THE ENVIRONMENTAL AND FINANCIAL PERFORMANCES ON THE ENERGY SECTOR. CASE STUDY IN NORTH AMERICA

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Abstract
Nowadays, the population is becoming more and more environmentally conscious compared to previous years. Governments are under pressure to adopt sustainable legislation in light of the increased public acknowledgement of environmental issues, and consumers are urged to make purchases that have a lower environmental impact. Due to this phenomenon, the competition becomes significantly challenging. Companies must therefore adopt sustainable strategies in order to achieve sustainable growth. The research examines how environmental factors affect the financial success of the energy industry since the viability of the energy sector has drawn criticism. The objective of the current study aims to emphasize the relationship between non-financial sustainability, as determined by the environmental performance score, and the financial performance as represented by total revenues in the aforementioned sector. The dataset is obtained from Thomson Reuters Eikon and consists of 100 publicly traded companies in North America over a five-year period. It is processed using multiple linear regression and bivariate correlation techniques. The analysis findings indicate that the environmental score has a conflicting influence on the financial performance of the companies.

Keywords
Environmental performance, financial performance, total revenue, energy industry

JEL Classification: G30, M14, Q50

Introduction

Contemporary corporate growth is currently based on an emerging global tendency called sustainability. In order to meet environmental, social and governance objectives - collectively referred to as ESG objectives, the notion of sustainability will require companies to develop and apply management approaches and tools. As a result, companies are facing sustainability risks that may act as barriers to the adoption of a sustainable development strategy. ESG factors are also influencing financial markets and

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investment activity, as one of the economic threads of the modern era is and will be green or socially conscious investing.

The current research aims at identifying any possible relationships between the financial performance of energy companies in North America and their scores for emission reduction, product innovation, and resource conservation, scores which define the environmental pillar score. The rationale behind choosing this industry is based on the assertions that businesses in sensitive industries are more driven to implement policies to better utilize these resources, under the consideration that companies in the energy sector are more exposed to environmental concerns than the ones in other industries, setting the goal to lessen the environmental effects and invest more in pollution policies. (Zheng, et al., 2020).

Considering that the effects of the three components of the environmental score on companies' financial performance may have different outcomes, each of them should be examined separately. It is also anticipated that the product innovation score has the weakest effect, out of the three mentioned, because innovation-oriented companies are less exposed to environmental risk. (Di Simone, Petracci and Piva, 2022). Another argument supporting the direction of this research considers energy companies that face market penalties for their negligent environmental management practices, and those that do not report these activities in terms of carbon emissions face fines and legal costs. Environmental scores increase a company's long-term value when it comes to greenhouse gas emissions or environmental pollution by the energy sector. (Behl, et al.,2021).

In order to create a study strategy to answer the hypotheses, the environmental score and its components are used to assess environmental performance and total revenue is used to assess the firm's financial performance, with data extracted from the Thomson Reuters Eikon platform. Due to data availability issues, the final sample is reduced to 100 firms with data covering a five-year period (2017-2021).

The paper is structured as follows: the first section reviews the literature, highlighting the main similar research and its findings, the second section describes the methodology, the data used and the detailed results. The last section deals with conclusions, implications and future lines of research.

1. Review of the scientific literature

There is an extensive quantity of research available on the relationship between corporate environmental performance and corporate financial performance. The inconsistencies in the relationship that exist between the two are related to the fact that environmental regulations divert resources and management away from core business sectors, increasing production costs and leading to poor financial performance, but that properly designed environmental regulations can induce and stimulate innovation, such as cleaner technologies and environmental advances, reducing compliance costs and allowing firms to compete more effectively. (Alsayegh, Rahman and Hamayoun, 2020). On the other

hand, some researchers have argued that stricter environmental regulations are compelling firms to prioritize technological innovation while paying attention to reducing pollution, reducing production costs and increasing sales, therefore, it makes sense that a significant portion of the literature has attempted to define the link between environmental impact and financial success (Billio, et al, 2021).

The environmental score focuses on concerns such as climate change, deforestation, air and water pollution, excessive land use and biodiversity loss. As a result, it assesses a company's efforts in waste, water and resource management, as well as energy efficiency and greenhouse gas emissions.

As the standard benchmark for evaluating any economic activity, financial performance shows a company's ability to achieve its profitability goals. Accounting metrics, which quantify financial success, serve as important decision-making tools for stakeholders (Siminică, et al, 2019). Given this statement, the choice of investigating the influence of environmentally oriented actions on the total revenues obtained by the companies in the chosen sample is founded.

When taking into consideration a company's financial performance, environmental performance might have an impact on its value through risk emerging from the unpredictability of new environmental legislation, as well as a higher probability of future liabilities and/or lower future earnings. (Choi, Han and Lee, 2020)

The better a company manages its stakeholder relations, the more successful it will be in the long run, therefore, the board of directors must cope with the pressure from both shareholders and stakeholders, as well as consider the needs of different groups, according to stakeholder theory. (Lee and Mansor, 2020)

From a legitimacy theory perspective, companies engage in sustainable activities to maintain their legitimacy and to gain the support of their entire stakeholder group, given that the current market is increasingly focused on environmental issues, high compliance with environmental disclosure standards improves corporate reputation, which is linked to high corporate efficiency and therefore improves environmental sustainability performance. (Alsayegh, Abdul Rahman and Homayoun, 2020).

Often, great initial investment in environmental efforts is required, but there are few immediate benefits, and in some circumstances even over time. In a shareholder primacy paradigm, managers should not invest in projects that address environmental performance unless they are required to do so by law. Financial markets sanction such behavior and the benefits allow managers to use better financing techniques. Better environmental performance is associated with reduced costs of financial distress and more tax savings, which managers and researchers consider favorable influences (Benlemlih and Cai, 2019, pp.2-3).

A significant correlation between environmental performance and financial performance is obtained by Sichigea, et. al (2020) by conducting an extensive study of 299 mining and mineral processing companies belonging to the European Economic Area and using data

extracted from the Refinitiv database for the period 2009-2018. The research highlights the concept that decision-making takes into account the environmental practices of these companies.

Shahbaz, et. al (2020) studies the influence of sustainable practices on the economic performance of firms in the energy sector over the period 2011-2018, with these firms having a higher exposure to environmental concerns than various other sectors. The results of the study are contrary to other studies, fixed effects regression showing that there is no link between return on assets and environmental performance. The author also argues that sustainable commitments are not extensive in the energy sector but just an operational routine.

Constantinescu, et. al (2021) use energy industry companies from the Top 100 Global Energy Leaders 2017 in their research, and regression analysis shows both a positive and negative association between environmental performance, combined and individual, and market value of North American companies. This result is also supported by Behl, et. al (2021), who use data from 62 Indian energy companies based on the Nifty 500 index and demonstrate that environmental performance negatively affects the Indian energy sector in the short run, while over the course of time, these factors have a favorable effect on the financial performance of energy companies. A reasonable justification can be mainly attributed to the investors' perceiving that investing in sustainable practices signals an inefficient allocation of resources, which can be observed in the evolution of stock prices.

The stock market only rewards strong environmental performance during periods of stable economic conditions because the relationship between environmental performance and financial rewards suggests that an energy company's stock market performance is affected by its environmental performance. As a result of the cyclical nature of the financial impact of environmental performance, businesses can only be beneficial when the economy is unstable. (Arslan-Ayaydi and Thewissen, 2016). The study is conducted using environmental scores compiled by Kinder, Lyndenberg and Domini Research and Analytics between 2000 and 2011.

Reasoning the different results of the studies reviewed, Billio, et. al (2020) demonstrate that rating agencies do not use the same metrics when defining environmental performance and that heterogeneity of perception can lead agencies to give completely different ratings to a given company. The study concludes that sustainable investments are not only seen as having little effect on financial performance but are also seen as a potential burden on it due to anticipated cost increases.

A negative association between environmental score and financial performance is also obtained by Dincă, Vezeteu and Dincă (2022) through the use of the correlation between the environmental score variable and company value of 131 companies in the automotive industry over the period 2015-2020, concretizing that it does not predict company value.

The findings are contradictory regarding the link between environmental practices and financial performance, following the literature review. It is assumed that reporting only on the total ENV - environmental score - may lead to contradictory results. Therefore, in this research, the component dimensions of the environmental factor on financial performance are considered individually in order to determine the effect of the environmental score.

2. Research methodology

To investigate the association between environmental performance and firm financial performance, the environmental score is used, which is a total percentage score for environmental performance. Further, the research is extended to include the three subcategories that make up environmental performance: emission reduction, product innovation, and resource conservation. The environmental score:

- evaluates how an organization's actions affect both living and non-living environmental processes (forests, soil, and water);
- is an indicator of how efficiently a company implements best management practices to reduce environmental risks and take advantage of environmental opportunities to create long-term shareholder value.

The environmental pillar score available on the Thomson Reuters Eikon platform is taken as the agreed independent value for linear regression models. Scores range from 0 to 100% and are calculated based on data on resource conservation, product innovation and emission reduction. These specific scores are used because the information on which they are calculated comes directly from companies, therefore there is a high degree of reliability and originality. Financial performance data, represented by total revenue, is also collected from the Thomson Reuters Eikon platform for companies with accessible environmental performance indicators, and all figures considered are presented in US dollars as this is one of the main global currencies. The analysis covers a five-year period 2017-2021, and the scope of the database has been limited to North American listed companies.

The variables used in correlation and linear regression analyses are displayed in Table 1:

Table no. 1 Variable description

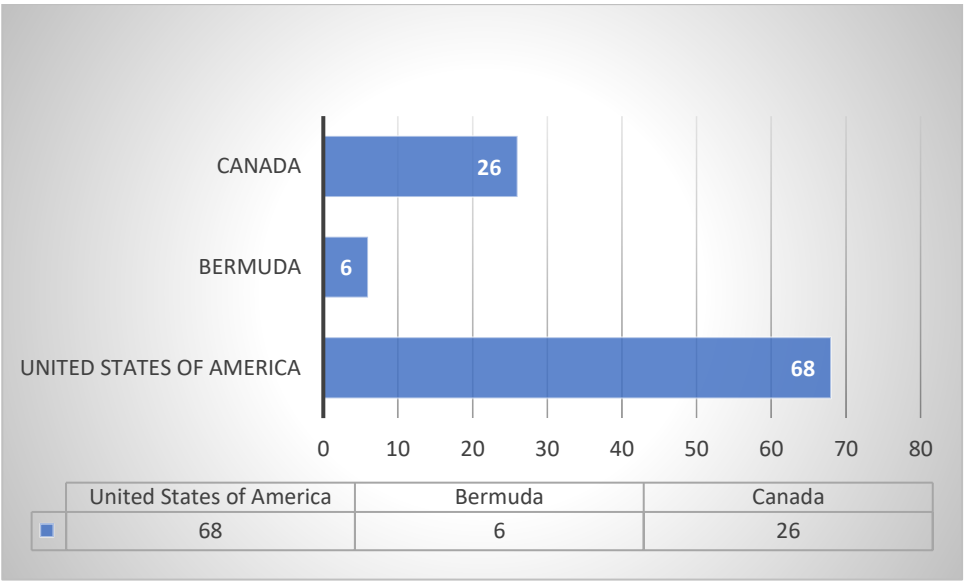
Variable name	*Symbol variable*	*Type of variable*	*Significance*
Total revenue	REV	dependent	total revenue from business activity
Environmental score	ENV	independent	the relative sum of the weights of the environmental dimensions: emission reduction, product innovation and product preservation.

Emission reduction	EMS	independent	the degree to which a company commits to and succeeds in reducing emissions during production and operational processes.
Product innovation	INS	independent	a company's ability to reduce costs by opening up new market opportunities through innovative environmental technologies, processes or green products.
Resource conservation	RUS	independent	A company's performance and ability to reduce resource use and find greener options by streamlining its supply chain.

Source: own processing

The final sample contains 100 companies in the energy sector, automatically selected within the platform according to GICS and divided into two main sub-categories: energy equipment and services, oil, gas and consumable fuels.

Table no. 2 Number of companies analyzed by region



Source: own processing

Table no. 2 lists the total number of companies in the dataset by country. As can be seen from this table, the dataset includes companies that are distributed across three regions, with the highest concentration of companies coming from the United States (68 companies), followed by Canada (26 companies) and Bermuda (6 companies).

In order to determine whether there is a relationship between environmental score and the financial performance of companies, for those operating in the energy sector, this paper is based on two main hypotheses, the first of which is derived into three secondary hypotheses.

- H_1: There is a direct relationship between environmental performance and financial performance for companies operating in the energy sector.

The first hypothesis leads to a number of supporting hypotheses such as:

- $H_{1.1}$: Emission reduction policy has a significant effect on the financial performance of companies operating in the energy sector.
- $H_{1.2}$: Product innovation has a significant effect on the financial performance of companies operating in the energy sector.
- $H_{1.3}$: Resource conservation has a significant effect on the financial performance of companies operating in the energy sector.

According to the hypotheses mentioned above, firms with a high rate of actions directed towards environmental performance are more likely to have a higher financial performance than firms with no such practices or a low number of environmental practices. The final statement summarizes this argument:

- H_2: The intensity of the relationship between environmental and financial performance increases as a result of the intensification of environmental factors.

To validate/invalidate these hypotheses it was used the correlation analysis between selected variables as well as multiple linear regression, also the Durbin-Watson test and multicollinearity test were used to validate the regression model.

3. Results and discussions

Correlation analysis

The correlation analysis is based on the use of the Pearson correlation coefficient between the variables analyzed. The Pearson correlation coefficient is calculated for the environmental and financial performance variables in SPSS software (Table 3) and addresses the assumption that the data are normally distributed. Data analysis is calculated for each year of the period, with symbols 1 through 5 representing each of the years between 2017-2021. The last table refers to the analysis of the data over the entire period, with variables preceded by the symbol T.

Table no. 3 Correlation of environmental and financial variables

	REV1	ENV1	RUS1	EMS1	INS1
REV1	1				
ENV1	.284**	1			
RUS1	.182	.876**	1		
EMS1	.236*	.866**	.701**	1	
INS1	.344**	.523**	.319**	.193	1

	REV2	ENV2	RUS2	EMS2	INS2
REV2	1				
ENV2	.297**	1			
RUS2	.211*	.907**	1		
EMS2	.224*	.876**	.720**	1	
INS2	.411**	.599**	.485**	.281**	1

	REV3	ENV3	RUS3	EMS3	INS3
REV3	1				
ENV3	.297**	1			
RUS3	.233*	.914**	1		
EMS3	.226*	.900**	.751**	1	
INS3	.424**	.621**	.497**	.357**	1

	REV4	ENV4	RUS4	EMS4	INS4
REV4	1				
ENV4	.345**	1			
RUS4	.278**	.910**	1		
EMS4	.274**	.909**	.748**	1	
INS4	.462**	.621**	.492**	.377**	1

	REV5	ENV5	RUS5	EMS5	INS5
REV5	1				
ENV5	.368**	1			
RUS5	.285**	.915**	1		
EMS5	.295**	.931**	.797**	1	
INS5	.505**	.620**	.454**	.430**	1

	REVT	ENVT	RUST	EMST	INST
REVT	1				
ENVT	.304**	1			
RUST	.228**	.912**	1		
EMST	.243**	.905**	.762**	1	
INST	.409**	.601**	.461**	.345**	1

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

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

Source: own processing based on SPSS software

The Pearson correlation coefficient between environmental performance - ENV and total revenue – REV- has positive but rather small values, which means that there is a weakly positive and statistically significant relationship (r_1= .284, r_2= .297, r_3= .297, p<0.005) for the period 2017-2019, and for the period 2020-2021, the correlation remains positive and statistically significant but of higher intensity (r_4= .345, r_5= .368, p< .005). Therefore, hypothesis H_1 is supported. This shows that an increase in environmental performance leads to a slight increase in company revenues. For the derived variables RUS – resource conservation - and EMS – emission reduction - there is a statistically significant correlation at the .05 level according to the correlation matrix, over the period 2017-2019. The correlation analyzed using the Pearson correlation coefficient between INS – product innovation - and REV is found to be weakly positive/moderately positive and statistically significant (r_1= .344, r_2= .411, r_3= .424, r_4= .462, r_5= .505, p< .005) for the whole period analyzed. The analysis carried out for the period 2020-2021 reflects a relationship between ENV, RUS, EMS, INS, and REV variables that is very weakly positive and moderately positive, as well as statistically significant. These results support hypothesis $H_{1.2}$ and provide mixed results with reference to hypotheses $H_{1.1}$ and $H_{1.3}$.

Linear regression

Linear regression analysis is used to estimate the type of relationship between the dependent variable (financial performance as measured by company revenues) and the independent variables (the environmental factor and its components). SPSS statistical software is used to run the linear regression models for the selected sample. The regression models are applied to each component variable individually (resource conservation, product innovation and emission reduction) to better observe the impact of environmental performance on the financial performance of the companies. Since the ENV variable results from the RUS, EMS and INS variables, there were used only the three component variables as independent variables and total REV revenue as the dependent variable in the linear regression to determine the variation in financial performance through environmental performance.

Table no. 4 Multiple linear regression of the analyzed variables

Year of analysis	Regression Weights	R^2	F	p-value	Hypothesis supported
2017	RUS,EMS,INS -> REV	.151	5.706	0.001	YES
2018	RUS,EMS,INS -> REV	.190	7.500	0.000	YES
2019	RUS,EMS,INS -> REV	.188	7.407	0.000	YES
2020	RUS, EMS,INS -> REV	.225	9.308	0.000	YES
2021	RUS,EMS,INS -> REV	.262	11.376	0.000	YES

Total	RUS,EMS,INS -> REV	.181	36.553	0.000	YES

Source: own processing based on SPSS software

The results of the regression analysis indicate that, for the whole period of analysis, 18.1% of the total variation in the financial performance of companies operating in the energy industry can be explained by the combined environmental score variables, underpinning the formation and validation of the first hypothesis and its derivatives. The results presented in Table 4 demonstrate, by the increase over time of the value of R^2, that the intensity of the relationship increased from 2017 to 2021, from 15.1% to 26.2%, a result of the involvement of companies in the energy sector in environmental protection actions validating hypothesis H_2 – which argues that the intensity of the relationship between environmental and financial performance increases due to the intensification of the action of environmental factors. The p-value results confirm linear relationships between total environmental performance composed of the three dimensions (RUST, EMST and INST) and total revenues, being well below the acceptance level ($p < 0.05$).

The results obtained for the period 2017-2021 reveal that the relative variables significantly predict REV, F (3,96) =, $p<0.001$, indicating that the relative variables composing environmental performance can play a significant role in shaping total revenue ($p<0.001$). These results clearly direct the positive effect of environmental performance. In addition, $R^2 = 0.151$-0.262 indicates that the model explains between 15.1% and 26.2% of the variance of the dependent variable REV. Given the results, hypothesis H_1 can be considered true for the period under analysis 2017-2021. Table 4 summarizes the findings.

Table no. 5 Multiple linear regression coefficients

2017						
Term	**Coef**	**SE Coef**	**t**	**p**	**Collinearity sts.**	
					Tolerance	**VIF**
Constant	-11.45739557	12.34781366	-.928	.356		
RUS1	-0.154513153	0.252103896	-.613	.541	.473	2.112
EMS1	0.454662151	0.259354013	1.753	.083	.507	1.970
INS1	0.606401867	0.184764705	3.282	.001	.896	1.116
2018						
Term	**Coef**	**SE Coef**	**t**	**p**	**Collinearity sts.**	
					Tolerance	**VIF**
Constant	-1.627969676	7.004161284	-.232	.817		
RUS2	-0.174414831	0.174746369	-.998	.321	.395	2.533
EMS2	0.248056442	0.156965976	1.580	.117	.476	2.103
INS2	0.566839774	0.141940785	3.993	.000	.755	1.325
2019						
Term	**Coef**	**SE Coef**	**t**	**p**	**Collinearity sts.**	
					Tolerance	**VIF**
Constant	3.012137271	3.957661149	.761	.448		
RUS3	-0.051699065	0.107784433	-.480	.633	.375	2.664
EMS3	0.0955357	0.100590881	.950	.345	.435	2.298
INS3	0.36571116	0.094051791	3.888	.000	.752	1.330
2020						
Term	**Coef**	**SE Coef**	**t**	**p**	**Collinearity sts.**	
					Tolerance	**VIF**
Constant	1.669837733	4.959609098	.337	.737		
RUS4	-0.037907625	0.142251313	-.266	.790	.389	2.571
EMS4	0.138410522	0.132290409	1.046	.298	.441	2.270
INS4	0.572390305	0.138297103	4.139	.000	.757	1.320
2021						
Term	**Coef**	**SE Coef**	**t**	**p**	**Collinearity sts.**	
					Tolerance	**VIF**
Constant	1.765758761	4.662270951	.379	.706		
RUS5	-0.005565035	0.156566463	-.036	.972	.350	2.857
EMS5	0.104606616	0.153779626	.680	.498	.359	2.783
INS5	0.679156577	0.145101934	4.681	.000	.781	1.281
Total period						
Term	**Coef**	**SE Coef**	**t**	**p**	**Collinearity sts.**	
					Tolerance	**VIF**
Constant	-0.062549734	2.786402979	-.022	.982		
RUST	-0.090449775	0.075739899	-1.194	.233	.375	2.667
EMST	0.195490381	0.072298443	2.704	.007	.420	2.384
INS	0.549521313	0.065107116	8.440	.000	.787	1.271

Source: own processing based on SPSS software

Hypotheses $H_{1.1}$, $H_{1.2}$ and $H_{1.3}$ test whether product innovation, resource conservation and emission reduction have a significant effect on the earnings of companies operating in the energy sector. According to Table 5, it can be stated that hypotheses $H_{1.1}$ and $H_{1.3}$ are invalidated because the p-value is in the range [0.123;0.947] although the regression model supports hypothesis H_1 for the period 2018-2021. This means that any change in developing the conservation of resources and investing in technologies meant to reduce the emission does not influence the increase/decrease of the total revenues over the period studied. Hypothesis $H_{1.2}$ is confirmed by obtaining, in the case of INS, a p-value included in the range [0.000;0.001] and it can be admitted that product innovation significantly influences the total revenues of the energy companies, meaning that if the companies chose to invest in product innovation, the total revenue will increase over time.

In order to meet the secondary objective of the present research, which is to validate hypothesis H_2, which argues that changes in environmental performance can explain part of the financial performance of companies, a regression model is constructed using the dependent variable and independent variables found in the literature. The total or individual environmental pillar scores serve as an example of the independent variable of the model. Numerical values for environmental scores and financial performance are downloaded from the Thomson Reuters platform. The regression model calculated for the total period is as follows:

REVT=-0.06254-0.09044*RUST+0.19549*EMST+0.54952*INST

To test for the presence of autocorrelation errors in the regression model, the Durbin-Watson statistical test is applied. Table 6 shows the result of the test.

Table no. 6 Durbin-Watson statistics

Period	Durbin-Watson value dW	1% significance point of dL and dU		5% significance point of dL and dU	
2017	2.036	1.482	1.604 4-dU = 2.396	1.613	1.736 4-dU= 2.264
2018	2.019				
2019	2.014				
2020	2.053				
2021	2.051				
Total	2.038				

Source: own processing

The test results range from 2.014 to 2.053, representing normal values as they are in the range 1.5-2.5, and by comparing the obtained values with the critical values in the Durbin-Watson table dL and dU it can be stated that all values meet the condition dL< dW<4-dU leading to the conclusion that there is no first-order autocorrelation of errors, the null hypothesis H_0 (no autocorrelation of errors) is not rejected. The critical values dL and dU are calculated for a number k of independent variables =3 and a number of observations n=100.

To test whether the independent variables are highly correlated with each other, which would bias the interpretation of the regression model and increase the confidence intervals, the multicollinearity of the EMS, INS and RUS variables are analyzed in Table 5. For the whole period, the inflation factor VIF shows values smaller than 10 ($1.116<VIF_{ix}<2.857$), and the tolerance values τ are larger than 0.1 ($0.35<\tau_{ix}<0.896$) which denotes the lack of collinearity and the viability of the regression model in the study.

Conclusions

The current research focuses on the relationship between financial performance and overall environmental performance for businesses operating in the energy industry. When one-way linear relationships are taken into account, a number of results in the literature are supported by earlier empirical data. The study's findings support the claim that there are mixed correlation results between an energy company's overall environmental performance and its financial performance. The results are in line with earlier studies regarding this relationship. (Constantinescu, et. al., 2021; Gonenc and Scholtens, 2017).

Applying regression models for each relative variable allowed to extend the regression models from the original model for the total environmental factor (resource conservation, product innovation and emission reduction). The results show a positive relationship between environmental performance and financial performance, assessed by total revenue in bivariate correlation and by the regression model in the second model for the period 2018-2021. The findings of this study demonstrate that both the environmental score and the component dimensions have not yet demonstrated their impact on the financial performance of energy companies. Both regression and correlation models provide mixed results. The certainty of the results obtained for the association analyzed increased as a result of using two separate models for analysis. Given the current findings, it can be stated that it partially supports the established hypotheses.

Future studies could examine whether there is still a favorable correlation between environmental performance and financial performance for companies operating in other sustainability controversial sectors. Using contributions from additional environmental scorecard data providers, the evaluation database can be extended simultaneously, which might result in slightly different outcomes. It should be noted that the current study is constrained to the time frame in which the research was developed; future studies will be developed over an extended period of time in order to more thoroughly investigate the relationship between environmental and financial success.

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