Available online at www.ijournalse.org

Emerging Science Journal

(ISSN: 2610-9182)

Vol. 10, No. 1, February, 2026

Does Board Diversity Influence Green Revenue and Firm Value? Evidence From an Emerging Market

Laila Mohamed Alshawadfy Aladwey [1*]

[1] *Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh, Saudi Arabia.*

Abstract

This study investigates the effect of board diversity on green revenue among Saudi-listed firms. It places particular emphasis on the moderating role of shareholder value. To achieve this objective, the study constructs a composite board diversity index using principal component analysis (PCA). It employs random-effects panel regression models on firm-level data covering the period 2020–2024. Robustness is ensured through alternative model specifications and Generalized Method of Moments (GMM) estimations. The findings reveal that board diversity is positively associated with green revenue. In contrast, higher shareholder value, as measured by market valuation, is negatively associated with green revenue. Importantly, board diversity significantly mitigates this negative relationship. This indicates that diverse boards encourage stronger engagement in sustainable activities, even in highly valued firms. The study contributes to the literature by integrating board diversity, green revenue, and shareholder value within a single empirical framework in an emerging market context. The results offer novel evidence that board diversity serves as an effective governance mechanism for aligning sustainability objectives with value-driven corporate strategies. From both theoretical and policy perspectives, the findings support agency and resource-dependence theories. They highlight the importance of inclusive board structures in embedding sustainability into corporate decision-making.

Keywords:
Green Revenue;
Board Diversity;
Shareholder Value;
Corporate Governance;
Emerging Markets;
KSA.

Article History:

Received:	16	June	2025
Revised:	19	January	2026
Accepted:	25	January	2026
Published:	01	February	2026

1- Introduction

The Kingdom of Saudi Arabia (KSA) has undertaken wide-ranging economic and regulatory reforms under Vision 2030, with the dual objectives of diversifying its oil-dependent economy and embedding sustainability as a central pillar of national development [1, 2]. A core element of this transformation is strengthening corporate governance, particularly by promoting diversity in leadership positions. Historically, women have been underrepresented in Saudi corporate governance due to conservative social norms and institutional constraints [3]. However, recent reforms have significantly expanded women's participation in economic and political life, including initiatives to increase female representation on corporate boards [4, 5]. These reforms align closely with Vision 2030's explicit objective of increasing women's labour force participation and advancing inclusive growth.

To support female board participation, the Capital Market Authority (CMA), in collaboration with the Women Empowerment Agency, issued directives outlining nomination procedures and emphasizing the strategic value of board diversity [6, 7]. This effort was further reinforced in 2020 through a memorandum of understanding between the CMA and the Ministry of Human Resources and Social Development, which introduced targeted training programs, guidance materials, and awareness campaigns to enhance women's presence on the boards of listed firms [8]. Together, these initiatives reflect a broader institutional commitment to improving governance quality and decision-making through diversity.

* **CONTACT**: laladawi@imamu.edu.sa

DOI: http://dx.doi.org/10.28991/ESJ-2026-010-01-025

Despite these regulatory advances, cultural and institutional barriers continue to constrain women's effective participation in senior leadership roles. Prior research highlights the persistence of traditional gender norms and male-dominated business networks that limit women's influence in boardrooms, even where formal inclusion policies exist [7, 9]. As a result, improvements in legal frameworks have not fully translated into equitable board participation, underscoring the enduring impact of patriarchal structures within Saudi society [3, 10]. Consequently, achieving substantive gender parity at the board level remains an ongoing challenge.

Alongside governance reform, sustainability has become a strategic priority in KSA, as it is increasingly recognized as a driver of firm performance and long-term competitiveness [11]. In this context, green revenue captures the extent to which firms shift from carbon-intensive activities toward environmentally sustainable investments, offering a direct firm-level indicator of environmental performance beyond conventional CSR metrics [12]. Recognizing the Kingdom's status as one of the highest per capita greenhouse gas emitters globally, KSA has responded with ambitious initiatives—such as carbon-neutral city projects, renewable energy programs, and sustainability-oriented economic zones—to align corporate activity with the United Nations Sustainable Development Goals [2].

Despite these advances, prior studies have rarely examined how board diversity specifically influences green revenue, nor how shareholder value conditions this relationship in emerging markets such as KSA. Against this backdrop, this study examines whether board diversity enhances environmental performance, measured through green revenue, among non-financial firms listed in KSA. It further examines whether shareholder value moderates this relationship, thereby capturing the role of capital-market incentives in shaping sustainable corporate behavior. Methodologically, the study employs random-effects panel regression complemented by Generalized Method of Moments (GMM) estimation to address potential endogeneity. Using Refinitiv Eikon data for 322 non-financial firms listed on the Saudi Exchange (Tadawul) from 2020 to 2024, the final sample comprises 1,610 firm-year observations. Green revenue is measured as the proportion of total revenue derived from environmentally sustainable activities. Board diversity is captured through a composite index constructed using Principal Component Analysis (PCA), incorporating gender diversity, independence, affiliation, professional background, industry experience, and tenure. Tobin's Q is included as a moderating variable to proxy shareholder value.

The results show that board diversity is positively associated with firms' green revenue. Although higher market valuation (Tobin's Q) is negatively associated with green revenue, this effect is significantly weaker in firms with more diverse boards. These findings suggest that board diversity helps firms balance market pressures with sustainability objectives, highlighting its importance in emerging-market governance contexts. These results remain robust across alternative specifications and GMM estimations. From an agency theory (AG) view, diverse boards strengthen oversight, curb managerial self-interest, and encourage investments in environmentally responsible projects that benefit both shareholders and society. At the same time, resource dependence (RD) theory suggests that board diversity adds valuable expertise, perspectives, and external networks, improving strategic decisions related to green initiatives.

This study makes several contributions: First, it provides rare empirical evidence on the governance determinants of green revenue in the Middle East, particularly in KSA, a context that remains underexplored in sustainability research. Second, by incorporating shareholder value as a moderating factor, the study highlights the complementary roles of governance structures and market incentives in advancing sustainability. While prior research has largely focused on the financial consequences of green activities [13, 14] or the economic outcomes of board diversity [15, 16], this study offers new evidence on how shareholder value conditions the board diversity–green revenue relationship. Finally, the study advances theory by integrating agency, stakeholder, legitimacy, and RD perspectives to explain sustainability outcomes in an emerging market context.

The remainder of the paper is organized as follows. First, the paper presents the contextual background of the key variables. Second, it develops the theoretical framework, reviews the relevant literature, and formulates the hypotheses. Third, the data, variables, and research design are outlined. Fourth, the empirical results are reported and discussed. Fifth, robustness checks and endogeneity analyses are presented. Finally, the study concludes by summarizing the main findings and discussing their implications and directions for future research.

2- A Contextual Background of KSA

2-1- Board Diversity in KSA

KSA's economy has not only become more diverse but also increasingly inclusive, particularly in terms of women's participation. Since the launch of Vision 2030, the women's labor force participation rate has doubled, surpassing initial targets, and the proportion of women in upper- and middle-management positions has risen to 43.8% by early 2024*. These shifts reflect the broader reforms under Vision 2030, which have prioritized corporate governance enhancements, including the promotion of board diversity [3]. Firms are expected to operate in line with societal expectations [17].

* Please refer to http://www.vision2030.gov.sa/en/media/articles/saudi-arabia-s-new-economic-development-model.

Historically, the conservative and masculine nature of Saudi society limited women's participation in business leadership [18]. However, recent reforms have actively supported women's empowerment across social and economic spheres, including representation on corporate boards [4]. Consequently, board diversity in Saudi firms has increased in recent years, signaling recognition of its importance as a key component of corporate governance systems [19].

Despite these improvements, challenges remain. Cultural norms continue to constrain women's full participation in business leadership, limiting the effectiveness of diversity initiatives [20]. Even though regulations mandate female representation on boards of listed firms, entrenched values and societal beliefs can hinder organizations from fully leveraging board diversity as a governance mechanism [21].

2-2- Sustainability Practices in KSA

KSA's significant dependence on the energy sector suggests higher levels of gas emissions [22]. his situation has prompted market policymakers to strongly support environmentally friendly projects, comply with the UN's SDGs, and move towards a more sustainable economy [2, 23]. In doing so, they have launched their vision 2030, where they clearly promote sustainability practices by issuing programs such as zero carbon projects, renewable energy technologies, environmental preservation, and green cities like 'The Line' project [24-26]. However, as the case with supporting board diversity, this activity is also facing some difficulties related to cultural acceptance [27], which motivated us to study the determinants of green revenue, as an indication of sustainability performance, in this unique emerging context.

3- Literature Review and Hypothesis Development

3-1- Theoretical lens

The factors influencing green revenue can be explained through several theoretical perspectives, notably agency theory and resource-dependency theory. From the AG perspective, information asymmetry between owners and managers can exacerbate agency problems, as managers may prioritize their own interests over shareholders' interests [28-30]. To mitigate such issues, governance and monitoring mechanisms—such as board diversity—are essential to align managerial behavior with shareholder interests, prevent suboptimal investment decisions, and reduce moral hazard, including the risk of investing in high-carbon or environmentally harmful projects [31]. Effective governance thus supports long-term corporate performance and value [28].

The resource-dependency theory suggests that firms grow by effectively leveraging available resources, including those in the external environment [32]. Robust governance systems and boards provide critical advice and information, enhancing managerial decision-making, including decisions on green investments and products [33]. Such governance also strengthens corporate legitimacy and reputation by fostering stakeholder trust and signaling fair representation [34]. Diverse boards, particularly those with representatives from minority groups, bring higher levels of education, experience, and knowledge [32, 35, 36], which facilitate oversight and encourage environmentally sustainable corporate strategies [33].

3-2- Corporate Governance and Green Revenue

Recent research has addressed the positive economic, social, and environmental impacts of using green revenues [12], [37, 38]. However, there is concern that green revenues might be costlier and riskier than other sources of revenue. This is because investment in low-carbon projects, as a form of green investment, requires significant financial resources. Further green revenues might be associated with higher uncertainty, which could result in financial difficulties [39]. Moreover, there is a concern that green revenue might be used for greenwashing [12]. On the positive side, green revenue could yield promising outcomes for firms. This is based on the view that engaging in green activities can enhance corporate relationships with various stakeholders, thereby improving corporate image and legitimacy in the market [40]. In this regard, focusing on China, Huang et al. [41] noted that green strategies can enhance corporate green revenues.

These conflicting influences motivate us to address the determinants of green revenue. These conflicting influences motivate us to address the determinants of green revenue, especially those related to governance. Effective governance mechanisms, particularly board diversity, are seen as vital for engaging in green activities and disclosure [42]. According to stakeholder theory, such activities align corporate practices with stakeholder interests. Engaging in environmentally friendly activities also helps legitimise business practices, consistent with legitimacy theory [43].

A few recent studies have taken some steps in this regard by explaining the potential role of corporate governance concerning environmentally friendly activities (e.g., [44, 45]). For instance, Makpotche et al. [45] noted that effective governance can encourage green innovation. Using USA data, Shrivastava & Addas [46] found that governance disclosures can significantly affect environmental and ESG performance. Using USA data, Amore & Bennedsen [44] show that worse governed firms generate fewer green patents relative to all their innovations, which could result in environmental inefficiency. Hence, it is important to examine the effects of board characteristics, particularly board diversity, on green revenue to identify potential factors contributing to greater green activities and revenues, as explained below.

3-3- Hypotheses Development

3-3-1- Board Diversity and green revenue

Previous research indicates that effective boards, particularly those characterized by diversity, can enhance corporate ESG and sustainability performance [46]. Cultural diversity has been shown to improve work performance [47], while ethnic diversity fosters innovation, inclusion, and superior organizational outcomes [48]. Diverse boards, including representatives from female and minority groups, are likely to comprise members with advanced degrees and extensive [32, 36].

From an AG perspective, diverse boards can mitigate agency problems by enhancing monitoring and oversight of managerial actions, reducing the likelihood of suboptimal investments or environmentally harmful activities, and aligning managerial decisions with shareholder and societal interests [28, 29, 31]. Effective board diversity thus functions as a governance mechanism that strengthens accountability and supports long-term corporate sustainability outcomes.

Consistent with resource-dependency theory, board diversity also provides access to a wider range of knowledge, expertise, and external networks, thereby enhancing strategic decision-making and problem-solving within the firm [32, 36]. Diverse boards can facilitate the adoption of green policies, compliance with environmental standards, and the rejection of environmentally harmful practices, thereby improving corporate performance and green revenue.

Empirical evidence supports these theoretical arguments. As argued by Shrivastava & Addas [46], effective boards—achievable through diversity—are more likely to adopt green building initiatives, comply with Global Reporting Initiative standards, implement climate change policies, and demonstrate superior environmental performance. In emerging economies, Bose et al. [49] found that governance mechanisms, including board characteristics, enhance green disclosure in Bangladesh; Gerged et al. [50] observed that board structure affects environmental performance in Jordan. Also, Xia et al. [51] reported a U-shaped relationship between gender and age diversity on boards and green innovation in China. Taken together, these studies suggest that diverse boards, through their varied knowledge, experience, and governance oversight, can promote green policies, discourage environmentally harmful activities, and ultimately enhance green revenue [36]. Accordingly, and integrating insights from agency and resource-dependency theories, the first hypothesis (H1) is proposed:

***H_1**: Board diversity positively affects green revenue.*

3-3-2- Shareholder Value as a Moderator on the Board Diversity-Green Revenue Link

From the AG perspective, board diversity can mitigate agency problems by improving oversight and monitoring of managerial decisions [29, 31]. Effective and diverse boards can align managerial actions with shareholder interests, reducing the likelihood of suboptimal investments and moral hazard, including those related to environmentally harmful activities [28]. In this way, board diversity serves as a governance mechanism that not only enhances firm performance but also encourages strategic decisions, such as investments in green products and sustainable practices.

Consistent with resource-dependency theory, board diversity is considered an economically valuable policy that can enhance firm performance by leveraging critical knowledge, skills, and networks [52]. Corporate management is therefore motivated to promote diversity to achieve positive firm value [53]. Diverse and effective boards are expected to improve interactions across managerial levels, strengthen problem-solving capabilities, and enhance organizational flexibility [54]. Furthermore, promoting diversity often involves recruiting high-quality personnel to represent minority groups, thereby improving decision-making and overall firm performance. For example, Ellis & Keys [55] found that racial diversity in firms positively influenced shareholder value, highlighting the potential link between board diversity and firm economic outcomes.

Moreover, shareholder value may influence the effect of board diversity on green revenue. Empirical evidence suggests that green products can improve firm performance by reducing costs, increasing efficiency, and generating revenue through offerings that meet societal and stakeholder expectations [56, 57]. Conversely, firms engaging in environmentally harmful activities may face financial penalties from investors, negatively affecting firm value [58]. Studies have found that developing green products can enhance corporate performance across various contexts [38], [59-61], although some findings remain inconclusive [62].

Given these considerations, it is argued that the effect of board diversity on green revenue is sensitive to a firm's shareholder value, reflecting the combined influence of agency and resource-dependency mechanisms. Figure 2 summarizes such an alluded relationship; accordingly, the second hypothesis (H2) is postulated:

***H2: Shareholder** value moderates the relationship between board diversity and green revenue.*

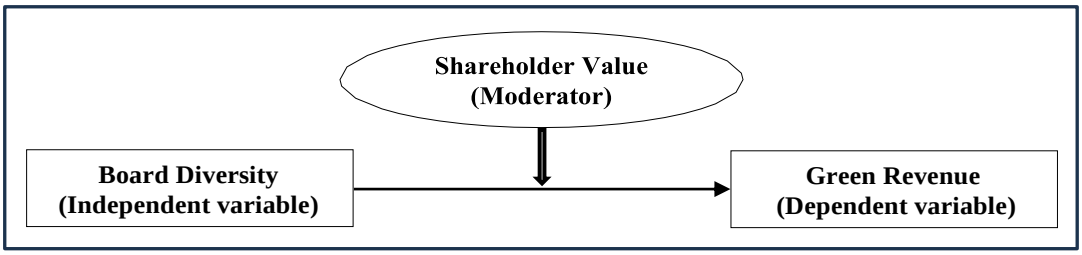

Figure 2. The moderating effect of Shareholder value on the relationship between Board Diversity and Green Revenue

4- Methodology

4-1- Sample Description and Data Collection

This study uses firm-level panel data from Refinitiv Eikon for 2020–2024. The sample period begins in 2020, coinciding with the implementation of KSA's National Transformation Program. This phase established strategic objectives to enhance women's empowerment, economic independence, and labor market integration, in line with Vision 2030*. The sample period ends in 2024, the latest year with consistent and reliable data.

The initial dataset comprised 1,890 firm-year observations across 378 listed companies on the Saudi Exchange (Tadawul). A systematic filtering process was applied to ensure the inclusion of complete data as follows. First, financial firms were excluded due to their distinct financial reporting standards and regulatory requirements [63]. Additionally, the financial sector in KSA is subject to unique ESG and AI adoption dynamics—such as the Sustainable Finance Framework introduced by the Saudi Central Bank (SAMA, 2021)—that are not generalizable to other sectors. This justifies the focus on non-financial firms when assessing governance-related impacts on green revenue performance, resulting in the removal of 52 firms and 260 observations Second, observations containing missing values for key variables or duplicate entries were eliminated, leading to the exclusion of an additional 4 firms and 20 observations. After applying these criteria, the final sample includes 322 non-financial companies and 1,610 firm-year observations. The sample selection process is summarized in Table 1.

Table 1. Sample selection process

Description	No. of companies	No. of Obs.
Initial Number of Observations	378	1890
Exclusion of Financial Companies	52	260
Exclusion of Missing or Duplicated Observations	4	20
The final sample	322	1610

The sample period is reasonably chosen to align with a pivotal phase in KSA's economic and environmental transition. Following the establishment of the Saudi Green Initiative and the broader commitments embedded in Vision 2030, the years from 2020 onward have witnessed a surge in green economy initiatives and ESG integration at the corporate level [64, 65]. As such, this period provides an appropriate empirical window to capture the evolving impact of board diversity on green revenue generation amid a shifting regulatory and sustainability landscape. Moreover, recent empirical research indicates that KSA's green economy is in an early yet transformative phase. Zhang et al. [66] show that environmental innovation and green energy adoption require institutional support and scientific capacity to yield substantial environmental benefits. These dynamics are particularly relevant when evaluating how board-level attributes may influence firms' strategic orientation toward sustainability goals. Diverse boards may foster broader perspectives, enhance stakeholder responsiveness, and promote long-term thinking, which are critical in driving organizational alignment with environmental priorities and national sustainable development frameworks [67, 68]. Therefore, examining how board diversity affects green revenue generation in Saudi firms offers valuable insights into the governance mechanisms that may accelerate or hinder the effectiveness of the Kingdom's green transition under Vision 2030.

4-2- Variables' Definition and Model Specification

Table 2 demonstrates the operational measures utilized for the main variables in this study First, the dependent variable, Green Revenue Percentage (Green_Rev), is extracted from Refinitiv Eikon and measures the share of a firm's total revenue that comes from products and services classified as environmentally sustainable [69, 70]. Refinitiv applies a standardized taxonomy aligned with widely recognized environmental objectives†—such as climate change mitigation, energy efficiency, renewable energy, pollution prevention, and resource efficiency—to categorize green revenues based on firms' disclosed information [69]. This approach allows for consistent comparison across firms. Firms with higher green revenue percentages are often perceived as more proactive in addressing climate-related risks and contributing to long-term sustainability objectives [71].

* Please refer to https://www.vision2030.gov.sa/media/nhyo0lix/ntp_eng_opt.pdf

† Please refer to https://developers.lseg.com/en/api-catalog/refinitiv-data-platform/refinitiv-data-platform-apis accessed at 24 December 2025.

Second, to capture the multidimensional nature of board diversity among Saudi-listed firms, a composite Board Diversity Index (BDI) is constructed using Principal Component Analysis (PCA). PCA was selected for its effectiveness in reducing dimensionality and identifying latent constructs that summarize the shared variance among interrelated indicators [72]. Consistent with prior corporate governance research [73-75], six board attributes were included in the index: gender (female representation), independence, affiliations (corporate connections), professional background and skills, industry experience, and tenure. These dimensions collectively capture both demographic and cognitive diversity, which prior studies associate with stronger board effectiveness, higher monitoring quality, and a stronger sustainability orientation [67, 68].

The PCA results are presented in Table A1 in Appendix I*. The first principal component (Comp1), which captures the most shared information from the original attributes, has the largest eigenvalue—meaning it accounts for the most variation. It explains 45% of the total variance among the six board attributes, substantially more than the other components, which individually account for 4–18% of variance. The scree plot (Figure A1), a graph of eigenvalues versus component numbers, shows a clear "elbow" at the first component, supporting the retention of a single component. Accordingly, Comp1 was used as the Board Diversity Index, capturing the main dimension of board diversity while ensuring interpretability.

The choice of PCA is further supported by its established use in corporate governance research. For instance, Anderson et al. [73] constructed a director heterogeneity index using multiple board-level attributes to examine firm complexity, while Bernile et al. [74] demonstrated that PCA-based diversity indices outperform individual indicators in predicting firm risk. In the Saudi governance context, where institutional norms may limit observable variation in gender diversity alone [3], PCA is particularly useful. It assigns greater weight to dimensions with greater variation, such as tenure, affiliations, and professional expertise, thereby yielding a robust, contextually grounded composite measure of board diversity.

The PCA was performed in Stata 17 using standard procedures for component extraction. The resulting BDI was derived from the first principal component, which was retained as the index because it accounted for the largest proportion of shared variance among the six selected board diversity measures. The index was used in its original scale to preserve the data's full variance structure without rescaling. This approach maintains the interpretive richness of PCA weights and aligns with previous literature using unnormalized diversity scores (e.g., [74, 73]). The data-driven weighting approach reduced subjectivity in equal-weighted indices and improved construct validity [76]. Additionally, PCA reduced multicollinearity, contributing to model parsimony when the index was used as an explanatory variable in regression analysis [77].

Third, the study employs Tobin's Q as a moderating variable to represent shareholder value. Consistent with Kyaw et al. [78], which is computed as the sum of the market value of equity and total liabilities, less the book value of equity, divided by the firm's total assets. Here, the market value of equity refers to the total value of the company's shares at current market prices, total liabilities are the company's outstanding debts and obligations, and the book value of equity is the net asset value of the company as reported in its financial statements. Tobin's Q serves as a proxy for a firm's market-based financial performance and is widely adopted in corporate governance research It is a forward-looking, market-oriented metric that captures investors' perceptions of a firm's governance practices, environmental initiatives, and long-term strategic potential [79, 78]. A Tobin's Q value exceeding one suggests that investors anticipate strong future growth. Conversely, a value below one indicates limited growth expectations and possibly weak market confidence [81]. This measure is particularly relevant in the Saudi and broader GCC context, where listed firms are increasingly evaluated based on market perceptions of their environmental and governance practices [3].

Table 2. Definition of Variables

Variables	Definition and Measurement	Key References
Dependent Variable; Green Revenue percentage (Green_Rev)	It is obtained and defined from Refinitiv Eikon as the percentage of revenue generated from environmentally sustainable (green) products/services to total revenue generated.	[70, 82]
Independent Variable; Board Diversity Index (BDI)	Composite index derived from PCA of board attributes (specifically; gender, skills, background, independence, affiliation).	[67, 75, 83]
Moderating Variable; Shareholder Value (Tobin_Q)	It is calculated as the sum of the market value of equity and total liabilities, minus the book value of equity, divided by the firm's total assets.	[79]
Control Variable		
Firm Size (FS)	It is computed as the natural logarithm of total assets reported at year end.	[83]
Profitability (ROA)	It is calculated by deflating the total profit before tax by total assets reported at year end.	[84]
Leverage (LEV)	It is long term debt divided by total assets reported at year-end.	[85]
Outstanding shares (SHARES)	It denotes as the number of shares outstanding as reported by Refinitiv Eikon.	[86]
Industry effect (INDU)	Industry dummy variable was incorporated into the mode for each industry sector.	[87]
Board Size (BS)	It is computed as the natural logarithms of number of board members.	[3]
CEO Duality (Dual)	It is a dummy variable that equals to one if CEO is also board chair, and zero otherwise.	[83, 88]

* Appendix I provides the full component loadings and variance explained for all components to enhance transparency and replicability.

Two categories of control variables are employed in this study. The first comprises firm-specific characteristics. Firm size (FS) is measured as the natural logarithm of total assets at the end of the fiscal year. According to Naciti [83], larger firms tend to attract greater public scrutiny and possess more resources, which can lead to more advanced and transparent sustainability initiatives. Profitability is proxied by return on assets (ROA), computed as profit before tax divided by total assets. Yavuz et al. [84] reported a positive association between ROA and sustainability performance. Similarly, Leyva-de la Hiz [89] argued that profitable firms have more slack resources available to invest in environmental and social initiatives. Leverage (LEV) is calculated as long-term debt divided by total assets at year-end [85]. The literature provides mixed evidence on the relationship between leverage and sustainability. While no significant association was reported, Lee & Koh [85] found a significant positive relationship, suggesting that firms with higher financial risk may use ESG initiatives to reduce perceived financial risk. In addition, following [86], the number of shares outstanding (SHARES) reported by Refinitiv Eikon is used. This variable captures the firm's equity base. Firms with a higher number of outstanding shares may face greater scrutiny from a broader shareholder base, potentially driving stronger sustainability practices [3]. To account for unobserved heterogeneity across sectors, industry dummy variables were incorporated into the model [87].

The second category of controls captures board-level attributes. Board size (BS) is measured as the natural logarithm of the number of board members. Using evidence from KSA, Aladwey & Alsudays [3] found a positive relationship between BS and sustainability performance, suggesting that larger boards may enhance governance oversight and strategic diversity in sustainability decisions. CEO duality (DUAL) is a binary variable equal to 1 if the CEO also serves as the board chair and 0 otherwise. While Naciti [83] suggested that CEOs in dual roles may promote stronger sustainability engagement, Jackson [88] found that CEO duality is associated with weaker environmental performance, possibly due to reduced board independence and oversight.

This study investigates how BDI influences Saudi companies' Green_Rev and whether this relationship is contingent on the shareholders' value, proxied by Tobin_Q. As argued by Hayes & Rockwood [90], moderation analysis allows researchers to determine whether the effect of an independent variable on a dependent variable varies across levels of a third variable—the moderator. Accordingly, the study adopts a moderated regression framework to explore whether the moderating variable, Tobin_Q, alters the strength or direction of the relationship between BDI (independent variable) and companies' Green_Rev (dependent variable). The analysis proceeds in two stages:

First, Baseline Model A assesses the direct effect of BDI on Green_Rev as follows:

$$Green\_Rev_{it}=\beta_0 + \beta_1 BDI_{it}+ \beta_2 FS_{it} + \beta_3 ROA_{it}+ \beta_4 LEV_{it} + \beta_5 SHARES_{it} + \beta_6 BS_{it} + \beta_7 DUAL_{it} + FIRM \text{ and } YEAR \text{ Fixed effect} + \varepsilon_{it} \quad ---$$

Baseline Model A(Direct effect).

Second, to test for moderation effects by including Tobin_Q and an interaction term (BDI × Tobin_Q) to estimate the Moderation Model B as follows:

$$Green\_Rev_{it}=\beta_0 + \beta_1 BDI_{it}+ \beta_2 Tobin\_Q_{it}+ \beta_3 BDI_{it}*Tobin\_Q_{it} + \beta_4 FS_{it} + \beta_5 ROA_{it} + \beta_6 LEV_{it} + \beta_7 SHARES_{it} + \beta_8 BS_{it} + \beta_9 DUAL_{it} + FIRM \text{ and } YEAR \text{ Fixed effect} + \varepsilon_{it} \quad ---$$

Moderation Model B (Moderating effect).

5- Discussion

5-1- Descriptive Analysis

Table 3 presents the descriptive statistics for the variables employed in this study, based on a balanced panel of 1,610 firm-year observations from Saudi-listed firms over the 2020–2024 period. Panel A summarizes the key continuous variables. In line with Aladwey et al. [19], all continuous variables were winsorized at the 1st and 99th percentiles to mitigate the influence of extreme values and ensure robust results. The dependent variable, Green_Rev, exhibits a mean of 2.55% and a standard deviation of 7.00%. The values range from 0% to 92%, highlighting substantial variability across firms. While many Saudi firms report no or minimal green revenue, a subset demonstrates significant commitment to sustainable practices. The primary independent variable, BDI, is designed to capture the multidimensional characteristics of board diversity. It ranges from –0.716 to 13.239, indicating notable differences in board structures across companies. The moderating variable, Tobin's Q, ranges from 3.32 to 50.10, indicating substantial variability in firm valuation across the sample of Saudi-listed companies during the sample period.

Table 3. Descriptive Statistics and Industry Distribution of Green Revenue Observations in Saudi Listed Firms

Panel A: Summary statistics for continuous variables used in the analysis					
Continuous variables					
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Green_Rev	1610	2.55	7	0	92
BDI	1610	0.020	1.98	-0.716	13.24
Tobin_Q	1610	11.7	18.2	3. 32	50.10
FS	1610	20.57	1.88	15.7	28.54
ROA	1610	.059	.309	-11.56	.92
LEV	1610	.242	.184	0	2.28
SHARES	1610	17.82	1.71	13.88	26.21
BS	1610	8.24	2.39	1.79	10.07

Relating to control variables, FS shows a relatively normal distribution, with a mean of 20.56 and a standard deviation of 1.88. The average ROA is 5.9%, suggesting that both loss-making and highly profitable firms are included in the sample. LEV has a mean of 24.2%, with values ranging from 0 to 2.28, indicating that some firms operate with minimal debt while others are highly leveraged. The SHARES range from 13.88 to 26.21. This suggests moderate variation in shareholder structures among Saudi firms. BS averages 8.24 members, with values ranging from approximately 1.79 to 10.07, indicating variability in board composition across firms. Figure 1 illustrates the distribution of green revenue observations across ICB industry classifications in KSA. The Industrials sector accounts for the largest share of observations, followed by Consumer Discretionary and Consumer Staples, while Energy and Utilities exhibit the lowest representation.

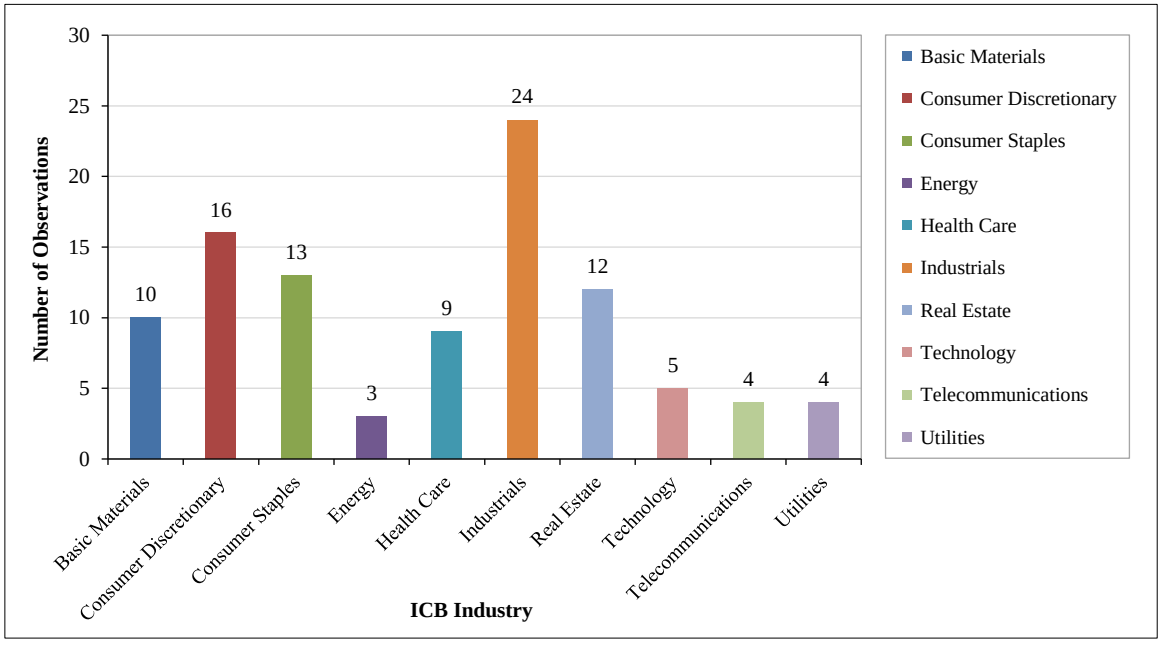

Figure 1. Distribution of green revenue percentage across ICB Industries in KSA

5-2- Pearson Correlation Matrix and Multicollinearity Diagnostics

Table 4 presents the bivariate correlation coefficients among the continuous variables (Panel A) and their corresponding multicollinearity diagnostics (Panel B). As argued by Kim (2019), correlation coefficients below 0.80 among regressors generally indicate the absence of multicollinearity, a standard upheld across all variable pairs in the data. Furthermore, all calculated variance inflation factors (VIFs) are below the conservative threshold of 10, and the corresponding tolerance values (1/VIF) exceed 0.2 [91]. This supports the statistical independence of the predictors in the regression analysis and alleviates concerns about biased estimates arising from multicollinearity.

Table 4. Pearson correlation and multicollinearity statistics

	Panel A. Pearson Correlation								Panel B. Multicollinearity Diagnosis	
Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**VIF**	**1/VIF**
(1) Green_Rev	1								1.27	0.79
(2) BDI	-0.078*	1							2.25	0.45
	-0.002									
(3) Tobin_Q	0.002	-0.022	1						1.03	0.97
	-0.931	-0.38								
(4) FS	-0.014	0.584*	-0.075*	1					3.53	0.28
	-0.574	0	-0.003							
(5) ROA	-0.022	0.015	-0.047	-0.031	1				1.16	0.87
	-0.385	-0.558	-0.059	-0.215						
(6) LEV	0.055*	0.057*	-0.044	0.279*	-0.355*	1			1.29	0.77
	-0.027	-0.021	-0.074	0	0					
(7) SHARES	-0.046	0.495*	0.028	0.791*	-0.017	0.134*	1		2.82	0.35
	-0.064	0	-0.26	0	-0.508	0				
(8) BS	0.085*	-0.918*	0.029	-0.548*	-0.017	-0.047	-0.441*	1	1.53	0.66
	-0.001	0	-0.242	0	-0.503	-0.06	0			

*** p<0.01, ** p<0.05, * p<0.1

5-3- Results

Table 5 shows the regression results for the baseline model A (direct effect) and the moderation model B (moderating effect). To identify the appropriate regression model, the Hausman specification test was used to guide selection between fixed- and random-effects models. The test yielded p-values of 0.335 and 0.547 for Models A and B, respectively, indicating that the null hypothesis of no systematic difference between the fixed- and random-effects estimators cannot be rejected. This outcome suggests that the random effects model is preferable for both models.

Table 5. Regression Results for the Effect of Board Diversity on Green Revenue: Direct and Moderating Role of Shareholder Value

Variables	**Baseline Model A (Direct effect)**			**Moderation Model B (Moderating effect)**		
	Coef.	**p-value**	**Standardized Coef.**	**Coef.**	**p-value**	**Standardized Coef.**
BDI	0.239***	0.000	0.067***	0.237***	0.000	0.067***
Tobin_Q				-0.128**	0.029	-0.033**
Interaction= BDI* Tobin_Q				0.461**	0.021	0.034**
FS	-0.28***	0.000	-0.075***	-0.277***	0.000	-0.074***
ROA	0.045	0.49	0.028	0.045	0.483	0.002
LEV	0.203	0.512	0.019	0.197	0.524	0.005
SHARES	0.418***	0.000	0.102***	0.416***	0.000	0.101***
IDUS	0.223*	0.088	0.11*	0.229*	0.091	0.12*
BS	0.335***	0.000	.114***	0.333***	0.000	0.113***
DUAL	0.689**	0.017	0.013**	0.689**	0.017	2.39
Constant	-1.96**	0.011	-2.15**	-1.975***	0.01	-2.71***
Number of Obs		1610			1610	
Firm and year effect		Controlled			Controlled	
Hausman test P-value		0.335			0.547	
R-squared within		0.159			0.159	

*** p<0.01, ** p<0.05, * p<0.1

5-3-1- Model Fit and Diagnostics

Table 5 presents the coefficients, p-values, and standardized coefficients for the utilized variables. The analysis is based on a firm-level panel dataset comprising 1,610 observations, with firm and year effects controlled. Both models report an R-squared of 0.159, indicating that the explanatory variables account for approximately 15.9% of the within-firm variation in green revenue. This level of explanatory power is typical in firm-level panel studies on sustainability

and corporate governance, where green revenue is influenced by numerous unobserved firm-specific, industry-, regulatory-, and macroeconomic factors that cannot be fully captured by regression models. The inclusion of firm- and year-fixed effects strengthens the validity of the estimates by controlling for unobserved heterogeneity. Overall, the findings provide robust evidence that board diversity positively affects green revenue performance and that this relationship is amplified by higher shareholder value, in line with RD theory [35, 36]. These results suggest that improvements in corporate environmental outcomes among Saudi listed firms depend on both internal governance mechanisms [92] and external market perceptions [38, 60, 61].

5-3-2- The Direct Effects Model

Table 5 (Model A) examines the direct association between the board diversity index (BDI) and firm green revenue. The results indicate a positive, statistically significant relationship ($\beta = 0.239$, $p < 0.01$), suggesting that greater board diversity is associated with higher green revenue. The standardized coefficient for BDI ($\beta = 0.067$, $p < 0.01$) indicates that a one standard deviation increase in board diversity is associated with a 0.067 standard deviation increase in green revenue. Although modest in magnitude, this effect is comparable to, or even larger than, several governance-related controls, highlighting the relative importance of board diversity in explaining variations in green revenue [93].

This finding supports the view that effective corporate governance boosts environmentally friendly activities, such as green project investments and green revenue generation [44, 46], 94]. From an AG perspective, this relationship is especially relevant in Saudi Arabia, where ownership concentration, family involvement, and state participation persist. In these settings, diverse, professional boards can monitor managers, strengthen oversight, limit opportunism, and ensure environmental investments align with shareholder value and national sustainability goals under Vision 2030 [29, 31]. The findings also align with RD theory. In Saudi Arabia, with evolving regulations and greater international scrutiny, board diversity improves access to resources, expertise, and legitimacy. Boards that include women and members with multi-board experience can offer new perspectives, best practices, and sustainability strategies, encouraging acceptance of green initiatives [35, 36]. These governance mechanisms are key in Saudi Arabia, where cultural norms and ongoing transitions make board legitimacy and stakeholder engagement more valuable. Green activities support green revenue and improve firm ties with regulators, investors, and society, in line with stakeholder and legitimacy theories [50, 51].

With respect to the control variables, Firm Size (FS) has a negative, highly significant relationship with green revenue ($\beta = -0.280$, $p < 0.001$), indicating that larger firms tend to generate a smaller share of green revenue. This may be due to structural rigidities, slower adoption of green innovations, or legacy assets that limit flexibility. Sectoral concentration in some large firms could also play a role. Although this result may seem counterintuitive, it is consistent with prior research showing that firm size can influence the speed of adoption of sustainability practices [95, 96]. In contrast, Shareholding concentration and Board Size both display positive and statistically significant effects ($\beta = 0.418$ and $\beta = 0.335$, respectively; $p < 0.001$), indicating that concentrated ownership structures and larger boards may promote sustainability-oriented investments [97]. Chairperson Independence is also positive and significant at the 5% level ($\beta = 0.689$, $p = 0.017$), implying that independent board leadership contributes to the advancement of green initiatives [98]. Finally, Return on Assets (ROA) and Leverage (LEV) are statistically insignificant, suggesting no robust direct relationship between firm profitability or financial leverage and green revenue in the baseline model.

5-3-3- The Moderating Effects Model

Table 5 (Model B) examines the moderating role of shareholder value in the relationship between board diversity and green revenue. The results show that Tobin's Q is negatively and statistically significantly associated with green revenue ($p < 0.05$), indicating that firms with higher market valuation tend to generate lower levels of green revenue. This finding is consistent with the argument that market pressures may discourage sustainability-oriented investments when they are perceived as less immediately value-enhancing. It also aligns with prior evidence documenting a negative association between shareholder value and board diversity [99, 100], and between shareholder value and environmentally oriented outcomes, including green revenue [62].

Importantly, the interaction term between the board diversity index (BDI) and Tobin's Q is positive and statistically significant ($p < 0.05$), providing strong support for the moderating hypothesis (H2). This result indicates that board diversity weakens the negative association between shareholder value and green revenue, suggesting that more diverse boards can better balance market valuation pressures with sustainability objectives. In other words, while higher market valuation may constrain green revenue generation, this constraint is significantly reduced in firms with more diverse boards.

The standardized coefficients further clarify the relative importance of these effects. The standardized coefficient for Tobin's Q is modest ($\beta = -0.033$) but statistically significant. This means Tobin's Q has a limited but meaningful direct effect. The standardized coefficient for the interaction term is positive and of similar size ($\beta = 0.034$). This reinforces that board diversity's moderating role is economically meaningful, not just a statistical artifact. Together, these findings show that board diversity is directly associated with green revenue and shapes how firms respond to shareholder value.

From a theoretical perspective, these results are consistent with agency theory (AG), which posits that diverse boards enhance monitoring effectiveness, leading to managerial decisions that are more environmentally responsible. This alignment ensures managerial behavior benefits both shareholder and societal interests [29, 31]. The results also align with resource-dependence theory, which posits that diverse boards provide firms with access to valuable knowledge, external networks, and strategic resources—factors that support the implementation of green initiatives, especially in firms with higher market valuation [32, 35, 36]. Both theories underscore that market perceptions can shape how firms engage in sustainable practices such as green investments and revenue generation [38, 55, 59].

Finally, the negative association between Tobin's Q and green revenue contrasts with that observed in other settings. For example, Chen & Ma [101] reports that green investments enhance financial performance among Chinese energy firms. This contrast underscores the influence of institutional and market-specific conditions on sustainability. In Saudi Arabia, family ownership, state participation, and evolving regulations under Vision 2030 shape the market. Here, market valuation may exert stronger disciplinary pressure on firms. A higher Tobin's Q could reflect increased investor scrutiny and short-term performance expectations. This may discourage discretionary green investments unless they align with strategic or regulatory priorities. In this setting, board diversity is critical in mitigating pressures and supporting sustainability strategies.

6- Robustness and Endogeneity Analysis

To further validate the reliability of the main regression results presented in Table 5, an additional robustness check was conducted by replacing Tobin's Q with an alternative proxy for shareholder value, following the approach of Aladwey et al. [19]. Consistent with the empirical frameworks of [102, 103], Earnings per Share (EPS) was employed as an alternative moderating variable. EPS, sourced from Refinitiv Eikon, represents the portion of firm earnings attributable to each outstanding share and is widely recognized as a practical measure of shareholder value, with higher values indicating greater profitability and enhanced returns to equity holders [102]. As reported in Table 6, the results of Model C closely align with those of the moderation Model B in Table 5 in terms of both coefficient direction and statistical significance. This consistency confirms the robustness and generalizability of the findings and indicates that the moderating effect of shareholder value on the relationship between board diversity and green revenue is not sensitive to the choice of proxy variable.

Table 6. The alternative measure of moderator variable, EPS

Variables	Baseline Model A (Direct effect)		Moderation Model C (Moderating effect)	
Green_Rev	Coef.	p-value	Coef.	p-value
BDI	0.239***	0.000	0.28***	0.000
EPS			-0.096***	0.000
Interaction_2=BDI*EPS			0.036***	0.000
FS	-.28***	0.000	-0.249***	0.001
ROA	0.045	0.49	0.057	0.375
LEV	0.203	0.512	0.261	0.400
SHARES	0.418***	0.000	0.393***	0.000
INDU	0.223*	0.088	0.211*	0.098
BS	0.335***	0.000	0.321***	0.000
DUAL	0.689**	0.017	0.515*	0.050
Constant	-1.956**	0.011	-1.987***	0.007
No., of Obs.		1610		1610
Firm and year effect		Controlled		Controlled
Hausman test P-value		0.335		0.347
R-squared within		0.159		0.185

*** p<0.01, ** p<0.05, * p<0.1

To address potential endogeneity, we used a two-step system Generalized Method of Moments (GMM) estimator for dynamic panel data. The GMM method is more flexible than traditional approaches because it relaxes strict exogeneity assumptions for instrumental variables [104]. The lagged values of the dependent variable (L.Green_Rev) is utilized as internal instruments to correct for simultaneity bias and address omitted-variable bias common in firm-level panel data.

To avoid overfitting due to too many instruments, we used the instrument-collapsing technique. Table 7 presents diagnostic tests supporting the validity and robustness of the GMM results. The Arellano–Bond AR(1) test indicates no first-order serial correlation in the differenced residuals ($p = 0.373$), while the AR(2) test shows no second-order autocorrelation ($p = 0.810$). Both the Sargan test ($p = 0.103$) and the Hansen J test ($p = 0.200$) confirm instrument validity. The Difference-in-Hansen test also supports the validity of instrument subsets ($p = 0.130$). The GMM estimates in Table 7 are consistent with the main findings from Table 5. The lagged dependent variable (L.Green_Rev) remains highly significant ($p < 0.001$), showing strong persistence in firms' green revenue behavior. The interaction between the Board Diversity Index (BDI) and Tobin's Q is positive and weakly significant ($p = 0.090$), suggesting that shareholder value moderates the relationship between board diversity and environmental performance.

Table 7. GMM Results for Green Revenue Determinants

Variable	Coefficient	p-Value	95% Confidence Interval
L. Green_Rev	0.929***	0.000	[0.894, 0.964]
L.BDI	0.129*	0.056	[0.142, 0.260]
L.Tobin_Q	0.265*	0.065	[0.024, 0.399]
L.Interaction =L.BDI*L.Tobin_Q	0.118*	0.090	[0.049, 0.214]
FS	0.066	0.448	[0.042, 0.149]
ROA	0.034	0.566	[-0.082, 0.149]
LEV	0.092	0.609	[-0.261, 0.445]
SHARES	0.175**	0.034	[0.099, 0.249]
BS	0.165*	0.078	[0.014, 0.189]
DUAL	0.231*	0.064	[-0.113, 0.475]
Constant	-0.231*	0.090	[1.203, 0.740]
Panel B.GMM Model Diagnostics			
Diagnostic Test	Statistic	p-Value	
Arellano-Bond AR(1)	z = -0.89	0.373	
Arellano-Bond AR(2)	z = -0.24	0.810	
Sargan Test (Overidentification)	$\chi^2(16) = 23.41$	0.103	
Hansen J Test (Robust)	$\chi^2(16) = 51.44$	0.200	
Difference-in-Hansen (GMM levels)	$\chi^2(8) = 39.33$	0.130	

*** p<0.01, ** p<0.05, * p<0.1

7- Conclusion

The study examined the potential relationship between board diversity and green revenue, drawing on evidence from the Saudi emerging market. In addition, the study investigated the moderating impact of shareholder value on this relationship. The finding reveals that board diversity is positively associated with firms' green revenue and plays a crucial moderating role in the relationship between shareholder value and sustainability outcomes. While higher market valuation is associated with lower green revenue generation, this negative effect is significantly attenuated in firms with more diverse boards. Overall, the findings suggest that board diversity enhances firms' capacity to pursue green revenue strategies even in the presence of strong shareholder value considerations, highlighting its importance as a governance mechanism in supporting sustainable business practices.

The findings provide useful insights for practise. For investors, the results suggest that board diversity—especially when accompanied by stronger market valuation—can act as an additional indicator of a firm's commitment to sustainable strategies. From a regulatory perspective, the findings provide supportive evidence for policies that promote diverse and independent boards. From a broader societal perspective, the study points to the potential of corporate governance to advance environmental sustainability goals. The findings also provide several important theoretical contributions. From the agency perspective, diverse boards can effectively monitor managers, reduce agency problems, and guide managerial decisions toward environmentally responsible investments, thereby aligning managerial behaviour with shareholder and societal interests. Resource-dependency theory further explains this relationship by emphasising that diverse boards bring critical knowledge, expertise, and external networks that enhance strategic decision-making, particularly regarding green initiatives. Several limitations provide opportunities for future research. First, although robust panel and GMM techniques are employed, future studies could further examine the alluded relationship between board diversity and green revenue by applying alternative identification strategies, such as instrumental variables or quasi-experimental designs, to more fully address endogeneity concerns. Second, given that environmental exposure and sustainability priorities vary substantially across sectors, future research could examine whether the impact of board diversity on green revenue differs between environmentally intensive and less intensive industries. Third, this study focuses on a single emerging-market context. Extending the analysis to other Gulf Cooperation Council (GCC) countries or to a broader set of developing economies would help assess the generalizability of the findings.

8- Declarations

8-1- Data Availability Statement

Data was obtained from [Thomson Reuters Eikon] and are available from https://apac1-apps.platform.refinitiv.com/web/apps/screenerapp with the permission of [Thomson Reuters Eikon].

8-2- Funding

This work was supported and funded by the Deanship of Scientific Research at Imam Mohammad Ibn Saud Islamic University (IMSIU) (grant number IMSIU-DDRSP2602).

8-3- Institutional Review Board Statement

Not applicable.

8-4- Informed Consent Statement

Not applicable.

8-5- Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the author.

9- References

[1] Moshashai, D., Leber, A. M., & Savage, J. D. (2020). Saudi Arabia plans for its economic future: Vision 2030, the National Transformation Plan and Saudi fiscal reform. British Journal of Middle Eastern Studies, 47(3), 381–401. doi:10.1080/13530194.2018.1500269.

[2] Allui, A., & Pinto, L. (2022). Non-Financial Benefits of Corporate Social Responsibility to Saudi Companies. Sustainability (Switzerland), 14(6), 3446. doi:10.3390/su14063446.

[3] Aladwey, L. M. A., & Alsudays, R. A. (2023). Does the Cultural Dimension Influence the Relationship between Firm Value and Board Gender Diversity in Saudi Arabia, Mediated by ESG Scoring? Journal of Risk and Financial Management, 16(12), 512. doi:10.3390/jrfm16120512.

[4] Alhokail, L. (2025). The inclusion of women in the labour market: Saudi Arabia's leap from 21.2 % to 35.5 % and beyond. World Journal of Women and Sustainable Development, 1(1), 15. doi:10.47556/j.wjwsd.1.1.2025.3.

[5] Parveen, N., Chowdhury, S., & Goel, S. (2022). Environmental impacts of the widespread use of chlorine-based disinfectants during the COVID-19 pandemic. Environmental Science and Pollution Research, 29(57), 85742–85760. doi:10.1007/s11356-021-18316-2.

[6] Al Naim, A., & Alomair, A. (2025). The role of female representation in enhancing audit quality: Insights from Saudi Arabia's emerging market. Humanities and Social Sciences Communications, 12(1), 1–16. doi:10.1057/s41599-025-05032-2.

[7] Alquraini, S. K. (2022). Women's access to corporate board positions: the perception of women on boards in the Kingdom of Saudi Arabia. PhD Thesis, Macquarie University, Sydney, Australia.

[8] Babiker, I., Bakhit, M., Bilal, A. O. A., Abubakr, A. A. M., & Abdelraheem, A. A. E. (2025). The Effect of Female Representation on Boards on Environmental, Social, and Governance Disclosure: Empirical Evidence from Saudi Highly Polluting Industries. Sustainability (Switzerland), 17(6), 2751. doi:10.3390/su17062751.

[9] Aldossari, H. M. (2023). Exploring interrelationships of COVID-19 dimensions in Saudi Arabia: a systematic review. Bulletin of the National Research Centre, 47(1), 73. doi:10.1186/s42269-023-01041-w.

[10] Al-Asfour, A., Tlaiss, H. A., Khan, S. A., & Rajasekar, J. (2017). Saudi women's work challenges and barriers to career advancement. Career Development International, 22(2), 184–199. doi:10.1108/CDI-11-2016-0200.

[11] Hanaysha, J. R., Saleh, I., Hussain, S., Lee, K. L., & Bakar, Z. A. (2021). Determinants of firm performance in automotive industry: Empirical Insights from Malaysia. International Journal of Service Science, Management, Engineering, and Technology, 12(4), 132–148. doi:10.4018/IJSSMET.2021070108.

[12] Guo, C., & Zhong, R. (2025). Is green revenue vanity or sanity? Evidence from corporate cash holdings. International Review of Financial Analysis, 101, 104018. doi:10.1016/j.irfa.2025.104018.

[13] Miroshnychenko, I., Barontini, R., & Testa, F. (2017). Green practices and financial performance: A global outlook. Journal of Cleaner Production, 147, 340–351. doi:10.1016/j.jclepro.2017.01.058.

[14] Aguilera-Caracuel, J., & Ortiz-de-Mandojana, N. (2013). Green Innovation and Financial Performance: An Institutional Approach. Organization and Environment, 26(4), 365–385. doi:10.1177/1086026613507931.

[15] Hosny, K., & Elgharbawy, A. (2022). Board diversity and financial performance: empirical evidence from the United Kingdom. Accounting Research Journal, 35(4), 561–580. doi:10.1108/ARJ-02-2020-0037.

[16] Molina-Azorín, J. F., Claver-Cortés, E., López-Gamero, M. D., & Tarí, J. J. (2009). Green management and financial performance: A literature review. Management Decision, 47(7), 1080–1100. doi:10.1108/00251740910978313.

[17] Asdiou, A., & Mokhtari, B. (2019). The indicators of the corporate social responsibility: A search for efficiency or a concern for legitimacy towards stakeholders? A proposed explanatory model. International Journal of Service Science, Management, Engineering, and Technology, 10(1), 62–76. doi:10.4018/IJSSMET.2019010105.

[18] Pillai, R., & Al-Malkawi, H. A. N. (2018). On the relationship between corporate governance and firm performance: Evidence from GCC countries. Research in International Business and Finance, 44, 394–410. doi:10.1016/j.ribaf.2017.07.110.

[19] Aladwey, L., Elsayed, M. F. M., & Diab, A. (2025). Breaking Barriers: Gender Diversity, ESG, and Corporate Misconduct in the GCC Region. Risks, 13(5), 97. doi:10.3390/risks13050097.

[20] Elhabib, M. A. A. (2024). Corporate governance and capital market development in the GCC: a comparative literature review. Journal of Capital Markets Studies, 8(2), 255–274. doi:10.1108/JCMS-06-2024-0027.

[21] Goldani, M., & Tirvan, S. A. (2024). Economic Diversification and Social Progress in the GCC Countries: A Study on the Transition from Oil-Dependency to Knowledge-Based Economies. Nov, 04. doi:10.48550/arXiv.2410.21505.

[22] Khondaker, A. N., Rahman, S. M., Malik, K., Hossain, N., Abdur Razzak, S., & Khan, R. A. (2015). Dynamics of energy sector and GHG emissions in Saudi Arabia. Climate Policy, 15(4), 517–541. doi:10.1080/14693062.2014.937387.

[23] Al-Tamimi, N. (2017). A state-of-the-art review of the sustainability and energy efficiency of buildings in Saudi Arabia. Energy Efficiency, 10(5), 1129–1141. doi:10.1007/s12053-017-9507-6.

[24] Alshuwaikhat, H. M., & Mohammed, I. (2017). Sustainability matters in national development visions-Evidence from Saudi Arabia's vision for 2030. Sustainability (Switzerland), 9(3), 408. doi:10.3390/su9030408.

[25] Wasiq, M., Kamal, M., & Ali, N. (2023). Factors Influencing Green Innovation Adoption and Its Impact on the Sustainability Performance of Small- and Medium-Sized Enterprises in Saudi Arabia. Sustainability (Switzerland), 15(3), 2447. doi:10.3390/su15032447.

[26] Aladwey, L. (2026). Artificial intelligence and unethical financial practices: Examining the mediating role of environmental; social; and governance (ESG) performance in the Saudi financial sector. Borsa Istanbul Review, 100784. doi:10.1016/j.bir.2026.100784.

[27] Grand, S. and Wolff, K. (2020) Assessing Saudi Vision 2030: A 2020 Review. Atlantic Council, Washington D.C., United States.

[28] Chemmanur, T. J., & Tian, X. (2018). Do Antitakeover Provisions Spur Corporate Innovation? A Regression Discontinuity Analysis. Journal of Financial and Quantitative Analysis, 53(3), 1163–1194. doi:10.1017/S0022109018000029.

[29] Jensen, M. C., & Meckling, W. H. (1979). Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure. Economics Social Institutions, 163–231. doi:10.1007/978-94-009-9257-3_8.

[30] Koch, C., & Schmidt, C. (2010). Disclosing conflicts of interest - Do experience and reputation matter? Accounting, Organizations and Society, 35(1), 95–107. doi:10.1016/j.aos.2009.05.001.

[31] Atanassov, J. (2013). Do Hostile Takeovers Stifle Innovation? Evidence from Antitakeover Legislation and Corporate Patenting. Journal of Finance, 68(3), 1097–1131. doi:10.1111/jofi.12019.

[32] Hillman, A. J., Withers, M. C., & Collins, B. J. (2009). Resource dependence theory: A review. Journal of Management, 35(6), 1404–1427. doi:10.1177/0149206309343469.

[33] Ziolo, M., Filipiak, B. Z., Bak, I., & Cheba, K. (2019). How to design more sustainable financial systems: The roles of environmental, social, and governance factors in the decision-making process. Sustainability (Switzerland), 11(20), 5604. doi:10.3390/su11205604.

[34] Minichilli, A., Zattoni, A., & Zona, F. (2009). Making boards effective: An empirical examination of board task performance. British Journal of Management, 20(1), 55–74. doi:10.1111/j.1467-8551.2008.00591.x.

[35] Singh, V. (2007). Ethnic diversity on top corporate boards: A resource dependency perspective. International Journal of Human Resource Management, 18(12), 2128–2146. doi:10.1080/09585190701695275.

[36] Cumming, D., & Leung, T. Y. (2021). Board diversity and corporate innovation: Regional demographics and industry context. Corporate Governance: An International Review, 29(3), 277–296. doi:10.1111/corg.12365.

[37] Bassen, A., Fieberg, C., Kordsachia, O., Lopatta, K., & Nendza, B. (2023). Index construction for sustainable development investing. Journal of Sustainable Finance and Investment, 13(1), 702–722. doi:10.1080/20430795.2022.2105790.

[38] Kruse, T., Mohnen, M., Pope, P., & Sato, M. (2020). Green Revenues, Profitability and Market Valuation: Evidence from a Global Firm Level Dataset. Grantham Research Institute on Climate Change and the Environment, 5709(3), 1–69.

[39] Akindayomi, A., & Amin, M. R. (2022). Does business strategy affect dividend payout policies? Journal of Business Research, 151, 531–550. doi:10.1016/j.jbusres.2022.07.028.

[40] Bhattacharya, C. B., Korschun, D., & Sen, S. (2009). Strengthening stakeholder-company relationships through mutually beneficial corporate social responsibility initiatives. Journal of Business Ethics, 85(SUPPL. 2), 257–272. doi:10.1007/s10551-008-9730-3.

[41] Huang, Z., Cao, J., & Pan, L. (2024). Greening your way to profits: Green strategies and green revenues. Finance Research Letters, 61, 105029. doi:10.1016/j.frl.2024.105029.

[42] Cheng, W. (2023). The green investment principles: from a nodal governance perspective. International Environmental Agreements: Politics, Law and Economics, 23(3), 373–393. doi:10.1007/s10784-023-09595-w.

[43] Scott, W. R. (2015). Institutions and Organizations - Ideas, Interests, and Identities. The Copenhagen Journal of Asian Studies, 32(2), 136–139.

[44] Amore, M. D., & Bennedsen, M. (2016). Corporate governance and green innovation. Journal of Environmental Economics and Management, 75, 54–72. doi:10.1016/j.jeem.2015.11.003.

[45] Makpotche, M., Bouslah, K., & M'Zali, B. (2024). Corporate governance and green innovation: international evidence. Review of Accounting and Finance, 23(2), 280–309. doi:10.1108/RAF-04-2023-0137.

[46] Shrivastava, P., & Addas, A. (2014). The impact of corporate governance on sustainability performance. Journal of Sustainable Finance and Investment, 4(1), 21–37. doi:10.1080/20430795.2014.887346.

[47] Arman, A., Sohaib, O., Begum, V., & Alkharman, A. A. (2024). Impact of Cultural Diversity on Employee Performance: A Study of Expatriates. International Journal of Service Science, Management, Engineering, and Technology, 15(1), 1–14. doi:10.4018/IJSSMET.342614.

[48] Lama, P. B., Budhathoki, P. B., & Ojha, H. P. (2025). Fostering an Inclusive Academic Workforce: Assessing the Impact of Age, Ethnic and Educational Diversity on Employee Performance. Business Ethics and Leadership, 9(1), 167–179. doi:10.61093/bel.9(1).167-179.2025.

[49] Bose, S., Khan, H. Z., Rashid, A., & Islam, S. (2018). What drives green banking disclosure? An institutional and corporate governance perspective. Asia Pacific Journal of Management, 35(2), 501–527. doi:10.1007/s10490-017-9528-x.

[50] Gerged, A. M., Albitar, K., & Al-Haddad, L. (2023). Corporate environmental disclosure and earnings management—The moderating role of corporate governance structures. International Journal of Finance and Economics, 28(3), 2789–2810. doi:10.1002/ijfe.2564.

[51] Xia, L., Gao, S., Wei, J., & Ding, Q. (2022). Government subsidy and corporate green innovation - Does board governance play a role? Energy Policy, 161, 112720. doi:10.1016/j.enpol.2021.112720.

[52] Richard, O. C. (2000). Racial diversity, business strategy, and firm performance: A resource-based view. Academy of Management Journal, 43(2), 164–177. doi:10.2307/1556374.

[53] Porcena, Y. R., Parboteeah, K. P., & Mero, N. P. (2021). Diversity and firm performance: role of corporate ethics. Management Decision, 59(11), 2620–2644. doi:10.1108/MD-01-2019-0142.

[54] Torchia, M., Calabro, A., & Morner, M. (2015). Board of directors' diversity, creativity, and cognitive conflict. International Studies of Management and Organization, 45(1), 6–24. doi:10.1080/00208825.2015.1005992.

[55] Ellis, K. M., & Keys, P. Y. (2015). Workforce diversity and shareholder value: a multi-level perspective. Review of Quantitative Finance and Accounting, 44(2), 191–212. doi:10.1007/s11156-013-0403-7.

[56] Dechezleprêtre, A., Koźluk, T., Kruse, T., Nachtigall, D., & De Serres, A. (2019). Do environmental and economic performance go together? A Review of Micro-level Empirical Evidence from the Past Decade or So. International Review of Environmental and Resource Economics, 13(1–2), 1–118. doi:10.1561/101.00000106.

[57] Horbach, J., & Rennings, K. (2013). Environmental innovation and employment dynamics in different technology fields - An analysis based on the German Community Innovation Survey 2009. Journal of Cleaner Production, 57, 158–165. doi:10.1016/j.jclepro.2013.05.034.

[58] Baboukardos, D. (2017). Market valuation of greenhouse gas emissions under a mandatory reporting regime: Evidence from the UK. *Accounting Forum*, 41(3), 221–233. doi:10.1016/j.accfor.2017.02.003.

[59] Jabbour, C. J. C., Jugend, D., De Sousa Jabbour, A. B. L., Gunasekaran, A., & Latan, H. (2015). Green product development and performance of Brazilian firms: Measuring the role of human and technical aspects. Journal of Cleaner Production, 87(1), 442–451. doi:10.1016/j.jclepro.2014.09.036.

[60] Palmer, M., & Truong, Y. (2017). The Impact of Technological Green New Product Introductions on Firm Profitability. Ecological Economics, 136, 86–93. doi:10.1016/j.ecolecon.2017.01.025.

[61] Dechezleprêtre, A., Märtin, R.-P. & Mohnen, M. (2014). Knowledge spillovers from clean and dirty technologies. Centre for Economic Performance London, United States.

[62] Kim, J., Woo, H. S., Balven, R., & Hoetker, G. (2023). A meta-analysis of cross-country context effects on the link between green product strategy and financial performance. Journal of Strategy and Management, 16(1), 56–75. doi:10.1108/JSMA-10-2021-0196.

[63] Aladwey, L. M. A., & Diab, A. (2025). Business bribery, corruption and fraud: audit committee and external auditor's attributes in GCC countries. Journal of Financial Regulation and Compliance, 33(5), 695–725. doi:10.1108/JFRC-09-2024-0173.

[64] Chaaben, N., Elleuch, Z., Hamdi, B., & Kahouli, B. (2024). Green economy performance and sustainable development achievement: empirical evidence from Saudi Arabia. Environment, Development and Sustainability, 26(1), 549–564. doi:10.1007/s10668-022-02722-8.

[65] Tsani, S., & Najm, S. (2021). Green policies and sustainable development in Saudi Arabia. Handbook of Sustainable Politics and Economics of Natural Resources: Edward Elgar Publishing, 123–134. doi:10.4337/9781789908770.00018.

[66] Zhang, D., Zheng, M., Feng, G. F., & Chang, C. P. (2022). Does an environmental policy bring to green innovation in renewable energy? Renewable Energy, 195, 1113–1124. doi:10.1016/j.renene.2022.06.074.

[67] Rao, K., & Tilt, C. (2016). Board diversity and CSR reporting: An Australian study. Meditari Accountancy Research, 24(2), 182–210. doi:10.1108/MEDAR-08-2015-0052.

[68] Galbreath, J. (2011). Are there gender-related influences on corporate sustainability? A study of women on boards of directors. Journal of Management and Organization, 17(1), 017–038. doi:10.1017/s1833367200001693.

[69] Kooroshy, J., Dai, L., & Clements, L. (2020). Sizing the green economy: Green Revenues and the EU taxonomy. FTSE Russell Report, Seattle, United States.

[70] Efremenko, P. (2025). Green Equity Classifications: Evidence from the London Stock Exchange's Green Economy Mark. SSRN Electronic Journal, 5162607. doi:10.2139/ssrn.5162607.

[71] Dussaux, D., Agnelli, A., & Es-sadki, N. (2023). Exploring new metrics to measure environmental innovation. OECD Working Paper, Paris, France.

[72] Jollife, I. T., & Cadima, J. (2016). Principal component analysis: A review and recent developments. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 374, 2065. doi:10.1098/rsta.2015.0202.

[73] Anderson, R. C., Reeb, D. M., Upadhyay, A., & Zhao, W. (2011). The Economics of Director Heterogeneity. Financial Management, 40(1), 5–38. doi:10.1111/j.1755-053X.2010.01133.x.

[74] Bernile, G., Bhagwat, V., & Yonker, S. (2018). Board diversity, firm risk, and corporate policies. Journal of financial economics, 127(3), 588-612. doi:10.1016/j.jfineco.2017.12.009

[75] Moussu, C., & Tuyet Nguyen, N. T. (2025). Do differences in directors make a difference? Evidence from a transitional economy. Asia-Pacific Journal of Accounting and Economics, 1–21. doi:10.1080/16081625.2025.2450317.

[76] Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. European Business Review, 31(1), 2–24. doi:10.1108/EBR-11-2018-0203.

[77] Sulaiman, M. S., Abood, M. M., Sinnakaudan, S. K., Shukor, M. R., You, G. Q., & Chung, X. Z. (2021). Assessing and solving multicollinearity in sediment transport prediction models using principal component analysis. ISH Journal of Hydraulic Engineering, 27(S1), 343–353. doi:10.1080/09715010.2019.1653799.

[78] Kyaw, K., Khatri, I., & Treepongkaruna, S. (2025). When R&D investment improves firm value: the role of board gender diversity. Corporate Governance (Bingley), 25(3), 471–495. doi:10.1108/CG-09-2023-0410.

[79] Butt, M. N., Baig, A. S., & Seyyed, F. J. (2023). Tobin's Q approximation as a metric of firm performance: an empirical evaluation. Journal of Strategic Marketing, 31(3), 532–548. doi:10.1080/0965254X.2021.1947875.

[80] Atif, M., Alam, M. S., & Hossain, M. (2020). Firm sustainable investment: Are female directors greener? Business Strategy and the Environment, 29(8), 3449–3469. doi:10.1002/bse.2588.

[81] Mysaka, H., & Derun, I. (2021). Corporate financial performance and Tobin's Q in dividend and growth investing. Contemporary Economics, 15(3), 276–288. doi:10.5709/ce.1897-9254.449.

[82] Loiseau, E., Saikku, L., Antikainen, R., Droste, N., Hansjürgens, B., Pitkänen, K., ... & Thomsen, M. (2016). Green economy and related concepts: An overview. Journal of Cleaner Production, 139, 361-371. doi:10.1016/j.jclepro.2016.08.024.

[83] Naciti, V. (2019). Corporate governance and board of directors: The effect of a board composition on firm sustainability performance. Journal of Cleaner Production, 237, 117727. doi:10.1016/j.jclepro.2019.117727.

[84] Yavuz, M. S., Tatlı, H. S., Bozkurt, G., & Öngel, G. (2025). Does ESG performance have an impact on financial performance? Evidence from Turkey. Journal of Entrepreneurship, Management and Innovation, 21(1), 24–42. doi:10.7341/20252112.

[85] Lee, J., & Koh, K. (2024). ESG performance and firm risk in the U.S. financial firms. Review of Financial Economics, 42(3), 328–344. doi:10.1002/rfe.1208.

[86] Koleosho, A. O., Akintoye, I. R., & Ajibade, A. T. (2022). The Effect of Dividend Policy on Share Price Volatility of Some Selected Companies on the Nigerian Exchange. Journal of Accounting, Business and Finance Research, 15(1), 10–20. doi:10.55217/102.v15i1.525.

[87] Bogdan, V., Popa, D. N., & Beleneşi, M. (2022). The Complexity of Interaction between Executive Board Gender Diversity and Financial Performance: A Panel Analysis Approach Based on Random Effects. Complexity, 2022(1), 9559342. doi:10.1155/2022/9559342.

[88] Jackson, L. A. (2025). Corporate Governance and Environmental Citizenship in Global Hospitality: A Cross-National Empirical Study. Sustainability (Switzerland), 17(9), 3918. doi:10.3390/su17093918.

[89] Leyva-de la Hiz, D. I., Ferron-Vilchez, V., & Aragon-Correa, J. A. (2019). Do Firms' Slack Resources Influence the Relationship Between Focused Environmental Innovations and Financial Performance? More is Not Always Better. Journal of Business Ethics, 159(4), 1215–1227. doi:10.1007/s10551-017-3772-3.

[90] Hayes, A. F., & Rockwood, N. J. (2017). Regression-based statistical mediation and moderation analysis in clinical research: Observations, recommendations, and implementation. Behaviour Research and Therapy, 98, 39-57. doi:10.1016/j.brat.2016.11.001.

[91] Kumar, P., Kaur, R., Radulescu, M., Kalaš, B., & Hagiu, A. (2025). Drivers of Environmental Sustainability, Economic Growth, and Inequality: A Study of Economic Complexity, FDI, and Human Development Role in BRICS+ Nations. Sustainability (Switzerland), 17(9), 4180. doi:10.3390/su17094180.

[92] Moses, E., Che-Ahmad, A., & Abdulmalik, S. O. (2020). Board governance mechanisms and sustainability reporting quality: A theoretical framework. Cogent Business and Management, 7(1), 1771075. doi:10.1080/23311975.2020.1771075.

[93] Hussain, N., Khan, S. A., Nguyen, D. K., Stocchetti, A., & Corbet, S. (2025). Board-level governance and corporate social responsibility: A meta-analytic review. Journal of Economic Surveys, 39(1), 3–31. doi:10.1111/joes.12603.

[94] Xue, Y. (2025). Corporate Governance and Corporate Green Innovation. Frontiers in Business, Economics and Management, 18(1), 101–103. doi:10.54097/scs72r81.

[95] Drempetic, S., Klein, C., & Zwergel, B. (2020). The Influence of Firm Size on the ESG Score: Corporate Sustainability Ratings Under Review. Journal of Business Ethics, 167(2), 333–360. doi:10.1007/s10551-019-04164-1.

[96] Gallo, P. J., & Christensen, L. J. (2011). Firm size matters: An empirical investigation of organizational size and ownership on sustainability-related behaviors. Business and Society, 50(2), 315–349. doi:10.1177/0007650311398784.

[97] Ahfeeth, A. M. J., & Çelebi, A. (2025). Environmental Fines and Corporate Sustainability: The Moderating Role of Governance, Firm Size, and Institutional Ownership. Sustainability (Switzerland), 17(20), 9252. doi:10.3390/su17209252.

[98] Post, C., Rahman, N., & Rubow, E. (2011). Green governance: Boards of directors' composition and environmental corporate social responsibility. Business and Society, 50(1), 189–223. doi:10.1177/0007650310394642.

[99] Nelling, E., & Webb, E. (2009). Corporate social responsibility and financial performance: The "virtuous circle" revisited. Review of Quantitative Finance and Accounting, 32(2), 197–209. doi:10.1007/s11156-008-0090-y.

[100] Cook, A., & Glass, C. (2009). Between a rock and a hard place: Managing diversity in a shareholder society. Human Resource Management Journal, 19(4), 393–412. doi:10.1111/j.1748-8583.2009.00100.x.

[101] Chen, Y., & Ma, Y. (2021). Does green investment improve energy firm performance? Energy Policy, 153, 112252. doi:10.1016/j.enpol.2021.112252.

[102] Shabbir, U. (2021). The Effect of Diversity on Shareholder Value: Do Gender, Ethnic and CSR Diversity Initiatives Influence Shareholder Value? SSRN Electronic Journal, 1-22. doi:10.2139/ssrn.3833073.

[103] Atan, R., Alam, M. M., Said, J., & Zamri, M. (2018). The impacts of environmental, social, and governance factors on firm performance: Panel study of Malaysian companies. Management of Environmental Quality: An International Journal, 29(2), 182–194. doi:10.1108/MEQ-03-2017-0033.

[104] Khatib, S. F. A. (2025). An assessment of methods to deal with endogeneity in corporate governance and reporting research. Corporate Governance (Bingley), 25(3), 606–630. doi:10.1108/CG-12-2023-0507.

Appendix I

Table A1. The PCA results

Component	Eigenvalue	Proportion of Variance	Cumulative Variance
Comp1	2.70	0.45	0.45
Comp2	1.10	0.18	0.63
Comp3	0.95	0.16	0.79
Comp4	0.60	0.10	0.89
Comp5	0.40	0.07	0.96
Comp6	0.25	0.04	1.00

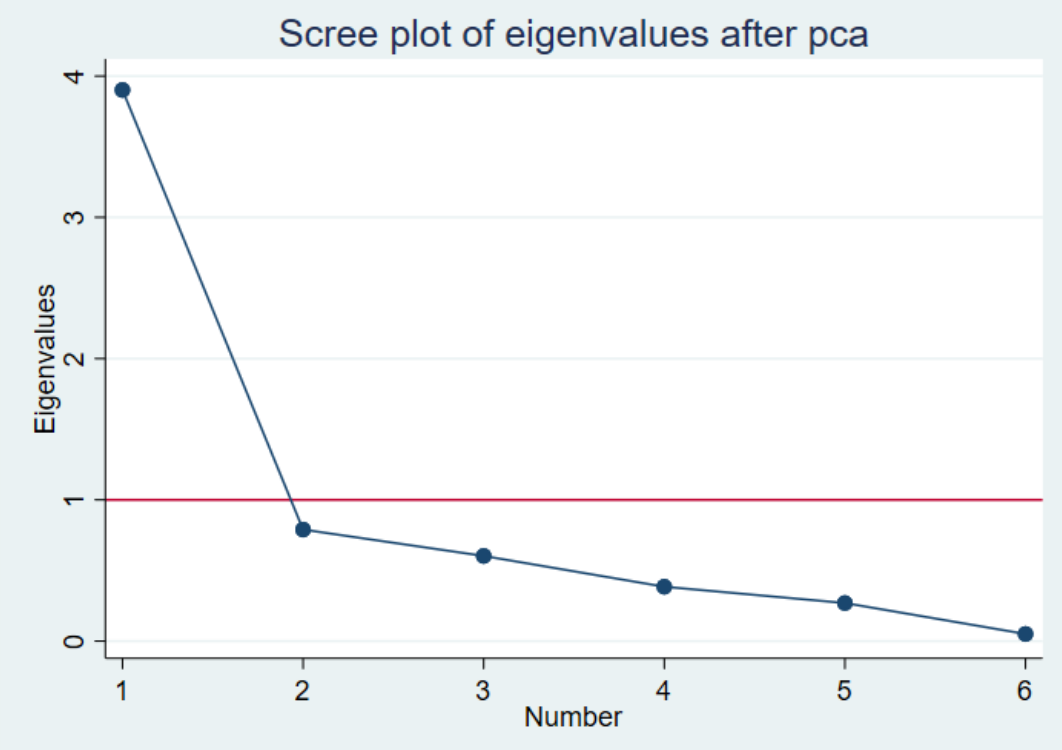

Figure A1. Scree plot of eigenvalues after PCA