

-RESEARCH ARTICLE-

## IMPACT OF GREEN FINANCE, GREEN INVESTMENT, GREEN TECHNOLOGY ON SMES SUSTAINABILITY: ROLE OF CORPORATE SOCIAL RESPONSIBILITY AND CORPORATE GOVERNANCE

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### —Abstract—

The present research endeavours to examine the mediating role of corporate social responsibility (CSR) in the relationships among green finance, green investment, green technology, and sustainability, with a concurrent investigation into the moderating influence of corporate governance within Small and Medium Enterprises (SMEs) in Saudi Arabia. Employing a quantitative research methodology, the study gathered numerical data from 250 employees through purposive sampling using structured surveys targeted at SME employees. The findings derived from Partial Least Square (PLS)-Structural Equation Modelling (SEM) indicate a positive and statistically significant impact of green finance, green investment, and green technology on sustainability within SMEs in Saudi Arabia. Furthermore, the study underscores the pivotal role of CSR as a mediating factor in the associations between green finance, green investment, green technology, and sustainability. Additionally, corporate governance is identified as a noteworthy moderator, shaping the translation of CSR initiatives into sustainable practices. This underscores the imperative of aligning internal organizational mechanisms with CSR endeavours to optimize outcomes in terms of sustainability. Theoretical contributions of this study encompass an expanded empirical inquiry within the Saudi context, underscoring the significance of green finance, green investment, technological innovation, CSR, and corporate governance in influencing sustainable outcomes. In practical terms, the research promotes the incorporation of these

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practices to cultivate sustainability within SMEs, providing guidance for managerial decisions to strategically align financial strategies, CSR initiatives, technological advancements, and internal governance mechanisms. This integrative approach aligns with global sustainability objectives and contributes to the establishment of sustainable business cultures within SMEs in Saudi Arabia. The study acknowledges its limitations and proposes future directions for research to address these constraints and advance the field.

**Keywords:** Green Finance, Green Investment, Green Technology, Corporate Governance, Sustainability.

## INTRODUCTION

Within the present competitive milieu, sustainability serves as the foundational element for companies to prosper ethically, strategically innovate, and secure enduring success amid the dynamically evolving global landscape. Green finance, green investment, and green technology are identified as transformative instruments that play a pivotal role in propelling sustainable practices within organizations (Wang et al., 2023; Wang & Yan, 2023; Wang et al., 2022; Xu et al., 2020). Green finance directs funds toward environmentally conscious projects, cultivating a financial ecosystem that aligns with and supports sustainable objectives (Wang & Yan, 2023). In conjunction with this, green investment serves as an incentive for businesses to embrace environmentally friendly practices, optimizing resource utilization and concurrently augmenting operational efficiency (Ye & Dela, 2023). Similarly, green technology contributes to heightened sustainability by optimizing the utilization of resources (Bernal-Conesa, de Nieves Nieto, & Briones-Peñalver, 2017). Stated differently, the enhancement of CSR is deemed essential as it aligns business objectives with societal and environmental well-being, fostering a more comprehensive approach to sustainable development. When organizations effectively prioritize their focus on green technology, green finance, and green technology within the context of CSR, it has the potential to contribute to heightened sustainability (Bernal-Conesa et al., 2017; Wang et al., 2023; Wang & Yan, 2023). The efficacy of these initiatives is contingent upon the organizational structure of corporate governance, which is regarded as a crucial determinant in the relationship between CSR and sustainability. Guided by agency theory, corporate governance ensures that management acts in the best interest of stakeholders (Wang & Yan, 2023). Efficient governance aligns CSR strategies with the interests of stakeholders and societal welfare, consequently reinforcing the connection between CSR commitments and concrete sustainability impacts (Wang & Yan, 2023). These studies demonstrate that corporate governance plays a pivotal role in overseeing CSR activities, thereby contributing to the sustainability of organizations.

Theoretically, stakeholders underscored the significance of responsibilities and a stakeholder-centric approach in enhancing the sustainability of organizations (Stieb, 2009). The stakes held by both employees and investors prove influential in the decision-making

and actions of organizations. The alignment of CSR initiatives with stakeholder expectations is imperative for businesses aspiring to adopt sustainable practices (Schaltegger, Hörisch, & Freeman, 2017). Governance mechanisms guided by stakeholder theory ensure inclusivity in decision-making processes, thereby augmenting the credibility of CSR endeavours and strengthening the social license to operate (Schaltegger et al., 2017). Ultimately, the integration of agency and stakeholder theories into governance structures, bolstered by the influence of green finance, investment, and technology, emerges as a formidable force in guiding businesses toward the adoption of sustainable practices.

Empirically, numerous studies have previously explored the interplay of green finance, green investment, green technology, CSR, and corporate governance in influencing sustainability. For instance Wang et al. (2022) conducted research that has employed corporate governance and green finance initiatives as foundational catalysts for organizational sustainability. However, it is noteworthy that this study omits consideration of green investment and green technology. In a separate study, a positive and significant impact of green investment on sustainability was identified through the mediation of CSR (Pambudi et al., 2022). While the research overlooks the aspects of green finance and green technology, it subsequently reveals a positive and significant impact of both green finance and technology on sustainability (Awawdeh et al., 2022). On the other hand, Jain, Zicari, and Aguilera (2023) identified a positive and statistically significant impact of green finance on CSR, while concurrently neglecting the consideration of green investment and green technology. Notably, the study by Sharma and Choubey (2022), revealed a positive impact of green finance on CSR, in contrast to the findings of Mavroulidis et al. (2022) which reported a negative impact of green finance on CSR. Furthermore, additional investigations, such as those conducted by Ye and Dela (2023), established a significant and positive impact of both green finance and green investment on sustainability. A positive and statistically significant relationship between corporate governance and sustainability has been established in numerous studies, as evidenced by the works of Chandrakant and Rajesh (2023) and Naciti, Cesaroni, and Pulejo (2022). Additionally, the impact of corporate governance on CSR has been identified in various studies (Ridwan & Mayapada, 2022; Zaman et al., 2020). While the direct influence of corporate governance on sustainability and corporate social responsibility has been investigated, the moderating effect of corporate governance remains unexplored. This gap in the literature could be addressed by examining the mediating impact of CSR and the moderating effect of corporate governance, aligning with prior studies that have advocated for testing the moderating effect between CSR and sustainability to elucidate their relationship (Wang & Yan, 2023).

Moreover, prior scholarly works concentrated on alternative sectors or diverse geographical contexts. For instance Rehman et al. (2021) research on manufacturing sector Ye and Dela (2023) study on internal chemical companies in Indonesia, science and technology parks in Spanish (Bernal-Conesa et al., 2017), banking sector in Pakistan (Aslam & Jawaid, 2023). Previous studies have primarily centred on different

countries and sectors, with limited attention directed towards SMEs in Saudi Arabia. Addressing this gap could involve an examination of the impact of government policies on sustainability outcomes within SMEs. Notably, governmental regulations in Saudi Arabia have played a crucial role in promoting environmentally conscious business practices among SMEs (Chaaben et al., 2022). SMEs in Saudi Arabia have played a pivotal role in contributing to gross domestic products and employment. Despite their substantial contributions, SMEs face challenges in accessing finance due to their limited business scale. In this context, green finance emerges as a crucial factor in mitigating environmental impact and enhancing overall sustainability for SMEs (Babiak & Trendafilova, 2011). Green investment holds significance within the context of manufacturing companies in Saudi Arabia (Abdou et al., 2022). Conversely, proficient corporate governance is essential for ensuring transparent and ethical management practices, fostering enduring relationships with stakeholders, particularly partners and suppliers. Through the integration of sustainability across all operational facets, SMEs can harmonize their practices with sustainable principles (Mahmood et al., 2018).

Building upon the significance and gaps identified in prior research, the current study aims to examine the mediating role of CSR in the relationship among green finance, green investment, green technology, and sustainability, with a concurrent exploration of the moderating impact of corporate governance in the context of SMEs in Saudi Arabia. Data were gathered from a sample of 250 employees within Saudi Arabian SMEs. Theoretical contributions of this research encompass the development of a comprehensive model, contributing not only to theoretical discussions but also laying the groundwork for future research. The study underscores the interconnectedness of financial strategies, CSR practices, technological innovations, and internal governance mechanisms in shaping sustainable outcomes. On a practical level, the findings offer guidance to SME managers in Saudi Arabia, emphasizing the pivotal role of CSR-focused cultures in enhancing green practices and internal governance structures to fortify sustainable practices. This significance extends beyond local SMEs, resonating globally by aligning with broader sustainability initiatives and providing a blueprint for businesses worldwide seeking to integrate sustainability into their operations. The research is structured into four sections: literature review, research methods, data analysis, and discussion, followed by considerations of limitations and directions for future research.

## LITERATURE REVIEW

### Green Investment and Sustainability

Green investment (GI) pertains to financial allocations specifically designated for environmentally sustainable projects, initiatives, or technologies. It assumes a crucial role in advancing sustainability by channelling capital into eco-friendly ventures, thereby facilitating the transition towards a more resilient paradigm (Freudenreich, Lüdeke-Freund, &

Schaltegger, 2020). Empirical literature has investigated the correlation between Green Investment (GI) and Sustainability (SUS) across various contexts, countries, industries, and temporal spans. These studies utilize diverse metrics for green investment, including but not limited to investments in renewable energy and the implementation of environmental management systems (Chen et al., 2023). Numerous studies have identified a correlation between GI & SUS (Cadestin et al., 2018; Ye & Dela, 2023). However, the outcomes from these investigations consistently underscore a positive association between GI & SUS. Further study of Ioannou and Serafeim (2019). Furthermore, it was observed that GI has a positive and statistically significant impact on SUS. Another study underscored the capacity of GI to enhance SUS (Li, Fu, & Jiang, 2023). Therefore, the ensuing research hypotheses are formulated based on preceding studies.

**H1:** *Green investment significantly impacts sustainability.*

### **Mediating Role of Corporate Social Responsibility Between Green Investment and Sustainability**

Companies have heightened their focus on SUS, with Green GI & CSR emerging as pivotal indicators for augmenting SUS (Dai, Siddik, & Tian, 2022). Several empirical studies have demonstrated a positive association between active CSR engagement by companies and their propensity to invest in sustainable energy projects, securing specialized green financing for environmentally friendly initiatives. These frameworks identify institutional support, opportunities for green investments, and financial resources as crucial factors influencing this relationship (Xu et al., 2020). Several empirical studies underscore the positive correlation between GI and CSR initiatives, thereby contributing to sustainability objectives. For instance (Eccles, Serafeim, & Krzus, 2011), Demonstrated that companies involved in environmentally sustainable practices exhibit elevated levels of CSR involvement, indicating a dedication to social and environmental considerations. Additionally Ye and Dela (2023), The studies suggest that green investment not only improves social responsibility strategies but also has the potential to enhance sustainability. These preceding studies serve as the basis for the subsequent research hypotheses outlined below,

**H2:** *Green investment significantly impacts to CSR.*

**H3:** *CSR significantly mediates between the association of green investment and sustainability.*

### **Green Finance and Sustainability**

Green finance (GF), encompassing financial instruments and strategies specifically tailored to promote SUS, has been subject to empirical scrutiny in previous studies. These investigations affirm the pivotal role of GF in enhancing sustainability. For instance Guo et al. (2020), Unveiled a positive correlation between GF & SUS, demonstrating that

heightened GF is markedly associated with a significant reduction in carbon emissions, signifying a substantial contribution to sustainability. Moreover, Wang and Yan (2023) and Wang et al. (2023) empirically validated that companies and industries availing GF manifest a heightened dedication to SUS. Additionally, Ronaldo and Suryanto (2022) identified that investments directed through GF mechanisms are linked to heightened SUS. Therefore, building on the preceding discussion, it is hypothesized that,

**H4:** *Green finance significantly impacts sustainability.*

### **Green Finance, Corporate Social Responsibility and Sustainability**

GF for organizations pertains to sustainable or environmentally oriented financing, facilitating the augmentation of SUS (Tran et al., 2020). In contemporary times, stakeholders not only expect companies to prioritize profit generation but also to emphasize SUS. GF & CSR share congruent objectives and foundational principles (Tran et al., 2020). GF functions as a valuable instrument for promoting SUS from both environmental and social perspectives. (Wang et al., 2023; Wang & Yan, 2023). Incorporating GF into CSR initiatives is perceived as a strategic approach for businesses to attain SUS (Zhang and Chen 2020). Additionally, it was observed that GF has the potential to further enhance CSR, thereby contributing to an increase in SUS. Scholars contend that the integration of GF into CSR strategies enables businesses to make meaningful contributions to SUS (Mohd & Kaushal, 2018; Wang et al., 2023; Wang & Yan, 2023). Their investigation suggests that enterprises investing in GF are more predisposed to participate in CSR initiatives, potentially leading to an increase in SUS. Consequently, the study posits the following research hypotheses:

**H5:** *CSR significantly effect by green finance.*

**H6:** *CSR significantly mediates on the association of green finance and sustainability.*

### **Green Technology and Sustainability**

Green Technology (GT) encompasses environmentally friendly technologies, including products and applications designed to enhance SUS (Guo et al., 2020). Empirically, (Guo et al., 2020) examined the impact of environmental technologies on SUS and identified a positive and statistically significant effect (Wang & Yan, 2023). Moreover Guo et al. (2020) subsequently discovered empirical evidence indicating that the adoption of GT results in enhanced resource efficiency and diminished environmental degradation, underscoring its pivotal role in advancing sustainability objectives. Additionally, Ali et al. (2023) identified a positive correlation between & SUS. Consequently, the research is formulated with the following hypotheses

**H7:** *The green technology has a significant impact on sustainability.*

## Green Technology, Corporate Social Responsibility and Sustainability

Empirical findings indicate that GT plays a significant role in enhancing CSR, thereby contributing to an increase in SUS. For instance [Guo et al. \(2020\)](#) illustrated that companies integrating green technology enhance sustainability, with an additional argument positing that it aids in improving sustainability through CSR. Furthermore, [Clauß, Kraus, and Jones \(2022\)](#) identified that the assimilation of green technology into business operations exerts a positive influence on CSR strategies, contributing to the enhancement of business sustainability. Also [Wang et al. \(2023\)](#) and [Wang and Yan \(2023\)](#) ascertained that companies utilizing green technology tend to attract investors and stakeholders interested in socially responsible practices, consequently enhancing their CSR reputation and fostering a sustainable corporate culture. Empirical evidence indicates that green investment plays a significant role in increasing corporate social responsibility to enhance sustainability. Therefore, the study posits the following investigative hypotheses:

**H8:** *CSR significantly impact by green technology.*

**H9:** *CSR significantly mediates on the association between green technology and sustainability.*

**H10:** *CSR has significant impact on sustainability.*

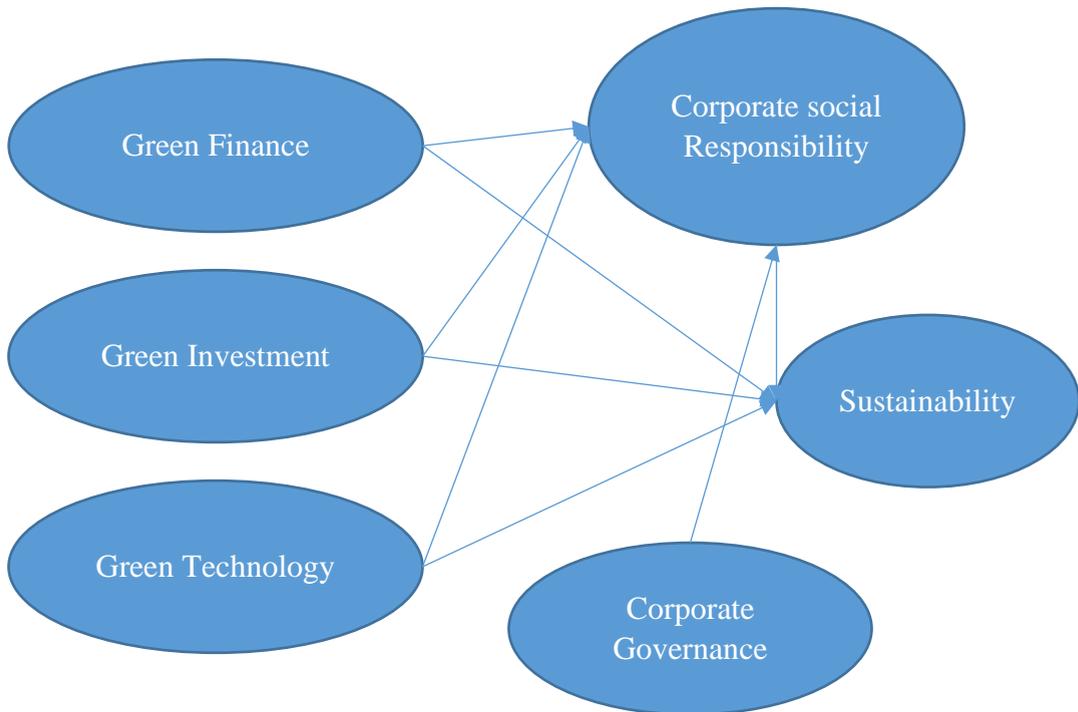
### Moderating Role of Corporate Governance

Previous studies have emphasized the pivotal role of CG in the growth and success of companies through fostering the implementation of enduring CSR initiatives ([Zeb et al., 2021](#)). CSR encompasses the integration of environmental and social considerations into a company's protocols and practices to enhance SUS ([Kamal, 2021](#)). Moreover, CSR serves as an expansive mechanism for addressing the interests of diverse stakeholders, all aligned with the overarching goal of optimizing SUS ([Yang & Basile, 2022](#)). Recent scholarly investigations have underscored the significance of effective CG in fostering CSR actions and outcomes. A robust CG structure notably influences the uptake and implementation of CSR initiatives, as indicated by the work of [Zaman et al. \(2020\)](#) thereby contributing to the improvement of SUS. Furthermore, companies endowed with robust CG structures and independent boards exhibit a heightened propensity to participate in socially responsible activities ([Mukhtaruddin et al., 2019](#)) that could enhance SUS ([Wu & Jin, 2022](#)). Therefore, drawing from the preceding discourse, the hypothesis is posited that,

**H11:** *Corporate governance significantly moderates between CSR and sustainability.*

## RESEARCH FRAMEWORK

The literature review above forms the basis for constructing the research framework, as depicted in Figure 1. Figure 1 outlines three distinct types of variables: Green finance, green investment, and green technology are independent variables, corporate governance serves as a moderating variable, and sustainability is considered the dependent variable.



**Figure 1:** Research Framework.

## RESEARCH METHODOLOGY

The present study adopted a quantitative research approach, employing a cross-sectional research design to examine the mediating impact of corporate social responsibility on the relationship between green finance, green investment, green technology, and sustainability, while considering the moderating influence of corporate governance within SMEs in Saudi Arabia. Utilizing quantitative methods, the study collected numerical data through structured surveys from SMEs, enabling statistical analysis and the generalization of results to a broader population (Hirose & Creswell, 2022). The explanatory nature of this study design facilitated the investigation of causality and the documentation of potential predictors, enhancing our understanding of the observed relationships (Creswell & Creswell, 2017). Differing from qualitative inquiries, the quantitative approach ensured objectivity in

both data collection and analysis, enabling precise quantification and statistical inference (Creswell & Creswell, 2017). Furthermore, the cross-sectional approach painted a comprehensive picture, offering efficiency in resource utilization and time compared to longitudinal studies, all the while capturing a diverse array of data at a singular point in time (Bryman, 2016). Diverging from exploratory research endeavours that focus on hypothesis generation, this explanatory research design aimed to establish and elucidate connections between variables (Creswell & Creswell, 2017). Consequently, contributing to a more profound understanding of the phenomenon under investigation.

The study adhered to a survey instrument derived from prior research. The assessment of green technology adoption involved three items adapted from the study conducted by Wasiq, Kamal, and Ali (2023). GF was assessed using five items derived from the work of Ye and Dela (2023), while green investment was also measured with five items sourced from the same study (Ye & Dela, 2023). Corporate social responsibility was gauged using five items sourced from the study conducted by Ye and Dela (2023). Corporate governance was assessed across four dimensions, encompassing accountability measured by four items, fairness measured by four items, transparency measured by four items, and board independence measured by four items. These measurement items were adopted from the study conducted by Abdullah et al. (2021). Finally, sustainability was quantified using 5 items adopted from the study conducted by Bernal-Conesa et al. (2017). The aforementioned constructs were assessed using a five-point Likert scale, ranging from 1= strongly disagree & 5=agree. The employed constructs were distributed among 300 employees of SMEs in Saudi Arabia actively involved in sustainability practices, utilizing purposive sampling techniques. A total of 255 questionnaires were returned, with 250 deemed valid for subsequent analysis.

## DATA ANALYSIS AND RESULTS

### Demographics Profile

Table 1 presents the anticipated values illustrating the demographic profile of respondents from SMEs. The demographic makeup of SMEs in Saudi Arabia exhibits a gender distribution that is reasonably balanced, with a slight majority of male respondents (60.0%) and a substantial representation of female respondents (40.00%), indicating a developing and inclusive workforce within these enterprises. The age distribution reveals a notable concentration of younger employees, particularly within the 20-24 age range, suggesting an emphasis on attracting and cultivating youthful talent. Nevertheless, there is also representation among employees above 45 years, indicating a multi-generational workforce.

In terms of experience, a significant proportion of employees fall within the 5 to 10 years range, indicating a mid-level experienced workforce. However, efforts to retain and leverage employees with varying experience levels, especially those with over 30 years, could contribute to a more diversified skill set. Furthermore, the distribution across designations reflects a structured grading within these SMEs, with assistant and deputy managers comprising a substantial portion, indicating potential opportunities for growth and career advancement within the organizational structure.

Efforts to empower mid-level managers and foster a diverse and inclusive environment could potentially enhance the efficiency and innovation of these Saudi Arabian SMEs. The detailed results are presented in [Table 1](#).

**Table 1: Demographic Profile.**

Demographic Variables	Frequency	Percentage
Gender		
Male	150	60.00
Femal	100	40.00
Age		
20–24 years	60	24.00
25–35 years	50	20.00
35–45 years	80	32.00
Above 45	60	24.00
Work experience		
<4 years	92	36.80
5-10 years	80	32.00
10-25 years	24	9.600
25-30 years	25	10.00
>30 years	29	11.60
Designation		
Senior officer	40	16.00
Assistant manager	74	29.60
Deputy manager	66	26.40
Manager	43	17.20
General manager	27	10.80

### Convergent Validity

Convergent validity in Smart PLS within the context of PLS-SEM is employed to ascertain the extent to which various items within a construct effectively measure the same underlying concept. In Smart PLS, the assessment of convergent validity involves the consideration of several critical indicators, with factor loadings being one of them.

It is recommended that factor loadings should meet or exceed a threshold of 0.50 to demonstrate satisfactory convergent validity (Hair Jr et al., 2017) which denotes the magnitude of the association between each indicator and its respective construct. Moreover, internal consistency metrics such as Cronbach's alpha, where a value of 0.7 or higher is recommended (Hair Jr et al., 2017), serve to indicate the reliability of items within a construct. Composite reliability, with a threshold of 0.70 or above (Hair Jr et al., 2017), assesses the consistency of the variance explained by the construct across its indicators. Lastly, the recommended AVE value exceeding 0.50 (Hair Jr et al., 2017), demonstrates the extent to which the construct captures variance from its indicators, thereby affirming convergent validity by establishing that the indicators reliably converge on the same construct. These values are presented in Table 2.

**Table 2: Convergent Validity.**

Construct	Mean Values	Alpha	Composite Reliability	Average Value
Green Technology	3.8	0.85	0.87	3.8
Green Finance	4.2	0.78	0.80	4.2
Green Investment	3.95	0.80	0.82	3.9
Corporate Social Responsibility	4.1	0.87	0.89	4.1
<b>Corporate Governance</b>				
Fairness	3.8	0.82	0.84	3.8
Transparency:	4.2	0.79	0.81	4.2
Independence board	4.0	0.78	0.80	4.0
Sustainability	4.3	0.88	0.90	4.3

### Discriminant Validity

The assessment of discriminant validity in Smart PLS involves the consideration of various criteria, with Heterotrait-Monotrait correlations (HTMT) being a prominent measure. Literature recommends that HTMT values should be below 0.85, signifying robust discriminant validity between constructs (Henseler, Ringle, & Sarstedt, 2015). Furthermore, the Fornell-Larcker criterion suggests that the square root of the AVE should surpass the inter-construct correlations, indicating sufficient discriminant validity (Ab Hamid, Sami, & Sidek, 2017). Cross-loadings, where indicators are expected to demonstrate higher loadings on their designated constructs compared to other constructs, also play a role in establishing discriminant validity. However, in the context of Smart PLS, researchers often prioritize HTMT values as they directly compare relationships between constructs, offering a robust evaluation of their distinctiveness (Henseler et al., 2015). The anticipated HTMT values are presented in the forthcoming Table 3.

**Table 3: Discriminant Validity.**

Constructs	GT	GF	GI	CSR	FAIR	TRANS	IB	SUS
<b>GT</b>	-							
<b>GF</b>	0.59	-						
<b>GI</b>	0.62	0.57	-					
<b>CSR</b>	0.54	0.52	0.49	-				
<b>FAIR</b>	0.58	0.56	0.53	0.51	-			
<b>TRANS</b>	0.61	0.58	0.55	0.53	0.60	-		
<b>IB</b>	0.63	0.60	0.57	0.55	0.62	0.64	-	
<b>SUS</b>	0.52	0.50	0.47	0.45	0.49	0.51	0.53	-

**Note:** GT-green technology, GF-green finance, GI-green investment, CSR-corporate social responsibility, TRAN-transparency, IB-independence board, Fair-fairness, SUS-sustainability

### **HYPOTHESIS TESTING**

The structural model findings reveal that green finance has a statistically significant positive impact (0.241,  $p < 0.001$ ) on sustainability in Saudi Arabian SMEs. This suggests that the adoption of eco-friendly financial strategies or investment practices by these SMEs significantly contributes to enhancing their overall sustainability efforts. This finding underscores the potential influence of integrating green finance principles as a fundamental component of sustainability for SMEs in Saudi Arabia, where environmental consciousness is increasingly vital.

Additionally, green investment demonstrates a significant positive impact (0.182,  $p < 0.001$ ) on sustainability within Saudi Arabian SMEs. This result underscores the positive outcomes associated with allocating resources to environmentally friendly projects or initiatives, aligning with the growing emphasis on eco-friendly investments in Saudi Arabia. Such investments are shown to drive the sustainability agenda of SMEs in the country.

Moreover, the direct impact of technology adoption is found to be significant (0.124,  $p < 0.001$ ) on sustainability among Saudi Arabian SMEs. This emphasizes the importance of incorporating innovative technologies to enhance sustainability practices within these organizations. In a context where technological advancements are prevalent in Saudi Arabia, leveraging innovative solutions appears crucial for driving sustainable practices among SMEs.

On the flip side, green finance exhibits a positive and significant impact (0.153,  $p < 0.002$ ) on CSR in Saudi Arabian SMEs. This suggests that the adoption of environmentally conscious financial strategies is associated with increased levels of CSR initiatives within these SMEs, reflecting a commitment to broader societal and environmental welfare.

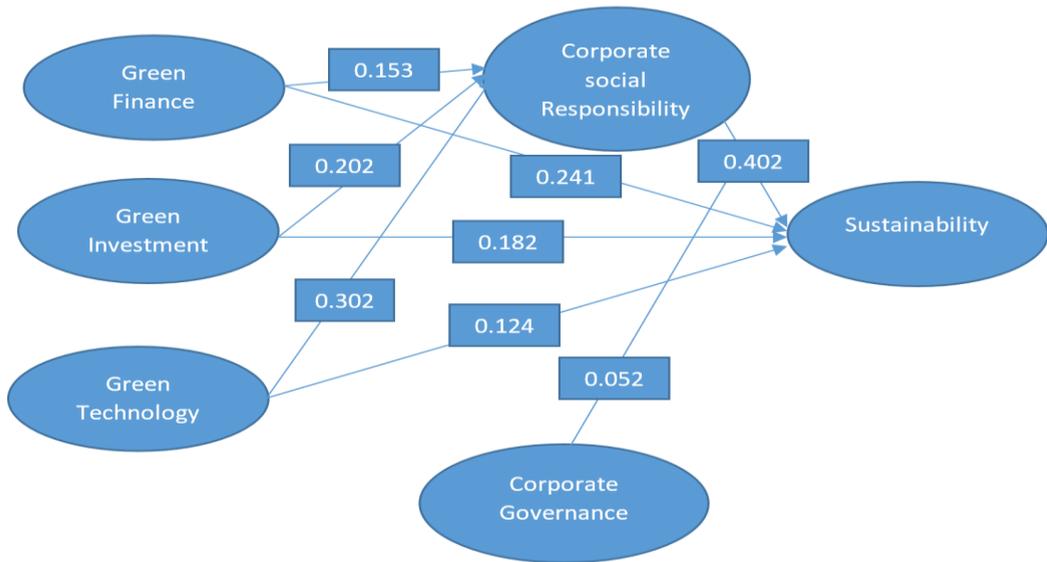
Additionally, green investment significantly and positively influences CSR within Saudi Arabian SMEs (0.202,  $p = 0.004$ ). Redirecting investments toward environmentally friendly projects aligns with and promotes a stronger focus on CSR activities, potentially cultivating a more socially responsible business culture in these SMEs.

Moreover, green technology also shows a significant and positive impact (0.302,  $p = 0.001$ ) on CSR. In essence, green technology has a positive and significant impact on CSR. Furthermore, CSR itself has a positive and significant impact on sustainability. This underscores the considerable influence of CSR on sustainability within Saudi Arabian SMEs, emphasizing that prioritizing CSR initiatives positively contributes to the overall sustainability efforts of these organizations. This alignment reflects a commitment to societal and environmental expectations in the Saudi Arabian business landscape.

The research identifies the mediating influence of CSR on the associations among green finance, green investment, green innovation, and sustainability within the context of SMEs in Saudi Arabia. The findings suggest that the impact of environmentally conscious financial practices, investment decisions, and innovative approaches is, in part, realized through their ability to foster a CSR-oriented organizational culture. This underscores the significance of CSR as a mechanism through which these factors contribute to sustainable outcomes in Saudi Arabian SMEs. Furthermore, the study reveals that corporate governance moderation enhances the positive and substantial correlation between CSR and sustainability within Saudi Arabian SMEs. This implies that specific internal corporate features or strategies play a pivotal role in shaping how CSR initiatives translate into sustainable practices. The anticipated research outcomes are outlined in [Table 4](#).

**Table 4: Hypothesis Results.**

Hypothesis	Beta	Standard Deviation	t-value	p-value
Green Finance ->sustainability	0.241	0.052	4.60	0.001
Green investment->sustainability	0.182	0.032	5.68	0.000
Green technology->sustainability	0.124	0.023	5.39	0.000
Green Finance->CSR	0.153	0.045	3.40	0.002
Green investment->CSR	0.202	0.062	3.27	0.011
Green technology->CSR	0.302	0.081	3.75	0.012
CSR->sustainability	0.402	0.091	4.41	0.003
Green Finance->CSR->sustainability	0.083	0.026	3.19	0.001
Green investment->CSR->sustainability	0.102	0.033	3.20	0.013
Green technology->CSR->sustainability	0.061	0.014	4.350	0.002
CSR*corporate governance->sustainability	0.052	0.025	2.08	0.045



**Figure 2:** Beta Values.

## DISCUSSION

The objective of this research is to assess the influence of green finance, green investment, and green technology on sustainability, considering the mediating role of CSR and the moderating effect of corporate governance in the context of Saudi Arabian SMEs. PLS-SEM analysis reveals a positive and statistically significant relationship between green finance and sustainability. This outcome aligns with findings from prior studies, indicating that environmentally conscious financial strategies significantly impact sustainability endeavours in businesses (Alharbi et al., 2023). The dedication to sustainability is apparent in the emphasis of the Saudi Arabia Green Initiative on reducing carbon emissions through investments in environmentally friendly activities (Ye et al., 2022). These findings underscore the potential benefits of incorporating green finance principles within Saudi Arabian companies, particularly those prioritizing the nation's sustainability objectives, such as renewable energy, in order to positively contribute to overarching sustainability initiatives. These outcomes align with prior research (Tran et al., 2020; Zhou & Li, 2022). Additional findings also demonstrate that green investment has a positive and significant influence on sustainability. This favourable impact of green investment aligns with research emphasizing the importance of investing in environmentally friendly projects for the sake of sustainable development (Tran et al., 2020). Within the context of Saudi Arabia, there is a growing momentum in investments directed towards clean energy and environmental initiatives, aligning with international sustainability agendas (Zhan & Santos-Paulino, 2021). This discovery underscores the significance of channelling investments into environmentally sustainable projects within the Saudi Arabian context to promote sustainable practices across various industries and

SMEs, in accordance with the country's sustainable development goals. These findings align with pertinent literature. Additionally, further results indicate a positive and statistically significant impact of technological innovation on sustainability, which is consistent with studies emphasizing the pivotal role of innovation in advancing sustainability (Zhang et al., 2019). Within Saudi Arabia, technological progress and innovation constitute integral pillars of the Vision 2030 strategy, emphasizing economic diversification and fostering sustainable growth (Alshuwaikhat & Mohammed, 2017). These results underscore the significant role played by SMEs in Saudi Arabia in investing in green technology, thereby contributing to sustainability. This highlights the impactful role of technological advancement on sustainability.

Conversely, significant findings reveal that green finance positively influences sustainability in Saudi Arabian SMEs. This suggests that prioritizing environmentally conscious financial strategies reflects a commitment to broader societal and environmental well-being. These outcomes align with research demonstrating the promotion of CSR practices through environmentally conscious financial strategies (Wang & Sarkis, 2017). These results are substantiated by evidence highlighting the critical importance of incorporating green finance practices to stimulate CSR initiatives within companies (Sadiq et al., 2022). Green investment demonstrates a positive and significant influence on corporate social responsibility, suggesting that channelling investments into environmentally friendly projects aligns with and promotes a heightened emphasis on CSR activities. This underscores the interconnectedness between environmentally focused investments and CSR practices (Ashrafi et al., 2018). In the context of Saudi Arabian SMEs, these results underscore the importance of directing investments towards environmentally friendly projects to cultivate a culture of social responsibility within SMEs, in accordance with the nation's sustainability objectives. This empirical observation is buttressed by pertinent literature (Zhang et al., 2022). In an alternative context, the influence of green technology on CSR was found to be both positive and significant. These results suggest that green technology, encompassing environmentally friendly innovations and sustainable practices, plays a crucial role in shaping CSR paradigms within Saudi Arabian SMEs. Prior research underscores the substantial impact of adopting green technology on enhancing CSR within organizational frameworks (Guo et al., 2020). CSR exhibits a positive and statistically significant influence on sustainability. This substantial impact of CSR on sustainability reinforces the correlation between CSR practices and comprehensive sustainability endeavours, a relationship substantiated by numerous studies (Simmou et al., 2023).

The mediation results indicate that CSR partially mediates the relationships among green finance, green investment, technology innovation, and sustainability in Saudi Arabian SMEs. This implies that while each factor independently contributes to sustainability outcomes, their impact is also mediated through the incorporation of CSR

practices. Thus, environmentally conscious financial practices, investment decisions, and innovative strategies partly operate by promoting a CSR-focused organizational culture. These findings align with previous studies (Simmou et al., 2023).

Conversely, corporate governance substantially moderates the relationship between CSR and sustainability in Saudi Arabian SMEs. This indicates that specific internal corporate features or strategies influence how CSR initiatives translate into sustainable practices. Consequently, optimizing the effectiveness of CSR efforts through modifications in corporate governance could enhance sustainable practices. In the Saudi Arabian business context, this underscores the importance of aligning internal organizational structures with CSR initiatives to maximize their impact on sustainability, highlighting the pivotal role of corporate governance in increasing CSR initiatives for SMEs' sustainability.

## CONTRIBUTIONS AND FUTURE DIRECTIONS

The research contributes both practically and theoretically. Theoretical contributions include being the first empirical study in Saudi Arabia to explore the impact of green finance, green investment, and green technology on sustainability. Additionally, the study highlights CSR as a crucial mediator channelling the impacts of financial and technological factors toward sustainability, emphasizing the role of organizational culture shaped by CSR practices. The identification of corporate governance as a significant moderator enriches theoretical understanding by emphasizing the influence of internal organizational mechanisms on translating CSR initiatives into tangible sustainability practices. This integrated model advances theoretical discussions by emphasizing the interdependence of financial strategies, CSR, technological innovation, and corporate governance in driving sustainable outcomes, providing a robust framework for future theoretical developments in sustainability and organizational dynamics.

Conversely, from a practical standpoint, the study's findings hold significant implications for managerial practices within Saudi Arabian SMEs. The recognition of CSR as a crucial mediator underscores the importance of fostering a CSR-focused organizational culture to enhance sustainability efforts. This highlights the need for SMEs to integrate environmentally conscious financial strategies, direct investments toward eco-friendly projects, and leverage innovative technologies while actively promoting CSR practices. Moreover, acknowledging corporate governance as a significant moderator underscores the necessity of aligning internal organizational structures and strategies with CSR initiatives to optimize their impact on sustainability outcomes. These collective findings provide guidance for managerial decisions, advocating for strategic alignment between financial strategies, CSR initiatives, technological innovations, and internal governance mechanisms within SMEs to effectively promote sustainable practices. This emphasis on integrated practices not only aligns with global sustainability trends but also contributes to the specific context of Saudi Arabian SMEs.

## CONCLUSION

The study investigates the mediating role of CSR in the relationship between green finance, green investment, green technology, and sustainability in Saudi Arabian SMEs, with corporate governance as a moderating factor. Data from SME managers in Saudi Arabia reveal a positive and significant impact of green finance, technology, and investment on sustainability, aligning with global trends and Saudi Arabia's commitment to initiatives like the Saudi Green Initiative. Additionally, CSR acts as a significant partial mediator, emphasizing its crucial role in enhancing the effects of financial strategies, investments, and innovation on sustainable business cultures within SMEs. The moderating effect of corporate governance underscores the importance of aligning internal mechanisms with CSR initiatives to optimize their impact on sustainability. In essence, the study highlights the intricate connections between these factors and underscores the necessity of integrating green finance, investment, technology innovation, CSR, and corporate governance to strengthen sustained sustainability efforts within Saudi Arabian SMEs.

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## APPENDIX A

### Survey Instrument

Construct	Items	Sources
<b>Green Investment</b>	Our company takes into account environmental preservation while making decisions pertaining to green investments.	(Ye & Dela, 2023)
	Our firm persistently engages in green investments	
	Our organization actively participates in enhancing their green advantages for fulfilling their responsibilities in the direction of both society and environment.	
	Our organization is attracted towards the appealing green investments.	
	Our organization is committed to green investments while not considering it as a cost cutting measure.	(Ye & Dela, 2023)

<b>Green Finance</b>	Our organization makes sure while establishing policies to prioritize financing towards projects that promotes environmental sustainability.	
	Our organization has apportioned budget to support the initiatives in green projects.	
	Our organization has allocated funds in green financial investments.	
	Our organization has secured funding mainly from financial institutions to provide support towards green projects.	
	Our organization has actively involved in increasing initiatives focusing towards enhancing green financing in both of international and national levels.	
<b>CSR</b>	Our organization actively engages in programs that enhances societal safety.	(Ye & Dela, 2023)
	Our organization aims its efforts to grow sustainably keeping in view future generation's requirements.	
	Our organization enhances its supports towards non-governmental organizations that aims to serve in underdeveloped regions facing various challenges.	
	Our organization exceeds its legal requirements and obligations to safeguard consumer rights.	
	Our organization adheres to all the legal regulations and obligations.	
<b>Green Technology</b>	Green technology has the potential to elevates economic benefits along with enhancing environmentally sustainable performance.	(Wasiq et al., 2023)
	green technology has notable ties to enhancing company's credibility.	
	Green practices are suitable to fit in an organizational setting.	
<b>Corporate Governance</b>		
<b>Accountability</b>	In my organization accountability is dually shared with each and every one at different levels.	(Abdullah et al., 2021)
	In my organization the effectiveness of governance framework is scrutinized by the company's respective board.	
	The board is efficient in overseeing the performance of underperforming directors coupled with those exhibiting inappropriate behaviors.	

	The board policies remain current and up to date while reviewing these on consistent basis.	
<b>Fairness</b>	In my company board members safeguard and works best in the interest of all stakeholders.	
	In my organization annual audit is supervised and held by an independent audit committee.	
	In my organization the board aims its efforts to maintain cordial relationships with all other staff members.	
	In my organization the board consistently reviews the employees contract to provide appropriate support to compensation plans.	
<b>Transparency</b>	In my organization communication structure has been established aiming to share the objectives and strategies of the organization along with providing corporate guidance.	
	In my organization noperating and financial results are made transparent through financial disclosures.	
	In my organization the procedure for disclosures and communication is supervised by the board.	
	In my organization accurate, high quality and timely information is shared with all the participants involved in decision making at various levels.	
<b>Independence</b>	In my organization the board is committed to oversee and fulfilled its roles and responsibilities.	
	In my organization the board exercise it's a authority as a single unit	
	Board members tries to diligently avoid conflicts of interest or any other conflicts related perceptions.	
	In my company the final decision sounds no conflicts of interest.	
<b>Sustainability</b>	Reduction of waste and emissions	(Bernal-Conesa et al., 2017)
	Decrease in energy consumption	
	Decrease in both environmental and risk hazards	
	Diminishing environmental impacts	
	Decrease in environmental penalties	
	Incrementing energy efficiency	