



# Relationship Between Green Innovation and Sustainability and Moderating Role of Foreigners: Evidence from Saudi Listed Companies

Lassaad Ben Mahjoub<sup>1</sup>

Received: 29 July 2022 / Revised: 16 January 2023 / Accepted: 2 February 2023 / Published online: 15 February 2023  
© The Author(s), under exclusive licence to Springer Nature Singapore Pte Ltd. 2023

## Abstract

This paper investigates the effect of the presence of non-Saudi members on the board and committees and the relationship between green innovation and sustainability reporting. I rely on the ISO 26000 and CSR guidelines as an index of sustainability measures. Based on a sample of Saudi listed firms, for the period 2017–2020, I run a multiple regression to test the moderating role of the effect of foreigners' presence on the link between green innovation and sustainability reporting. The main issue of the paper is to address whether the presence of foreign members on the board of directors affects the firm's decision to voluntarily respond to major stakeholders' demands for increased sustainability reporting in Saudi Arabia. I found that the last appearance of COVID-19 affected the level of sustainability reporting, which led to the impact on the results of the relationship between the variables as well. By using a hierarchical moderated regression analysis, my findings confirm that green innovation has a crucial role in promoting sustainability, but the presence of foreigners in different committees has no effect on the relationship.

**Keywords** Green innovation · Sustainability · Foreigners · Moderator variable

## Introduction

The determinants of the corporate social responsibility, its sustainability, and its association with organizational performance have been studied extensively, with most of these determinants centered on financial and institutional aspects Albarak and Ben Mahjoub (2020), (Ben Mahjoub 2019; Kao et al. 2018; Timbate and Park 2018, Lu and Wang 2020). On the other hand, the most important studies in this aspect focused on the developed countries, and since the issue of sustainability concerns the activities associated with the environment, in particular, the study of these aspects in Saudi Arabia is the most prominent motivation for this study (Ben Mahjoub 2018, 2019; Aina et al. 2019; Habbash 2016; Windsor 2017). The emergence of the UN 2030 Agenda and 17 Sustainable Development Goals promoted addressing the other determinants of sustainability, as green innovation and

the presence of foreigners are the most prominent current topics, which can influence the extent of corporate sustainability, Gennari (2019) found that the pressure by the internal (ownership structure) and external variables (soft law) has an effect on the establishment of a CSR committee. In the same context, Garanina and Aray (2021) argue that foreign board members and cross-listing help companies improve their accountability through strengthened corporate social responsibility (CSR) reporting. In another hand, Fuente et al. (2017) find a positive significant relation between the presence of non-executive directors and the importance of preserving diversity; the same research proves that the existence of a CSR committee is important in the successful CSR reporting.

Based on the above, will green innovation affect the extent of sustainability disclosure for Saudi listed companies? Do foreign members in the company play an effective role in strengthening this relationship?

So, I attempt in this paper, to highlight the importance of green innovation in promoting sustainability in Saudi Arabia and to find out the moderating role of the existence of foreign members on the relationship between green innovation and sustainability reporting.

✉ Lassaad Ben Mahjoub  
ltbenmahjoub@imamu.edu.sa

<sup>1</sup> Imam Mohammad Ibn Saud Islamic University, Riyadh, Saudi Arabia

The remainder of the paper is organized as follows. The “**Background**” section presents the theoretical background, in which I discuss the concepts of green innovation and foreigners in Saudi Arabia. In the “**Literature review and hypotheses development**” section, hypotheses were developed by referring to previous studies and appropriate theories. While in the “**Research design**,” “**Empirical results and discussion**,” and “**Summary and conclusion**” sections, the research design of the study will be presented, where the population, the sample, and the sampling will be explained, as well as the interpretation of the results, the testing of hypotheses, and finally the conclusion and recommendations.

## Background

### Green Innovation

Various terms and ideas have been utilized to characterize the innovations that target diminishing negative environmental effects. Among them, green innovation (GI), eco-innovation, environmental innovation, and reasonable innovation have been the well-known ones. In accordance with Kemp and Pearson (2007), I characterized GI as new or essentially improved products and enterprises, measures, promoting techniques, hierarchical structures, and institutional game plans that lead to environmental enhancements contrasted with relevant electives (Wang et al. 2021b, Guo et al. 2020).

A few other definitions have been recommended by scholars and experts. The World Bank characterizes green innovation as “the turn of events and commercialization of better approaches to tackle environmental issues through upgrades in technology, with a wide understanding of technology as incorporating item, measure, hierarchical, and promoting enhancements” (World-Bank 2012). All the more barely, the United Nations Industrial Development Organization characterizes it as “items that diminish their general life—cycle environmental devil acts by preferring reparability, dismantling, recyclability, and recoverability” (UNIDO 2015). The EU Eco-Innovation Observatory characterizes it as “the presentation of any new or fundamentally improved item (great or administration), measure, authoritative change or advertising arrangement that diminishes the utilization of common assets (materials, energy, water, and land) and diminishes the arrival of unsafe substances over the entire life – cycle” (Doranova et al. 2017).

The environmental advantage can occur when the presented innovation diminishes the utilization of normal assets, diminishes the environmental contamination (air, water, soil, or commotion contamination), replaces environmentally hurtful substances with less unsafe ones, or has longer assistance life or superior recyclability than other

important options. This advantage can either be the essential objective or an unintended consequence of the innovation. In accordance with the Oslo Manual, the dispersion and reception of green arrangements are new to the firm; however, previously existing available ones are additionally viewed as GIs (OECD 2018). Following the world’s most commonly perceived philosophy for the assortment and utilization of innovation measurements set in the Oslo Manual (OECD, 2018), I can recognize two general classes of GI:

- Product GI: another or improved or great administration that prompts critical environmental enhancements contrasted with the great administration recently created or utilized by the firm.
- Business-process GI: another or improved business measure for at least one business work that has been brought into utilization by the firm and which creates environmental upgrades contrasted with the business measures recently utilized by the developing firm. These kinds of GI are not totally unrelated; that is, one green innovation could be an item and also a business-process GI simultaneously. For instance, the presentation of refillable cleanser jugs may represent to both a product and a business-process GI.

### Presence of Foreign Members

Policies for integrating immigrants or people of immigrant origin into the labor market are one of the objectives of effective and responsible diversity management. Diversity is understood as ethnic, cultural, or even identity diversity. Diversity in the sense that it must be managed also refers to gender, age, or disability. In the rest of the text, when I talk about diversity, I am referring to the notion of diversity in connection with the integration of immigrants or people of immigrant origin. Otherwise, I specify what type of diversity I am talking about. Diversity, understood in this way, is set to increase the challenges, and companies will be increasingly confronted with it. This diversity is a challenge for society as a whole and companies in particular (Ben-Amar et al. 2017, Ben-Amar and McIlkenny 2015, Wolff et al. 2018).

Concerning the context of Saudi Arabia, and despite the passage of decades since the beginning of the first oil boom in Saudi Arabia, its economy is still largely dependent on oil exports, and the attempts to diversify the economy have not succeeded during that period, as the oil still represents more than 80% of exports, as well as revenues. Oil contributes to more than 90% of the Saudi government’s revenue. This paper seeks to explain the reasons for Saudi Arabia’s failure to transform from a rentier economy dependent on oil to a productive, sustainable economy (Callen et al. 2014).

In Saudi Arabia, expatriates represent more than a third of the population, which are diverse, with various ethnic and

linguistic backgrounds. Recently, the Saudi government permitted the foreigners to be members of the board of directors of the chambers and the issuance of a new type of visa that allows for privileged residence, to encourage investment. In recent years, it has issued legislation urging the Saudization (Saudi nationalization scheme) of several sectors in Saudi Arabia, but it does not include especially the areas that require expertise and higher qualifications.

### Sustainability in Saudi Arabia

Sustainability is an international socioeconomic term with which the different national and international organizations have drawn a map for environmental, social, and economic development all over the world. Its main goal is to improve the living conditions of every individual and develop the production of quality tools, and manage them in a way that does not deplete the natural resources of the planet and does not deprive the future generations of their fair share of the same and without abusing the remaining natural resources (Leonidou et al. 2018; Pimonenko et al. 2020; PwC 2008).

So, the United Nations, and many national organizations, NGOs, and countries, including Saudi Arabia, joined efforts and forces to fight this issue (especially the overuse of the natural resources). They aimed at adopting objectives of the sustainable development towards creating an international humanitarian community amalgamated to fight the challenges, reduce poverty, change production and consumption behaviors as to non-renewable resources, and protect and sustainably manage natural resources, air, and sea (Ibrahim et al. 2015; Albarrak and Ben Mahjoub 2020).

Driven by this, the Ministry of Environment, Water and Agriculture of Saudi Arabia (MEWA) was set to play a crucial role in achieving these virtuous goals and objectives. Saudi Arabia has been among the first countries to adopt sustainable development objectives since its announcement. MEWA joined hands with other government institutions to adhere to the national constructive initiatives, face the challenges, and carry out the national transformation programs that aim at attaining sustainable development, according to the principles announced by the international community as the main pillars:

- Sustainable economic development
- Sustainable social development
- Sustainable protection of the environment and natural resources

In the same context, Saudi Arabia is ranked 161st in the Global Sustainability Index for the year 2019 (Lafortune and Schmidt-Traub 2019). Saudi Arabia is set to host the 2030 nationally determined contributions (NDCs). For this purpose, intensive preparations began during this period,

mainly represented by the Saudi Green Initiative ([www.saudi-greeninitiative.org](http://www.saudi-greeninitiative.org)). Nevertheless, Climate Action Tracker has anticipated that Saudi Arabia's emissions will attain a 92–108% rise higher than 2010 levels in 2030 (Dargin 2021). Saudi Arabia's environmental image in the world was not better, especially by the effect of the big petroleum companies such as Aramco, which was named the biggest contributor to carbon dioxide emissions.

In another important aspect, I find that Saudi Arabia has several initiatives in the field of green economy, sustainable development, and green innovation. Among these initiatives, I discover what King Abdullah University of Science and Technology is doing regarding green buildings (Overview | King Abdullah University ([kaust.edu.sa](http://kaust.edu.sa))) and King Salman Energy Park on innovative solutions for sustainable development (Spark).

On the other hand, the Kingdom is making considerable efforts regarding the United Nations Agenda 2030 (Sustainable Development Goals and the Saudi Efforts to Achieve Them ([my.gov.sa](http://my.gov.sa))). Finally, Saudi Arabia participated in October–November 2021 in the summit of the Parties (COP26) in Glasgow related to climate change, where the extent of the Kingdom's contribution to preserving the environment was confirmed, and the propaganda for the Saudi Green Initiative and the Middle East Green Initiative was debated (Xing and Rai 2021).

## Literature Review and Hypotheses Development

### Green Innovation and Sustainability Reporting

Claims to protect the earth from pollution began a long time ago considering the great impacts that humans caused on the planet, as organizations to protect the environment began to form, aiming to introduce the great danger posed by humans and the result of industrial development that was negatively affected by the natural environment of the globe (Manisalidis et al. 2020). As a result, the whole world and companies in particular began to focus on developing their products in such a way that their impact on the environment is less, but also extended to encouraging the manufacture of products that contribute to improving the earth's environment, and here stems the essence of the idea of my research "green innovation," which aims to encourage companies to provide green products that are not harmful to the environment, and not only products, but the processes and machinery that produce these products must be harmless to the environment as well (Welford 2014; World-Bank 2012).

This context includes several areas in the domain of sustainability and many areas through which companies can reduce the level of pollution and benefit greatly

because the concern for the environment has become one of the competitive precedents that focus on it as a result of the increased awareness of the customer in this area (Gal et al. 2018; Vezzoli and Manzini 2008). Focuses on obtaining products that protect the environment in addition to the social responsibility that companies feel towards society, thus, preserving the share of its future generations in the context of environmental sustainability (González-Rodríguez et al. 2019).

The literature in the domain of the green economy suggests that companies must design a strategic plan in order to define their innovation possibilities and capabilities to comply with the external exigencies, especially with the external competitive environment and the society in general. If someone assumes that research and training and innovation are ambiguous and especially interrelated, there are aspects of enhancing a greater value, containing innovative products via a modern production process (World-Bank 2012, Wang et al. 2021b).

Some studies prove the existence of a positive relationship between the extent of innovativeness and the disposition to change and accept new ways of doing things and invest greater efforts in research and development (Musaeva 2015); also, a high level of innovation has a relation with the green innovation programs or strategies in line with the environmental tendencies and transformations (Andersén, 2021; Huang and Wang 2020).

Companies can adapt to the circumstances and demands of their institutional context whether on the economic side or the social side. There are three distinct types of institutional forces both inside and outside of organizations: regulative, normative, and cultural-cognitive (Khan et al. 2021). Companies' green innovation efforts and initiatives stemmed from their CSR and sustainability interests which can furnish an opportunity to assess the interaction of contextual issues and companies' reactions and their preemptive strategies for employing institutional services.

Corresponding to the tenets of organizational learning theory, companies tend to act and discover from their current proficiency and acquired knowledge. For that, companies get inspired by interrelated processes, models, and organized activities that touch on directors' standpoints that are inspired by previous habits. Furthermore, the principle of learning theory is that the level of firms' capability to obtain differs on firms' accumulated skills associated with expertise assimilation into managerial purposes. Likewise, green innovation is judged important in advancing satisfactory direction, and communication, and helps to rearrange the firm's understanding and competencies in improving the chance of being "green" (Ullah et al. 2021; Chiou et al. 2011). Several researchers explored the association between green innovation and CSR and sustainability; nevertheless, the literature in this area is confusing to prove a precise connection among

the variables. For example, in an Indonesian context and by using a learning machine method, De Las Heras et al. (2020) argue that companies can reduce production costs via CSR behavior; their study results confirm that corporate social responsibility can be the company's mainstay in firm performance and CSR owned by the companies can influence the level of empowerment of the company's atmosphere in terms of sustainability.

In the recent period, I have been talking about the use of modern technologies (learning machine, ultra-precision machining, green learning...) as a way to achieve sustainability, including avoiding pollution, as well as extravagance and damage, and a good number of studies have worked on this aspect (Zhou et al. 2022; Khan et al. 2022; Wang et al. 2022). By the way, most of the works found a positive relationship between green innovation and sustainability (Rehman et al. 2021; Kuzma et al. 2020; Ullah et al. 2021). Given the above, the following hypothesis can be presented:

**Hypothesis 1** The higher spending on green innovation, the greater the sustainability reporting made by Saudi listed companies.

### Presence of Foreigners on Board and Committees and Sustainability Reporting

Discussing foreigners in companies brings me back to evoking the notion of cultural differences and their organizational role. Several researches have addressed this axis (Tata and Prasad 2015, Fernandez-Feijoo et al. 2014, Ben Mahjoub and Amara 2020); in my research, I will focus on the role of the presence of foreigners on the boards of directors and the different committees, on the level of disclosure on the sustainability.

There have been very few studies conducted on the foreign nationality of managers and directors in the Gulf countries context. Miletkov et al. (2014) carry out a cross-country comparison concerning the effect of the presence of foreigners on corporate governance.

A culturally diverse company allows employees to develop their talents and skills. A range of ideas and expertise allows everyone to learn from their mates.

It can also strengthen problem-solving skills and increase happiness, well-being, and productivity. In an environment where all voices are heard, this spirit of innovation and encouragement to contribute is an accelerator of business success.

Bremholm (2015) argue that foreign ownership has a positive effect on corporate performance, and foreign investors may encourage organizations to work better.

Some research papers emphasize the importance of foreigners' presence in the companies and this in several aspects, for example, Setiawan et al. (2021) argue that

foreigners are more concerned about the quality of corporate governance practice and foreign investors enhance organizations to ask for better corporate governance practices. On the other hand, according to Bertrand et al. (2021), the firms hiring foreigners are characterized by good governance and subsequently by a good performance. In the same context, Tokas and Yadav (2020) and Garanina and Aray (2021) confirm the expectation that foreign boards improve CSR in India and in Russia, respectively.

In a study on the Australian context, Mishra (2014) find a positive effect of foreign ownership on firm value. In the same context, foreigners line up their interests with shareholders; therefore, foreign ownership encourages transparency and earnings quality (Vo and Chu 2019). In addition, foreign owners reckon to the firm's activities on corporate social responsibility. Rustam et al. (2019) examined the effect of foreign ownership on CSR using the Pakistan context. The findings of this research found that foreign ownership has a significant effect on CSR, and they argue that foreigners employ discretion to incite firms to be more engaged in CSR and sustainability events. In Asian countries, such as Malaysia and Japan, interest in gas emissions and environmental pollution is of increasing concern, and some recent studies focused on the role of foreign workers in reducing gas emissions and the extent of care exerted by them in this aspect (Rahman et al. 2022; Kitao and Yamada 2021). Saudi Arabia, as an Asian country, abounds with a huge number of foreign workers, as it has recently become keen to reduce cheap labor in favor of attracting specialized workers who can be aware of social responsibility, including environmental protection (Rutkowski and Koettl 2022).

From the above, I can conclude that the variable “presence of foreigners” can have an effect on sustainability reporting and also it can have a moderating effect on the relationship between green innovation and sustainability reporting.

**Hypothesis 2a** The presence of non-Saudi members within the board of directors and different committees has a positive effect on sustainability reporting made by Saudi listed companies.

**Hypothesis 2b** The presence of non-Saudi members within the board of directors and different committees enhances the relationship between green innovation and sustainability reporting made by Saudi listed companies.

## Research Design

### Population and Sample

The choice to include Saudi companies in the study is based on the regional place of the Kingdom of Saudi Arabia and

the existence of its oil and petroleum resources. These companies, which belong to industries that are often perceived as polluters, represent the best and the most effective proof of their capability to disclose social and environmental information in the presence of the ISO 26000 standard (Raufflet et al. 2014).

“During the decade of 2003 to 2013, it almost doubled in size on the back of a protracted oil boom” (McKinsey and Company, 2015).

Therefore, the sample is extracted from a population of Saudi listed companies that excludes financial institutions, service industries, and firms that do not have updated websites (see the Appendix Table 8).

The final list of the companies included in the sample includes 112 companies belonging to 7 industries during the 3-year period (2017–2020), resulting in 448 observations. My data was collected from “tadawul,” “argaam,” and “asmainfo”<sup>1</sup> Saudi websites and the annual reports of the companies.

### Specification of the Model

$$SUST_{it} = a_0 + a1GRIN_{it} + a2FORG_{it} + a3GRIN * FORG_{it} + a4INDS_{it} + a5LVRG_{it} + a6AUQU_{it} + a7AGE_{it} + a8SIZE_{it} + it$$

$$i = 1, 2, 3, \dots, 89.$$

$$t = 1, 2, 3.$$

where

SUST	level of sustainability reporting
GRIN	green innovation
FORG	percentage of foreigners on the board of directors, sub-committees, and executive management
SIZE	size of firm <i>i</i> in year <i>t</i>
INDS	the firm <i>i</i> among the sensitive industries or not
LVRG	leverage of firm <i>i</i> in year <i>t</i>
AGE	number of years from creation to present
AUQU	audit quality, binary variable (1 if auditor from big four auditors, 0 otherwise)

### Variables Measurement

#### Measurement of Green Innovation (GRIN)

By reviewing the literature related to green innovation, academics are searching for a measurable index. Since it is useful to identify the facts about green innovation, relying on recent empirical research, the innovative aspects that must be counted in measuring green innovation are as follows: production,

<sup>1</sup> <https://www.argaam.com/en>, <https://www.tadawul.com.sa/>, [www.asmainfo.com/](http://www.asmainfo.com/)

process, marketing, organizational aspect, material flow, and social aspect (Park et al. 2016).

The Eco-Innovation Scoreboard, established by the Eco-Innovation Observatory and supported by the European Union, collects an index compounded from a group of indicators to measure the strengths, weaknesses, and green innovation performance of the European Union countries. These indicators counted 16, englobe 5 fields: eco-innovation inputs, eco-innovation activities, eco-innovation outputs, resource efficiency, and socioeconomic outcomes (Moreno and García-Álvarez 2018). There are many other tools used to measure green innovation, such as the number of eco-patents developed by the companies (Urbaniec et al. 2021; García-Granero et al. 2018; Oltra et al. 2010).

On the other hand, when observing the definition of “green innovation,” I conclude that a green innovation may be new technology, product, process, business model, etc. Even though, a lot of research papers refer to green innovation in general terms, i.e., green innovation encompasses the different techniques that can help the various parties, whether at the micro or macro level, so as not to allow damage and violate the environment, and therefore, the appropriate measure for this variable can be the sum of the expenditures centered around this aspect (Tumelero et al. 2019; Park et al. 2016; Xu et al. 2021). And therefore, in my research, I use the research and development (R&D) expenditures as a measure of green innovation to be in line with the nature of the research problem first and in line with the nature of the sample that I chose, secondly.

### Measurement of the “Presence of Foreigners”

In this research, I use, as a measure of the variable “presence of foreigners,” the percentage of foreigners on the board of directors, sub-committees, and executive management; all measurements are gathered from annual reports, direction reports, and companies’ websites.

## Measurement of Sustainability Reporting

The index created in order to measure sustainability reporting (SUST) is used to evaluate the overall performance of social, environmental, and economic principles of companies to ensure sustainability (Appendix Table 9). This index englobes 21 indicators extracted from 76 underlying variables. The principles sources of these variables are the Global Reporting Initiative (GRI), the guidelines of ISO 26000, and the goals of the Agenda of United Nation 2030 (Diez-Cañamero et al. 2020; Gerged et al. 2018; Sethi et al. 2017; Ben Mahjoub 2019).

These indicators are deemed to contain the quality of air and water, biodiversity, artificialization of the territory, constraints on ecosystems, waste, natural resource management, environmental policy, social aspects, etc. SUST refers to the ability to reach major levels of social and environmental performance in 5 areas (environmental systems, reducing environmental stress, reducing human vulnerability, social and institutional capabilities, and global stewardship) in a sustainable approach (Table 1).

## Empirical Results and Discussion

### Descriptive Analysis

My research englobes both the dichotomous variables and continuous variables. Regarding Table 2, I conclude that my sample contains 60% of companies that are controlled by the government and 43% of companies that are audited by a big four auditors.

Concerning the mean age of the companies is 33 years indicates that the companies are well established with many years of experience making up the sample of the study.

Finally, regarding the mean (1.77) of the dependent variable SUST, if I take into consideration the values assigned to the items of the measurement index of this variable, I notice that

**Table 1** Variable measurements summary

Variable	Code of the variable	Measurement
Green innovation	GRIN	Research and development expenditures
Presence of foreigners	FORG	The percentage of foreigners on the board of directors, sub-committees, and executive management
Sustainability reporting	SUST	An index englobing 21 indicators (Appendix Table 9)
Size of the company	SIZE	Total assets
Leverage of the company	LVRG	Debt ratio
Presence of foreigners	FORG	Percentage of foreigners on board of directors, sub-committees, and executive management
Age of the company	AGE	Number of years from creation to present
Audit quality	AUQU	Binary variable (1 if auditor from big four auditors, 0 otherwise)

**Table 2** Descriptive analysis of all the variables

Dichotomous variables					
	Frequency	Percent	Valid percent	Cumulative percent	
INDS	0	180	40.2	40.2	40.2
	1	268	59.8	59.8	100.0
	Total	448	100.0	100.0	
AUQU	0	257	57.4	57.4	57.4
	1	191	42.6	42.6	100.0
	Total	448	100.0	100.0	
Continuous variables					
	<i>N</i>	Minimum	Maximum	Mean	Std. deviation
AGE	448	8	68	32.92	14.540
LVRG	432	0.00830	2.7180	0.4093	0.29303
FORG	448	0.0000	1.0000	0.2279	0.2042
GRIN	448	0.0000	24.1258	14.7750	6.3115
SUST	448	0	3	1.77	0.910
Valid <i>N</i> (listwise)	432				

**Table 3** Test of comparison of means of sustainability by industry sensitivity

Independent samples test											
		Levene's test for equality of variances		<i>t</i> -test for equality of means							
		<i>F</i>	Sig.	<i>t</i>	<i>df</i>	Sig. (2-tailed)	Mean diff.	Std. err diff.	95% Confidence interval of the difference		
										Lower	Upper
SUST	Group 1: sensitive industries	1.698	0.193	0.234	446	0.815	0.021	0.088	-0.152	0.193	
	Group 2: non-sensitive industries			0.238	405.750	0.812	0.021	0.086	-0.149	0.190	

it is an acceptable average since the minimum value assigned is equal to zero and the maximum value is equal to 3.

Concerning the level of sustainability reporting by the industry sensitivity, I conduct a *t*-test for the mean comparison (Table 3); the findings confirm that there is no remarkable difference between the two groups, which proves that this sensitivity variable has no effect on the SUST level, and this finding corroborates with those of several studies in the field (Simoni et al. 2020; Chrysos-Anestis et al. 2021).

**Correlations**

Regarding Table 4, it is related to Pearson correlation; I find that the majority of variables are statistically correlated at a 5% level.

Finally, by analyzing the progress of the level of SUST over the period 2017–2020 (Table 5), I conclude a big number of companies communicate about sustainability more in the years 2019 and 2020. This rise is especially due to the repercussions of the Corona pandemic on companies, as the

recent period has represented a great concern for them, and several studies have recently proven that companies in the world have increased disclosure about these risks related to the 2019 Corona pandemic (Adams and Abhayawansa 2022; Zharfpeykan and Ng 2021).

**Hierarchical Moderated Regression Analysis<sup>2</sup>**

Hierarchical regression is a type of regression model in which the predictors are entered in blocks. This method is needed in the presence of the interaction term.

I conducted this regression for two models (blocks): model 1 without the interaction term (moderated variable) and the model 2 with the interaction term (Table 6).

<sup>2</sup> Hierarchical regression is a statistical tool used to show if the variables of interest in a model explain a statistically significant amount of variance in the dependent variable after accounting for all other variables, especially when the model contains a moderator variable (ANDERSON, C. H. 1986. Hierarchical moderated regression analysis: A useful tool for retail management decisions. *Journal of retailing*).

**Table 4** Pearson correlations for all the variables

		SENS	ASSE	AUQU	FORG	SUST	GRIN	LVRG	AGE
SENS	Pearson	1	−0.017	−0.085	−0.040	0.011	0.043	0.054	0.147**
	Sig. (2-tailed)		0.721	0.071	0.400	0.815	0.368	0.266	0.002
ASSE	Pearson	−0.017	1	0.436**	0.079	0.374**	0.331**	0.232**	−0.106*
	Sig. (2-tailed)	0.721		0.000	0.097	0.000	0.000	0.000	0.025
AUQU	Pearson	−0.085	0.436**	1	0.134**	0.220**	0.203**	0.071	−0.113*
	Sig. (2-tailed)	0.071	0.000		0.004	0.000	0.000	0.139	0.016
FORG	Pearson	−0.040	0.079	0.134**	1	0.022	−0.009	0.072	−0.084
	Sig. (2-tailed)	0.400	0.097	0.004		0.648	0.843	0.137	0.076
SUST	Pearson	0.011	0.374**	0.220**	0.022	1	0.334**	0.095*	−0.088
	Sig. (2-tailed)	0.815	0.000	0.000	0.648		0.000	0.049	0.062
GRIN	Pearson	0.043	0.331**	0.203**	−0.009	0.334**	1	0.208**	−0.018
	Sig. (2-tailed)	0.368	0.000	0.000	0.843	0.000		0.000	0.705
LVRG	Pearson	0.054	0.232**	0.071	0.072	0.095*	0.208**	1	−0.043
	Sig. (2-tailed)	0.266	0.000	0.139	0.137	0.049	0.000		0.371
AGE	Pearson	0.147**	−0.106*	−0.113*	−0.084	−0.088	−0.018	−0.043	1
	Sig. (2-tailed)	0.002	0.025	0.016	0.076	0.062	0.705	0.371	
N		448	448	448	448	448	448	432	448

\*\*Correlation is significant at the 0.01 level (2-tailed)

\*Correlation is significant at the 0.05 level (2-tailed)

**Table 5** Sustainability evolution over the period 2017–2020

		N				Total
		2017	2018	2019	2020	
SUST	Score 0	10	9	6	4	29
	Score 1	53	48	34	27	162
	Score 2	34	35	35	37	141
	Score 3	15	20	37	44	116
Total		112	112	112	112	448

**Table 6** Model summary

Model	R	R square	Adjusted R square	Std. error of the estimate	Change statistics				
					R square change	F change	df1	df2	Sig. F change
1	0.400 <sup>a</sup>	0.160	0.144	0.822	0.160	9.781	7	359	0.000
2	0.401 <sup>b</sup>	0.161	0.142	0.823	0.001	0.404	1	358	0.525

<sup>a</sup>Predictors: (constant), AGE, GRIN, FORG, LVRG, SENS, AUQU, ASSE

<sup>b</sup>Predictors: (constant), AGE, GRIN, FORG, LVRG, SENS, AUQU, ASSE, Zscore(FORG\_GRIN)

After checking the necessary conditions for using linear regression, I found the problem of multicollinearity related to the variable “FORG\_GRIN” (describing the moderating role of the variable “presence of foreigners” in the model); to resolve this problem, I standardized this variable via SPSS commands (Table 7).

From the tables above, I conclude that the variable green innovation in both models has a positive and significant effect on the sustainability reporting at a 5% level, similarly to the variable size of the company which is measured by

total assets. But the other control variables have no significant effect on the dependent variable.

Concerning the variable “foreigners” only (model 1), I found no significant effect on sustainability reporting. Similarly, by the moderating role of this variable (model 2), I detect no significant effect.

The importance of GRIN and its impact on sustainability reporting has been the subject of many studies, and their results corroborate my results (Wang et al. 2021a, Qiu et al. 2020). In Saudi Arabia, in support of its global trends in



**Table 7** Hierarchical moderated regression result

Coefficients <sup>a</sup>									
Model		Unstandardized coefficients		Standardized coefficients	<i>t</i>	Sig.	Correlations		
		<i>B</i>	Std. error				Beta	Zero-order	Partial
1	(Constant)	-1.713	0.584		-2.936	0.004			
	SENS	0.132	0.090	0.073	1.467	0.143	0.059	0.077	0.071
	ASSE	0.138	0.028	0.281	4.911	0.000	0.352	0.251	0.238
	AUQU	0.090	0.097	0.050	0.920	0.358	0.205	0.048	0.044
	FORG	-0.089	0.215	-0.020	-0.412	0.680	-0.014	-0.022	-0.020
	GRIN	0.034	0.010	0.170	3.286	0.001	0.276	0.171	0.159
	LVRG	-0.109	0.148	-0.036	-0.737	0.462	0.038	-0.039	-0.036
	AGE	-0.001	0.003	-0.020	-0.407	0.685	-0.032	-0.021	-0.020
2	(Constant)	-1.941	0.685		-2.832	0.005			
	SENS	0.137	0.090	0.075	1.515	0.131	0.059	0.080	0.073
	ASSE	0.137	0.028	0.278	4.826	0.000	0.352	0.247	0.234
	AUQU	0.088	0.097	0.050	0.904	0.367	0.205	0.048	0.044
	FORG	0.421	0.830	0.096	0.507	0.612	-0.014	0.027	0.025
	GRIN	0.043	0.018	0.218	2.395	0.017	0.276	0.126	0.116
	LVRG	-0.108	0.148	-0.036	-0.728	0.467	0.038	-0.038	-0.035
	AGE	-0.001	0.003	-0.022	-0.450	0.653	-0.032	-0.024	-0.022
	Zscore(FORG_GRIN)	-0.113	0.178	-0.127	-0.636	0.525	0.074	-0.034	-0.031

<sup>a</sup>Dependent variable: SUST

reducing carbon emissions, achieving zero-neutrality and the green economy, advancing innovation and encouraging investment in the private sector, and in support of the Kingdom’s orientation in leading the green era in the region, Saudi Aramco (the biggest company in the country) engaged with national and international investors five conventions related to the investment in green hydrogen industry and services and led to the fabrication of advanced non-metallic building materials, and digital technologies in the industrial fields (2022). This giant company in the field of petroleum industries and with its services is certainly a role model for the rest of the Saudi companies.

On the other hand, the results of the study did not show a strong influence on the variable “the presence of foreigners,” which can be explained by the insignificant role of foreigners in the recent period in the Kingdom of Saudi Arabia, especially with the increasing number of local skills. Recently, Saudi Arabia started compulsory nationalization programs for most sectors.

### Summary and Conclusion

In this paper, I analyzed the effect of green innovation on the level of sustainability reporting in Saudi Arabia, and I tested the moderating role of “the presence of foreigners in the different

committees in the company” in strengthening the relationship between green innovation and sustainability reporting.

The results of the study prove a positive and significant effect of green innovation, but the presence of the foreigners appeared to have no effect in this relationship. My findings were affected to some extent by the effects of the Coronavirus pandemic on the companies and the increase in awareness among various parties of the need to raise awareness of future risks. My findings corroborate with those found by Sobaih et al. (2022) in Saudi context by using a green innovation and CSR as mediating variables to prove the effect of sustainability on corporate performance. The same affirmation on SMEs companies in Saudi Arabia is argued by Al Doghan et al. (2022).

Finally, this paper is a challenge for me, given the difficulty of context and given the scarcity of data and the specific desired variables to be included in the study. I believe the outputs will contribute to the existing literature, serve as useful leads for different stakeholders, and, essentially, open new opportunities for future research. In view of some of the limitations that have been made in this research, I will work to avoid in later research works, including enlargement of the sample and making comparisons, especially among the countries of the Gulf Cooperation Council, as well as using modern techniques, including machine learning.

## Appendix

**Table 8** List of companies (the sample)

Company	Sector
City Cement Co.	Cement
Abdullah A. M. Al-Khodari Sons Co.	Building and Construction
Abdullah Al Othaim Markets Co.	Retail
Advanced Petrochemical Co.	Petrochemical Industries
Al Abdullatif Industrial Investment Co.	Industrial Investment
Al Hammadi Company for Development and Investment	Retail
Al Hassan Ghazi Ibrahim Shaker Co.	Industrial Investment
Al Jouf Cement Co.	Cement
Al Sorayai Trading and Industrial Group	Industrial Investment
Al-Babtain Power and Telecommunication Co.	Building and Construction
Aldrees Petroleum and Transport Services Co.	retail
Al-Jouf Agricultural Development Co.	Agriculture and Food Industries
Alkhaleej Training and Education Co.	Retail
Almarai Co.	Agriculture and Food Industries
Alujain Corp	Petrochemical Industries
Anaam International Holding Group	Agriculture and Food Industries
Arabian Cement Co.	Cement
Arabian Pipes Co.	Building and Construction
Ash-Sharqiyah Development Co.	Agriculture and Food Industries
Astra Industrial Group	Industrial Investment
Basic Chemical Industries Co.	Industrial Investment
Bawan Co.	Building and Construction
Dallah Healthcare Holding Co.	retail
Eastern Province Cement Co.	Cement
Electrical Industries Co.	Building and Construction
Filing and Packing Materials Manufacturing Co.	Industrial Investment
Fitaihi Holding Group	retail
Hail Cement Co.	Cement
Halwani Bros. Co.	Agriculture and Food Industries
Herfy Food Services Co.	Agriculture and Food Industries
Jarir Marketing Co.	retail
Jazan Development Co.	Agriculture and Food Industries
Methanol Chemicals Co.	Petrochemical Industries
Middle East Paper Co.	Industrial Investment
Middle East Specialized Cables Co.	Building and Construction
Mouwasat Medical Services Co.	retail
Najran Cement Co.	Cement
Nama Chemicals Co.	Petrochemical Industries
National Agricultural Development Co.	Agriculture and Food Industries
National Agricultural Marketing Co.	retail
National Gas and Industrialization Co.	Energy and Utilities
National Gypsum Co.	Building and Construction
National Industrialization Co.	Petrochemical Industries
National Medical Care Co.	retail
National Metal Manufacturing and Casting Co.	Industrial Investment
National Petrochemical Co.	Petrochemical Industries
Northern Region Cement Co.	Cement
Qassim Agricultural Co.	Agriculture and Food Industries

**Table 8** (continued)

Company	Sector
Qassim Cement Co.	Cement
Rabigh Refining and Petrochemical Co.	Petrochemical Industries
Red Sea Housing Services Co.	Building and Construction
Sahara Petrochemical Co.	Petrochemical Industries
Saudi Airlines Catering Co.	Agriculture and Food Industries
Saudi Arabia Fertilizers Co.	Petrochemical Industries
Saudi Arabian Amiantit Co.	Building and Construction
Saudi Arabian Mining Co.	Industrial Investment
Saudi Automotive Services Co.	retail
Saudi Basic Industries Corp	Petrochemical Industries
Saudi Cable Co.	Building and Construction
Saudi Cement Co.	Cement
Saudi Ceramic Co.	Building and Construction
Saudi Chemical Co.	Industrial Investment
Saudi Company for Hardware	retail
Saudi Electricity Co.	Energy and Utilities
Saudi Fisheries Co.	Agriculture and Food Industries
Saudi Industrial Development Co.	Building and Construction
Saudi Industrial Export Co.	Industrial Investment
Saudi Industrial Investment Group	Petrochemical Industries
Saudi International Petrochemical Co.	Petrochemical Industries
Saudi Kayan Petrochemical Co.	Petrochemical Industries
Saudi Marketing Co.	retail
Saudi Paper Manufacturing Co.	Industrial Investment
Saudi Pharmaceutical Industries and Medical Appliances Corp	Industrial Investment
Saudi Steel Pipe Co.	Building and Construction
Saudi Vitrified Clay Pipes Co.	Building and Construction
Savola Group	Agriculture and Food Industries
Southern Province Cement Co.	Cement
Tabuk Agricultural Development Co.	Agriculture and Food Industries
Tabuk Cement Co.	Cement
Takween Advanced Industries Co.	Industrial Investment
The National Company for Glass Industries	Industrial Investment
Umm Al-Qura Cement Co.	Cement
United Electronics Co.	retail
United Wire Factories Co.	Building and Construction
Wafrah for Industry and Development Co.	Agriculture and Food Industries
Yamama Cement Co.	Cement
Yanbu Cement Co.	Cement
Yanbu National Petrochemical Co.	Petrochemical Industries
Zamil Industrial Investment Co.	Building and Construction

**Table 9** CSR disclosure through ISO 26000 index based on Omair Alotaibi and Hussainey (2016), GRI guideline, and ISO 26000 core subjects

1. Employee	4. Customer
Employee data	Commercial and marketing information
Training and development	Meeting customers' needs
Employee benefits	Customer feedback
Pension	Customer service
Workplace	Customer satisfaction
2. Community	Existing certificated systems of quality
Community investment	5. Environmental issues
Contribution to national economy	Environmental policy statement
Education	Designing facilities harmonious with environment
Health and safety	Using recycling material
Social loan	Sponsoring environmental activities
Social activities support	Pollution
Funding scholarship programs	Waste management
Human rights	Conservation of natural resources
Charity, donations, Zakah, Hajj, for Quran and Ongoing Charity (WAGFF)	6. Energy
Others disclosure related to Shariah activities	Disclosing the company's energy policies
Volunteering	Conservation of energy
Establishing non-profit projects	Disclosing increased energy efficiency of products
3. Products and services	
Developing and innovating new products	
Product and service quality	
ISO and other awards	
Guidance campaigns	

**Funding** This research was supported by the Deanship of Scientific Research, Imam Mohammad Ibn Saud Islamic University, Saudi Arabia, Grant No. (20–13-11–006).

**Data Availability** Data are available on request via this mail: tbenmahjoub@imamu.edu.sa.

## Declarations

**Conflict of Interest** The author declares no competing interests.

## References

- Adams CA, Abhayawansa S (2022) Connecting the COVID-19 pandemic, environmental, social and governance (ESG) investing and calls for 'harmonisation' of sustainability reporting. *Crit Perspect Account* 82:102309
- Andersén J (2021) A relational natural-resource-based view on product innovation: the influence of green product innovation and green suppliers on differentiation advantage in small manufacturing firms. *Technovation* 104:102254
- Anderson CH (1986) Hierarchical moderated regression analysis: a useful tool for retail management decisions. *J Retail* 62(2):186–203
- Aina YA, Wafer A, Ahmed F, Alshuwaikhat HM (2019) Top-down sustainable urban development? Urban governance transformation in Saudi Arabia. *Cities* 90:272–281
- Al Dughan MA, Abdelwahed NAA, Soomro BA, Ali Alayis MMH (2022) Organizational environmental culture, environmental sustainability and performance: the mediating role of green HRM and green innovation. *Sustainability* 14:7510
- Albarrak HM, Ben Mahjoub L (2020) Sustainability reporting in the financial industry: further evidence from Saudi Arabia. *SMART J Business Manag Stud* 16:10–18
- Aramco (2022) [Online]. Saudi Arabia: Aramco. Available: <https://www.aramco.com/>. Accessed 30 Dec 2021
- Ben Mahjoub L (2019) Disclosure about corporate social responsibility through ISO 26000 implementation made by Saudi listed companies. *Cogent Business Manag* 6:1609188
- Ben-Amar W, McIlkenny P (2015) Board effectiveness and the voluntary disclosure of climate change information. *Bus Strateg Environ* 24:704–719
- Ben-Amar W, Chang M, McIlkenny P (2017) Board gender diversity and corporate response to sustainability initiatives: evidence from the carbon disclosure project. *J Bus Ethics J Business Ethics* 142:369–383
- Ben Mahjoub L (2018) Sustainability reporting and income smoothing: evidence from saudi-listed companies. In: Gokten S (ed) *Sustainability assessment and reporting*. London, UK, IntechOpen
- Ben Mahjoub L, Amara I (2020) The impact of cultural factors on shareholder governance and environmental sustainability: an international context. *World J Sci Technol Sustain Dev* 17(4):367–385

- Bertrand O, Betschinger M-A, Moschieri C (2021) Are firms with foreign CEOs better citizens? A study of the impact of CEO foreignness on corporate social performance. *J Int Bus Stud* 52:525–543
- Bremholm A (2015) Foreign ownership and foreign directors—the effects on firm performance in Japan. Master Thesis, Lund University 62 pages. <https://www.lup.lub.lu.se/luur/download?fileOId=7363303&func=downloadFile&recordOId=7363282>
- Callen M, Isaqzadeh M, Long JD, Sprenger C (2014) Violence and risk preference: Experimental evidence from Afghanistan. *Am Econ Rev* 104(1):123–148
- Chiou T-Y, Chan HK, Lettice F, Chung SH (2011) The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. *Transp Res Part E: Log Transp Rev* 47:822–836
- Chrysos-Anestis A, Achillas C, Folinas D, Aidonis D, Anestis MC (2021) Sensitivity of Greek organisations in sustainability issues. *Eng Proc* 9:4
- Dargin J (2021) The pathway to a green Gulf: a review and analysis of the evolution of Saudi Arabia, Qatar, and the United Arab Emirates' climate change positions. *Carbon Climate Law Rev* 15:313–341
- De Las Heras A, Luque-Sendra A, Zamora-Polo F (2020) Machine learning technologies for sustainability in smart cities in the post-covid era. *Sustainability* 12:9320
- Diez-Cañamero B, Bishara T, Otegi-Olaso JR, Minguez R, Fernández JM (2020) Measurement of corporate social responsibility: a review of corporate sustainability indexes, rankings and ratings. *Sustainability* 12:2153
- Doranova A, Laura R, Bettina B-W, Henning W, Meghan O'B, Stefan G, Mary AK, Mathieu H (2017) Policies and practices for eco-innovation up-take and circular economy transition: EIO bi-annual report 95
- Fernandez-Feijoo B, Romero S, Ruiz-Blanco S (2014) Women on boards: do they affect sustainability reporting? *Corp Soc Responsib Environ Manag* 21:351–364
- Fuente JA, García-Sánchez IM, Lozano MB (2017) The role of the board of directors in the adoption of GRI guidelines for the disclosure of CSR information. *J Clean Prod* 141:737–750
- Gal G, Akisik O, Wooldridge W (2018) Sustainability and social responsibility: regulation and reporting. Springer
- Garanina T, Aray Y (2021) Enhancing CSR disclosure through foreign ownership, foreign board members, and cross-listing: does it work in Russian context? *Emerg Mark Rev* 46:100754
- García-Granero EM, Piedra-Muñoz L, Galdeano-Gómez E (2018) Eco-innovation measurement: a review of firm performance indicators. *J Clean Prod* 191:304–317
- Gerged AM, Cowton CJ, Beddewela ES (2018) Towards sustainable development in the Arab Middle East and North Africa region: a longitudinal analysis of environmental disclosure in corporate annual reports. *BSE Business Strat Environ* 27:572–587
- González-Rodríguez MR, Díaz-Fernández MC, Biagio S (2019) The perception of socially and environmentally responsible practices based on values and cultural environment from a customer perspective. *J Clean Prod* 216:88–98
- Guo Y, Wang L, Yang Q (2020) Do corporate environmental ethics influence firms' green practice? The mediating role of green innovation and the moderating role of personal ties. *J Clean Prod* 266:122054
- Habbash M (2016) Corporate governance and corporate social responsibility disclosure: evidence from Saudi Arabia. *Social Respons J* 12:740–754
- Huang Y, Wang Y (2020) How does high-speed railway affect green innovation efficiency? A perspective of innovation factor mobility. *J Clean Prod* 265:121623
- Ibrahim MS, Darus F, Yusoff H, Muhamad R (2015) Analysis of earnings management practices and sustainability reporting for corporations that offer Islamic products & services. *Procedia Econ Fin* 28:176–182
- Kao EH, Yeh CC, Wang LH, Fung HG (2018) The relationship between CSR and performance: evidence in China. *Pacific-Basin Financ J* 51:155–170
- Kemp R, Pearson P (2007) Final report MEI project about measuring eco-innovation. UM Merit, Maastricht 10(2):1–120
- Khan M, Lockhart J, Bathurst R (2021) The institutional analysis of CSR: learnings from an emerging country. *Emerg Mark Rev* 46:100752
- Khan MA, Abbas K, Su'ud MM, Salameh AA, Alam MM, Aman N, Mehreen M, Jan A, Hashim NAABN, Aziz RC (2022) Application of machine learning algorithms for sustainable business management based on macro-economic data: supervised learning techniques approach. *Sustainability* 14:9964
- Kitao S, Yamada T (2021) Foreign workers, skill premium and fiscal sustainability in Japan. *Econ Anal* 202:220–243
- Kuzma E, Padilha LS, Sehnem S, Julkovski DJ, Roman DJ (2020) The relationship between innovation and sustainability: a meta-analytic study. *J Clean Prod* 259:120745
- Lafortune G, Schmidt-Traub G (2019) SDG challenges in G20 countries. Sustainable development goals: harnessing business to achieve the SDGs through finance, technology, and law reform, 219–234
- Leonidou CN, Skarmeas D, Saridakis C (2018) Ethics, sustainability, and culture: a review and directions for research. *Advances in Global Marketing: A Research Anthology* 471–517
- Lu J, Wang J (2020) Corporate governance, law, culture, environmental performance and CSR disclosure: a global perspective. *J Intl Fin Mark Inst Money* 70:101264
- Manisalidis I, Stavropoulou E, Stavropoulos A, Bezirtzoglou E (2020) Environmental and health impacts of air pollution: a review. *Front Public Health* 8:14. <https://doi.org/10.3389/fpubh.2020.00014>
- Miletkov MK, Poulsen AB, Wintoki MB (2014) The role of corporate board structure in attracting foreign investors. *J Corp Finan* 29:143–157
- Mishra AV (2014) Foreign ownership and firm value: evidence from Australian firms. *Asia-Pacific Finan Markets* 21:67–96
- Moreno B, García-Álvarez MT (2018) Measuring the progress towards a resource-efficient European Union under the Europe 2020 strategy. *J Clean Prod* 170:991–1005
- Musaeva K (2015) Research organizations and business: interaction barriers in the context of innovative development. *Procedia Soc Behav Sci* 214:201–211
- Oltra V, Kemp R, De Vries FP (2010) Patents as a measure for eco-innovation. *Int J Environ Technol Manage* 13:130–148
- Omair Alotaibi K, Hussainey K (2016) Determinants of CSR disclosure quantity and quality: evidence from non-financial listed firms in Saudi Arabia. *Int J Discl Gov Intl J Disclos Govern* 13:364–393
- Park M, Bleischwitz R, Han K, Jang E, Joo J (2016) Comparing eco-innovation indices: ASEM ecoinnovation index & eco-innovation scoreboard. ASEIC and University College London, London
- PWC (2008) Sustainability: are consumers buying it? Blog paper, UK. 9 pages. [https://www.pwcblogs.com/files/pwc-sustainability-pamphlet13\\_06\\_08.pdf](https://www.pwcblogs.com/files/pwc-sustainability-pamphlet13_06_08.pdf)
- Pimonenko T, Bilan Y, Horák J, Starchenko L, Gajda W (2020) Green brand of companies and greenwashing under sustainable development goals. *Sustainability* 12:1679
- Qiu L, Hu D, Wang Y (2020) How do firms achieve sustainability through green innovation under external pressures of environmental regulation and market turbulence? *Bus Strateg Environ* 29:2695–2714

- Rahman ARA, Shaari MS, Masnan F, Esquivias MA (2022) The impacts of energy use, tourism and foreign workers on CO2 emissions in Malaysia. *Sustainability* 14:2461
- Rehman SU, Kraus S, Shah SA, Khanin D, Mahto RV (2021) Analyzing the relationship between green innovation and environmental performance in large manufacturing firms. *Technol Forecast Soc Chang* 163:120481
- Rustam A, Wang Y, Zameer H (2019) Does foreign ownership affect corporate sustainability disclosure in Pakistan? A sequential mixed methods approach. *Environ Sci Pollut Res* 26:31178–31197
- Rutkowski M, Koettl J (2022) Saudi Arabia announces major reforms for its migrant workers [Online]. World Bank. Available: <https://blogs.worldbank.org/peoplemove/saudi-arabia-announces-major-reforms-its-migrant-workers>. Accessed December 2022
- Sethi SP, Rovenpor JL, Demir M (2017) Enhancing the quality of reporting in corporate social responsibility guidance documents: the roles of ISO 26000, global reporting initiative and CSR-sustainability monitor. *Bus Soc Rev* 122:139–163
- Setiawan D, Brahmana RK, Asrihapsari A, Maisaroh S (2021) Does a foreign board improve corporate social responsibility? *Sustainability* 13:11473
- Simoni L, Bini L, Bellucci M (2020) Effects of social, environmental, and institutional factors on sustainability report assurance: evidence from European countries. *Meditari Accountancy Res* 28(6):1059–1087
- Sobaih AEE, Gharbi H, Hasanein AM, Abu Elnasr AE (2022) The mediating effects of green innovation and corporate social responsibility on the link between transformational leadership and performance: an examination using SEM analysis. *Mathematics* 10:2685
- Tata J, Prasad S (2015) National cultural values, sustainability beliefs, and organizational initiatives. *Cross Cult Manag* 22(2):278–296
- Timbate L, Park C (2018) CSR performance, financial reporting, and investors' perception on financial reporting. *Sustainability* 10:522
- Tokas K, Yadav K (2020) Foreign ownership and corporate social responsibility: the case of an emerging market. *Global Bus Rev* 24. <https://doi.org/10.1177/0972150920920444>
- Tumelero C, Sbragia R, Evans S (2019) Cooperation in R & D and eco-innovations: the role in companies' socioeconomic performance. *J Clean Prod* 207:1138–1149
- Ullah R, Ahmad H, Rehman FU, Fawad A (2021) Green innovation and sustainable development goals in SMEs: the moderating role of government incentives. *J Econ Administ Sci* 38(4):17
- Unido (2015) Global green growth: clean energy industrial investments and expanding job opportunities. United Nations Industrial Development Organization and Global Green Growth Institute. [http://gggi.org/wp-content/uploads/2015/06/GGGI-VOL-I\\_WEB.pdf](http://gggi.org/wp-content/uploads/2015/06/GGGI-VOL-I_WEB.pdf)
- Urbaniec M, Tomala J, Martinez S (2021) Measurements and trends in technological eco-innovation: evidence from environment-related patents. *Resources* 10:68
- Vezzoli C, Manzini E (2008) *Design for environmental sustainability*. Springer
- Vo XV, Chu TKH (2019) Do foreign shareholders improve corporate earnings quality in emerging markets? Evidence from Vietnam. *Cogent Econ Financ* 7:1698940
- Wang H, Khan MAS, Anwar F, Shahzad F, Adu D, Murad M (2021a) Green innovation practices and its impacts on environmental and organizational performance. *Front Psychol* 11:3316
- Wang M, Li Y, Cheng Z, Zhong C, Ma W (2021b) Evolution and equilibrium of a green technological innovation system: simulation of a tripartite game model. *J Clean Prod* 278:123944
- Wang C, Zhang S, Zhang X (2022) How to embrace sustainable performance via green learning orientation: a moderated mediating model. *Sustainability* 14:7933
- Welford R (2014) *Corporate environmental management 1: systems and strategies*. Routledge
- Windsor D (2017) Defining corporate social responsibility for developing and developed countries comparing proposed approaches. *Comparative Perspectives on Global Corporate Social Responsibility*, edited by Dima Jamali, IGI Global 1–27. <https://doi.org/10.4018/978-1-5225-0720-8.ch001>
- Wolff A, Gondran N, Brodhag C (2018) Integrating corporate social responsibility into conservation policy. The example of business commitments to contribute to the French National Biodiversity Strategy. *Environ Sci Policy* 86:106–114
- World Bank (2012) *Green innovation and industrial policies. Inclusive Green Growth: The pathway to sustainable development*. The World Bank. <https://doi.org/10.1596/978-0-8213-9551-6>
- Xing MLY, Rai SC (2021) Key outcomes of COP26: the glasgow climate pact. *ESI Policy Brief* 49:1–4. ScholarBank@NUS Repository. <https://www.scholarbank.nus.edu.sg/handle/10635/214117>
- Xu J, Liu F, Shang Y (2021) R&D investment, ESG performance and green innovation performance: evidence from China. *Kybernetes* 50(3):737–756
- Zharfpeykan R, Ng F (2021) COVID-19 and sustainability reporting: what are the roles of reporting frameworks in a crisis? *Pacific Account Rev* 33(2):189–198
- Zhou H, Yip WS, Ren J, To S (2022) Topic discovery innovations for sustainable ultra-precision machining by social network analysis and machine learning approach. *Adv Eng Inform* 53:101715

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.