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The impact of governance on environmental performance: evidence from African countries

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Abstract

This article assesses the impact of governance mechanisms on the environmental performance of a sample of 122 listed African firms between 2010 and 2022. We distinguish between the performance relative to the control of harmful emissions and that related to the firm's pro-environmental innovations. We also consider two governance proxies, reflecting the management quality and the corporate social responsibility strategy, respectively. The System GMM results show that enhancing the governance quality significantly contributes to promoting environmental performance. Results also reveal that the environmental scores are highly persistent, which reflects the African firms' commitment to a long-term CSR strategy. Finally, we notice that results differ from one sector to another. In particular, CSR has little effect on industrial harmful emissions and no effect on the industrial sector's ability to produce innovations. Such results suggest that the green transition in African industry is particularly difficult to implement and requires more resources.

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1. Introduction

The classical definition of governance focuses on the management of a country's economic and social resources for development (World Bank, 1992), without explicitly taking into account environmental and social dimensions. Today, the definition of governance should be expanded to include environmental and social issues, given their growing importance in the global context of sustainable development. Indeed, governance is a crucial aspect of sustainable development. Its link to environmental, social, and governance (ESG) considerations has gained increasing attention in recent years. The World Bank and other international organizations have recognized the importance of integrating environmental and social issues into governance frameworks. Effective governance practices are crucial for creating a stable and predictable operating environment for businesses and investors, and for promoting social and environmental well-being.

In the literature, theories of corporate governance provide a useful framework for understanding the relationship between corporate governance and environmental responsibility (Ahmad et al., 2013; Hua and Yanhong, 2002; Jiang et al., 2013; Li et al. 2016). Thus, governance is a critical factor in achieving sustainable development, particularly with environmental issues. Moreover, corporate governance has recently been strengthened by publishing several codes, laws, and reports. In the last decade of the 20th century, the concept of governance was established as a symbol of the new modernity of public behavior and forms of corporate management.

Today, governance constitutes - with ecological issues, social equity, and economic efficiency - one of the important pillars of sustainable development. Indeed, public demands regarding the environmental impact of business practices are forcing companies to implement an environmental management system to measure and reduce the negative effects of company products on the environment (Ambec and Lanoie, 2009).

The world is changing, and developing countries will have to follow the requirements of international organizations[1]. The corporate social responsibility (CSR) approach and environmental issues will not be a choice to maintain competitiveness. In the context of Africa, governance has historically been a significant challenge, with corruption, political instability, and weak institutions often hindering development. However, there have been positive developments in recent years, with some African countries making progress in improving governance practices and implementing policies that promote ESG considerations. The United Nations Economic Commission for Africa (2020) presented an update on the policies undertaken by African countries to promote sustainable development. For instance, Ghana created a plan for environmental fiscal reform and engaged in the design of a green fund, while Kenya implemented policies aiming to foster the green transition, which include investment in renewable energy and the promotion of resource-efficient and cleaner production. Similarly, South Africa engaged in 2011 in a program aiming to achieve reduced waste emissions and lower dependence on coal. More recently, the United Nations (2022) reported that the world's first sovereign blue bond was launched by Seychelles in October 2018 to enhance the management of its marine resources. The same report pointed out that Algeria implemented a green dam covering an area of 3.7 million hectares. These efforts have the potential to promote economic growth while also addressing social and environmental concerns. Additionally, some African countries have made strides in promoting gender equality and addressing human rights issues, which are important social considerations for ESG (Africa Gender Index Report, 2019).

[1] Such as the United Nations

However, much work still needs to be done to improve governance practices and promote ESG considerations in Africa. Many countries continue to struggle with corruption, political instability, and weak institutions, which can hinder progress in addressing environmental and social challenges.

Africa has been facing significant environmental challenges for decades, including an increase in its ecological footprint and vulnerability to climate change. From this perspective, Due to mining, agricultural, energy, forestry, and infrastructure activities, Africa lost 4,067,000 hectares of forest each year between 1990 and 2000 (Megevand, 2013). Several initiatives demonstrate the commitment of African companies to environmental responsibility. Thus, several African companies have started issuing Green Bonds since the COP 22 Conference. According to the African Ministerial Conference on the Environment, climate actions play an essential role in accelerating the economic and social transformation of the continent (AMCEN, 2021). Despite the current environmental challenges, little research has focused on the environmental responsibility of companies in the African context. The multiple managerial approaches on the subject generally suffer from acculturation because they are most often developed in non-African contexts.

This study aims to bridge this gap by investigating the impact of corporate governance on environmental performance for a sample of 122 African firms over the 2010-2022 period. We intend to identify the main determinants of the environmental performance of African firms and to verify if enhancing the governance quality contributes to boosting green transmission in Africa. Furthermore, besides the global indicator measuring the company's overall environmental performance, we distinguish two specific indicators reflecting the firm’s ability to reduce harmful emissions and introduce green innovations. This should enable us not only to assess the impact of governance on environmental performance but also to verify the extent to which it contributes to boosting the innovation process within African companies. We also seek to verify whether the African firm’s environmental commitment is induced by standard governance mechanisms, or whether it requires the implementation of a governance strategy specific to the socio-environmental dimension. To that end, we control separately the firm’s management quality and CSR strategy. We also introduce country dummies to control for the cross-country differences in the institutional frameworks dealing with environmental issues. Since the effectiveness of environmental policies may also differ from one sector to another, we conduct a sectoral analysis to identify which sector governance contributes most to fostering the green transition. Finally, we opt for a dynamic panel data model by introducing the lagged dependent variable among the set of independent variables to control for the persistence of the environmental performance. This should enable us to gauge if African firms are engaged in a long-term environmental transition. To our knowledge, this is the first paper that offers such a detailed analysis of the impact of governance on corporate environmental strategy in the African context.

The remainder of this study is organized as follows. Section 2 summarizes the theoretical and empirical underpinnings of the relationship between governance and environmental performance. Section 3 defines the empirical model, describes the methodology, and provides the main statistical features of the sample. Section 4 presents and discusses the main empirical results. The main conclusions and policy recommendations are summarized in the last section.

2. Governance and environmental performance: theoretical underpinnings and empirical evidence

Various governance theories provided the underpinnings for corporate social responsibility. The stakeholders' theory states that corporate governance should not focus exclusively on financial performance, but must also take into account the interests of the firm's stakeholders and the requirements of the environment in which it operates (Freeman, 1984). Accordingly, the firm's commitment to a socially responsible strategy is a voluntary approach stemming from the shareholders' and managers' awareness of the importance of promoting social welfare while seeking to achieve the firm's economic and financial objectives (Mathieu, 2008). This approach is consistent with the definition provided by the Commission of the European Communities (2001), according to which CSR corresponds to "*the voluntary integration of social and environmental concerns into business operations and stakeholder relations*". New institutionalism, however, views CSR as a response to institutional constraints. In this respect, Ménard (2003) pointed out that the firm's strategy is highly dependent on its institutional environment, which refers to the political, social, or legal rules laid down by the institutional framework (North, 1990). Finally, according to the resource dependency theory, opting for a socially responsible strategy enables attracting highly qualified directors and managers (Orazalin and Baydauletov, 2020), offering thereby the firm a diversified panel of expertise which leads to an improved governance process.

Garriga and Melé (2004) classified the CSR's underpinnings into four groups of theories. First, the instrumental theories, for which CSR is a strategic tool aiming to boost the firm's performance. The importance attached by companies to environmental and social issues is, therefore, far from altruistic. It is simply a way of improving a company's image and reputation (Allouche et al., 2004) to attract a segment of consumers who are particularly sensitive to these issues. Secondly, for political theories, CSR is the result of power relations between business and society. In this respect, Gulema and Roba (2021) asserted that foreign firms showing a collaborative attitude toward the host governments are more likely to adopt CSR practices. The integrative theories represent a third alternative approach, according to which CSR reflects the idea that the existence and growth of the company are subject to the goodwill of society. For instance, the social activities undertaken by some companies are aimed at offsetting the environmental damages caused by their activities. This is particularly true of mining and chemical activities, which are highly polluting and represent a serious threat to the health of surrounding populations. For these firms, a high commitment to CSR may be considered as an effective tool to be accepted and integrated in their immediate environment. Finally, the ethical theories, for which CSR reflects the ethical dimensions and values of society, to which the company must respond above all other concerns.

An important body of empirical studies investigated the relationship between governance and the environmental and social performance of firms. Walls et al. (2012) evaluated the environmental performance of 313 American-listed companies according to various aspects of governance. They concluded that ownership structure, board of directors, and management are major determinants of environmental performance. Similar findings were highlighted by Salo (2008) for a sample of 361 companies listed in the FTSE Eurotop 300. Halme and Huse (1997) focused on the relationship between the board structure and environmental performance. Their results suggest that the board's characteristics positively affect environmental reporting. Other studies shed light on the positive relationship between ownership structure and environmental performance (Huang, 2010; Mahoney and Roberts, 2002). In a more recent study, Dixon-Fowler et al. (2017) detected a positive relationship between corporate governance structures and strategies and environmental-related decisions. Furthermore, Doonan et al. (2005) demonstrated that the commitment of senior management to environmental evaluation and

control positively impacts environmental performance. However, another strand of studies emphasized that high board diversity hinders environmental progress (Goodstein et al.,1994; Gautschi and Jones 1987; Kesner et al. 1986).

Orazalin and Baydauletov (2020) found that firms with more effective CSR strategies are showing higher environmental and social performances. Their results also suggest that a higher percentage of female directors contributes to promoting the firm's environmental and social performance. Moreover, gender diversity shapes the positive relationship between CSR strategy and environmental performance. Another important finding of this study is that the corporate's environmental and social performance is dependent on the quality of the national institutional framework. Similar results were highlighted by Naciti (2019) for a sample of 362 firms from 46 countries. Firms exhibiting higher board diversity and separate CEO and chair positions are those enjoying higher sustainability performance. However, results revealed that the board's independence contributes to hindering the firm's environmental performance. Asni and Agustia (2022) confirmed that corporate governance matters for environmental sustainability. Their results indicate that the board's size and independence significantly contribute to spurring green innovation. Masud et al. (2018) provided empirical evidence on the determinants of environmental sustainability reporting performance in three South Asian countries (Bangladesh, India, and Pakistan) for a sample of 88 listed organizations over the 2009–2016 period. Results indicated that foreign and institutional ownership, board independence, and board size contribute to enhancing environmental sustainability reporting.

Focusing on the Chinese context, Zheng et al. (2023) detected a bidirectional relationship between the ESG score and corporate green innovation, both in the short and long run, for clean industries. This positive relationship is valid only in the long run for polluting industries. Such results suggest that the transition to green technologies is a difficult process to implement. Similar conclusions were highlighted by Irshad et al. (2023) who showed that governance boosts sustainability and environmental performance only for firms exhibiting acceptable and high initial environmental scores. Using data relative to Spanish firms, García-Pozo et al. (2019) pointed out that firms engaged in research and development, improvements of products and processes, and organizational innovations are the most successful in producing environmental innovations. Their results also suggest that public financial support for innovation activities is a main driver for ecological innovation and that the determinants' effects significantly vary across sectors. Overall, the review of the empirical literature suggests the existence of a strong relationship between corporate governance and environmental performance.

3. Sample and Methodology

3.1.Model and estimation method

Our empirical model is described by the following equation:

$$Env_{i,t} = \alpha_0 + \delta\, Env_{i,t-1} + \beta 1\, Gov_{i,t} + \gamma\, Z_{i,t} + \varepsilon_{i,t} \qquad (1)$$

Where $Env_{i,t}$ represents the vector of environmental scores: Environmental Innovation Score, Emissions Score, Resource Use Score, and Environment Pillar Score of company i at period t. $Gov_{i,t}$ is a vector of governance scores which includes the Management Score and the CSR strategy Score of company i at period t. $Z_{i,t}$ is a vector of control variables and $\varepsilon_{i,t}$ is the error term.

Including the lagged dependent variable allows to assess the persistence of the firm's environmental performance. A high positive and significant coefficient associated with this variable indicates that past performances contribute strongly to boosting the actual performance, which reflects the firm's long-term commitment to a pro-environmental strategy.

In Model (1) causality may run from the environmental performance proxies to some independent variables, thereby triggering an endogeneity problem which leads to biased estimates. Several studies highlighted a reverse causality between governance and CSR strategies (Jo and Harjoto,2012). A high performance should encourage the firm to maintain and reinforce its environmental strategy, while a weak score should lead to a rethink of its governance model. Similarly, obtaining a high innovation score should encourage the company to consolidate its management and CSR strategies. Moreover, the environmental score may influence the company's financial performance. Pro-environmental practices can be costly for companies, resulting in a short-run drop in performance. In the long run, however, such a strategy can enhance the company's reputation and attract environmentally-conscious customers, boosting its bottom line.

To control for endogeneity, we apply the System GMM estimator developed by Arellano and Bover (1995). The idea is to estimate a system composed of the level equation and the first differenced equation while using the lagged differences and levels of the endogenous variables as instruments[2]. Only second and higher lags may be retained as instruments since the model includes the lagged dependent variable among the set of control variables. Enlarging the instruments' set to include both the lagged differences and levels of the endogenous variables remedies for the weak instruments problem which represents the main weakness of the Difference GMM estimator. The post-estimation tests include the Arellano and Bond (1991) test which checks for the absence of second-order residual autocorrelation. We also implement the Sargan-Hansen overidentification test to confirm the validity of the instruments. Using too many instruments may lead to an overfit of the endogenous variables (the probability of the test should tend to 1 in this case). Following Roodman (2008), we try to avoid this instrument proliferation problem by limiting the number of instruments to a maximum of three lags for each endogenous variable. We also check for the robustness of the results by verifying that a variation in the number of instruments does not lead to a significant change in the estimation outcomes.

We used global and specific governance and environmental performance measures. Environmental performance is a multifaceted concept that encompasses a variety of factors such as environmental innovation, emission scores, environmental management systems, reporting and transparency, and stakeholder engagement. For this reason, we used Refinitiv environmental scores to measure the environmental performance. Indeed, this comprehensive approach provides a more nuanced understanding of a company's environmental performance and its potential risks and opportunities related to environmental sustainability. Moreover, it is important to note that governance is a complex and multifaceted concept that encompasses a wide range of factors. Good governance involves effective management practices, a strong CSR strategy, transparency, accountability, and stakeholder engagement. For this reason, we used Refinitiv governance scores to measure the quality of corporate governance. These scores provide a comprehensive view of a company's governance practices and can be used by the different stakeholders to evaluate the quality of a company's governance and identify areas for improvement.

We use three measures to assess environmental performance: the Environmental Innovation Score, Emissions Score, and the Environment Pillar Score, which gives an overall idea of the company's environmental performance.

[2] The lagged differences are used as instruments for the level equation, while the lagged levels are serving as instruments for the differenced equation.

Table 1: Dependent variables

Dependent Variables	Definition	Source
Environment Pillar Score	The company's score summarizes its capacity for reducing its emissions, reducing the resources it uses, and the eco-efficient innovation included in the product. It measures a company's impact on living and non-living natural systems, including air, land, and water, as well as entire ecosystems. Establishing this score requires information about the energy used by the company, its CO2 emissions, the water, and the waste it recycles. Any controversies concerning spills or pollution caused by the company's activity are also considered in the rating. The score varies from 0 to 100.	Refinitiv
Environmental Innovation Score	Reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes or eco-designed products. The score varies from 0 to 100.	Refinitiv
Emissions Score	Assesses the company's commitment and effectiveness towards reducing environmental emissions in the production and operational processes. The score varies from 0 to 100.	Refinitiv

Two proxies are used to assess the governance quality: the Management Score and the CSR strategy score. The measures used in the literature generally reflect a single dimension of governance (Pekovic and Vogt, 2021; Akram et al., 2018; Walls et al., 2011). The two scores used in this study reflect the most important governance factors. We also included some control variables suggested by previous studies on the relationship between governance, environmental performance, and CSR (Walls et al., 2012; Akram et al., 2018).

Table 2: Independent and control variables

Variables	Definition	Source	Expected relationship
Independent Variables			
Management Score	It measures a company's commitment and effectiveness towards following best practice corporate governance principles. It reflects a company's ability to ensure a critical exchange of ideas and independent decision-making through an experienced, diverse, and independent board of directors, etc. The score varies from 0 to 100.	Refinitiv	The Management score should produce a positive effect on environmental performance since it consolidates traditional corporate governance practices into a single score. It includes board independence (Johnson and Greening, 1999; Webb, 2004), diversity (Webb, 2004; Coffey and Fryxell, 1991; Stanwick and Stanwick, 1998), board size (Kassinis and Vafeas, 2002; (Brown et al., 2006), CEO duality (Berrone et al., 2010), level of managerial control (Johnson and Greening, 1999), etc.

CSR strategy	Captures the strategic position of the company vis-à-vis its social and environmental responsibilities. It assesses the degree of commitment of the company and the effectiveness of its decisions regarding these responsibilities. The score summarizes five main engagements: (1) the decision to establish a CSR committee, (2) the decision to comply with the guidelines of the Global Reporting Initiative (GRI), (3) the decision to create and maintain an external audit of CSR reports, (4) the decision to integrate the company's financial and extra-financial reports, (5) the decision to draw up a report on the company's CSR activities. The score varies from 0 to 100.	Refinitiv	We expect a positive relationship between CSR strategy score and environmental performance. The CSR strategy score consolidates all sustainable governance practices into a unified score, such as the board orientation toward CSR issues (Kassinis and Vafeas, 2002; Hillman et al., 2001).
Control variables			
ROA	It measures the ratio of the net result to the total assets. It assesses the ability of a company to generate income from its resources	Refinitiv	A higher financial performance should help the firm to undertake environment-friendly practices (King and Lenox, 2002)
Financial leverage	It measures the ratio of the total debt to total equity. It reflects the capital structure of a company.	Refinitiv	Highly indebted firms are less keen to adopt costly environmental strategies (King and Lenox, 2002)
Company size	Measured by the Log of total assets	Refinitiv	Big firms are better placed than small ones to implement successful environmental strategies (King and Lenox, 2002)
Inflation	Rate of change of the Consumer Price Index	World Bank	High inflation stems from macroeconomic instability and should deteriorates the firm's environmental performance (Saidane and Ben Abdallah, 2021)
GDP	Real GDP growth rate	World Bank	A higher growth rate should boost the firm's performance and, therefore, promote its environmental performance (King and Lenox, 2002)

3.2.Sample and descriptive statistics

In this study, we assess the relationship between the governance quality and the environmental performance of African companies during the period 2010-2022. Our sample is composed of 122 companies from South Africa, Morocco, and Egypt.

Table 3: Classification of companies in the sample by sector of activity

Sector	Number of companies and %
Industrial	36 (29.5%)
Service	74 (60.66%)
Agricole	12 (9.84%)
Total	122

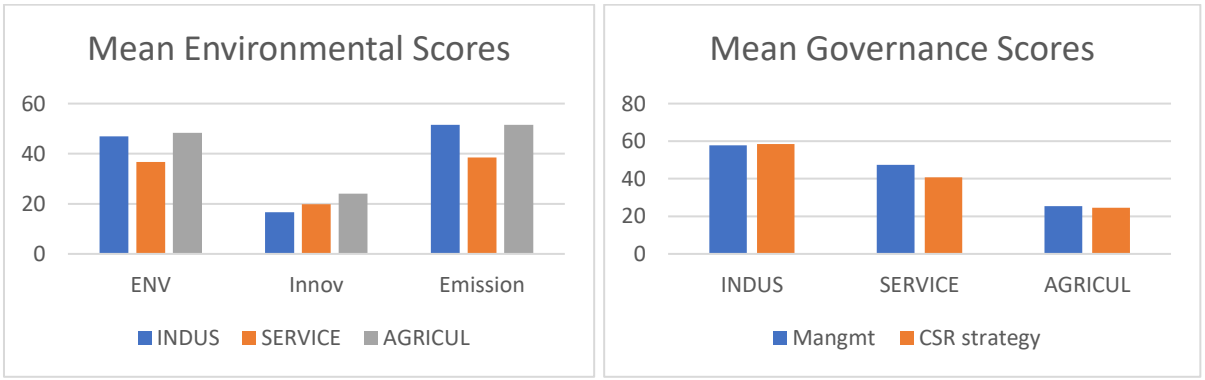
The governance variables and those evaluating the environmental performance of these companies were extracted from the ESG database proposed by Refinitiv, while the financial variables were extracted from the Worldscope of Datastream databases. The macroeconomic variables were collected from the World Bank database.

Table 4: Descriptive Statistics

Variables	Observations	Mean	Std.Div	Min	Max
Env	1402	40.87	25.82	0	96,68
E- Innov	1402	19.25	28.58	0	98,58
Emission	1402	43.69	28.93	0	98,37
Magt Score	1402	51.87	27.96	0,67	99,64
CSR strategy	1402	47.48	30.98	0	99,6
Size	1538	7.42	0.68	5.34	9.46
ROA	1519	7.38	10,1	-43.06	123.26
Fin Leverage	1538	104.49	800.75	-6182.83	27568.27
Inf	1586	5.5	2,6	0,30	29,5
GDP	1586	7.42	2,58	-7.19	8

Table 4 and Figure 1 show that the average environmental scores of African companies (Env, E-Innv, and Emission) are below 50 for all the sectors. The E-Innv score is exhibiting a particularly low average (19.25 for the full sample and 16.63 for the industrial sector). These results highlight the significant challenges that African companies are facing when prioritizing environmental concerns, due to the associated costs, especially for innovation, which is too expensive for these companies. However, we note that the average governance scores (Magt Score and CSR strategy) is fairly good, especially for the industrial sector (about 60). These results confirm the findings of Saidane and Ben Abdallah (2021), which suggest that good governance practices are a priority for African firms. However, the high standard deviations of environmental and governance scores show that these are unstable and disparate.

Figure1: Environmental and governance scores by sector



The correlation coefficients of the variables are reported in Table 5. The environmental scores (Env, E-Innv, and Emission) and governance scores (Magt Score and CSR strategy) are positively and highly correlated. In particular, we notice a strong correlation between the Magt Score and the CSR Score on one hand, and Env Score on the other hand (0.71 and 0.67 respectively). Similarly, a correlation of 0.66 is observed between the CSR strategy and the Emission Score. We also observe a correlation of 0.59 between the Magt Score and the E-Innov Score. Finally, we note the absence of a multicollinearity problem between the independent variables.

Table 5: Correlation Matrix

		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Env	**1**	1									
E- Innov	**2**	0.59	1								
Emission	**3**	0.87	0.4	1							
Magt Score	**4**	0.71	0.59	0.15	1						
CSR strategy	**5**	0.67	0.36	0.66	0.21	1					
Size	**6**	0.37	0.31	0.33	0.005	0.34	1				
ROA	**7**	-0.05	-0.10	-0.04	0.03	-0.05	-0.13	1			
Fin Leverage	**8**	0.029	0.1	0.03	0.09	0.01	0.015	-0.03	1		
Inf	**9**	-0.17	-0.06	-0.19	-0.04	-0.13	0.034	0.0003	-0.05	1	
GDP	**10**	-0.08	-0.05	-0.10	-0.008	-0.07	0.02	0.12	0.01	0.32	1

4. Results and discussion

The estimation results for the full sample are reported in Table 7. We note the significance of the coefficients associated with the lagged dependent variables at the 1% level, which confirms the dynamic nature of the models. The strong persistence of the three environmental performance proxies reveals that African companies are highly committed to the ecological transition, and are engaged in long-term environmental strategies.

Results in Table 7 also show that environmental performance is positively and significantly influenced by the quality of the company's governance mechanisms. Standard governance mechanisms, summarized by the management score, contribute to boosting the environmental performance of African firms. These results, confirm previous empirical findings highlighting the positive impact of the board of directors' attributes on the environmental practices implemented by firms (Gallego-Álvarez and Rodriguez-Dominguez, 2023; Zubeltzu-Jaka et al., 2020; Campanella et al., 2021). We also note that the company's CSR strategy is a major driver for its environmental performance. Moreover, estimation results reveal that CSR is more relevant than traditional governance mechanisms for promoting environmental innovation and controlling harmful emissions. Indeed, management quality plays an important role in implementing CSR and environmental approaches. These findings are in line with the paradigm considering the board as a driving force that boosts CSR and environmental policies (Khan et al., 2012; Bournois et al., 2007).

Table 7: Determinants of Environmental Performance, Full Sample

	System GMM		
Variables	**Env**	**E- Innov**	**Emission**
Env $_{t-1}$	0.70 ***		
E- Innov $_{t-1}$		0.83 ***	
Emission $_{t-1}$			0.78 ***
Magt Score	0.15 ***	0.13 **	0.11 ***
CSR strategy	0.12 ***	0.32 ***	0.15 ***
Size	5.9***	2.005	2.83
ROA	0.03	-0.21	-0.02
Fin Leverage	-0.003***	0.0026**	-0.004***
Inf	-0.26**	0.09	-0.13
GDP	0.05	-0.022	0.16
Sector (base group: Industry)			
Agriculture	15.14***	50.35***	19.77***
Service	0.14	10.06	4.94
Country (base group: South Africa)			
Egypt	-3.66	8.57*	-3.4
Morocco	-4.64**	5.06	-4.7
Constant	-44.6***	-42.89**	-26.99*
Sargan test	Prob > chi2 = 0.47	Prob > chi2 = 0.644	Prob > chi2 = 0.713
AR (1)	Pr > z = 0.000	Pr > z = 0.000	Pr > z = 0.000
AR (2)	Pr > z = 0.607	Pr > z = 0.46	Pr > z = 0.913
Number of obs	1260	1260	1260

For the control variables, we note a positive and significant impact of the firm's size on the environmental score. Big firms have higher financial resources available to cover the costs induced by environmental policies. This result may also be justified by the fact that big firms, such as multinationals, involve more stakeholders, who put more pressure on management to adopt environmentally responsible strategies. Results also reveal that financial leverage has a significant impact on environmental scores. High indebtedness ratios are associated with a lower environmental performance for African companies. It seems that high financial charges reduce the firm's ability to undertake environmental policies.

Our results also demonstrate that inflation contributes to reducing environmental performance. As mentioned previously, high inflation rates are associated with a deteriorated macroeconomic framework. Such a result confirms that appropriate macroeconomic conditions are essential for promoting environmental practices in the African context.

To determine whether belonging to a specific country influences the firm's environmental performance, a categorical variable was introduced in the model[3]. Compared to South Africa, Egyptian firms exhibit significantly higher E-Innov scores, while Moroccan firms are showing significantly lower Env scores. We can conclude that country-specific factors play a significant role in shaping environmental practices in the African context. Such country-specific effects

[3] South Africa is considered as the base group.

may be attributed to the differences in the institutional frameworks across countries (Khan et al., 2022).

Similarly, to capture the sector-specific effect, a sectorial categorical variable was included in the model, with the industrial sector serving as the base group. The results show that being in the agriculture sector increases the chance of having higher environmental scores compared to the industrial sector. However, the differences between the service and industrial sectors are positive but not statistically significant. To better assess the sector-specific effects, specific estimations were performed by sector (tables 8, 9, and 10).

Table 8: Determinants of Environmental Performance, Industrial Sector

	System GMM		
Variables	**Env**	**E- Innov**	**Emission**
Env $_{t-1}$	0.49**		
E- Innov $_{t-1}$		0.74***	
Emission $_{t-1}$			0.48***
Magt Score	0.26**	-0.02	0.17***
CSR strategy	0.18*	0.07	0.13***
Size	15.18***	-0.34	7.16***
ROA	0.11	0.07	0.024
Fin Leverage	0.0014	-0.0006	-0.056***
Inf	-0.39	-0.51	-1.1**
GDP	0.087	-0.044	0.05
Constant	-111.89***	7.5	-33.91**
Sargan test	Prob > chi2 = 0.752	Prob > chi2 = 0.370	Prob > chi2 = 0.347
AR (1)	Pr > z = 0.005	Pr > z = 0.000	Pr > z = 0.005
AR (2)	Pr > z = 0.169	Pr > z = 0.971	Pr > z = 0.645
Number of obs	391	391	391

The results in Table 8 show that the management and CSR scores both produce positive and statistically significant effects on Env and Emission scores, but fail to promote the E Innov score. These results confirm the crucial role of effective management practices in enhancing environmental performance within the industrial sector, particularly in the reduction of harmful emissions. We can conclude that governance practices in the industrial sector in Africa are directed towards prioritizing the reduction of emissions. This could be attributed to regulatory requirements mandated by multinational corporations and financial backers.

Traditional management mechanisms and CSR strategies are found to be non-significant for E-Innovation in the industrial sector. These results can be explained by the costs generated by environmental investments (Saidane and Ben Abdallah, 2021). The industrial firms seem to be reluctant to engage in environmental innovations. Various factors constrain the green transition for these companies, including those related to costs, technical barriers, etc. These barriers are more complex in the African context. Unlike European countries, most African governments do not encourage companies to adopt a responsible approach, either by subsidies or tax facilities.

Results also indicate that the firm's size has a significant positive effect on Env and Emission Scores, indicating that larger industrial companies tend to achieve higher environmental performance. The results also demonstrate the significant role of the macroeconomic context,

specifically inflation, in influencing the reduction of emissions among African companies. Indeed, higher inflation could pose challenges, potentially affecting investment in sustainable practices.

Table 9: Determinants of Environmental Performance, Service Sector

	System GMM		
Variables	**Env**	**E- Innov**	**Emission**
Env $_{t-1}$	0.79***		
E- Innov $_{t-1}$		0.36***	
Emission $_{t-1}$			0.73***
Magt Score	0.105**	0.16***	0.02
CSR strategy	0.17***	0.22***	0.14***
Size	1.55	17.34***	0.75
ROA	0.05	-0.5***	0.008
Fin Leverage	0.001	0.004***	0.0015*
Inf	-0.22**	0.29	0.20
GDP	-0.06	-0.07	0.19
Constant	-14.15	-133.07***	-1.23
Sargan test	Prob > chi2 = 0.179	Prob > chi2 = 0.21	Prob > chi2 = 0.534
AR (1)	Pr > z = 0.000	Pr > z = 0.000	Pr > z = 0.000
AR (2)	Pr > z = 0.835	Pr > z = 0.426	Pr > z = 0.401
Number of obs	751	751	751

For the service sector, the results in Table 9 show that the quality of governance positively and significantly affects the firms' environmental performances. Unlike the industrial sector, both governance proxies are boosting environmental innovations in the service sector. Implementing a CSR strategy within the service sector is much less complex and expensive. Indeed, environmental innovations in this sector often refer to process and organizational innovations which are easier to implement.

Results relative to the agricultural sector (see Table 10), show the management score contributes to promoting the global environmental score and the emissions score, while the CSR strategy contributes to spurring environmental innovation in addition to the two other environmental performance proxies. Our results are in line with Khanh Chi (2022) which demonstrates that specific environmental practices play a crucial role in boosting innovation in the agriculture sector. The implementation of a CSR strategy within this sector is less expensive and does not raise major technical challenges. Furthermore, the consumer is much more sensitive to the environmental standards of agricultural products since they directly affect their health.

For the control variables, we note a positive and significant impact of the size on environmental innovation and emissions in the service and agriculture sectors respectively. Previous research assessing the determinants of corporate environmental commitment showed that environmental commitment is positively related to firm size (Gonzalez-Benito and Gonzalez-Benito, 2006).

Our results suggest that the company's commitment to CSR approach, in general, and to environmental responsibility, in particular, depends above all on good governance.

Table 10: Determinants of Environmental Performance, Agricultural sector

	System GMM		
Variables	**Env**	**E- Innov**	**Emission**
Env $_{t-1}$	0.054***		
E- Innov $_{t-1}$		0.56***	
Emission $_{t-1}$			0.27***
Magt Score	0.15**	-0.08	0.22***
CSR strategy	0.34***	0.6***	0.15***
Size	25.43***	-6.6	13.26***
ROA	0.68	-0.32	-0.63*
Fin Leverage	0.01	0.067**	0.044***
Inf	1.44*	0.6	1.71*
GDP	-0.2	-0.037	-0.27
Constant	-170.35***	16.73	-84.65**
Sargan test	Prob > chi2 = 0.431	Prob > chi2 = 0.451	Prob > chi2 = 0.457
AR (1)	Pr > z = 0.000	Pr > z = 0.011	Pr > z = 0.000
AR (2)	Pr > z = 0.731	Pr > z = 0.984	Pr > z = 0.801
Number of obs	118	118	118

In conclusion, the sectorial analysis revealed interesting results for the industrial sector, where the ecological transition and innovation prove to be more challenging due to its higher costs and inherent complexity. Our findings are in line with those of García-Pozo et al. (2019) who demonstrated that the effects of green innovation significantly vary across sectors. They also showed that firms engaged in organizational innovations and CSR strategies are the most successful in producing environmental innovations. While recognizing the importance of management quality in the service and agricultural sectors, our results show that it is not sufficient for fostering innovation and reducing emissions. Implementing a specific environmental strategy seems to be essential for achieving more substantial results.

5. Conclusions and recommendations

This research aims to analyze the impact of governance mechanisms on the environmental performance of 122 African companies between 2010 and 2022. In addition to the global environmental score, we distinguished two performance indicators gauging respectively the ability of the firm to reduce its harmful emissions, and its capacity to implement environmentally friendly innovations. To control for governance effectiveness, we have assessed separately the firm's management quality and its CSR policy. This study represents, therefore, an additional step to better understand the company's environmental outcomes and to identify their major determinants.

Three main conclusions can be drawn from these empirical results. First, the environmental performance is highly persistent, which suggests that African firms are committed to long-term environmental strategies. Moreover, the full-sample result reveals that both governance indicators are producing a positive and significant impact on the three environmental performance proxies. Such a result confirms that improved governance is a major driver of the green transition in Africa. Results show, however, that the CSR strategy is more effective in promoting environmental innovation and emissions control than standard governance practices assessed by the management score. Finally, the effectiveness of the governance strategies

implemented by African firms differs significantly across sectors. In particular, we notice that both management and CSR strategies were unable to promote environmental innovations in the industrial sector, while they accomplished this role in the service sector. This result may be attributed to the fact that environmental innovations are more challenging in the industry due to higher costs and technological complexity.

These results lead to some important recommendations. Improving environmental performance requires African firms to enhance their governance standards. These include the traditional governance mechanisms as well as the CSR policies targeting specific environmental issues. Secondly, the industrial green transition is particularly challenging for African firms. Companies operating in this sector should benefit from public support to overcome financial and technical hurdles. On the financial side, flanking policies may include grants and fiscal incentives. International aid, channeled through domestic governments, may also be of great help. On a technical level, training programs and international exchanges of know-how are necessary to help African companies upgrade their environmental strategies.

A decomposition of the firm's SCR score should make it possible to identify the most effective environmental strategies and those exhibiting limited effectiveness. Future empirical studies adopting such an approach should help companies optimize their environmental policies. Further investigations are also necessary to assess the specific needs of industrial firms in Africa, and to help policymakers identify the appropriate flanking measures to be implemented for this sector.

References

Ahmad, F., Zayed M., & Harun A. (2013). "Factors behind the Adoption of Green Banking by Bangladeshi Commercial Banks". *ASA University Review*, Vol. 7, No.2, pp. 241 - 255.

Akram, F., Abrar ul Haq, M., & Raza, S. (2018). "Corporate Governance and Firm's Environmental Performance: A Moderating Role of Institutional Regulations". *International Journal of Management Studies*, 25(2), 19-37.

Allouche, J., Huault, I. and Schmidt, G. (2004). Responsabilité Sociale de l'Entreprise : la Mesure Detournée. Actes du Congrès de l'AGRH, UQAM, ESG, Montreal.

Ambec, S., & Lanoie, P. (2009). « Performance environnementale et économique de l'entreprise », *Économie & Prévision*, (4), 71-94.

Arellano M., & Bond S., (1991). "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations". *The review of economic studies*. 58(2), 277-297.

Arellano Manuel & Olympia Bover (1995), "Another Look at Instrumental Variables Estimation of Error Component Models". *Journal of Econometrics*, 68 (1995), 29-51.

Asni, N. and Agustia, D. (2022). Does corporate governance induce green innovation? An emerging market evidence. Corporate Governance, Vol. 22 No. 7, pp. 1375-1389.

Berrone P, Cruz C, Gomez-Mejia LR, LarrazaKintana M. (2010). "Socioemotional wealth and corporate responses to institutional pressures: do family-controlled firms pollute less?" *Administrative Science Quarterly.* 55: 82–113.

Blundell R., Bond S., (1998). "Initial conditions and moment restrictions in dynamic panel data models". *Journal of econometrics*. 87 (1998), 115—143.

Bournois F., Duval-Hamel J., Roussillon S., & Scaringella J.-L., *« Comités exécutifs »*, Ed. Eyrolles, Paris, 2007.

Brown WO, Helland E, Smith JK. (2006). "Corporate philanthropic practices". *Journal of Corporate Finance.* 12(5): 855–877.

Campanella, F., Serino, L., Crisci, A., & D'Ambra, A. (2021). The role of corporate governance in environmental policy disclosure and sustainable development. *Corporate Social Responsibility and Environmental Management, 28*, 474–484.

Cheng, B., Ioannou, I., & Serafeim, G. (2014). "Corporate social responsibility and access to finance." *Strategic Management Journal*, 35(1), 1-23.

Coffey BS, Fryxell GE. (1991). "Institutional ownership of stock and dimensions of corporate social performance: an empirical examination". *Journal of Business Ethics.* 10(6): 437–444.

Commission of the European Communities. (2001). GREEN PAPER Promoting a European Framework for Corporate Social Responsibility. Brussels 18 July.

Dixon-Fowler, H. R., Ellstrand, A. E., & Johnson, J. L. (2017). "The role of board environmental committees in corporate environmental performance". *Journal of Business Ethics*, 140(3), 423-438.

Doonan, J., Lanoie, P., & Laplante, B. (2005). "Determinants of Environmental Performance in the Canadian Pulp and Paper Industry: An Assessment from Inside the Industry", *Ecological Economics*, 55(1), 73-84.

Freeman, R. (1984). Strategic management: a stakeholder approach. Boston: Pitman.

Gallego-Álvarez, I. and Rodriguez-Dominguez, L. (2023). Board of directors and environmental practices: the effect of board experience, culture, and tenure. *Environ Dev Sustain*. https://doi.org/10.1007/s10668-023-03937-z

García-Pozo, A., Campos-Soria, J.A., Custódio Santos, M. and Santos, J.A.C. (2019). Determinants of Environmental Innovations: New Evidence at the Sector Level. Journal of Scientific & Industrial Research Vol. 78, February 2019, pp. 76-80.

Garriga, E. and Mele, D. (2004). Corporate Social Responsibility Theories: Mapping the Territory. Journal of Business Ethics, vol. 53, n°1-2, p. 51-71, August.

Gautschi, F. & Jones, T. (1987). "Illegal corporate behavior and corporate board structure, in J. Post and L. Preston (eds)", *Research in Corporate Social Performance and Policy* (Greenwich, CT: JAI Press), pp. 93–106.

Gonzalez-Benito J. and O. Gonzalez-Benito (2006) « A review of determinant factors of environmental proactivity » *Business strategy and the environment*, 15, 87-102.

Goodstein, J., Gautam, K. & Boeker, W. (1994). "The effects of board size and diversity on strategic change". *Strategic Management Journal*, 15(3): 241–250.

Gulema, T.F. and Roba, Y.T. (2021). Internal and external determinants of corporate social responsibility practices in multinational enterprise subsidiaries in developing countries: evidence from Ethiopia. *Futur Bus J,* **7**, 7.

Halme, M. & Huse, M. (1997). "The influence of corporate governance, industry and country factors on environmental reporting*"*. *Scandinavian Journal of Management*, 13(2): 137–157.

Hillman AJ, Keim GD, Luce RA. (2001). "Board composition and stakeholder performance: do stakeholder directors make a difference?" *Business & Society.* 40(3): 295–314.

Hua, W., & Yanhong J. (2002). "Industrial ownership and environmental performance: evidence from China", *World Bank Policy Research Working Paper* N° 2936, December 2002, 28p.

Huang, C-J. (2010). "Corporate Governance, Corporate Social Responsibility and Corporate Performance", *Journal of Management & Organization*, 16, 641–655.

Irshad, AuR., Safdar, N., Younas, Z.I., Manzoor, W. (2023). Impact of Corporate Governance on Firms' Environmental Performance: Case Study of Environmental Sustainability-Based Business Scenarios. *Sustainability*, 15(10):7775.

Jiang L., Lin C. & Lin P. (2013). "The Determinants of Pollution Levels: Firm-Level Evidence from Chinese Manufacturing". *Journal of Comparative Economics*, Vol. 42, pp. 118 -142.

Jo, H., & Harjoto, M. A. (2012). "The causal effect of corporate governance on corporate social responsibility". *Journal of Business Ethics*, 106(1), 53–72.

Johnson RA, Greening DW. (1999). "The effects of corporate governance and institutional ownership types on corporate social performance". *Academy of Management Journal.* 42(5): 564–576.

Judith L. Walls, Pascual Berrone, Phillip H. Phan (2011). "Corporate governance and environmental performance: is there really a link?" *Strategic Management Journal*. 33(8), 885-913.

Kassinis G, Vafeas N. (2002). "Corporate boards and outside stakeholders as determinants of environmental litigation". *Strategic Management Journal.* 23(5): 399–415.

Kesner, I., Victor, B. & Lamont, B. (1986). "Board composition and the commission of illegal acts: an investigation of Fortune 500 companies", *Academy of Management Journal*, 29: 789–799.

Khan A., Muttakin M. B., & Siddiqui J. (2012) "Corporate Governance and Corporate Social Responsability Disclosures: Evidence from an Emerging Economy", *Journal of Business Ethics*, 117 (2), 207-223.

Khan, H., Weili, L. and Khan, I. (2022). The role of financial development and institutional quality in environmental sustainability: panel data evidence from the BRI countries. *Environ Sci Pollut Res* **29**, 83624–83635. https://doi.org/10.1007/s11356-022-21697-7.

Khanh Chi N.T. (2022). "Driving factors for green innovation in agricultural production: An empirical study in an emerging economy". *Journal of Cleaner Production.* Vol 368*,* 132965.

King A, Lenox M. 2002. "Exploring the locus of profitable pollution reduction". *Management Science.* 48: 289–299.

Klassen, R. & McLaughlin, C. (1996). "The impact of environmental management on firm performance", *Management Science*, 42: 1199–1214.

Kocmanová, A., Hrebicek, J., & Docekalova, M. (2011). "Corporate governance and sustainability." *Economics & Management*, 16, 543-550

Le Borgne-Larivière, M., Mauléon, F. and Schier, G. (2009). Une lecture néo-institutionnaliste des pratiques de RSE : le cas des chartes éthiques. Management & Avenir, 23, 187-198.

Li, J., Zhao F., Chen S., Jiang W., Liu T., & Shi S. (2016). "Gender Diversity on Boards and Firms' Environmental Policy". *Business Strategy and the Environment*. 26 (3), 306-315.

Mahoney, L. and Roberts, R. (2002). "Corporate social and environmental performance and their relation to financial performance and institutional ownership: empirical evidence on Canadian firms", Working paper.

Masud, M.A.K., Nurunnabi, M. and Bae, S.M. (2018). The effects of corporate governance on environmental sustainability reporting: empirical evidence from South Asian countries. *AJSSR* **3**, 3.

Mathieu, P. (2008). La RSE : Fondements théoriques et problématiques gestionnaires. Entreprise Ethique, 28, pp.13-21.

Megevand, C. (2013). « Dynamiques de déforestation dans le bassin du Congo : Réconcilier la croissance économique et la protection de la forêt ». *Working paper*, World Bank.

Menard, C. (2003). L'Approche Néo-institutionnelle : des Concepts, une Méthode, des Résultats. Cahiers d'Economie Politique, n° 44, p. 103-118.

Naciti, V. (2019). Corporate governance and board of directors: The effect of a board composition on firm sustainability performance. Journal of Cleaner Production, Volume 237, 117727.

North D.C. (1990). Institutions, Institutional Change, and Economic Performance, Cambridge University Press, Cambridge.

Orazalin, N. and Baydauletov, M. (2020). Corporate social responsibility strategy and corporate environmental and social performance: The moderating role of board gender diversity. *Corporate Social Responsibility and Environmental Management*, 27, issue 4, p. 1664-1676.

Saidane, D., & Ben Abdallah, S. (2021). "African firm default risk and CSR", *Finance Research Letters*, Volume 43. https://doi.org/10.1016/j.frl.2021.101964

Salo, J. (2008). "Corporate governance and environmental performance: Industry and country effects", *Competition & Change*, 12(4), 328-354.

Sanja Pekovic & Sebastian Vogt (2021). "The fit between corporate social responsibility and corporate governance: the impact on a firm's financial performance". *Review of Managerial Science*, 15, 1095–1125

Stanwick PA, Stanwick SD. (1998). "The relationship between corporate social performance, and organizational size, financial performance and environmental performance: an empirical examination". *Journal of Business Ethics.* 17(2): 195–204.

United Nations Development Programme. (2022). Africa Sustainable Development Report 2022: building back better from the coronavirus disease (COVID-19) while advancing the full implementation of the 2030 agenda for sustainable development. Addis Ababa, UN. ECA.

United Nations Economic Commission for Africa. (2020). Political Economy of a Green Economy: Transition in Africa. Economic Commission for Africa, Addis Ababa, Ethiopia.

Walls, J.L., Berrone, P., & Phan, P.H. (2012). "Corporate governance and environmental performance: Is there really a link?", *Strategic Management Journal*, 33(8), 885-913.

Webb E. (2004). "An examination of socially responsible board structure". *Journal of Management and Governance.* 8(3): 255–277.

Zheng, M., Feng, G.-F., Jiang, R.A. and Chang, C.-P. (2023). Does environmental, social, and governance performance move together with corporate green innovation in China? *Business Strategy and the Environment*, 32(4), 1670–1679.

Zubeltzu-Jaka, E., Alvarez-Etxeberria, I., & Ortas, E. (2020). The effect of the size of the board of directors on corporate social performance: A meta-analytic approach. *Corporate Social Responsibility and Environmental Management, 27*, 1361–1374.