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Do firm-level sustainability targets drive environmental innovation? Insights from BRICS economies

Abstract

This paper examines the relationship between sustainability targets and their impacts on corporate environmental innovation. Using data over the period 2009-2018 on 202 companies from BRICS countries, covering firm-level governance, social responsibility, and sustainability, this paper examines whether firm-level sustainability targets and incentives encourage managers to engage in more environmentally friendly activities. Using panel data probit regression, and after controlling for country-level governance and institutional factors, the study finds that embedding environmental targets in corporate strategy does encourage corporate managers to design and develop eco-friendly products and services, and such firm-level commitments at the top motivates managers to promote, market, and label environmentally friendly products. The findings call for greater emphasis on aligning executive compensation with sustainability targets rather than focusing too much on short-term accounting and market-based measures of firm performance.

Keywords: environmental innovation, sustainability targets, environmental strategy

1. Background

Large listed companies have embedded corporate social responsibility (CSR) in their strategies (Becchetti, Ciciretti, Hasan and Kobeissi, 2012). CSR is considered a legitimacy tool, and companies are investing in CSR activities to preserve their corporate legitimacy. More recently, CSR targets and CSR engagement have been taken into account in determining executive compensation (Burchman and Sullivan, 2017; Flammer, Hong and Minor, 2019; Coombs and Gilley, 2005). Generally, a balanced executive compensation target will include firm-specific accounting-based measures (e.g. return on assets), market-based measures of performance (e.g. stock return) and non-financial measures (e.g. community engagement and CSR commitment and practices). Previous studies (Kovilage, 2020; Tran, 2018; Salehi et al. 2019) have focused on the CSR and sustainability performance of companies in various institutional contexts, but generally the empirical findings from CSR/sustainability research have been inconclusive.

This paper investigates the determinants of corporate environmental innovation, using data on firm-level governance, sustainability, social responsibility from 202 companies in Brazil, Russia, India, China, and South Africa (the 'BRICS economies'). These middle-income economies account for around one-fifth of the global economy. The substantial economic growth witnessed in the BRICS countries in the past few decades has attracted attention from global policy-makers, regulators, investors, and academic researchers. Researchers have focused on the socio-economic factors in these economies in isolation or using aggregate company data from the companies, and they have made cross-country comparisons. Although the aggregate growth rate is high, these economies exhibit substantial differences in terms of culture, regulatory quality, rule of law, and the quality of judicial institutions.

The substantial GDP growth rate of the BRICS economies has some associated sustainability challenges, particularly in relation to energy, water, and human rights. Large-scale industrial expansion and poor-quality environmental regulations have made these economies more vulnerable to climate change and the associated extreme weather, and the massive energy consumption resulting from their GDP growth led to rising CO2 emissions and other forms of environmental degradation.

Climate change is at the top of the agenda of several transnational organizations. A series of climate change conferences have focused on several interdisciplinary issues: action on climate and the United Nations' Sustainable Development Goals (SDGs), adaptation and resilience, capacity-building, climate finance, climate technology, education and youth, gender and environment, land use, local communities, and indigenous peoples' platforms.[1] Climate change conferences are considered to be instrumental in reshaping policy-makers' perspectives about national-level environmental issues, and the Climate Change Conference (the COP25) in Madrid and the upcoming UK Climate Change Conference (COP6) are expected to produce positive outcomes in terms of environmental targets and CO2 emissions. In addition, "The European Green Deal" in 2019 brought together the member states of the European Union (EU) in designing and developing a new regional environmental and developmental strategy. This agreement also provided a leadership opportunity for the EU in collectively tackling global issues related to climate change (The Guardian, 2020; European Commission, 2019). Furthermore, the UK has drawn up a 25-year plan to preserve biodiversity and tackle climate change, and environmental spending and targets are matters for government policy (Department for Environment, Food & Rural Affairs and The Rt Hon Michael Gove MP, 2018).

[1] See for example the key themes of the UN Climate Change Conference at Madrid: https://unfccc.int/topics

The paper makes several contributions to the sustainability literature. First, we carry out a cross-country study of BRICS economies to assess the role of country-level institutional factors in determining corporate environmental innovation. Second, we explore whether firm-level corporate governance characteristics and financial characteristics can be used to predict the degree of corporate innovation in the sample economies. Third, we use multiple theoretical perspectives in uncovering the complex relation between firm-level governance, country-level regulations, and corporate environmental activities. In particular, the relationship between sustainability targets in the corporate strategy and sustainability incentives in executive compensation and corporate environmental innovation has not been fully explored in the CSR and environmental management literature. Finally, in a supplementary analysis we uncover the relationship between firm-level commitment to ethics and R&D spending and its impact on corporate environmental innovation.

The remainder of this paper is organized as follows. Section 2 draws on multiple-theories to develop the conceptual framework, gives an overview of the literature, and presents the study hypothesis. Section 3 discusses the data, method, econometric model, and sample selection. Section 4 presents the results produced by several econometric models, and section 5 summarizes the paper.

2. Theoretical framework and literature review

Stakeholder theory and resource dependency theory along with institutional theory are often used to explain respectively the roles of firm-level governance, environmental factors, and country-level institutional factors in determining corporate environmental innovation. Stakeholder theory is widely used and cited in the literature on CSR, environmental management, sustainability and research on climate change and global warming. Stakeholder

theory marks a radical shift from the traditional shareholder-based model (Freeman 1999). In the latter, shareholder primacy is embedded in the business model and strategy of a company, and the primary aim of directors, company management responsibilities and accountability is enhancing the value of shareholders' wealth. Stakeholder theory, however, takes a more holistic view of a firm's objectives, and it proposes accountability to a wide range of internal and external stakeholders, including shareholders. Local communities and societies expect that companies will embed environmental responsibilities within their core business models and corporate strategies. In response to such external expectations and pressures, many companies have appointed 'community engagement officer(s)' and have established a 'social responsibility committee' to look after the social and environmental aspects of their operations.

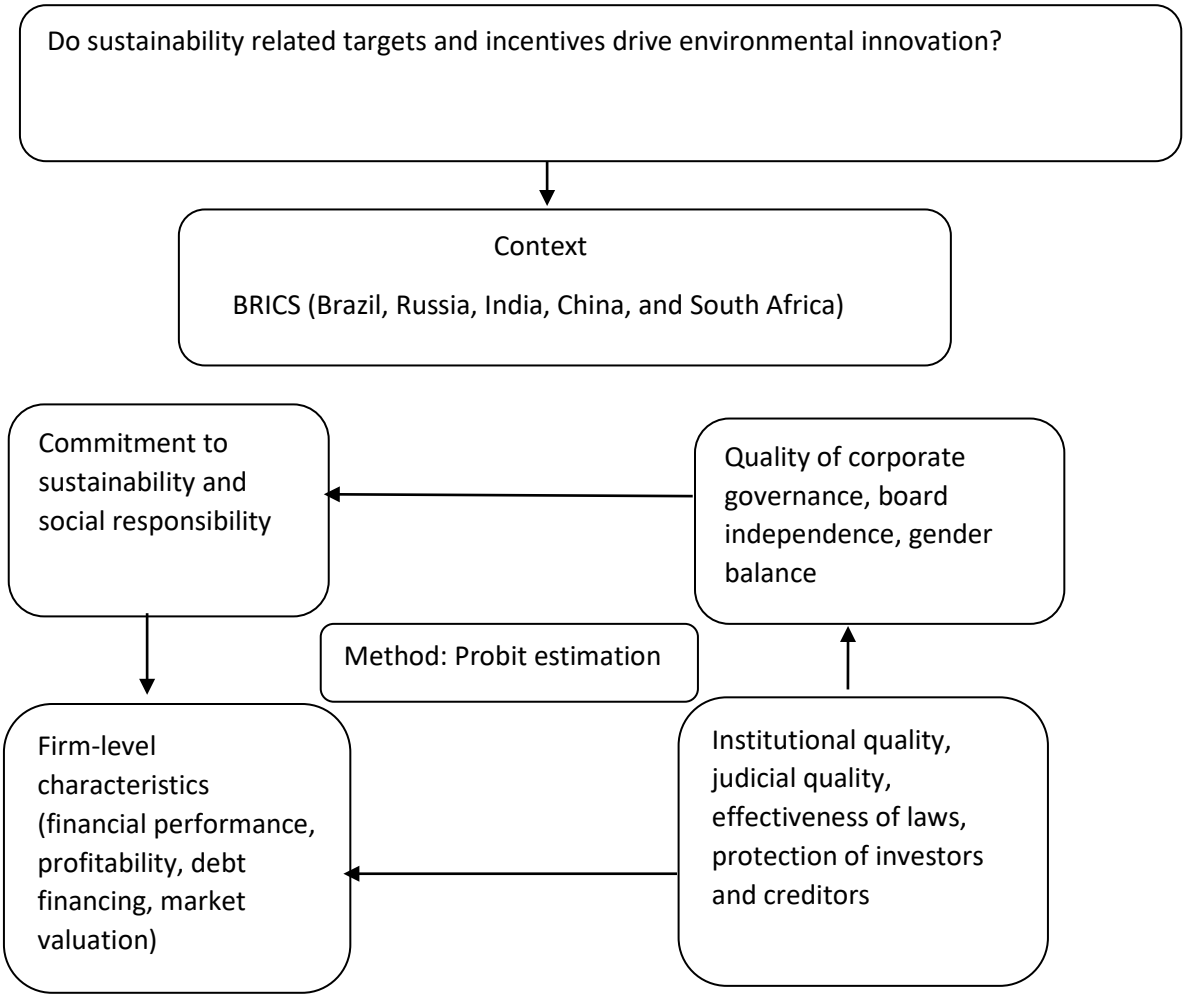
From a resource-based view, the corporate board is considered an important strategic resource for a company and it is argued that the board of directors brings and connects a company with vital external resources (financial capital, intellectual capital, network, skills, expertise, political connections) (Pfeffer and Salancik, 1978). Large listed companies use the appointment of prominent external directors from civil societies, banks, other listed companies, and regulatory bodies to preserve their legitimacy and enhance boardroom diversity and inclusiveness. These appointments provide companies with different and innovative thinking, with the general intuition that *'everybody will bring something to the party'*.

Institutional factors play a mediating role in enhancing the governance and sustainability practices of large listed companies operating in a fragile institutional environment. Institutional theory is a branch of positive theories explaining why companies discharge their social responsibility and corporate accountability in general. Institutional theory can be used as a lens in understanding the relationship between organizations and commitment to CSR. According to

institutional theory, organizations engage in CSR-related activities as a result of immense peer pressure. In other words, if competing firms behave responsibly, this will motivate (or at least put pressure on) other firms in the industry to follow or imitate their actions. Such replication of good practices can result in 'homogenization', where everybody does the same thing. A good example of this is the growing similarity of the social responsibility and sustainability disclosures produced by listed companies. Guttman et al. (2018) report that these 'non-state actors' can play an important role along with state institutions and actors in addressing domestic environmental issues, as local companies have greater understanding of the local environmental requirements and regulations.

These three complementary theories therefore suggest that strong internal corporate governance mechanisms and social responsibility practices at the firm level are partly mediated by country-level institutional factors. Figure 1 presents this conceptual framework for the research. It shows that several firm-specific factors (corporate governance and boardroom quality, commitment to CSR and sustainability, commitments to ethics in general, financial performance of a firm), as well as country-specific institutional factors, such as judicial quality, effectiveness of laws, and protection of investors and creditors, have an influence on a firm's environmental innovation. It is also believed that the interaction of country-specific and firm-level governance measures further enhances the level and quality of corporate environmental innovation.

Figure 1 Conceptual framework



Source: Developed by the authors

While shareholders do play an active and vital role in setting goals for the company, it is the board of directors that decides the corporate goals and targets. These can cover anything from customer satisfaction to financial goals (e.g., profit maximization or market share maximization), resources and operations goals, competition and risk goals, and CSR goals. CSR has become one of the trending topics for business and finance researchers working with stakeholder theory, and that theory has been widely applied in the fields of management,

economics, finance, CSR, law, ethics, strategy, health care, and organization. Nevertheless, CSR and environmental innovation in the BRICS have been little studied. In advanced countries like Europe, corporate targets often cover CSR as well as civic and environmental issues. The present study examined environmental innovation on the part of the company.

Freeman's stakeholder theory changed understanding of how business is done in today's competitive and challenging environment. Doing business is no longer simply a matter of earning the greatest possible profit. The company needs to create value for all its stakeholders (both direct and indirect). These stakeholders are customers, employees, suppliers, the financial community, government, political groups, activist groups, customer advocate groups, unions and trade associations, etc. Stakeholder theory states that moral value should be created for all these stakeholders. Thus, the theory is related to CSR, social contract theory, and the market economy. "A stakeholder assessment of strategy assimilates a resource-based view and a market-based view and complements a socio-political level" (Philip, 2003).

Corporate social responsibility helps a company to be socially responsible and accountable to all stakeholders and the public. The company not only needs to be responsible for the economic interest of shareholders but also needs to focus on the company's social and environmental performance. Stanwick and Stanwick (2001) used the stakeholder approach to study the relationship between CSR and executive compensation and found that the perception that CEOs are not in general compensated for improving the company's environmental credibility is reinforced by an inverse relationship between CEO compensation and environmental reputation. That is, executives are actually encouraged not to have a strong environmental reputation. Similarly, McGuire et al. (2003) analyzed data from 374 US companies and found that weak social performance was correlated with a high rate of

compensation and long-term benefits for executives. Coombs and Gilley (2005) took an agency theory approach and found that stakeholder management's key impacts on CEO compensation were often more harmful than beneficial and that salaries were the only form of compensation significantly influenced by stakeholder management. LaGore, Mahoney, and Thorne (2015) used the stakeholder and agency approaches to examine 90 firms traded on the Toronto stock exchange and found that there is a strong relationship between long-term compensation and overall CSR weakness (Mahoney, Thorne, Gregory, and Convery 2017). To test these findings, Mahoney and Thorn (2006) used OLS regression analysis instead of panel data analysis and found that there is a positive relationship between stock options and CSR weakness, bonuses and CSR strengths, and total CSR and stock options.

Furthermore, Cordeiro and Sarkis (2008) used the agency and stakeholder perspectives to examine the relationship between CSR and executive compensation, as well as the moderating effects of CSR targets. They found a significant relationship between CSR and executive compensation. Berrone and Gomez-Mejla (2009) used agency theory and institutional theory to look at 469 US firms. They found that external environmental pay systems do not make their executives firmly reward their social efficiency, implying that these frameworks serve a mere significant function. Kolk and Perego (2014) undertook a case study of the Netherlands and found that CSR played an important role in promoting firm engagement in environmental activities. Eccles, Ioannou, and Serafeim (2014) studied a sample of 180 US firms that had voluntarily adopted either a high-sustainability policy or a low-sustainability policy. They used a logit regression model and statistical and financial comparison method, and found that companies whose board of directors was more responsible for sustainability targets performed better and had greater stakeholder involvement in management.

The integration of a CSR target in executive remuneration was discussed by Deegan and Islam (2012). Indeed, it is very important to find the exact relation between CSR target and executive remuneration. A sustainability target can consist of a lot of goals, relating for example to innovation, environmental protection, or the health and safety of employees and the public. Deegan and Islam (2012) examined 10 carbon-intensive Australian firms from the perspective of legitimacy and institutional theory. Their content analysis suggested that only two of those 10 firms pursued most of their CSR targets through executive remuneration.

Maas and Rosendaal (2016) also used content analysis, but with cross-country data. They used stakeholder theory and agency theory and studied a sample of 490 firms from 11 countries. They found that most of the 'dirty' companies in their sample had only short-term CSR goals and that only 33% of companies stipulated sustainability targets in their executive remuneration packages in 2010. However, Russo and Harrison (2005) used agency theory in a case study of a US electronics firm and found a relationship between the integration of CSR targets in executive remuneration and corporate sustainability performance, whereby only a link between compensation for plant managers and environmental performance reduced emissions. Emerton and Jones (2019) used an inductive research methodology in their interview study of UK firms and found that sustainability-related pay schemes were used for executive managers. Baraibar-Diez and Odriozola (2019) used stakeholder theory to study 197 firms that were listed in the UK, France, Germany, and Spain. They found that 90% of companies in the sample had a CSR committee in 2014 and that those companies had significantly different environmental, social and governance (ESG) scores than those without a CSR committee.

Researchers began to check the relationships among corporate governance, market value, and firm financial performance more than 30 years ago (see Brooks, Fenton, and Schopohl, 2019).

However, there have been few studies of the relation between sustainability targets and environmental innovation, and their results have been divergent (Cordeiro and Sarkis, 2008; Lattemannet al., 2009; Chang, Li, and Lu, 2015; Li, Zhao, Sun, and Yin, 2017). Moreover, just a few industrialized countries have been studied, such as the USA, China, Australia, and India. This means that there is still a need not only to study the effects of institutional factors like effectiveness of laws, investor protection, and quality of regulation on the relation between sustainability targets and environmental innovation. Moreover, there is still a need to study industrializing countries such as the BRICS. Both CSR and environmental management have been examined from the perspective of agency theory and resource dependency theory (Busch and Hoffmann, 2011; Lins, Servaes, and Tamayo, 2017), but not from the perspective of stakeholder theory and neo-institutional theory, and not empirically.

Sustainability targets are seen as a new way to achieve environmental innovation (Fischer et al. 2007; Moldan, Janoušková and Hák, 2012; Haffar and Searcy, 2018; Saint Akadiri et al. 2020). In the context of BRICS economies, Ummalla and Goyari (2020) found a positive association between clean energy consumption and economic growth. On the other hand, Azevedo et al. (2018) reported mixed findings regarding the environmental consequences, specifically in the form of CO2 emissions, of economic activities in BRICS economies. Furthermore, some recent studies from China have discussed the effect of economic development on carbon emissions and the environment (Umar et al. 2020; Li, Lui, Gibson and Zhu, 2012; Cheng and Li, 2019; Lei and Shimokawa, 2020). A wide range of research has looked at the implementation of sustainability targets in the BRICS countries separately: Brazil (Da Silva, Selig, and Bellen, 2014), Russia (Su, Wang, Streimikiene, Balezentis and Zhang, 2019; Kılkış, 2016), India (Bisht and Thakur, 2019; Patel, Sharma and Singh, 2020; Spillias,

Kareiva, Ruckelshaus and Madden, 2020), China (Cheng, Li, Lu, Zhou, and Meng, 2020; Lei and Shimokawa, 2020; Umar, Ji, Kirikkaleli and Xu, 2020), and South Africa (Moldan, Janoušková, and Hák, 2012; Geijzendorffer et al. 2017; Dos Santos, Svensson and Padin, 2013). On the basis of the above arguments from both the theoretical and the empirical literature, the following hypothesis is posited:

H1. **Embedding sustainability targets in executive compensation has a positive impact on corporate environmental innovation.**

3. Data and methodology

Corporate governance, social responsibility, sustainability and firm-level financial data were downloaded from Bloomberg for 2009–2018. 2018 was the last year for which the majority of the observations were available. Unbalanced panel data were collected for 202 companies from BRICS countries. Table 1 defines the key dependent, explanatory, and control variables and country-level indicators of institutional quality for BRICS economies.

Table 1 Key variables and their definitions

Variables	Definitions
Dependent variables	
Environmental Innovation	1 if a company reports at least one product or service that is designed/developed to have a positive impact on the environment or if the product is environmentally marketed or labeled, 0 otherwise.
Explanatory variables	
Sustainability targets	1 if a company sets out annual sustainability targets, 0 otherwise
Sustainability incentives	1 if a company's executive compensation has environmental and sustainability targets/incentives, 0 otherwise.
Ethical initiatives	1 if a company has developed a clear policy or guidelines on ethics, such as an ethics committee or ethics hotlines, 0 otherwise
Women directors	% of women directors on a company board
Social responsibility	1 if a company has a social responsibility committee, 0 otherwise
Corporate board size	The total number of board members
Largest shareholdings	The largest shareholder has more than 3% of total shares
Control Variables	
Debt	Total debt of a company divided by total assets
Board independence	The percentage of directors who are external non-executives (this is a measure of boardroom quality/independence)
Return on equity	Operating income divided by stockholder equity
Market-to-book value	Market value of equity / balance sheet value of equity
Return on assets	Operating income / total assets
R&D expenditures	Research and development expenditures divided by sales.
Institutional factors for BRICS	
Effectiveness of law	World Bank indicator: measures how governments develop and implement regulations that allow and promote private-sector development
Investor protection	World Bank indicator: varies from 0 (poor investor protection) to 10 (strong investor protection)
Quality of regulations	World Bank indicator: varies from 0 to 100 (excellent) and this index measures the quality of judiciary and enforcement of law

We estimated the following panel data probit regression:

Environmental Innovation= f(Sustainability targets, Sustainability incentives, Ethical initiatives, Women directors, Social responsibility, Corporate board size, Largest shareholdings, Debt, Board independence, Return on equity, Market-to-book value, Return on assets, Effectiveness of law, Investor protection, Quality of regulations)

The key variable of interest is environmental innovation, which is a dummy variable that takes a value of 1 if a company reports at least one product or service that is designed/developed to have a positive impact on the environment or if the product is environmentally marketed or labeled, and 0 otherwise. Our post-estimation tests show that the estimation approach adopted in the paper is not vulnerable to any of the potential endogeneity issues that can apply to cross-sectional and time series datasets (Ullah et al., 2018; Ullah et al. 2020; Tiwari et al., 2021, Huynh et al., 2020).

Measures relating to corporate social responsibility and sustainability include: sustainability targets in the corporate strategy, firm-level ethical initiatives (e.g. policies or guidelines that promote ethical behavior), the presence of women directors on the board of directors, and the establishment of a social responsibility committee. Corporate governance variables include corporate board size and the presence of large shareholders, defined as those with a holding of 3% or more of all shares, who have a significant influence over management. Control variables include: debt financing, boardroom independence (measured as the percentage of directors on the board who are external and independent), and financial performance measures (return on equity, market-to-book value, and return on assets). Institutional factors for BRICS economies are: effectiveness of law, investor protection, and quality of regulations. As the dependent variable is a dummy variable, panel data probit estimation is a good approach to

understanding the determinants of environmental innovation in a cross-country context. Table 2 gives an overview of the sample companies from BRICS economies. Brazil and China have 56 and 50 companies in the sample, while India, Russia and South Africa have 38, 28, and 30 companies, respectively. A large number of companies lacked viable data on their environmental innovation and so could not be included in the main analysis, which is why the final sample is relatively small, at 202 companies.

Table 2 Sample composition

Country	Total companies	Number of industries
Brazil	56	4
China	50	8
India	38	9
Russia	28	8
South Africa	30	4
Total	**202**	

Table 3 Industrial composition of the sample

Basic Materials	35
Consumer services and Consumer goods	25
Financial services, Banks and financial institutions	24
Pharmaceutical and healthcare	26
Industrial goods	18
Energy and Utilities	36
Telecommunications and Technology	38
Total	**202**

Table 3 presents a summary of the industrial composition of the sample, using a broad industrial classification. The industrial classification used in this study and shown in Table 3 gives similar numbers of firms in each of these seven broad industrial classifications.

4. **Empirical Findings**

Table 4 presents descriptive statistics for the sample. Of the sample companies, 48% had established social responsibility committees to look after their CSR activities, while around 90% had sustainability targets and had linked executive remuneration with sustainability and environmental targets. Large listed companies are under media pressure and scrutiny, and so are likely to demonstrate their public commitment and disclosures on several sustainability measures.

Table 4 Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Social responsibility	2025	.48	.5	0	1
Sustainability targets	2025	.911	.285	0	1
Sustainability incentives	2025	.909	.288	0	1
Ethical initiatives	1934	.797	.402	0	1
Corporate board size	1870	10.528	3.706	1	38
Board independence	2024	44.137	29.427	0	86.9
Women directors	2025	4.696	7.227	0	41.67
Large shareholdings	1879	23.338	19.312	0	65
Environmental innovation	1337	.657	.475	0	1
Debt	2025	.035	.048	0	.572
Return on equity	2025	.149	.33	-2.508	9.528
Return on assets	2025	.022	.06	-.054	.572
Market-to-book value	1977	3.173	3.889	.12	18
R&D expenditures	2024	.013	.03	0	.11

Almost 80% of the sample companies displayed their public commitment to ethical initiatives on their websites, or in annual reports or other corporate communications. Generally, these commitments included membership of organizations that promote ethics (such as ethical trading initiatives), issuing guidelines to protect whistleblowers within the organization, or setting up hotlines to which unethical business activities could be reported by internal and external stakeholders. The average board size was around 10, which is low for companies from BRICS economies as the cross-shareholding and presence of family ownership and other blockholders increase boardroom size. Fewer than 5% of the companies had at least one woman on the board. There are two possible reasons for this. First, the data cover 2009-2018, and it is possible that companies have only more recently moved towards having more inclusive boards. Second, emerging economies are still undergoing firm-level and country-level governance reforms, and have not yet introduced fixed national quotas to impose greater female representation in the upper echelons of the firms.

Table 5 reports the results of the panel data probit regression. We find that firm-specific sustainability targets have a significant impact on corporate environmental innovation. However, the firm-specific corporate governance variables (ethical initiatives, corporate board size, women directors, large shareholdings, debt financing) have no significant impact. In fact, the governance literature has reported widely discrepant findings in this regard, with either positive, negative, or no impact of corporate governance mechanisms. The effectiveness of laws has a strongly positive impact on environmental innovation. This is in line with the general economic intuition that large listed companies operating in strong legal and judicial regimes are under strict environmental scrutiny, and are encouraged or rewarded by investors to introduce

environmentally friendly products and packaging. We also find that the market valuation of firms (proxied by market-to-book value) has a strong influence on corporate environmental innovation, as does R&D expenditure. This implies that investment in R&D expenditures by companies in BRICS economies is productive in terms of tangible corporate outcomes.

Table 5 Impact of sustainability targets on corporate environmental innovation

Variables	Model 1	Model 2	Model 3	Model 4
Sustainability targets	0.966**	1.030**	1.115**	0.981**
	(0.466)	(0.449)	(0.450)	(0.440)
Ethical initiatives	0.030	0.113	0.105	0.094
	(0.273)	(0.267)	(0.265)	(0.265)
Corporate board size	0.025	0.027	0.027	0.023
	(0.020)	(0.020)	(0.020)	(0.019)
Women directors	0.002	-0.002	-0.002	-0.002
	(0.009)	(0.009)	(0.009)	(0.009)
Large shareholdings	-0.005	-0.005	-0.005	-0.004
	(0.005)	(0.005)	(0.005)	(0.005)
Debt	1.167	3.001	2.928	1.738
	(2.476)	(2.462)	(2.436)	(2.476)
Return on equity	0.337			
	(0.323)			
Effectiveness of laws	0.065**			
	(0.033)			
Market-to-book value		0.023	0.078**	
		(0.043)	(0.034)	
Return on assets				0.119
				(1.827)
R&D expenditures		13.512**		14.387***
		(6.762)		(5.077)
Constant	-6.376**	-0.922*	-0.994*	-0.770
	(3.026)	(0.554)	(0.553)	(0.527)
Observations	1,028	1,080	1,080	1,104
Number of firms	167	173	173	176

The dependent variable is environmental innovation. It is a dummy variable: 1 if a company reports at least one product or service that is designed/developed to have positive impact on the environment or if the product is environmentally marketed or labeled, 0 otherwise. Model 1 includes the additional country-level measure of effectiveness of laws. Model 2 includes additional firm-specific variables: market-to-book value of assets and R&D expenditures. Model 3 & 4 includes additional firm-level financial performance (profitability) measures such as return on assets. Coefficients are reported for the panel data probit regression. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6 includes additional country-level variables: effectiveness of laws, investor protection and the quality of regulations. After controlling for country-level indicators for institutional quality, the main findings regarding the relationship between sustainability targets and environmental innovation does not change. The issue of climate change and global warming has put enormous pressure on companies to reassess their core business activities and fundamental business models. In fact, ethical investors and environmentally sensitive institutional investors ask for greater scrutiny and transparency in environmental disclosures in corporate sustainability reports. Many large firms now require external auditing/consulting firms to issue an assurance certificate regarding their corporate environmental activities, which is another way to signal the environmental contribution of a firm. Quality of regulations and the effectiveness of laws have a significant impact on environmental innovation. However, investor protection and environmental innovation in BRCS economies do not have a significant impact. Many multinational companies are signatories to the United Nations Global Reporting Initiative, which requires commitment to social and environmental issues. The positive impact of the effectiveness of laws also signals the proactive role played by national and transnational environmental organizations and environmental protection agencies. Non-compliance with national and international environmental standards could make large listed companies more vulnerable to several exogenous shocks, such as regulatory fines, investors withdrawing their investment, stock market delisting, and public anger in general. On the other hand, some companies may voluntarily adopt these best practices to signal firm-level commitment to the environment.

Table 6 Impact of sustainability targets on corporate innovation (the role of country-level governance indicators)

Variables	Model 5	Model 6	Model 7
Sustainability targets	0.950**	1.056**	0.966**
	(0.463)	(0.456)	(0.466)
Ethical initiatives	0.052	0.078	0.030
	(0.271)	(0.268)	(0.273)
Corporate board size	0.026	0.024	0.025
	(0.020)	(0.020)	(0.020)
Women directors	0.002	-0.003	0.002
	(0.009)	(0.009)	(0.009)
Large shareholdings	-0.004	-0.005	-0.005
	(0.005)	(0.005)	(0.005)
Debt	1.634	1.212	1.167
	(2.531)	(2.491)	(2.476)
Return on assets	-0.183	0.182	
	(1.856)	(1.842)	
Quality of regulations	0.058***		
	(0.021)		
Investor protection		-0.031	
		(0.222)	
Return on equity			0.337
			(0.323)
Effectiveness of laws			0.065**
			(0.033)
Constant	-5.784***	-0.406	-6.376**
	(1.978)	(1.405)	(3.026)
Observations	1,028	1,103	1,028
Number of firms	167	176	167

The dependent variable is environmental innovation. It is a dummy variable: 1 if a company reports at least one product or service that is designed/developed to have positive impact on the environment or if the product is environmentally marketed or labeled, 0 otherwise. Model 5 includes quality of regulations. Model 6 includes an index representing the protection of investors and creditors. Model 7 includes the effectiveness of laws, which is a World Bank indicator. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In Table 7the analysis includes several interaction terms between firm-specific sustainability targets and social responsibility measures. In model 8, the interaction between sustainability targets and social responsibility has no impact. Model 9 includes the interaction between sustainability targets and sustainability incentives and the effect of the additional interaction term is non-significant. However, the market-to-book value variable has a significantly positive impact across all three models (models 8-10). Interestingly, the interaction term in model 10 (women directors × social responsibility) has a significantly negative impact on firm-level environmental innovation. The interaction term aimed to examine whether more gender diversity in the board room and the presence of a social responsibility committee have any impact on environmental innovation. This negative relationship is contrary to the recent literature on gender and CSR, which suggests that women tend to be more involved than men in environmental activities. Perhaps the prevailing culture and institutional context of the BRICS countries partly explain the negative impact of gender and social responsibility initiatives.

Table 7 Impact of sustainability targets on corporate innovation (the role of interaction terms)

Variables	Model 8	Model 9	Model 10
Sustainability targets × social responsibility	-0.070		
	(0.199)		
Ethical initiatives	0.091	0.121	0.054
	(0.263)	(0.265)	(0.265)
Corporate board size	0.025	0.028	0.028
	(0.019)	(0.020)	(0.020)
Women directors	-0.001	-0.002	0.020
	(0.009)	(0.009)	(0.013)
Large shareholdings	-0.004	-0.005	-0.005
	(0.005)	(0.005)	(0.005)
Debt	1.051	2.830	2.713
	(2.475)	(2.445)	(2.456)
Return on assets	0.170		
	(1.830)		
Sustainability targets × sustainability incentives		0.513	
		(0.345)	
Market-to-book value		0.076**	0.075**
		(0.034)	(0.033)
Women directors ×social responsibility			-0.038**
			(0.016)
Constant	0.373	-0.413	0.072
	(0.346)	(0.475)	(0.367)
Observations	1,104	1,080	1,080
Number of firms	176	173	173

The dependent variable is environmental innovation. It is a dummy variable: 1 if a company reports at least one product or service that is designed/developed to have positive impact on the environment or if the product is environmentally marketed or labeled, 0 otherwise. Model 8 includes the interaction sustainability targets × social responsibility. Model 9 includes the interaction term sustainability targets × sustainability incentives. Model 10 includes the interaction of women directors × social responsibility. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

4. Summary of findings and conclusion

This paper explores the interaction between the quality of firm-level governance, commitment to social responsibility, ethical initiatives, and corporate environmental innovation. Stakeholder theory, resource dependency theory, and institutional theory are applied as complementary theoretical perspectives in understanding the determinants of corporate environmental innovation. Using firm-level and country-level data on 202 companies from BRICS economies, the study finds that sustainability-related annual targets encourage managers to think creatively and develop and design environmentally friendly products. We also find that country-level institutional quality (effectiveness of laws, quality of regulations) plays an important role in driving corporate innovation.

The study has implications for investors, managers, and policy-makers in BRICS economies. Investors need to carefully assess the environmental disclosure of listed companies when making their investment decisions. Managers in the sample countries (BRICS) need to enhance their disclosure of key performance indicators regarding environmental targets and environmental outcomes. Similarly, regulatory bodies, particularly the environmental protection agencies in these countries, need to scrutinize corporate disclosure relating to environmental targets and achievements, to ensure such company information is accurately determined and verified independently.

The study identifies several avenues for future research. First, future studies can examine stock market reactions to announcements of the launch of environmentally friendly products, to determine whether investors are prepared to pay a premium for such green innovation. Second, it is important to understand variations in corporate sales activities following the introduction of environmentally friendly products, to know whether consumers are willing to pay higher prices, and to assess how

consumers perceive such products compared with non-environmentally friendly products. We also recommend the use of a content analysis approach to assess corporate disclosure relating to environmental targets in executive compensation contracts. Content analysis would also be helpful in capturing intra-firm and cross-country variation in the reporting behavior of firms with regard to the disclosure of environmental targets in corporate communication documents (annual reports, websites, etc.).

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