

Does board size and board independence affect social and environmental performance? Evidence from Energy industry

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ABSTRACT:*The purpose of this study is to examine the impact of board size and board independence on social and environmental performance of companies in the energy industry. The data was collected from Thomson Reuters database for a sample of 345 companies during the period 2018-2021, consisting of 1.380-year observations for which data present social and environmental aspects at the end of 2021. The SPSS statistical program was used to run the regression models for the selected sample. We find that board size has a positive impact on social and environmental performance. The results reveal that board independence has a positive and significant impact on social performance, while for social performance, it has an insignificant negative impact. This study complements and supports the existing literature on this relationship in the energy sector. The study has practical implications for investors in their decision-making and for board members.*

KEY WORD: *Board size, Board independence, social aspects, environmental aspects, energy industry*

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I. INTRODUCTION

Nowadays, the companies are oriented to achieve more than financial performances, and an important goal is to achieve social and environmental performances. These aspects play an important role for the companies in their activity to find new investors. The environmental, social, and governance (ESG) aspects play a key role in the economy, all the interested parties being preoccupied by investing in those companies which report ESG aspects. Radu et al. (2022) mentioned that these ESG and financial performance should be in the same direction oriented.

During the time, the scholars' interest in this ESG field increased and they were focused in studying the relationship of these aspects with firms aspects such as: value firm (Constantinescu et al., 2020), financial performance (Batae, et al., 2021; Alsayegh et al., 2020; Cek and Eyupoglu, 2020), earnings management (Velte, 2020), stock return (La Torre et al., 2020), firm risk (Sassen et al., 2016) or corporate scandals (Buallay et al., 2020). The relationship of board size with other companies' metrics was largely debated in the literature. Hyun Kim et al. (2012), Orozco et al. (2018), Hemza (2020) and Garcia-Ramos and Diaz (2021) studied the relationship of board size and financial performance. Chouaibi et al. (2018), Tran et al. (2020) and Abu-Dawleh et al. (2021) studied the relationship of board size with earnings management while authors such as Vintila et al. (2015), Mishra and Kapil, (2018) and Uddin et al. (2021) studied the relationship of board size with firm value.

The board independence play an important role for the companies because the managers should efficiently monitor and protect the shareholder's interest and avoid personal enrichment (Naciti, 2019). Moreover, the independence directors should ensure that the laws and regulations are respected by the company (Nguyen and Thanh, 2021). A higher number of independent directors in board might don't have firm base knowledge to ensure a better environmental performance (De Villiers et al., 2011). Hussain et al. (2018) notes that the external independent directors might protect their place at the director's table by protecting their own reputation, thus they should feel responsible and act to help the company to achieve more environmental performance.

Therefore, studying the impact of board size and board independence on social performance, Zubeltzu- Jaka et al. (2021) found a positive relationship while, Issa and Zaid (2021) in their study found that board gender diversity helps the companies to achieve better social performance. Furthermore, Haque (2017) found that both board gender diversity and board independence positively affect environmental performance represented by carbon reduction initiatives, while Radu et al. (2022) found that board gender diversity negatively affects social performance.

To test our hypothesis, we used the Refinitiv Eikon database that gives us information about environmental, social, and governance scores for companies. Our sample consists of 345 companies for the

energy industry, analysing a period of 4 years (2018-2020). We run the regression models using SPSS statistical software version 28.0.0.0.

Our results sustain and complete the literature that refers to the impact of corporate governance mechanism represented by board size and board independence on social and financial performance, and we find mixed results. The size of the board has a positive impact on both social and environmental performance, concluding that larger boards increase social and environmental performance. We expect that board independence environmental performance, but our hypothesis is not accepted. Moreover, the board independence seems to be concerns more about social issues where we find a positive impact then environmental issues.

The reminder of this paper is advance as follows: The next section presents the literature review and hypothesis development, the research design of the paper is the following section, continuing with the results and discussions and the conclusions of the paper.

II. LITERATURE REVIEW

The board size play an important role in the business environmental being the responsible for the business strategy and decision making. The authors were interested to study the relationship of the board size with social performance. Zubeltzu- Jaka et al. (2021) studied the relationship of board size and corporate social performance. The authors analysed 80 papers and they found that larger board achieve more social performance. For the public institutions, such hospitals, Bai (2012) conducted a study who analyse the impact of board size on social performance. The results show a negative impact of the board size on social performance. Moreover, the author illustrates that the presence of the government in public hospitals is positively associated with social performance. Radu et al. (2022) conducted an interesting study based on a sample of 983 firm-year observations using a multivariate approach. The social performance and board size measurement was downloaded from Bloomberg database. The results show that board size is positively associated with social performance. Reguera-Alvarado and Bravo-Urquiza (2021) studied the impact of board size on corporate social responsibility reporting. By employ a panel data based on Generalized Method of Moments the authors found that corporate social responsibility reporting is positively associated with board size. Moreover, Pucheta- Martinez and Gallego- Alvarez (2019) analysed the impact of board characteristics, especially board size on corporate social responsibility performance on a sample of 13.178 observations from 39 countries. The authors found a positive relationship between board size and corporate social responsibility reporting. The role of board is important for set up the corporate social responsibility agenda. Jizi (2017) suggest that lager boards tend to support the social needs, having a better workload allocation for increase the efficiency of social disclosure.

De Villiers et al. (2011) studied the impact of board characteristics on environmental performance for a sample of 2.151 observations from 1.216 firms, collecting the data from e KLD database for period 2003-2004. Using a quantitative method and based on dependence theory the authors found that larger board influence the environmental performance. Moreover, Walls et al. (2012) analysed the board characteristics and environmental performance for a sample of 500 companies from Standard & Poor's (S&P). The results show that board size is positively corelated with environmental performance, which sustain the idea that larger board increase the environmental performance. Ng and Thosuwanchot (2017) also found a positive relationship between board size and environmental performance. Studying the impact of board characteristics on environmental performance, Khan et al. (2021) found a positive relationship between board size and environmental performance.

Nguyen and Thanh (2021) analysed the impact of board characteristics on environmental performance for a sample of 1.394 firm-year observations for the period 2011-2016 from three emerging East Asian markets. The depended variable used was environmental performance and three sub-dimensions represented by Resource reduction, Emission reduction and Product innovation which are scores calculated by Thomson Reuters database. The independent variable board size is measured as total number of directors. The results suggest that an ideal board size will help the companies from manufacturing sector to increase their environmental performance. Garcia Martin and Herrero (2020) measuring the impact of board size on environmental performance found neutral relationship. Analysing 152 years-firm observations during 2007-2011 for the US companies Hussain et al. (2018) found a neutral relationship between board size and environmental performance.

Based on the literature presented above, we developed our first hypothesis of the study:

H1.1 The relationship between board size and social performance is positive.

H1.2 The relationship between board size and environmental performance is positive.

The relationship between board independence and social and environmental performance was studied by the scholars founding mixed results. Al-Gamrh et al. (2020) studied the impact of board independence on financial and social performance for a sample of 451 companies listed on Dubai Financial Market (DFM) and Abu Dhabi Securities exchange (ADX) during 2008-2012 period. The results show that the board independence, measured as a percentage of total number of board directors, weakness the negative relationship

of social performance which is an index computed from 4 pylons: environment, social programs, internal audit, and no penalties of law. Biswas et al. (2018) examined 407 listed firm on Australian Securities Exchange for the period 2004-2015 in their relationship between board characteristics and corporate social and environmental performance. The results show that higher number of independent directors tend to increase the social and environmental performance.

By analysing 87 published papers, Ortas et al. (2017) found that board independence positively influences the corporate social performance. Also, a positive impact of board independence on social performance was found by Veltri et al. (2021) in their study on the relationship between board diversity and social performance. Contrary with previous authors, Karim et al. (2020) found that board independence negatively affects social performance by analysing 588 companies from Malaysia during 2006-2017 period. Alipour et al. (2019) by analysing the environmental disclosure for the 2012-2016 period on 120 Iranian companies found that companies which have more independent board members are involved in more environmental activities which will help the companies to improve their performances.

Liao et al. (2015) analysed the relationship between board independence and greenhouse gas disclosure for a sample of 329 UK largest companies. They note that the boards with more independent directors seem to be more ecologically friendly. By analysing the board independence on environmental disclosure, moderated by the effect of national culture, Cui et al. (2020) shows that an important role in promoting the environmental disclosure is played by the independent directors of the board, being higher in high-masculinity societies.

Overall, the prior studies found mixed results on the impact of board independence on social and environmental performance. Hence our second hypothesis is:

H2.1 The relationship between board independence and social performance is positive.

H2.2 The relationship between board independence and environmental performance is positive.

III. RESEARCH METHODOLOGY AND DATA SAMPLE

We use the multivariate multiple regression to test our hypotheses developed in the prior section. This type of regression estimates a single regression model which have more control variables as many authors used in their studies such as: Radu et al. (2022), Batae et al. (2021), Alsayegh et al. (2020), Batae et al. (2020) or Biswas et al. (2018). Our general equation model is presented below:

$$Performance_{it} = \beta_0 + \beta_1 Governance_{it} + \beta_2 Controls_{it} + \varepsilon_{it}$$

Where:

- Performance - will take subsequently the value of the social performance (SOC), and environmental performance (ENV).
- Governance is represented by corporate governance mechanisms which will take subsequently the value of board size (BZ) and board independence (BI).
- Controls is represented by return of assets (ROA), return of equity (ROE), firm size (FZ), and leverage (LV)
- β_{0-3} - Regression coefficients
- ε_{it} - Error

The variables used in our research model are presented in Table 1. To test our hypotheses, we used three types of variables: Dependent, independent and control variables, as many authors used in their studies, such: Orazalin and Mahmood (2021); Orazalin and Baydauletov (2020); Batae et al. (2021); Biswas et al. (2018); Zhang et al. (2020) or Alsayegh et al. (2020).

Our dependent variables, as presented in Table 1, are represented by social and environmental scores, collected from Refinitiv Eikon database. Social performance is constructed based on four individual scores: workforce, human rights community, community, and product responsibility, which will take a percentage between 0 and 100. Environmental performance is constructed based on three dimensions: (resource use, emissions, and innovation), which will take a percentage between 0 and 100.

In order to test our hypotheses, the corporate governance mechanisms that we included in our study are represented by board size, which is calculated as total numbers of director and board independence which is the percentage of independent directors from board. These variables were used by many other authors in their studies. For example, Orazalin and Mahmood (2021) used board size as independent variable in their relationship with environmental performance. Biswas et al. (2018) used board independence in its relationship with corporate social and environmental performance in Australia.

Apart of our independent variables from our linear regression, in the literature we identified data for following control variables: firm size represented by natural logarithm from total assets, return on assets calculated as ratios between Income After Taxes and total assets, return on equity, calculated as a ratio between total income and total equity and leverage, a ratio between total debts and total assets, also used by Orazalin

and Mahmood (2021); Orazalin and Baydauletov (2020); Orazalin (2019); Biswas et al. (2018) or Batae et al. (2021).

The data was collected from Refinitiv Eikon databases, known as Thomson Reuters database. In line with other studies conducted by Ionaşcu et al. (2022), Batae et al. (2021), Batae et al. (2020), Orazalin and Baydauletov (2020), Zhang et al. (2020) or Orazalin (2019) we chose this database because has a great credibility and high data quality. The Refinitiv Eikon database present all types of data, especially ESG datasets, being a well-known database.

Table 1: Variables description

Variables	Type	Proxy	Description	Authors
Social performance score	Dependent	SOC	Social performance score is constructed based on individual performance dimensions including workforce, human rights, community, and product responsibility and is measured by the Refinitiv Eikon database. The total score is expressed in percentages and ranges between 0% and 100%	Orazalin and Mahmood (2021); Orazalin and Baydauletov (2020); Orazalin (2019); Batae et al. (2020), Alsayegh et al. (2020); Biswas et al. (2018)
Environmental performance score	Dependent	ENV	Environmental performance score is constructed based on individual performance dimensions including resource use, emissions, and innovation and is measured by the Refinitiv database. The total score is expressed in percentages and ranges between 0% and 100%	Orazalin and Mahmood (2021); Orazalin and Baydauletov (2020); Orazalin (2019); Batae et al. (2020), Alsayegh et al. (2020); Biswas et al. (2018)
Board size	Independent	BZ	The total number of directors on the board	Orazalin and Mahmood (2021); Biswas et al. (2018); Walls et al. (2012)
Board independence	Independent	BI	The percentage of independent directors on the board	Orazalin and Mahmood (2021); Biswas et al. (2018); Karim et al. (2020); Veltri et al. (2021)
Firm size	Control	FZ	The natural logarithm of total assets	Orazalin and Mahmood (2021); Orazalin and Baydauletov (2020); Orazalin (2019); Biswas et al. (2018); Batae et al. (2021);
Return on equity	Control	ROE	company's net income to total equity	Orazalin and Mahmood (2021); Orazalin and Baydauletov (2020); Orazalin (2019); Biswas et al. (2018); Batae et al. (2020); Batae et al. (2021); Alsayegh et al. (2020);
Return on assets	Control	ROA	Income After Taxes for the fiscal period divided by the average Total Assets	Orazalin and Mahmood (2021); Orazalin and Baydauletov (2020); Orazalin (2019); Biswas et al. (2018); Batae et al. (2020); Batae et al. (2021); Alsayegh et al. (2020);
Leverage	Control	LV	The ratio of total debt to total assets	Orazalin and Mahmood (2021); Orazalin and Baydauletov (2020); Orazalin (2019); Biswas et al. (2018); Batae et al. (2020); Batae et al. (2021); Alsayegh et al. (2020);

Table 2: Energy sector distribution sample

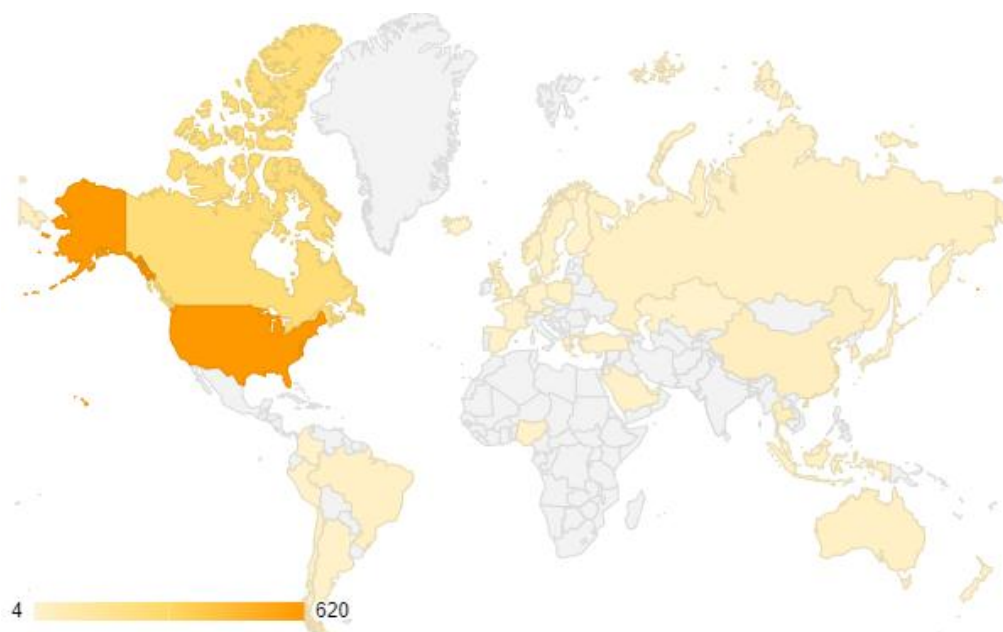
Energy sector	Year				Total	% of total
	2018	2019	2020	2021		
Coal	17	17	17	17	68	5%
Integrated Oil & Gas	16	16	16	16	64	5%
Oil & Gas Drilling	13	13	13	13	52	4%
Oil & Gas Exploration and Production	98	98	98	98	392	28%
Oil & Gas Refining and Marketing	70	70	70	70	280	20%
Oil & Gas Transportation Services	42	42	42	42	168	12%
Oil Related Services and Equipment	56	56	56	56	224	16%
Renewable Energy Equipment & Services	20	20	20	20	80	6%
Renewable Fuels	6	6	6	6	24	2%
Uranium	7	7	7	7	28	2%
Total	345	345	345	345	1.380	100%

Our sample consists of 1.380 firm-year observations for the period 2018-2021 for which data for environmental and social was presented at the end of 2021. From the sample those companies which doesn't present a report at the end of 2021 was eliminated as well those companies which present no data for environmental pillar score. Our sample distribution per companies and industry are presented in Table 2. Moreover, the geographic distribution is presented in Figure 1.

Analysing by energy sector distribution, we can see that 28%, being 392 year-observations are from Oil & Gas Exploration and Production. A number of 98 companies has reported environmental and social data at the

end of 2021 from this section. The next place is taken by Oil & Gas Refining and Marketing sector with 20% of our sample. Uranium and Renewable Fuels are 4% of our sample.

Figure 1: Geographic distribution



Analysing by region, we can see that 69%, representing 956 year-observations are from America with 239 companies which has reported environmental and social data at the end of 2021 followed by Europe and Asia with 15% and 14% of our sample. For Africa region we found only one company who presented at the end of 2021 social and environmental information, being from Oil & Gas Exploration and Production Energy sector.

IV. RESULTS AND DISSCUTION

In a first-level analysis, descriptive statistics for continuous regression variables are calculated. The descriptive statistics of all dependent, independent and control variables are presented in Table 3.

Table 3: Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
						Statistic	Std. Error	Statistic	Std. Error
ENV	1.214	0.000	96.325	37.770	26.797	0.244	0.070	-1.081	0.140
SOC	1.214	0.389	94.967	44.522	24.277	0.275	0.070	-1.083	0.140
BZ	1.212	1	21	8.89	2.704	0.788	0.070	1.589	0.140
BI	1.212	0.00	100.00	68.66	22.49	-1.036	0.070	0.408	0.140
ROE	1.019	-251,8%	264,1%	5,80%	32,05%	-0.085	0.077	20.060	0.153
ROA	887	-62,4%	68,4%	2,39%	9,54%	-0.677	0.082	10.805	0.164
FZ	1.378	16,01	27,08	22,03	1,789	0.126	0.066	0.068	0.132
LV	1.378	0,00	2,20	0,31	0,223	1,974	0.066	11.422	0.132

The sampled firms show a mean value of environmental score of 37.77, being at one difference more than 7 pp of social score which has a mean of 44.552. The governance mechanisms present a mean of higher numbers of board members of 8.89/company, also having a high percentage of members that are independent, with a mean of 68.66% of them being independent. The mean of return of assets and return of equity is positively, being at the level of 5,8% with a standard deviation of 32,05% and 2,39 with a standard deviation of 9,54%. Furthermore, Table 3 presents descriptive statistics that support the premise that the data are normally distributed and that a regression model based on these variables is valid (Lungu et al., 2019).

Table 4: Pearson and Spearman matrix correlations

Variables	ENV	SOC	BZ	BI	ROE	ROA	FZ	LV
ENV	1	,820**	,469**	-,056*	,151**	,122**	,606**	,071*
SOC	,818**	1	,421**	-0,003	,119**	,120**	,486**	0,014
BZ	,487**	,422**	1	-0,003	0,064	0,037	,533**	,059*
BI	-,100**	-0,038	-,119**	1	-,116**	-,081*	-0,037	0,052
ROE	,081*	0,052	0,010	-,096**	1	,879**	,224**	-0,031
ROA	,119**	,110**	0,035	-,110**	,656**	1	,195**	-,121**
FZ	,618**	,492**	,511**	-,104**	,130**	,178**	1	,247**
LV	0,032	-0,005	0,023	0,033	-,065*	-,132**	,131**	1

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

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

Table 4 presents the Pearson (below) and Spearman (above) correlation matrix. Firstly, assessing the Pearson correlation it can be seen that board size is positively and significant correlated with both our dependent variables at the level 0.01. This strongly and positively correlation support our hypothesis H1.1 and H1.2. A negative and strong correlation at the level 0.01 was found by board independence with environmental performance while a negative relationship was found between board independence and social performance. except for social performance and community score, thus our H2.1 and H2.2 hypothesis are rejected. Spearman correlations confirm all the results provided by Pearson correlation.

In order to assess the association between corporate governance mechanisms and social and environmental performance and rest of our dependent variables for the sample of companies from energy sector, the samples were transformed in cross-panel data in the SPSS statistical programme. The results obtained are presented in Table 4 and Table 5.

Table 4: The impact of board size and board independence on social performance

	B	Sig.	Tolerance	VIF	B	Sig.	Tolerance	VIF
BZ	1,552	0,000	0,756	1,323				
BI					0,020	0,565	0,980	1,020
ROE	-0,023	0,523	0,558	1,791	-0,017	0,636	0,559	1,790
ROA	0,109	0,336	0,531	1,884	0,065	0,569	0,533	1,877
FZ	5,309	0,000	0,710	1,409	6,568	0,000	0,935	1,069
LV	-8,779	0,034	0,958	1,044	-9,931	0,018	0,956	1,046
(Constant)	-82,423	11,228			-97,331	0,000		
F statistic	44,007				38,708			
Durbin-Watson	1,563				1,498			
Adjusted R-square	0,214				0,193			
ANOVA Sig	<,001 ^b				<,001 ^b			

Table 5: The impact of board size and board independence on environmental performance

	B	Sig.	Tolerance	VIF	B	Sig.	Tolerance	VIF
BZ	1,977	0,000	0,756	1,323				
BI					-0,074	0,032	0,980	1,020
ROE	-0,016	0,648	0,558	1,791	-0,011	0,765	0,559	1,790
ROA	0,044	0,687	0,531	1,884	-0,034	0,762	0,533	1,877
FZ	8,215	0,000	0,710	1,409	9,873	0,000	0,935	1,069
LV	-5,841	0,143	0,958	1,044	-6,494	0,111	0,956	1,046
(Constant)	-158,361	0,000			-171,943	0,000		
F statistic	100,904				90,517			
Durbin-Watson	1,760319				1,705			
Adjusted R-square	0,387				0,362			
ANOVA Sig	<,001 ^b				<,001 ^b			

The impact of corporate governance mechanisms on social and environmental performance are presented in Table 4 and Table 5. Firstly, for checking all the potential multicollinearity issues the variance inflation factor (VIF) was used. The results of the multicollinearity test (VIFs) for the independent variables are a 10, being between 1.01 and 2.27 a minimum and a maximum value while the correlation is 0.1 being between 0.44 and 0.99 which means that there are no issues for multicollinearity according to Wooldridge (2005).

Board size has a significantly positive impact at the level 0.01 on both social and environmental performance. Radu et al. (2022) found similar results in what concerns the positive impact on social and environmental performance. Similar results were found also by Hussain et al. (2018) and De Villiers et al. (2011), confirming our hypotheses H1.1, H1.2. Stakeholder theory may explain the positive impact of board size on both social and environmental performances. More directors in boards might be more concerned about social and environmental issues in equal measure. Moreover, the board independence has a negative impact on

environmental performance at the level 0.05 while on social performance board independence has an insignificant statistic and positive impact. A positive relationship was found also by Biswas et al. (2018) and Veltri et al. (2021) on social performance while the results of Alipour et al. (2019) and Liao et al. (2015) found the contrary. Thus, our H2.1 is accepted while H.2.2 is rejected.

V. CONCLUSION

Nowadays, companies want to get more from the markets and attract more investors to develop their products and services. Moreover, investors are oriented to see how companies engage in environmental issues and how they are involved in social activities. This study aims to see the impact of two corporate governance mechanisms (board size and board independence) on social and environmental performance. Our sample consisted of 345 companies from Energy industry, distributed in ten subsectors. We predicted a positive impact of corporate governance mechanisms on both social and environmental performance, also for its individual pillars.

Overall, the results of the regression model support a part our hypotheses developed. Referring to the board size, larger boards seem to help the companies to have better social and environmental performance, our analysis found a statistically significant and positive association between social and environmental performance. Our results are supported Radu et al. (2022), Reguera-Alvarado and Bravo-Urquiza (2021) or Pucheta- Martinez and Gallego- Alvarez (2019) who also founded a positive relationship between board size and social and environmental performance

Furthermore, continuing the investigation on the impact of board independence on the social and environmental performance, we find mixed results. Our linear regression suggest that board independence have a statistically positive impact environmental performance. On the other hand, a negatively impact was found between board independence and environmental performance. Thus, more independent board members seem to be more concern about social aspects than environmental issues.

This study has practical implications for investors who are considering in their decision to invest in the energy industry. Now they might be better informed about how the board's characteristics affect the social and environmental performance. Furthermore, now the boards have an overview of the social and environmental aspects and how these factors help to improve the company's profitability.

This study has some limitations. First, our study has a small sample and is based on the energy industry. Future research might extend the data base to other industries and find new research pathways. Second, we used the general scores for each social and environmental aspects and did not consider the subdimensions of each of them. Furthermore, future studies might include more corporate governance mechanisms and control variables in the equation model.

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