



## ESG Performance and Capital Investment in BRICS Countries: The Moderating Role of Environmental Innovation

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### Abstract

**Purpose** – This study aims to investigate the relationship between Environmental, Social, and Governance (ESG) performance and capital investment decisions in non-financial firms across BRICS countries. Specifically, it explores how environmental innovation moderates this relationship, and how the three ESG pillars - environmental, social, and governance- individually affect capital investment behavior.

**Methodology** – The research utilizes a panel dataset comprising 3,120 firm-year observations covering the period from 2015 to 2024. To ensure robust estimation and address potential endogeneity and unobserved heterogeneity, the study applies both fixed-effects and system Generalized Method of Moments (GMM) regression techniques.

**Findings** – The empirical results show that ESG performance, as well as its environmental and governance, has a positive and significant with capital investment. These findings suggest that ESG commitments help firms focus on long term investment, make it easier for them to access financing, and build trust with investors, which in turn encourages them to invest more in productive capital assets. The social pillar, however, does not have a significant effect on capital investment.

**Originality** – This study contributes to the growing ESG–investment literature by disaggregating ESG into its three dimensions and introducing environmental innovation as a moderating variable. It offers novel insights into the interaction between investment efficiency and sustainability oriented practices in emergent market contexts by concentrating on BRICS.

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## 1. Introduction

In the global economic environment, Environmental, Social, and Governance (ESG) concepts have developed from a side concern to a crucial component of company strategy. Nowadays, ESG is a business issues that influences its long-term sustainability (Broadstock et al., 2021a; Fatemi et al., 2018). Asset managed according to with ESG principles were USD 35.3 trillion, indicating a substantial increase from 2020 (Global Sustainable Investment Alliance, 2021). This indicates a change in the way stakeholders and investors evaluate the performance of the firm (Krueger et al., 2019). ESG implementations is driven by several interconnected key

factors. Social issues and climate change are becoming more widely known. Additionally, governments and regulators are starting to mandate that businesses disclose their ESG performance in a more transparent. Business with strong sustainability performance is increasingly being selected by institutional investors. Furthermore, it demonstrates that organizations that strong ESG performance exhibit more consistent long-term performance.

BRICS play an important to the global sustainability agenda. On the other hand, BRICS has many people and is a key force behind global economic expansion. In 2024, it accounted for 40% of the world's economy when measured by Purchasing Power Parity (PPP) (IMF, 2025). The economic contribution of these countries is significant to the global economy. However, BRICS is also responsible for a significant portion of carbon emissions. The IEA's Global Energy Review 2025 says that emissions from natural gas went up by about 2.5% in 2024 (IEA, 2025). This increase is because more natural gas was used in China, India, and the Middle East. At the same time, emissions from coal also went up, but by a smaller amount about 0.9%. This happened mainly because more coal was being used in China and Southeast Asia. Therefore, BRICS are confronted with the challenge of achieving an equilibrium between environmental sustainability and economic growth. The regulations, development objectives, and sustainability concerns of each nation are distinct. China is implementing stricter environmental disclosure laws as part of its ecological civilization. Brazil's deforestation in the Amazon and its inadequate enforcement of environmental regulations have resulted in international scrutiny.

Capital investment can be defined as allocation of financial resources toward long term productive assets with the objective to expanding, modernizing, or sustaining a firm's operational capacity. When ESG is incorporated into capital investment decisions, assessments of investments based on financial considerations also take long term sustainability and risk into account (Narula et al., 2025; Yu et al., 2024). By lowering risk premiums, strong ESG performance decreases the cost of capital and increases the feasibility of investment projects (El Ghouli et al., 2011). Internally, ESG integration pushes businesses to invest in profitable assets that promote sustainable operational excellence and to take a longer planning horizon. As a result, ESG affects how risk is perceived in the financial markets and changes how corporate resources are allocated to long-term investments.

Adoption of ESG may also increase costs for companies (Shan et al., 2025). ESG auditing, reporting, and certification come at high financial expense. These expenses can reduce the funds available for productive asset investment. For companies with financial constraints, this condition poses a major challenge. In addition, management's attention may be divided between the ESG agenda and business investment plans. As a result, the scope for capital investment may become more limited. Normatively, ESG is positioned as a strategic framework that encourages companies to operate sustainability while creating long term values.

However, in practice, ESG implementation is often faced with resource constrains and short-term financial performance demands, raising the question of whether ESG commitments encourage companies to increase capital investment in productive assets such as machinery, production technology, and infrastructure, or whether they limit investment space due to increased compliance burdens and implementation costs. In this context, ESG not only serves as a normative standard for sustainability, but also signal of the quality of corporate governance, risk management, and credibility in the eyes of investors, which in turn can influence the ease of access to financing and the courage of companies in making long-term capital investment decisions.

The impact of ESG on capital investment are heterogeneous across companies, as it is greatly influenced by a company's internal ability to convert sustainability commitments into operational and economic advantages. Companies with high environmental innovation capacity tend to be able

to integrate ESG principles into their production and technology development processes more efficiently, so that capital investment is not only oriented towards meeting sustainability standards, but also results in increased productivity, cost efficiency, and long-term competitiveness (Cabaleiro-Cerviño & Mendi, 2024). Thus, environmental innovation acts as a contingency factor that strengthens the relationship between ESG and capital investment (Omonijo & Zhang, 2025). Without adequate environmental innovation support, ESG commitments have the potential to remain at the policy and reporting level, thereby limiting their impact on capital investment decisions.

According to Resource-Based View (RBV), capital investment is shaped by green innovation that is fueled by internal ESG commitments (Lee & Min, 2015). Based on the Natural Resource-Based View (NRBV), sustainable long-term asset management is motivated by the idea that firm environment linkages are the source of competitive advantage (Hart, 1995). In this case, environment investment becomes a mechanism that strengthens connections between ESG and capital investment rather than an ESG outcome. For example, companies that make significant environmental investments are more likely to match capital expenditures with ecological objectives. Similarly, according to stakeholder theory suggests environmental investments lend credibility to ESG signals, bolstering investor confidence and legitimizing capital allocation decisions (Freeman, 1984).

Previous research highlights the moderating influence of environmental innovation. According to Zhou et al. (2022), ESG enhances financial performance, which in turn contributes to market value. This effect is more pronounced in organizations that allocate significant resources to environmental initiatives. Environmental spending moderates the innovation impacts of ESG (Li et al., 2023). Conversely, organizations that have considerable environmental investment but low ESG ratings are vulnerable to accusations of greenwashing, which can undermine the efficacy of capital allocation and long-term trust (Yu et al., 2024). In emerging markets, a credible ESG combined with environmental investment can attract international funding. This changes ESG from just a signal into a strategic tool for attracting capital, even when regulatory and financial constraints are still present (Zaid et al., 2025).

In emerging markets, a credible ESG combined with environmental investment can attract international funding. This changes ESG from just a signal into a strategic tool for attracting capital, even when regulatory and financial constraints are still present (Zaid et al., 2025). First, this research aims to explain the link between ESG and capital investment by looking into how each ESG factor affects a company's choice to invest capital in its own unique way. More importantly, it looks into how new technologies in the world might change these patterns. Second, the study highlights the strategic value of innovation by exploring whether and how proactive environmental innovation can serve as a catalyst that transforms ESG strengths into tangible advantages in capital allocation, or alternatively, reveals potential trade-offs in resource distribution. Third, the study offers practical guidance for corporate managers in BRICS countries by providing actionable empirical evidence to strategically align ESG commitments, innovation investments, and capital budgeting processes in pursuit of sustainable financial performance.

This study aims to investigate how non-financial companies in the BRICS might use environmental innovation as a moderating factor when making capital investment decisions based on their ESG performance. The main contribution of this study is to link ESG studies with real corporate investment decisions by placing capital investment as the focus. This is important because capital investment reflects a company's long-term strategic decisions in building production capacity, adopting technology, and determining the direction of sustainable growth. In addition, the novelty of this study lies in testing the role of environmental innovation as a factor

that explains why the influence of ESG on capital investment can vary between companies. Environmental innovation is positioned as a mechanism that enables companies to convert ESG commitments into real capital investment decisions through technology adoption, asset modernization, and increased production process efficiency.

## 2. Research Methods

### 2.1. Data and Sample

This study uses data from non-financial companies that are listed on the stock markets of five BRICS countries like Brazil, Russia, China, Indonesia, and South Africa, covering the years 2015-2024. These countries were chosen because to their potential and challenges in putting sustainability principles and long-term investment plans into practice, as well as their status as emerging economies with important roles in global economy. Companies in the financial sector were left out of the sample because their regulatory capital structures and investment behavior are not directly like companies in other industries that invest in productive assets.

**Table 1.** Variable Description

Variable	Type	Operational Definition	Measurement / Indicator	Data Source
Capital_Index	Dependent	Index measuring the firm's capital investment intensity in fixed assets and long-term projects	Capital investment / Total assets	(Yu et al., 2024)
ESG_Score	Independent	Combined score representing overall Environmental, Social, and Governance performance	ESG combined score (0–100)	(Broadstock et al., 2021b)
Environ_Innovation	Moderator	The firm's level of engagement in environmental innovation to enhance sustainability and efficiency	Green innovation score or number of environmental patents	(Zaid et al., 2025)
Environment_Score	Independent	Score capturing firm performance on environmental sustainability dimensions	Score of Environment Pillar (0–100)	(Yu et al., 2024)
Social_Score	Independent	Score representing firm responsibility towards society, employees, and communities	Score of Social Pillar (0–100)	(Yu et al., 2024)
Governance_Score	Independent	Score indicating corporate governance quality, transparency, and board effectiveness	Score of Governance Pillar (0–100)	(Yu et al., 2024)
ROA	Control	A proxy that represent the effectiveness of asset in generating profit	Net income / Total assets	(El Ghouli et al., 2011; Wang et al., 2022)
Cash_Holding	Control	Cash availability ratio that influences investment decisions and financial flexibility	Cash and cash equivalents / Total assets	(El Ghouli et al., 2011)

Variable	Type	Operational Definition	Measurement / Indicator	Data Source
Leverage	Control	Measure of a firm's financial risk and reliance on debt	Total liabilities / Total assets	(Yu et al., 2024)
Firm_Size	Control	Size of the firm used to control for scale effects in investment behavior	Natural logarithm of total assets	(Yu et al., 2024)

Source: processed data

The data was obtained from LSEG Refinitiv Eikon database. The selection criteria that were applied to the final sample are as follows: (1) firms with ESG scores available for at least three years to ensure sufficient within firm variation for fixed effects estimation; (2) firms with complete data on all financial variables used in the analysis; and (3) all variables winsorized at the 1 st and 99 th percentiles to mitigate the influence of extreme outliers on regression. The final sample comprises 3.120 firm year observations.

**Table 2.** The Operational Variable

Variable	Indicators
Financial Performance (FP)	FP1-Coordination with inter-multilevel company FP2-Developing company risk communication FP3- Profitability FP4-Liquidity FP5-Solvability
Global Competition (GC)	GC1-Availability of preparedness and company management planning GC2-Enhancing the competence and instruction for stakeholders GC3-Monetary and technical assistance GC4- Intensity of Company GC5-Developing Innovation GC6-Sustainability
Company Value Growth (CVG)	CVG1-Execution of safety protocols and standards CVG2-Preemptive alert mechanisms and instantaneous communication CVG3-Routine safety audits and risk evaluations CVG4-Stock price CVG5-Profitability CVG6-Market value added (MVA)

Source: processed data

However, reform and liberalization activities reflect the magnitude of pressures and incentives created from external factors that affect firm internality and seek to encourage the possibility of additional reforms to catch up with firm achievements (Andriana & Panggabean, 2017; Olowofela et al., 2018). Finally, some strategies have emerged that are personalized by the company and considered important to adopt as part of the evaluation structure of the company; this is strongly connected with the economic exploration during high global competition and the development of modernity (Panjaitan, 2017).

### 2.2. Econometric Models and Methodology Description

This study examines between ESG performance and capital investment using panel data regression with the Fixed Effect Model. As a robustness check, the System GMM is also applied to address potential endogeneity, ensuring that the estimated relationship is not driven by potential reverse causality or omitted variable bias. The baseline econometric model is specified as follows:

**Model 1:** ESG to Capital Investment

$$Capital\ Investment_{i,t} = \alpha_i + \beta_1 ESG\_Score_{i,t} + \beta_2 ENV\_Score_{i,t} + \beta_3 SOC\_Score_{i,t} + \beta_4 GOV\_Score_{i,t} + \beta_5 Control\_Variable_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t} \tag{1}$$

**Model 2:** Moderation

$$Capital\ Investment_{i,t} = \alpha_i + \beta_1 ESG\_Score_{i,t} + \beta_2 ENV\_Score_{i,t} + \beta_3 SOC\_Score_{i,t} + \beta_4 GOV\_Score_{i,t} + \beta_5 Env\_Inno_{i,t} + \beta_6 ESG\_Score * Env\_Inno_{i,t} + \beta_7 ENV\_Score * Env\_Inno_{i,t} + \beta_8 SOC\_Score * Env\_Inno_{i,t} + \beta_9 GOV\_Score * Env\_Inno_{i,t} + \beta_{10} Control\_Variable_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t} \tag{2}$$

Analytical strategies are employed in this study to mitigate the potential influence of China-dominance bias on the estimated coefficients. First, all models incorporate firm fixed effects ( $\alpha_i$ ) that absorb all time-invariant, firm-specific unobserved heterogeneity including China-specific characteristics such as state ownership, industry policy exposure, and firm-level ESG reporting culture thereby isolating within-firm variation in ESG performance over time. Second, year fixed effects ( $\lambda_t$ ) control for common time-specific shocks affecting all BRICS firms simultaneously, including synchronized ESG policy developments such as China's 2018 CSRC mandatory disclosure mandate and global ESG regulatory tightening post-2020. Third, the System GMM estimator (Blundell & Bond, 1998) uses internal instruments derived from within-firm variation in ESG scores, reducing reliance on cross-country differences that would disproportionately amplify China's institutional idiosyncrasies in coefficient estimation.

### 3. Results and Discussions

Table 3 shows the descriptive statistics for all variables in this study, which are based on 3,120 firm year observations from 2015-2024. The average Capital Investment is recorded at 0.05 with a standard deviation of 0.041, indicating relatively low variation among firms. The mean ESG Score is 49.21, while the constituent pillars Environmental, Social, and Governance show average scores of 51.41, 44.53, and 53.49, respectively.

**Table 3.** Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Capital_Investment	3120	.05	.041	0	.33
ESG_Score	3120	49.214	17.251	13.763	86.672
Environment Score	3120	51.406	20.782	8.369	92.105
Social Score	3120	44.533	23.268	3.593	92.212
Governance Score	3120	53.494	20.691	10.317	91.194
Envi_Innovation	3120	46.942	22.862	4.651	96.25
Cash Holding	3120	.134	.104	0	.719
Leverage	3120	.082	.156	0	1.429
Firm_Size	3120	22.435	1.364	17.942	26.803
ROA	3120	.045	.06	-.107	.281

Source: processed data

The Environmental Innovation variable has a mean value of 46.94, with values ranging from 4.65 to 96.25, suggesting substantial heterogeneity in environmental innovation adoption among firms. Control variables including Cash Holding, Leverage, and Firm Size exhibit average values of 0.134, 0.082, and 22.43, respectively. Return on Assets (ROA) has a mean value of 0.045, ranging from -0.107 to 0.281, reflecting disparities in financial performance across firms.

The research sample covers a range of industries, as shown in Table 4, which presents the sector distribution. Healthcare sector with 866 observations (28.39 percent) of the total sample. This is followed by the Basic Materials sector with 539 (17.27 percent) observations, Technology sector contributes 153 observations, consumer cyclicals with 280 observations (8.9 percent) and consumer non cyclicals with 247 observations (7.91 percent). The industries with the smallest representation are Energy 2.7 percent, Industrials with 3.23 percent and Real Estate with 3.01 percent.

**Table 4.** List of Sector

<b>Sector</b>	<b>Freq</b>	<b>Percent</b>
Basic Materials	733	23.49
Consumer Cyclicals	539	17.28
Consumer Non-Cyclicals	280	8.97
Energy	247	7.92
Healthcare	87	2.79
Industrials	886	28.40
Real Estate	101	3.24
Technology	94	3.01
Utilities	153	4.90
<b>Total</b>	<b>3120</b>	<b>100</b>

Source: processed data

Table 5 shows the distribution of firm year observations across the five BRICS countries. Chinese companies dominate the sample, with 2100 observations, or 67.30 percent of the total sample. China's Shanghai and Shenzhen Stock Exchanges form the largest stock market among BRICS countries in terms of market value. Between 2016-2018, the China Securities Regulatory Commission (CSRC) introduced rules that required companies to disclose environmental information. After the CSRC's 2018 regulation, the number of Chinese companies reporting standardized ESG information grew quickly, placing China as the main source of ESG data for BRICS countries on commercial platforms.

**Table 5.** List of Country

<b>Country</b>	<b>Freq</b>	<b>Percent</b>
South Africa	367	11.76
Brazil	397	12.72
China	2100	67.30
Indonesia	161	5.16
Russia	95	3.04
<b>Total</b>	<b>3120</b>	<b>100</b>

Source: processed data

South Africa contributes 367 observations (11.76%) and Brazil gives 397 observations (12.72%), both of which demonstrate the developed ESG reporting cultures and maturity of their

capital markets. With sustainability disclosure required for JSE-listed businesses since 2010 under the King III Code, which was later strengthened by the King IV Code of Corporate Governance in 2016, South Africa is acknowledged as a global leader in integrated reporting (Doni et al., 2019). A wealth of ESG disclosure data is produced by JSE-listed firms' yearly integrated reports, which must report on their application of King IV principles on an "apply and explain" basis. The B3 Corporate Sustainability Index (ISE B3), which was created in 2005 and encourages voluntary ESG commitment and standardized ESG reporting among listed businesses on the Brazilian exchange, supports Brazil's representation (MDPI, 2024). Despite having smaller equities markets than China, Brazil and South Africa have comparatively strong ESG data coverage in Refinitiv Eikon, which can be explained by these institutional frameworks.

**Table 6.** Pairwise Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Capital_Index	1.000									
Esg_Score	0.045	1.000								
Environ_Innovation	0.026	0.299	1.000							
Environment_Score	0.043	0.824	0.536	1.000						
Social_Score	0.063	0.893	0.153	0.661	1.000					
Governance_Score	-0.012	0.582	-0.001	0.234	0.302	1.000				
ROA	0.131	0.084	0.056	0.108	0.074	0.016	1.000			
Cash_Holding	-0.126	-0.086	-0.011	-0.026	-0.094	-0.065	0.193	1.000		
Leverage	0.074	0.188	0.064	0.141	0.200	0.074	-0.010	-0.090	1.000	
Firm Size	0.041	0.230	0.059	0.271	0.141	0.127	-0.073	-0.097	0.101	1.000

Source: processed data

Rusia and Indonesia collectively account for only 8.20% observations of the total sample. Otoritas Jasa Keuangan (OJK) in Sustainable Finance Roadmap's evolving nature is evident in Indonesia's lower share. This roadmap makes ESG reporting voluntary for most listed corporations, limiting its availability and consistent on commercial platforms. Combined with Russia's carbon-intensive economic structure and its heavy reliance on extractive industries, formal sustainability reporting has been slow to integrate into mainstream corporate practice. These difference between countries in how ESG is institutionalized have a direct effect on the data that is available on business platforms and are a part of the BRICS ESG data infrastructure.

Table 6 presents the pairwise correlation matrix among the main variables of the study. The results show that no pairwise correlation exceeds the threshold of 0.80, indicating the absence of strong linear relationships. Although the highest correlation is observed between *ESG Score* and *Social Score* (0.893), this is not a major concern, as the aggregate ESG score and its individual pillars are not included simultaneously in the same regression model. Instead, they are analyzed separately to avoid potential construct overlap. Moreover, the correlations between each independent variable and the dependent variable *Capital\_Investment* are relatively low, ranging from -0.012 to 0.131. This suggests weak linear associations. Therefore, all variables are retained for further analysis in the panel regression models.

The result in Table 7 shows that overall ESG performance has a positive and significant effect on capital investment. The regression results indicate that among the three statistically significant ESG dimensions, aggregate ESG Score has the largest association with capital investment, followed by Environmental Score and Governance Score. A ten-point improvement in each dimension, a realistic and achievable change within a single annual reporting cycle for firms actively pursuing sustainability improvement, is associated with an increase of 0.00136 in the Capital Investment ratio for ESG Score, 0.000945 for Environmental Score, and 0.000819 for

Governance Score. Relative to the sample mean Capital Investment ratio of 0.0502, these effects correspond to increases of approximately 2.7%, 1.9%, and 1.6%, respectively. This differentiated pattern confirms that the influence of ESG performance on capital investment is not uniform across dimensions: the environmental and governance pillars are more effective in driving productive capital allocation than the social dimension in the BRICS context, consistent with the argument that environmental and governance improvements carry more direct and verifiable signals to capital providers regarding a firm's long-term risk profile and investment discipline (El Ghoul et al., 2011; Benlemlih & Bitar, 2018).

**Table 7. ESG Regression Results**

	(1)	(2)	(3)	(4)
	CI	CI	CI	CI
Esg_Score,	0.000136** (0.0000555)			
Environment_Score,		0.0000945** (0.0000429)		
Social_Score,			0.0000623 (0.0000446)	
Governance_Score,				0.0000819** (0.0000379)
Cash_Holding	-0.0207** (0.00976)	-0.0204** (0.00976)	-0.0199** (0.00976)	-0.0202** (0.00976)
Leverage	0.00420 (0.00361)	0.00399 (0.00361)	0.00413 (0.00361)	0.00435 (0.00361)
Firm_Size	0.000677 (0.00207)	0.000618 (0.00210)	-0.000372 (0.00203)	-0.000917 (0.00190)
ROA	0.0853*** (0.0121)	0.0857*** (0.0121)	0.0863*** (0.0121)	0.0876*** (0.0120)
Constant	0.0404 (0.0453)	0.0398 (0.0462)	0.0599 (0.0449)	0.0737* (0.0423)
Observations	3120	3120	3120	3120
R-Squared	0.0743	0.0753	0.0787	0.0747
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Source: processed data

To further contextualize the practical magnitude of these effects, a one-standard-deviation increase in ESG Score raises capital investment by approximately 0.00235, equivalent to about 46% of the effect associated with a similar change in ROA, the primary financial determinant in corporate finance. This indicates that ESG performance plays a meaningful, though smaller, role relative to profitability in shaping investment decisions. By lowering information asymmetry and financing costs, stronger ESG performance broadens the set of viable projects that meet required return thresholds (Cheng et al., 2025). In BRICS economies, where disclosure remains largely voluntary particularly in Indonesia and Russia cross-country evidence further highlights the importance of credible social initiatives in strengthening firms' access to capital and enhancing investment capacity.

This supports the hypothesis that firms with stronger sustainability commitments allocate more resources to productive capital assets. This result is consistent with Spence (1973) signaling theory, which holds that ESG performance serves as a reliable indicator of a company's risk profile

and long-term stability to outside capital investment. This makes such performance difficult to imitate, increasing its informational value for investors and creditors. When investors and creditors interpret strong ESG performance as a sign of lower risk and stronger long-term prospects, they respond by offering more favorable financing terms. These include lower interest rates on debt, a smaller equity risk premium, and broader access to international capital markets (Wang, 2026). This finding is consistent with Wen et al. (2025) said that positive effect of all three ESG pillars on capital investment across BRICS countries from 2010 to 2022., identifying bank financing as a mediating channel through which ESG performance expands corporate investment capacity.

Environmental performance has a positive and significant impact on capital investment. An investment in tangible assets is frequently necessary to enhance environmental performance in the capital-intensive sector, which comprises a significant portion on non-financial firms in the BRICS countries. Companies that are dedicated to measurable environmental enhancements must inherently allocate capital to upgrade such assets (Khan et al., 2016). The environmental regulations of the BRICS countries are becoming more stringent. For instance, Brazil's commitments, South Africa's King IV requirements for integrated reporting, and China's mandatory emissions disclosure rules all advocate for companies to enhance their compliance capabilities prior to regulatory implementation. Companies that have achieved high environmental scores have already implemented these policy directives and have proactively updated their assets. Therefore, they mitigate the likelihood of incurring substantial expenses as a result of abrupt regulatory modifications or future penalties (Chen et al., 2023).

Governance quality exerts a positive and significant effect on capital investment. This finding reflects a fundamental principle of corporate finance: well-governed firms make better investment decisions (Yadav & Yadav, 2024). When boards are independent, transparent, and accountable, agency conflicts between managers and shareholders are reduced managers are less likely to engage in empire-building or value-destroying investments, and more likely to pursue capital projects that generate sustainable long-term returns (Benlemlih & Bitar, 2018). The result is that high-governance firms invest more, not because they have more resources, but because their decision-making processes are more disciplined, their investment proposals face more rigorous scrutiny, and their approved projects carry higher probability of value creation.

Social score is not significant to capital investment. These benefits typically impact long term performance but do not directly lead to increased capital expenditures in the short term, making the empirical relationship less clear (Liang & Renneboog, 2017; Servaes & Tamayo, 2013). From a capital market perspective, social dimensions tend to be less effective in influencing financing decisions. Investors and lenders tend to be more sensitive to factors that directly impact financial risk and cash flow. Meanwhile, social performance is often considered more difficult to measure objectively and can carry symbolic meaning, so it does not always result in a lower cost capital or increased ease of obtaining funding (Krüger, 2015). On the other hand, in the context of developing countries such as BRICS, corporations and stakeholders continue to prioritize financial stability with key regulations over social aspects. Social aspects are not a primary consideration in investment decision making due to disparities in social reporting standards and unequal levels of regulatory enforcement. Consequently, insignificant social score on capital investment is contingent upon reputation and is less correlated with the investment requirements of companies in productive assets.

**Table 8.** ESG Regression Results Moderation Environment Innovation

	(1)	(2)	(3)	(4)
	CI	CI	CI	CI
ESG_Score	0.000128*			
	(0.0000682)			
ESG_Score * Env_Innovation	0.0000284*			
	(0.0000163)			
Environment_Score		0.0000118*		
		(0.000212)		
Env_Score*Env_Innovation		0.0000364*		
		(0.0000538)		
Social_Score			0.0000253	
			(0.000191)	
Soc_Score*Env_Innovation			0.0000257	
			(0.0000501)	
Governance_Score				0.000164
				(0.000185)
Gov_Score*Env_Innovation				-0.0000663
				(0.0000486)
Env_Innovation	0.00318*	0.00463*	0.00210	0.00446
	(0.00271)	(0.00264)	(0.00238)	(0.00299)
Cash_Holding	-0.0200**	-0.0198**	-0.0196**	-0.0201**
	(0.00977)	(0.00976)	(0.00978)	(0.00977)
Leverage	0.00442	0.00451	0.00430	0.00455
	(0.00362)	(0.00362)	(0.00362)	(0.00362)
Firm_Size	0.000698	0.000771*	-0.000581*	-0.00103*
	(0.00209)	(0.00211)	(0.00205)	(0.00195)
ROA	0.0851***	0.0848***	0.0862***	0.0873***
	(0.0121)	(0.0121)	(0.0121)	(0.0120)
Constant	0.0248	0.0221	0.0571	0.0596
	(0.0468)	(0.0470)	(0.0456)	(0.0443)
Observations	3.120	3120	3120	3120
R-Squared	0.364	0.382	0.321	0.323
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Source: processed data

Table 8 presents the results of the moderation analysis, which examines whether environmental innovation conditions the strength of the ESG–capital investment relationship across each ESG dimension. There is a positive moderating effect of environmental innovation on both aggregate ESG performance and environmental performance on capital investment, but its moderating effect on social and governance is not significant. This implies that environmental innovation acts as a link between ESG commitments and concrete implementation through investment projects (Yadav et al., 2025). On the other hand, environmental innovation enables businesses to find specific investment opportunities, such waste management, efficient production processes, and sustainable energy technology (Gao et al., 2025). As a result, environmental innovation turns ESG into real investment opportunities rather than just a normative signal (Chang & Wang, 2024). Additionally, because businesses have the technical skills and expertise to carry

out ESG based projects, environmental innovation lowers risk and uncertainty while boosting investor trust (Li et al., 2025).

Theoretical basis is found in the importance of moderation in the relationship between Environmental Score and capital investment. Environmental innovation and environmental performance are complementary skills (Yu et al., 2024). While environmental innovation shows a company's capacity to consistently develop new ways to enhance its performance, environmental performance shows the outcomes a company has attained in controlling ecological impacts (Wang & Zhang, 2023). Businesses that succeed in both will be in a cycle of reinforcement innovation is fuelled by environmental commitment, and innovation necessitates investment in cleaner, more efficient technologies, which in turn enhances environmental performance. On the other hand, great environmental performance is frequently only attained through passive regulatory compliance without creating new sustainable investment prospects in the absence of innovative capabilities. According to Lee and Min (2015) and Zaid et al. (2025), environmental innovation therefore functions as an execution mechanism that converts environmental commitment from merely reputational success into concrete and sustainable capital investment decisions.

**Table 9.** Robustnes Test GMM Estimation Results

	(1)	(2)	(3)	(4)
	CI	CI	CI	CI
L.CI	0.533*** (0.026)	0.533*** (0.027)	0.521*** (0.025)	0.532*** (0.026)
ESG_Score	0.000** (0.000)			
Environment_Score		0.000** (0.000)		
Social_Score			0.000 (0.000)	
Governance_Score				-0.000* (0.000)
Cash_Holding	-0.022* (0.012)	-0.019 (0.012)	-0.018 (0.013)	-0.020* (0.012)
Leverage	0.006 (0.009)	0.005 (0.009)	0.004 (0.009)	0.009 (0.009)
Firm_Size	0.005** (0.003)	0.006** (0.003)	0.005 (0.004)	0.005** (0.002)
ROA	0.204*** (0.036)	0.206*** (0.037)	0.189*** (0.044)	0.195*** (0.035)
Constant	-0.101* (0.055)	-0.109* (0.056)	-0.090 (0.092)	-0.094* (0.053)
AR (1)	0.000	0.000	0.000	0.004
AR (2)	0.147	0.142	0.140	0.186
Hansen	0.535	0.587	0.802	0.573
Number of Ins	76	76	11	11
Number Group	618	618	297	240
Observations	2405	2405	2405	2405

Standard errors in parentheses \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Source: processed data

However, variations in value creation mechanisms can account for the lack of considerable moderating of environmental innovation on the social and governance dimensions. Improvements in stakeholder trust, social legitimacy, and human capital quality are the main ways that business value is created in the social dimension. These effects are indirect in terms of capital expenditure since they have less to do with the necessity of investing in tangible assets or technology and more to do with reputation, employee loyalty, and community connections. As a result, the relationship between capital investment and social performance is not strengthened by environmental innovation. In contrast, its main function in the governance dimension is to support the mechanisms and decision-making procedures that guarantee the effective and responsible distribution of resources. Organizations that can allocate funds to value-added projects without depending on environmental innovation now have good governance as its cornerstone.

The robustness test results presented in Table 9, using the System GMM model, show that the relationship between capital investment and ESG performance remains consistent and significant, even after controlling for potential endogeneity and dynamic bias. This finding aligns with the study by Farooq et al. (2024), which states that capital investment has a positive effect on ESG. Furthermore, the ESG score and the environmental score continue to show a positive influence, reinforcing the previous results from the fixed effects model in Table 5. This result is also consistent with Wen et al. (2025), who found that ESG performance can enhance capital investment capacity through broader access to financing, particularly among companies in BRICS countries.

On the other hand, the social score shows no significant effect, indicating that its impact is more indirect and reputation-related, and thus does not directly influence capital expenditure decisions (Liang & Renneboog, 2017). Meanwhile, the governance score shows a negative effect. This suggests that stronger governance may act as a control mechanism that prevents overinvestment, rather than hindering productive investment (Benlemlih & Bitar, 2018).

#### **4. Conclusions**

The study shows that ESG performance has a significant impact on capital investment decisions in non-financial businesses in the BRICS nations, with the environmental and governance components having the most influence. Because these traits convey stability, efficiency, and reduced environmental risk to investors, businesses that exhibit great environmental responsibility and good corporate governance typically draw more long-term investment. Additionally, environmental innovation serves as a means of converting sustainability pledges into observable investment results and strengthens good relationships. Businesses not only exhibit ESG compliance, but they also translate this into increased capital spending and investment. The consistency and dependability of these findings as strategic drivers of financial growth and investment in emerging markets are confirmed by a robustness test utilizing the GMM technique. These findings affect BRICS non-financial company management and investors. These results show managers that ESG is a strategic tool that can be used to improve a company's investment capacity and attract capital sources, in addition to being a regulatory requirement and a reputational tool. As a result, companies need to integrate ESG principles into their strategic plan and long-term investment choices. It is also demonstrated in this study that it is crucial to enhance ESG regulations and reporting standards to enhance market transparency and information quality for policymakers. Additionally, by reducing the information gap between BRICS companies and investors, these initiatives help accelerate capital flows to more productive and sustainable enterprises. There are limitations to this study that provide opportunities for further investigation. First, there is no distinction made between conventional and green capital investment; instead,

capital investment is calculated as the total amount spent on tangible assets. To fill a significant gap in the literature, future studies should separate capital expenditure into ESG-aligned categories (such as pollution control equipment and renewable energy assets) and conventional categories to determine whether ESG explicitly influences ecologically oriented investment. Second, most of the sample China (67.39%) which highlights problems with data accessibility in relation to China's mandatory ESG disclosure laws (Ruan & Liu, 2021). Future research should employ stratified sampling and expand the sample to include BRICS+ member economies such as Saudi Arabia, the United Arab Emirates, Egypt, Ethiopia to test the generalizability of findings across a wider range of institutional environments and ESG regulatory frameworks.

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