 34, 5].

The data analysis, which includes descriptive analysis, correlation, and regression is presented in the section that follows as a conclusion to the findings.

5. Result

The results specify that BS, frequency of BMs, ACS, frequency of ACMs, and AQ significantly and positively affect SP. GE originated to mediate these relationships, supporting the importance of diverse boards in enhancing SP. Robustness tests, including alternative events of GD (Shannon and Blau indices), confirm the findings.

5.1 Descriptive result

Table I summarizes the statistics for the model's variables. The mean value of SP is 0.554 percent, with a minimum of 0.008 percent and a maximum of 0.991 percent. This suggests that the majority of the firms report on their SP. The average value of SP in this study is bigger than those reported by certain researchers in other developing countries (Kwarteng *et al.*, 2023) [28]. Concerning the independent variables, the mean of BS is approximately nine members of Pakistani non-financial firms. Similarly, the average BM held in one year is seven. The mean value of CEOD is .87. 0.58 is the mean value of ACS. The average value of ACM is .617. AQ's mean value is .75. FS and Lev's mean values are .516 and .459 respectively while GE's mean value is .459. It shows that in Pakistani firms 45% equality exists.

Table I: Descriptive Statistics

Variables	Obs.	Mean	St. Dev	Min	Max
SP	616	.5545	.2982	.0087	.9918
BS	616	.9142	.0646	.7781	1.0413
BM	615	.7198	.1431	.3010	1.0185
CEOD	616	.87	.336	0	1
ACS	616	.5587	.0971	.4771	.8450
ACM	616	.6171	.0403	.3010	.6989
AQ	616	.75	.431	0	1
FS	616	8.1820	1.37906	5.9855	10.9933
Lev	616	.5162	.2015	.0086	.9877
GE	616	.4597	.1979	-.0063	.7776

5.2 Correlation Statistics

The correlation analysis of the study's variables is shown in Table II, with the bulk of correlations being less than 0.30. Notably, the correlation between BS and SP is 0.36, which is above the 0.30 limit. However, it is important to note that this 0.36 correlation stays under the acceptable minimum correlation coefficient requirement of 0.7 suggested by (Schober *et al.*, 2018) [42]. This suggests that the variables do not have a significant multicollinearity issue.

Table II: Correlations Statistics

	SP	BS	BM	CEOD	ACS	ACM	AQ	FS	Lev	GE
SP	1									
BS	.360**	1								
BM	.101**	-.030	1							
CEOD	.035	.020	.016	1						
ACS	.252**	.345**	.039	.051	1					
ACM	.096**	.024	.026	.040	-.018	1				

AQ	.229**	.237**	.006	-.008	.075*	-.003	1			
FS	.103**	.012	-.019	.006	-.326**	-.079*	.197**	1		
Lev	.309**	.110**	.103**	.071*	-.003	.050	.044	.040	1	
GE	.140**	.019	-.013	.006	-.283**	-.088*	.177**	.974**	.053	1

** . Correlation is significant at the 0.01 level.

* . Correlation is significant at the 0.05 level.

5.3 Result

5.3.1 Corporate Governance and Performance of Sustainability

The regression results of this investigation are presented in Table III. Model 1 is based on the CG-SP link. Model 1 findings show that many kinds of CG elements, including BS, BMs, ACS, ACM, and AQ, have a positive and significant impact on SP. These findings indicate that strong governance processes contribute to better sustainability outcomes by improving supervision, accountability, and decision-making quality. CMT supports these findings by claiming that a sufficiently sized and diverse board more effectively achieves long-term organizational change. As a board reaches critical mass, particularly in terms of GD, it becomes better positioned to express various viewpoints and advocate for policies that address long-term social and environmental goals. Larger boards with more regular meetings enable board members to collectively advocate for sustainability, ensuring that the organization's strategic direction corresponds with broader stakeholder expectations and sustainability goals.

SRT emphasizes the importance of gender-inclusive and diverse boards in strengthening SP. It contends that women are more socialized into societal roles, and provides distinct viewpoints and beliefs that prioritize ethical responsibility and long-term welfare, which are strongly aligned with sustainability concepts. When boards are diverse and have a sufficient number of female directors, they are more likely to pursue sustainable practices, balancing shareholder objectives with social and environmental responsibilities. This outcome supports SRT's recommendation that women on boards struggle for stronger monitoring and ethical policies that benefit both stakeholders and the organization. These findings imply that varied governance structures not only improve financial responsibility but also build a corporate culture that values sustainability, emphasizing the critical role of CG aspects in furthering SP through inclusive and well-rounded board compositions. These findings are consistent with previous studies on BS-SP (Tjahjadi *et al.*, 2021) [41], BM-SP (Almaqtari *et al.*, 2023), ACS-SP (Zama *et al.*, 2021), ACM-SP (Hamidah & Arisukma, 2020; Arif *et al.*, 2020), and AQ-SP (Al-Shaer & Zaman, 2018). So the hypotheses H1a, H1b, H1d, H1e, and H1f are accepted.

Conversely, the results show a negative but insignificant association between CEOD and SP, indicating that the CEO's dual function has little impact on sustainability outcomes. This conclusion is consistent with (Hu & Loh 2018; Hamidah & Arisukma 2020). So, H1c is rejected. This finding suggests that CEOD diminishes board independence, lowering effective oversight of environmental issues. However, its insignificance shows that, while theoretically troubling, CEOD does not significantly harm sustainability efforts, possibly due to compensatory governance systems that reduce this concentration of power. Control variable leverage (Lev) has a negative effect, indicating that financial restrictions impede sustainability initiatives. This finding

suggests that leverage imposes financial limits on a company's ability to invest in sustainability projects. This negative impact emphasizes the difficulties faced by enterprises with significant leverage in combining short-term financial responsibilities with long-term sustainability goals, implying that financial stability is required for successful SP.

Table III: Regression results

Dependent Variables				
Variables	Model 1	Model 2	Model 3	Model 4
Lagged of Dependent	0.007** (0.015)	0.013*** (0.015)	0.009*** (0.016)	0.0914** (0.015)
BS	0.000*** (0.229)	-0.764 (0.003)		0.000*** (0.230)
BM	0.039* (0.072)	0.710 (0.003)		0.042* (0.070)
CEOD	-0.936 (0.003)	-0.802 (0.002)		-0.965 (0.001)
ACS	0.000*** (0.207)	0.000*** (0.041)		0.000*** (0.184)
ACM	0.006* (0.096)	-0.330 (0.009)		0.003*** (0.101)
AQ	0.001** (0.122)	-0.032* (0.021)		0.000*** (0.134)
GE			0.000*** (0.682)	0.000*** (0.563)
Constant	-0.000*** (1.816)	-0.000*** (0.716)	0.000*** (0.870)	-0.000*** (1.208)
FS	0.000*** (0.138)	0.000*** (0.990)	-0.001** (0.573)	-0.008* (0.420)
Lev	-0.000*** (0.264)	0.105 (0.015)	0.000*** (0.296)	0.000*** (0.256)
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes
Observations	616	616	616	616
Wald Chi2	56.44	617.87	668.24	462.11
Hansen's test	0.517	0.45	0.44	0.88
AR(1)	0.03	0.003	0.017	0.002
AR(2)	0.69	0.41	0.52	0.62
No. of companies	88	88	88	88
Note: The figures in parentheses are the standard errors.				
*** p<0.01, ** p<0.05, * p<0.1				

5.3.2 Corporate Governance and Gender Equality

The regression results in Table III Model 2 reveal a positive and significant impact of ACS, AQ, and FS on GE in CG. These findings suggest that larger, more active ACs and high-quality auditing processes foster an environment supportive of GD. CMT supports this result, as a well-structured AC is likely to advocate for diverse perspectives, including gender inclusivity, especially when the committee has reached a critical size. A larger ACS can promote GE by reducing groupthink and increasing diverse viewpoints, making it more likely for inclusive practices to be embedded into governance processes. SRT also aligns with these findings, positing that boards with effective audit mechanisms may better recognize the importance of including women, who bring communal, ethical perspectives that benefit governance and stakeholder relationships. This result is aligned with Herghiligiu *et al.* (2023)^[43].

In contrast, the study indicates that BS, BMs, CEOD, and ACM had insignificant impacts on GE, leading to the rejection of hypotheses H2a, H2b, H2c, and H2e. These findings suggest that just increasing the number of board

members, meeting frequency, or separating the CEO and chair responsibilities does not guarantee gender inclusion. It implies that structural factors such as BS and meeting frequency do not naturally encourage GE without targeted policies or cultural reforms within the boardroom. The insignificant effect of CEOD demonstrates that separating these responsibilities does not always boost female representation, possibly due to the survival of traditional leadership systems. This nuanced finding emphasizes that, while some governance variables improve GE, others require additional supportive activities to achieve significant inclusiveness on boards.

5.3.3 Gender Equality and Sustainability Performance

Table III model 3 contains the result of the effect of GE on SP. The regression results suggest a positive and significant association between GE and SP, whereas FS has a negative influence, and Lev has a positive effect on SP. These findings underscore GE's importance in advancing sustainability, lending support to CMT's claim that hitting a key threshold of female representation on boards can considerably influence corporate decision-making toward more sustainable outcomes. When GE is valued, firms are more likely to embrace different perspectives, hence strengthening their commitment to ethical and sustainable practices that comply with the SDGs 2030. Gender-equal boards are better positioned to handle environmental and social concerns, producing value for a larger variety of stakeholders and ensuring that sustainability considerations get integrated into corporate governance.

SRT also supports the positive impact of GE on SP, arguing that women, due to their societal roles that emphasize communal and ethical orientations, are more likely to advocate for sustainable practices that benefit both the organization and the stakeholders. This inclusive strategy assists organizations in addressing concerns such as environmental responsibility, social fairness, and ethical governance, which directly contribute to meeting SDG targets. On the other hand, the negative effect of FS shows that larger firms may struggle to successfully coordinate and implement sustainability programs, maybe due to bureaucratic constraints or competing objectives. The beneficial impact of leverage on SP suggests that enterprises with larger debt levels may pursue sustainability to boost stakeholder trust and reduce financial risks.

5.3.4 Mediating Role of Gender Equality between Corporate Governance and Sustainability Performance

The mediation result in Table III shows that GE completely mediates the association between CG elements (BS, BM, ACS, ACM, and AQ) and SP. The strong positive effects of these variables on SP when mediated by GE highlight the importance of GD in improving governance structures' impact on sustainability. This comprehensive mediation shows that GE plays an important role in turning the benefits of effective CG into concrete sustainability outcomes, hence magnifying the impact of CG practices on sustainable goals. Notably, FS has a negative significant influence on SP, which could indicate that larger enterprises confront more complicated sustainability difficulties or inefficiencies that even gender-diverse governance may struggle to entirely offset.

These findings are consistent with CMT, which holds that a sufficient proportion of women on boards is required to exert real influence and generate substantive change. In this context, GE enables a critical mass of female directors to

actively participate in corporate governance procedures that prioritize sustainability, such as improving board debates on environmental and social issues and advocating for responsible, long-term strategy. Through gaining critical mass, female directors can challenge traditional techniques, encourage inclusive practices, and support monitoring measures that match long-term goals. This emphasizes the significance of GE as a functional component in creating successful, sustainability-focused governance, rather than simply an ethical ideal.

SRT reinforces these findings by emphasizing the communal and ethical characteristics that women frequently bring to boards. According to SRT, women's attitudes toward caring, social welfare, and ethical decision-making complement CG practices that seek to balance profitability and sustainability. When women are well-represented, they advocate for SP initiatives that address broader stakeholder concerns, like as environmental impact and social responsibility, resulting in governance outcomes that benefit both the firm and its stakeholders. The full mediation impact of GE demonstrates that without a gender-inclusive perspective, CG practices lack the depth required for optimal SP. This finding implies that gender-diverse governance not only benefits SP directly, but also improves the performance of other governance mechanisms, making GE an important mediator in the CG-SP link.

6. Test and Result of Robustness

To confirm the robustness of our findings, we showed additional analyses using alternative measures of GD, exactly the Blau index. These indices deliver a more nuanced view of GD because of the distribution of gender on the board moderately than just the proportion of female directors.

The Blau index, another portion of diversity, ranges from 0 (no diversity) to 1 (maximum diversity). The formula for the Blau index is: $B=1-\sum^n i=1 pi^2$

Where pi is the proportion of board members of gender i .

Using the Blau index, our conclusions remain consistent. Higher values of the Blau index, indicating superior GD, are surely correlated with improved SP.

The robustness tests, using alternative measures of GD and a split-sample analysis, authorize the validity of our primary findings. GD, as measured by both the Shannon and Blau indices, consistently improves the optimistic impact of CG on SP.

Table IV: Robustness through Blau Index

Dependent Variables			
Variables	DV (SP)	DV(GE)	DV(SP)
Lagged of Dependent	0.003**	0.032***	0.005***
	(0.017)	(0.019)	(0.201)
BS		0.002**	0.000***
		(0.213)	(0.127)
BM		0.000**	0.000***
		(0.002)	(0.053)
CEO		-0.005*	-0.631
		(0.013)	(0.009)
ACS		0.000***	0.000***
		(0.039)	(0.132)
ACM		0.007*	0.005**
		(0.019)	(0.701)
AQ		0.023*	0.000***
		(0.019)	(0.214)
GE	0.001***		0.000***

	(0.151)		(0.473)
Constant	0.013*	-0.006*	0.000***
	(0.072)	(0.613)	(0.281)
FS	-0.006**	0.009***	0.000***
	(0.437)	(0.870)	(0.441)
Lev	-0.017**	0.132	-0.007*
	(0.173)	(0.012)	(0.172)
Industry dummy	Yes	Yes	Yes
Observations	616	616	616
Wald Chi2	49.32	67.21	71.60
Hansen's test	0.613	0.47	0.51
AR(1)	0.09	0.020	0.013
AR(2)	0.732	0.612	0.291
No. of companies	88	88	88
Note: The figures in parentheses are the standard errors.			
*** p<0.01, ** p<0.05, * p<0.1			

7. Conclusion, Implications and Recommendations

This study seeks to investigate the role of GE in mediating the relationship between CG and SP, by SDG 5's goals of promoting GE and empowering women. The study adds to the continuing discussion about how different governance systems might improve sustainable company practices by emphasizing the role of GE in corporate leadership. The findings show that CG elements like BS, BMs, ACS, ACMs, and AQ have a beneficial impact on SP when mediated by GE, emphasizing the importance of GD in allowing good governance that prioritizes sustainability. This full mediation highlights the importance of corporations implementing inclusive governance frameworks that incorporate women's perspectives, hence improving decision-making processes and establishing a culture of accountability for environmental and social responsibilities. Furthermore, the negative impact of FS on SP implies that larger firms may encounter particular problems when adopting sustainability programs, underlining the importance of tailored governance solutions. The study's findings not only contribute to theoretical understanding but also have practical implications for policymakers and practitioners seeking to improve business sustainability through gender-inclusive governance. This study advocates for the incorporation of gender considerations into CG practices by demonstrating that effective CG, when combined with GE, can lead to improved sustainability outcomes, contributing to broader efforts to achieve the SDGs and ensuring a more sustainable future for all. Finally, this study emphasizes GE's essential role as a sustainability driver in CG, providing significant insights for firms looking to align their operations with global sustainability goals.

The results of this investigation have significant theoretical, practical, and societal implications. Theoretically, the findings contribute to our understanding of how GE acts as a full mediator in the interaction between CG and SP, complementing CMT and SRT by revealing the significant impact of gender-inclusive governance on sustainability outcomes. Practically, these findings suggest that businesses should promote GD on boards to improve governance practices that support long-term sustainability, as a critical mass of female directors creates a broader and more ethically-oriented viewpoint in decision-making processes. Companies that employ rules that foster GD in leadership can increase monitoring, transparency, and stakeholder engagement, all of which benefit long-term growth. Socially, these findings highlight the broader societal benefit of gender-equal boards, which contribute to inclusive

corporate strategies that support environmental and social goals, aligning corporate practices with the global agenda for sustainable development and fostering positive community change.

This study has various limitations that should be recognized. First, the study is limited to Pakistani enterprises, which may limit the findings' applicability to other countries with distinct cultural, economic, or regulatory situations. Second, reliance on quantitative statistics may obscure complex qualitative insights about board members' motivations and experiences with GE and environmental initiatives. Furthermore, the study does not account for the potential impact of external factors such as industry type or market conditions on the CG-SP link, which could lead to differences in outcomes. Future research should include a larger sample from various nations and sectors to strengthen the conclusions. It is also encouraged to use mixed-method approaches that combine quantitative data and qualitative interviews to acquire a better understanding of how GE influences governance and sustainability efforts. Finally, more research into the exact processes by which GE mediates CG and SP is needed to help policymakers and practitioners improve sustainable practices through better governance frameworks.

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