

Exploring the relationship among ESG, innovation, and economic and financial performance: evidence from the energy sector

Alan Bandeira Pinheiro, Graziela Bizin Panza,
Nicolas Lazzaretti Berhorst, Ana Maria Machado Toaldo and
Andréa Paula Segatto
School of Management, Universidade Federal do Paraná, Curitiba, Brazil

Abstract

Purpose – This study aims to investigate the effect of innovation on environmental, social and governance (ESG) performance and, consequently, its influence on the economic and financial performance of companies.

Design/methodology/approach – A quantitative and descriptive research was carried out based on secondary data from the Refinitiv Eikon® database, using the panel data regression technique, considering the constructs: innovation, ESG performance and economic and financial performance.

Findings – The results showed that companies that tend to invest more financial resources in R&D are more likely to have higher ESG performance. In addition, companies that have higher ESG performance tend to have higher economic and financial performance.

Practical implications – Managers may consider investing more resources in R&D to achieve superior ESG performance. They should be aware that ESG is a strategic tool for creating financial and nonfinancial value for the organization. More than the traditional preparation of a financial report, stakeholders demand another type of information: ESG information.

Originality/value – The results confirm the basis of Stakeholder Theory, showing that the companies that meet the needs of all stakeholders tend to have greater economic and financial performance. ESG practices can include keeping employees motivated to work, improved corporate image in the eyes of customers, more satisfied suppliers and community and environment aligned with management. Therefore, these ESG initiatives are instrumental in protecting organizational objectives as well as increasing shareholder value.

Keywords ESG performance, Research and development, Economic performance, Financial performance, Energy sector, Innovation, Regression, Econometric, Environmental damages, Correlation analysis, Dynamic regression

Paper type Research paper



1. Introduction

Environmental concern has gained notoriety with the concepts of sustainable development worldwide (Pinheiro *et al.*, 2022). Consequently, the search for better business practices has led to increased interest in activities focused on sustainability, along with environmental legislation, forcing companies to consider the impact of their operations on the environment (Shakil *et al.*, 2019; Slacik *et al.*, 2022).

Funding: The research that led to these results received financial support from CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior).

The term environmental, social and governance (ESG) is often used in corporate procedures to point out a set of ESG elements that allow estimating the long-term sustainability of investment, integrating traditional economic and financial parameters (Xu *et al.*, 2021). The term has gained relevance, as investors increasingly incorporate ESG visions into their portfolios, seeking to diversify their investments among ethical companies that exhibit good corporate behavior without sacrificing their financial returns (Pedersen *et al.*, 2021). Simultaneously, sustainable investment has a positive social impact, making companies greener and shifting traditional investment towards environmentally responsible companies (Pástor *et al.*, 2021).

ESG ratings are increasingly important factors for sustainable investments in the European Union and the USA, with regulations for the progressive dissemination of company reports (Costa *et al.*, 2022). In developed countries, environmental, social, and governance (ESG) ratings have become an integral part of financial, business and consumer decisions, with their importance recently recognized by European and American political leaders (Erhart, 2022), highlighting the need for studies that shed light on this topic.

In addition, renowned credit rating agencies, or risk assessment agencies, have given much attention to the formulation of innovative indicators capable of reporting the ESG performance of companies (Nirino *et al.*, 2021). Therefore, companies listed on stock exchange manage the impact of ESG indicators on economic and financial performance.

In the literature of the area, this trend is also confirmed. However, there is a lack of research addressing innovation in the relationship between ESG and performance. Therefore, there are still gaps regarding research with ESG indicators, innovation capacity and the performance of companies (Du and Li, 2019; Song *et al.*, 2020; Velte, 2017). The European Commission (European Commission, 2015) emphasized the need to further explore the influences of ESG indicators on economic growth through the innovation process, also considering the Stakeholder Theory.

There is a significant research gap, specifically, in the effect of innovation on ESG performance, aligned with the impacts of the heterogeneity of stakeholders (Tan and Zhu, 2022). Kumar *et al.* (2022) point to the influence of ESG performance on the financial risk of oil and gas companies, however, the relationship with innovation is not evident.

According to Baran *et al.* (2022), there are correlations between ESG scores and corporate financial performance in the energy sector. Companies in this sector have specificities regarding the importance of strict regulations that are subject to the energy market, the innovation that affects the state of development and infrastructure of the entire sector, and the environmental and social impacts of this type of business. These aspects highlight the importance of ESG studies in the energy sector. Companies that operate in the energy sector deal directly with natural resources, which can generate a greater impact of their activities on the environment (Kumar *et al.*, 2022).

The present study aims to investigate the effect of innovation on ESG performance and, consequently, its influence on corporate economic-financial performance.

To achieve the purpose of this study, a quantitative and descriptive research was conducted based on secondary data from the Refinitiv Eikon® database, using the panel data regression technique, considering the constructs: innovation, ESG performance and economic-financial performance. The results showed that companies that tend to invest more financial resources in R&D also tend to have higher ESG performance. In addition, firms that have higher ESG performance similarly tend to have higher economic-financial performance. These results carry important academic and managerial implications.

As such, in Section 2, this research presents the theoretical foundations and hypothesis construction; in Section 3, the methods, the sample and the process of data collection and

analysis; then, the results of the research with discussions based on previous studies are given in Section 4; and, finally, the main conclusions, theoretical and practical implications/contributions, limitations and suggestions for further research are given in Section 5.

2. Theoretical foundations and hypothesis construction

The *neoclassical economics* and most management theories are based on the assumption that profit maximization is a key business objective (Eccles *et al.*, 2014). Shareholders are considered the main stakeholders of the company. Therefore, organizations drive efforts to satisfy this group. Nevertheless, organizations should go beyond this focus (Harrison and Freeman, 1999).

Thus, in recent decades, there is an increasing predisposition of corporations to participate in environmental and social concerns, and many firms have incorporated ESG into their commercial strategy (Widyawati, 2020). Unlike traditional management theories, companies can perform well financially while also contributing to the good of society ESG's positive activities benefit several shareholders and ultimately create direct value for stakeholders (Grushina, 2017).

Therefore, based on the vision of the Stakeholder Theory, the ESG performance of companies presents an additional benefit not only to shareholders but also to all stakeholders in the business, such as customers, employees, non-governmental organizations, media, government, among others. Stakeholders drive companies' strategies with their identities, ideologies, interests and expectations. Stakeholder Theory is concerned with the nature of these relationships in terms of processes and outcomes and offers a new way of understanding and managerial action by suggesting that a company cannot meet the needs of shareholders without satisfying the needs of other stakeholders (Freeman, 1984).

Innovation benefits this process because innovative companies have a greater need for product differentiation (Padgett and Galan, 2010). According to Mishra (2017), engagement in social and environmental issues can help establish a competitive image for new products. Additionally, innovative companies tend to value innovation at all its levels: product, process, position and paradigm innovation (Tidd and Bessant, 2018). Therefore, companies that invest resources for ESG activities do not compromise on the quality and reliability of their new launches for consumers and society in general.

2.1 Environmental, social and governance

The term "ESG" is often used in corporate procedures to point out a set of ESG elements that allow estimating the long-term sustainability of investment, integrating traditional economic and financial parameters. In general, ESG performance is measured by companies' commitment to disclose their ESG practices (El Khoury *et al.*, 2022).

Companies' choices regarding ESG implementation strategies can unarguably have a positive impact on their value and performance. The incorporation of ESG into a company's operations is an innovation strategy for contemporary companies and can be considered a countermeasure to mitigate market cycles from the impacts of COVID-19 on the global economy (Chen *et al.*, 2022).

ESG transparent information proves that companies are actively taking ecological and social responsibility, thus improving their reputation among consumers and investors, accessing capital at a lower cost and enhancing their competitive advantage (Costa *et al.*, 2015). According to Shakil *et al.* (2019), *ESG practices can be a powerful source of competitive advantage*.

2.2 Innovation

Companies that generate innovation as a priority, compared to their competitors, launch new products faster, have fewer suppliers, record greater efficiency of marginal costs/marginal sales, invest more in fixed assets and R&D and have a higher net operating income (Hughes *et al.*, 2021).

According to Tidd and Bessant (2018), there are four broad categories of innovation: product, process, position and paradigm. Product innovation produces a change in the products and services offered. Process innovation focuses on how the company's offer is created and delivered. Position innovation acts within the context wherein products and services are offered. Paradigm innovation focuses on changes in the mental models that guide the organization's performance. In addition, according to the authors, innovation is essential so that the company can continue to grow and not succumb to its competitors and lose market to the point of closing its doors. By innovating, the company keeps up to date with the fluctuations and changes in preferences of its consumer market and also increases its chances of recording both revenue and profitability increases.

The results of the literature review research Keupp *et al.* (2012) indicated that for the topic of performance improvement, the main keywords linked to innovation are "growth", "returns", "performance" and "advantage". The findings of this research also indicate that the effectiveness of innovation is commonly measured by the investment in R&D made by the company.

Innovation with social impact is an increasingly important component in large organizations. These large companies are currently required to demonstrate concern for regional development in their area of operation and ESG practices. In this way, social responsibility is an important initiative to monitor and communicate actions and practices that go beyond the pursuit of profitability (Tidd and Bessant, 2018).

2.3 Economic and financial performance

A high level of economic and financial performance and strong corporate governance help companies maintain the stable profitability and the price of stock of less volatile companies (Aras and Crowther, 2008). According to Katsikeas *et al.* (2016), revenue and *return on assets* (ROA) are commonly used to represent economic and financial performance, as these metrics can be calculated from easily accessible accounts in corporate statements.

The ROA of a company, which is defined as an accounting metric for financial performance, is calculated from the ratio of net income to its total assets. In turn, revenue is calculated through the price and quantity of sales (Nirino *et al.*, 2021).

In the financial report, the amount of net income is typically related to sales volume. Thus, in productive private sectors, which are not financial institutions (commercial banks, insurance companies) or pharmaceutical companies, it can be expected that an increase in profitability will be accompanied by an increase in revenue. This is important because this paper seeks to identify the influence of ESG practices on revenue and ROA.

2.4 Construction of hypotheses

When a company invests resources in innovation of product, process, position and/or paradigm, it is possibly investing resources for ESG practices. Investment in R&D can facilitate the implementation of a new process in the production system, which positively impacts the social and environmental performance of the company (Nirino *et al.*, 2021). R&D activities can improve the efficiency of natural resources and reduce pollutant emissions (Du and Li, 2019). Some previous studies (Li *et al.*, 2023; Song *et al.*, 2020; Yang and Zhu, 2022) have shown that investment in innovation motivates the company to perform better in green

innovation. *The study by Tan and Zhu (2022) found that innovation plays an important role in promoting proactive green innovation and deepening sustainable development in China, which improves ESG performance.* Therefore, the following hypothesis is proposed:

H1. Innovation has a positive effect on companies' ESG performance in the energy sector.

A company's ESG performance acts as a shield against adverse market reactions and safeguards its shares (Nirino *et al.*, 2021). The company's social activities improve its reputation and enhance the company's brand image in the market. Thus, with a better reputation and image, it is possible to expect a boost in the organization's financial performance, positively impacting revenue and ROA. Previous studies (El Khoury *et al.*, 2022; Shakil *et al.*, 2019; Sinha Ray and Goel, 2023) have found a significant positive relationship between corporate social performance by ESG actions and financial performance. Kalia and Aggarwal (2023) *found that better ESG performance drives companies towards better financial performance in the health care sector.* In addition, it is Wirawan *et al.* (2020) claimed that investors consider ESG performance before investing in emerging markets, as organizations with high ESG performance tend to have robust risk management, which makes it easier to attract investments. Therefore, the following hypothesis is proposed:

H2. ESG performance has a positive effect on the economic and financial performance of companies in the energy sector.

3. Methods

For this research, information on companies based in the G20 group of countries was obtained from the Thomson Reuters ® Refinitiv Eikon database, which is considered to be one of the most reliable sources of data (Galbreath, 2018). *This group was chosen for the economic representativeness that these economies have and these countries have the greatest contribution to carbon dioxide emissions (Erdogan et al., 2020).* In addition, El Khoury *et al.* (2022) found that G20 companies have greater social responsibility than companies outside the group. So, it is expected that the large companies of the G20 have greater commitment to ESG performance. In this group, companies in the energy sector were studied as the development and implementation of new technologies in this sector have been and will be central to the transition to more efficient forms of energy consumption and production (Kehrel and Sick, 2014). Additionally, energy companies operate in an environmentally sensitive sector, which is essential for dialogue with stakeholders (Hassan and Kouhy, 2015; Slacik and Greiling, 2020).

Out of a total of 1743 companies, the sample consisted of 413 international energy companies from the G20 group, as there was no available data for other companies. Information was collected from 2016 to 2020. *This period was chosen because, according to Saenz and Brown (2018), after signing the United Nations (UN) Global Compact in 2015, companies had a greater concern to publicize their social and environmental issues. The United Nations Global Compact 2015 is a global initiative that provides guidelines and helps companies consider ESG factors in their strategies (Lokuwaduge and Heenetigala, 2017).* 2020 was the last year with data available at the time of data collection. Table 1 shows the distribution of companies by country and industry.

Table 1 shows companies headquartered in 19 countries: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, Russia, Saudi Arabia,

| Country/Industry | COA | INT | DRI | EXP | REF | TRA | SEQ | REN | RFU | URA | Total |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Argentina | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| Australia | 5 | 1 | 0 | 12 | 2 | 0 | 2 | 0 | 0 | 2 | 24 |
| Brazil | 0 | 1 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 6 |
| Canada | 1 | 2 | 3 | 35 | 6 | 5 | 8 | 2 | 0 | 5 | 67 |
| China | 13 | 2 | 1 | 2 | 4 | 2 | 2 | 12 | 0 | 0 | 38 |
| France | 0 | 1 | 0 | 1 | 2 | 1 | 2 | 1 | 0 | 0 | 8 |
| Germany | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 2 | 0 | 8 |
| India | 1 | 0 | 0 | 2 | 5 | 0 | 0 | 1 | 0 | 0 | 9 |
| Indonesia | 5 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 |
| Italy | 0 | 1 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 5 |
| Japan | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 7 |
| Korea | 0 | 0 | 0 | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 6 |
| Mexico | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Russia | 1 | 6 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 10 |
| Saudi Arabia | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 3 |
| South Africa | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| Turkey | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| UK | 0 | 1 | 0 | 13 | 3 | 1 | 4 | 1 | 1 | 0 | 24 |
| USA | 6 | 2 | 5 | 59 | 26 | 24 | 39 | 12 | 6 | 4 | 183 |
| Total | 33 | 20 | 9 | 130 | 68 | 36 | 61 | 35 | 9 | 12 | 413 |

Economic and
financial
performance

505

Notes: COA = Coal; INT = Integrated Oil and Gas; DRI = Oil and Gas Drilling; Exp = Oil and Gas Exploration and Production; REF = Oil and Gas Refining and Marketing; TRA = Oil and Gas Transportation Services; SEQ = Oil Related Services and Equipment; REN = Renewable Energy Equipment and Services; RFU = Renewable Fuels; URA = Uranium

Source: Created by authors

Table 1.
Number of
enterprises by
country and industry

South Africa, Turkey, the UK and the USA. As the G20 is composed of 19 countries and the European Union, this study considered only the 19 countries. The country with the highest representation of companies is the USA, followed by Canada and China. On the other hand, the least representative countries are Mexico, South Africa, Saudi Arabia, Turkey and Argentina.

It is also considered that the energy sector is divided into ten industries: coal; integrated oil and gas; oil and gas drilling; oil and gas exploration and production; oil and gas refining and marketing; oil and gas transportation services; oil-related services and equipment; renewable energy equipment and services; renewable fuels and uranium. The industry with the highest representation is oil and gas exploration and production. On the other hand, the industries with the lowest representation are oil and gas drilling and renewable fuels.

To meet the objective of the research, the variables used in the econometric models, described in [Table 2](#), were selected.

ESG performance consists of 70 key performance indicators, classified into three dimensions: environmental performance, social performance and governance performance. Each of these dimensions ranges from 0 (lowest performance) to 100 (highest performance). The environmental dimension reveals how the company reduces the environmental risks of its operations, including the use of resources (water, energy, sustainable packaging and environmental supply chain), innovation (implementing new ideas, improving services and creating dynamic products) and emissions (CO₂ emissions, waste, biodiversity and environmental management systems).

The social dimension reveals how the company deals with social issues, which includes the workplace (diversity and inclusion; career development and training; working conditions; and health and safety), human rights (commitment to business ethics and human rights that will be guided by values such as dignity, justice, equality, respect and responsibility), community

Table 2.
Description of
variables

| Variables | Definition | Source |
|-----------------------------------|---|--------------------------|
| ESG | ESG Performance: continuous variable ranging from 0 (lowest corporate ESG performance) to 100 (highest corporate ESG performance) | Refinitiv Eikon database |
| ENVIR | Environmental performance: continuous variable that varies from 0 (lowest environmental performance) to 100 (highest environmental performance) | Refinitiv Eikon database |
| SOCIA | Social performance: continuous variable that varies from 0 (lowest social performance) to 100 (highest social performance) | Refinitiv Eikon database |
| GOVER | Governance performance: continuous variable that ranges from 0 (lower governance performance) to 100 (higher governance performance) | Refinitiv Eikon database |
| INNOVT | Innovation: R&D expenses reported | Refinitiv Eikon database |
| REVENUE | Revenue: Number of units sold \times average price | Refinitiv Eikon database |
| ROA | Return on Assets: Operating income before interests and taxes over total assets | Refinitiv Eikon database |
| CSRCOM | Corporate Social Responsibility Committee: Dummy variable: 1 = if the company has a CSR committee, and 0 = otherwise | Refinitiv Eikon database |
| UNSIGN | UN Global Compact Signatory: Dummy variable: 1 = if the company is a signatory of the UN Global Compact, and 0 = otherwise | Refinitiv Eikon database |
| DEVELOPED | Dummy variable: 1 = if the country is developed; 0 = if the country is developing | – |
| Source: Created by authors | | |

(well-being of society, positively benefiting society) and product responsibility (healthy product, product safety and instructions). Finally, the governance dimension reveals how the company treats management, shareholders and corporate social responsibility strategies.

Innovation is measured by the company’s expenses with R&D. According to [Lorca and de Andrés \(2019\)](#), investment in R&D is the first step towards innovation and technological progress, which involves the application of new knowledge towards the improvement of products, processes, systems and society as a whole. Revenue is the variable that measures the economic performance of the company, whereas ROA is the metric to measure the financial performance of companies. According to [Katsikeas et al. \(2016\)](#), these variables are adequate to represent the economic and financial performance of a firm.

In addition to the explanatory variables above, three control variables were selected based on their relevance indicated in the previous literature ([Nirino et al., 2021](#); [Song et al., 2020](#); [Yang and Zhu, 2022](#)). The presence of the corporate social responsibility committee, being a signatory to the UN Global Compact is at the company level and the country’s level of development is at the country level. Previous evidence has shown that the level of ESG performance can be affected by these potential factors. Therefore, in this study, three control variables moderate the relationship between dependent variable and independent variables. Moreover, when working with companies based in more than one country, it is important to measure the country effect through its degree of development ([Pucheta-Martínez and Gallego-Álvarez, 2019](#)).

After data collection, data were analyzed using descriptive statistics, correlation analysis between variables and panel regression models with fixed and random effects. To test *H1*, the following model was operationalized:

$$ESG_{it} = \beta_{it} + \beta_1 INNOVT_{it} + CSR_{COM_{it}} + UNSIGN_{it} + DEVELOPED_{it} + \theta_i + \varepsilon_{it}$$

In order to test $H2$, the following model was operationalized:

$$ECOFINPER_{it} = \beta_{it} + \beta_1 ESG_{it} + CSR_{COM_{it}} + UNSIGN_{it} + DEVELOPED_{it} + \theta_i + \varepsilon_{it}$$

For each operationalized model, tests were performed to increase confidence in the results. For example, the variance inflation factor (VIF) was performed to confirm the absence of multicollinearity between the regressors, the Breusch–Pagan test to measure heteroscedasticity, the Durbin–Watson test for endogeneity and the Hausman test for the choice of fixed or random effects in the data panel. As a robustness analysis, additional tests were carried out by removing information from the sample for the year 2020 and for American companies. All tests were operationalized in the STATA 13® software.

4. Results and discussion

The results obtained and their reflections are presented here.

4.1 Descriptive statistics and correlations

Table 3 presents the descriptive statistics of all study variables. The average ESG performance value is 41.33 out of 100 possible points. The lowest score was 0.31 points, whereas the highest score was 91.70 points. Regarding the environmental dimension (ENVIR), the average value is 34.84, the minimum value was 0 and the maximum was 96.34. This indicates that there was a company in the sample that did not disclose any environmental risks. Regarding the social dimension (SOCIA), the average value is 40.93, the minimum value was 0.43 and the maximum was 94.97. Regarding the corporate governance dimension (GOVER), the average value is 51.13, the minimum value was 0.16 and the maximum was 98.64. The data reveal that among the three dimensions of ESG performance, companies generally disclose more information about corporate governance, whereas there were companies that did not disclose information about the environmental dimension.

Table 3 shows that the innovation variable (INNOVT) has an average of 15.03 and has a minimum value of 0, that is, in the sample, there were companies that did not invest in innovation in the period analyzed. In addition, this variable has a maximum value of 85.90, which indicates that there are companies that invest significantly in innovation. Revenue (REVENUE) has average of 47.71, with a minimum of 0 and a maximum of 3017. ROA

| Variables | Obs. | Mean | SD | Min | Max |
|--------------------|-------|--------|---------|------|---------|
| ESG | 1,703 | 41.33 | 21.058 | 0.31 | 91.70 |
| ENVIR | 1,703 | 34.849 | 27.012 | 0.00 | 96.34 |
| SOCIA | 1,703 | 40.937 | 24.209 | 0.43 | 94.97 |
| GOVER | 1,703 | 51.130 | 23.402 | 0.16 | 98.64 |
| INNOVT | 1,703 | 15.037 | 25.569 | 0.00 | 85.90 |
| REVENUE | 1,703 | 47.714 | 199.462 | 0.00 | 3017.13 |
| ROA | 1,703 | 9.505 | 0.870 | 6.28 | 11.76 |
| CSR _{COM} | 1,703 | 0.655 | 0.475 | 0.00 | 1.00 |
| UNSIGN | 1,703 | 0.171 | 0.376 | 0.00 | 1.00 |
| DEVELOPED | 1,703 | 0.817 | 0.386 | 0.00 | 1.00 |

Source: Created by authors

Table 3.
Descriptive statistics

averages 9.50, with a minimum of 6.28 and a maximum of 11.76. The last three variables are binary and therefore assume values of 0 or 1. With this, the minimum value is 0 and the maximum is 1. The average value of the presence of the sustainability committee (CSRCOM), being a signatory to the Global Compact (UNSIGN) and the level of development of the country (DEVELOPED) are 65%, 17% and 81%, respectively, which indicates that not all companies that have the sustainability committee are signatories to the UN Global Compact; however, with regard to the level of development of the country, the result seems to be significant.

Table 4 reports the paired correlations for all variables. The ESG performance variable has a high correlation with its composing variables: environmental and social performance and governance. The findings demonstrate that ESG performance has a positive and significant correlation with innovation, with revenue, ROA, the social responsibility committee and being a signatory to the Global Compact. However, the results show that the ESG performance has a negative and significant correlation with the degree of development of the country, that is, although the ESG variable presents a positive correlation with innovation and financial performance, such correlation is negative regarding the degree of development of the country.

According to Pucheta-Martínez and Gallego-Álvarez (2019), if the correlation coefficient is less than 0.80 between the dependent variable and the independent variables, then multicollinearity is not a problem in the multivariate analysis. Based on this assumption, multicollinearity is not likely to be a problem for multivariate analysis. Although previous studies (Oliveira *et al.*, 2019; Shaukat *et al.*, 2016) have used only the collinearity matrix to verify the absence of multicollinearity problems, in this study, the operationalization of the VIF was also performed.

4.2 Multivariate data analysis and discussion

Table 5 presents the findings of the four initial models designed to test H1. The results demonstrate that innovation has a positive and significant effect on ESG performance of companies. This is evidence that when companies invest more in R&D they perform better in ESG, which shows that innovation can positively influence the company’s engagement in ESG issues.

The results of the control variables, in Table 5, reveal that companies holding a sustainability committee also have better ESG performance. The result of the ESG variable

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|----------------|----------|----------|----------|---------|----------|---------|----------|----------|----------|
| (1) ESG | 1.00 | | | | | | | | |
| (2) ENVIR | 0.91*** | 1.00 | | | | | | | |
| (3) SOCIA | 0.91*** | 0.81*** | 1.00 | | | | | | |
| (4) GOVER | 0.62*** | 0.36*** | 0.36*** | 1.00 | | | | | |
| (5) INNOVT | 0.50*** | 0.57*** | 0.45*** | 0.14*** | 1.00 | | | | |
| (6) REVENUE | 0.05*** | 0.07*** | 0.01 | 0.04* | 0.02 | 1.00 | | | |
| (7) ROA | 0.61*** | 0.64*** | 0.51*** | 0.31*** | 0.30*** | 0.14*** | 1.00 | | |
| (8) CSRCOM | 0.59*** | 0.55*** | 0.54*** | 0.35*** | 0.19*** | -0.02 | 0.40*** | 1.00 | |
| (9) UNSIGN | 0.51*** | 0.49*** | 0.50*** | 0.22*** | 0.35*** | 0.07** | 0.38*** | 0.32*** | 1.00 |
| (10) DEVELOPED | -0.19*** | -0.25*** | -0.16*** | 0.00 | -0.07*** | -0.00 | -0.29*** | -0.13*** | -0.21*** |

Table 4.
Correlation matrix

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$
Source: Created by authors

| Variables | Model 1 – ESG | Model 2 – E | Model 3 – S | Model 4 – G | Economic and financial performance |
|--------------------|----------------|----------------|----------------|----------------|------------------------------------|
| | Coef. (sig) | Coef. (sig) | Coef. (sig) | Coef. (sig) | |
| INNOVT | 0.28*** | 0.46*** | 0.28*** | 0.05*** | 509 |
| CSRCOM | 20.70*** | 23.39*** | 21.56*** | 16.24*** | |
| UNSIGN | 12.93*** | 12.68*** | 16.67*** | 6.71*** | |
| DEVELOPED | −6.16*** | 11.26*** | −7.77*** | 4.08*** | |
| _CONS | 28.14*** | 21.69*** | −28.36*** | 35.85*** | |
| Obs. | 1,180 | 1,180 | 1,180 | 1,180 | |
| R ² | 0.6082 | 0.6269 | 0.5572 | 0.1601 | |
| VIF | 1.15 | 1.15 | 1.15 | 1.15 | |
| Breusch-Pagan test | 21.69** | 8.18*** | 30.95*** | 0.77*** | |
| Durbin-Watson test | No endogenous | No endogenous | No endogenous | No endogenous | |
| Wald χ^2 test | 1,823.97 | 1,974.31 | 1,478.34 | 224.00 | Table 5. Results for H1 |
| Hausman test | Random effects | Random effects | Random effects | Random effects | |

Notes: *** $p < 0.01$, ** $p < 0.05$
Source: Created by authors

was similar in terms of signal to those of the sub variables: environmental performance, social performance and governance performance. The findings show that companies that have signed the UN Global Compact also tend to have greater engagement in ESG. The degree of development of a country negatively affects ESG performance, that is, companies operating in developed countries do not necessarily have higher ESG performance.

These results support the *H1*, as innovation was predicted to have a positive effect on the ESG performance of companies in the energy sector. These findings confirm the indications of previous studies (Nirino *et al.*, 2021; Song *et al.*, 2020; Yang and Zhu, 2022), which indicate that ESG practices can be a powerful source of competitive advantage, if combined with investment in innovation.

The results indicated that the country's degree of development positively affects the environmental and governance pillars. This result is in line with previous studies (Maama, 2021; Mooneeapen et al., 2022), which showed that countries with better regulatory quality, companies perform better in corporate governance, as well as they are subject to stricter environmental rules. The negative association between ESG and the country's level of development may indicate that, when developing ESG policies and practices, companies help alleviate social problems, especially in emerging countries.

Table 6 presents the results obtained with the operationalization of eight models. The first four models show how ESG performance affects companies' economic performance and the following four models demonstrate how ESG performance affects organizations' financial performance. These models were constructed to test *H2*.

The results demonstrate that ESG performance, environmental performance and governance performance positively affect the company's economic performance. In other words, companies that invest in additional issues, such as ESG, have higher annual revenue. The results also show that companies that have signed the UN Global Compact with headquarters in developed countries tend to have better economic performance.

Regarding the effect of ESG performance on the company's financial performance, the data show that ESG performance, ESG performance positively affect financial performance. Thus, companies that invest more in socio-environmental issues tend to have a higher return on their assets. This finding corroborates previous studies (El Khoury *et al.*, 2022; Shakil *et al.*, 2019) which point to a significant positive relationship between corporate social

Table 6.
Results for H2

| Dep. variable Variables | Model 5 REV Coef. (sig) | Model 6 REV Coef. (sig) | Model 7 REV Coef. (sig) | Model 8 REV Coef. (sig) | Model 9 ROA Coef. (sig) | Model 10 ROA Coef. (sig) | Model 11 ROA Coef. (sig) | Model 12 ROA Coef. (sig) |
|----------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|--------------------------------|
| ESG | 0.64* | 0.64** | | | 0.02*** | 0.01*** | | |
| ENVIR | | | 0.05 | | | | 0.01*** | |
| SOCIA | | | | 0.45** | | | | 0.06*** |
| GOVER | | | -6.42 | -12.69 | 0.17*** | 0.19*** | 0.35*** | 0.52*** |
| CSRCOM | -19.69 | -22.12 | 39.46** | 37.21** | 0.15*** | 0.15*** | 0.26*** | 0.48*** |
| UNSIGN | 28.43* | 26.11 | 22.11 | 20 | -0.36*** | -0.30*** | -0.39*** | -0.50*** |
| DEVELOPED | 25.18 | 28.41* | 29.11 | 14.54 | 8.88*** | 9.08*** | 9.13*** | 9.25*** |
| _CONS | 11.43 | 14.83 | | 1.178 | | | | |
| Obs. | 1,178 | 1,178 | 1,178 | 1,178 | 1,200 | 1,200 | 1,200 | 1,200 |
| R ² | 0.2619 | 0.1118 | 0.7449 | 0.1625 | 0.4117 | 0.4340 | 0.3482 | 0.3166 |
| VIF | 1.53 | 1.45 | 1.47 | 1.17 | 1.53 | 1.45 | 1.47 | 1.17 |
| Breusch-Pagan test | 0.314** | 105.96** | 0.56*** | 28.86*** | 0.01** | 3.65** | 2.56* | 0.03* |
| Endogenous regressors | No | No | No | No | No | No | No | No |
| Wald x ² test | 10.11 | 12.41 | 7.09 | 10.14 | 836.15 | 916.39 | 638.32 | 553.62 |
| Hausman test | Random | Random | Random | Random | Random | Random | Random | Random |

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$
Source: Created by authors

performance by ESG actions and financial performance. This confirms *H2*, which predicted that ESG performance would have a positive effect on the economic and financial performance of companies in the energy sector.

According to Wirawan *et al.* (2020), investors consider ESG's performance before investing in emerging markets, as ESG's high-performing organizations tend to have robust risk management, which confirms that companies that have social responsibility actions attract more attention from all stakeholders, which includes investors.

Energy companies that include ESG management in their daily activities reduce the risks of environmental accidents, which improves the corporate image. Furthermore, investing in ESG conveys the idea to society that the company handles natural resources well, consequently reducing the environmental risks of its operations and limiting the fall of its shares on the market due to involvement in environmental controversies. This draws the attention of potential shareholders who decide to invest in companies with better ESG performance.

The findings also reveal that the presence of a sustainability committee in the company positively affects financial performance. In addition, companies that are signatories to the Global Compact tend to have higher ROA. Unlike the finding for the variable revenue, the results show that the degree of development of the country may not be decisive for its companies to have a better ROA. In practice, this means that companies based in emerging countries tend to perform better financially.

A robustness analysis was conducted to collaborate with the previous results, as shown in Table 7. In this respect, Models 13, 14 and 15 exclude information from the year 2020, as in that year the companies were affected by the covid-19 pandemic, and this could modify the results of the analyses. Models 16, 17 and 18 restrict the sample, excluding American companies, as they account for 44% of the total sample. The results could be considered biased if this procedure was not performed.

Despite the operationalized modifications in the sample, the results are generally in line with previous findings. Therefore, it can be confirmed that innovation has a positive and significant effect on ESG performance, indicating that companies that invest more in R&D

| Dep. Variable | Model 13 | Model 14 | Model 15 | Model 16 | Model 17 | Model 18 |
|--------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Variables | ESG | REV | ROA | ESG | REV | ROA |
| | Coef. (sig) | Coef. (sig) | Coef. (sig) | Coef. (sig) | Coef. (sig) | Coef. (sig) |
| ESG | | 0.63 | 0.01*** | | 1.244*** | 0.02*** |
| INNOVT | 0.28** | | | 0.22*** | | |
| CSRCOM | 21.54*** | -18.90 | 0.21*** | 16.51** | -53.44 | 0.14* |
| UNSIGN | 12.13*** | 14.98 | 0.15*** | 15.65*** | 38.18 | 0.33*** |
| DEVELOPED | -5.86*** | 13.63 | -0.36*** | -5.00*** | 21.86 | -0.55*** |
| _CONS | 27.61*** | 22.46 | 8.85*** | 31.39*** | 0.80 | 8.80*** |
| Obs. | 986 | 986 | 986 | 586 | 586 | 586 |
| R ² | 0.6064 | 0.0471 | 0.4185 | 0.5240 | 0.0249 | 0.464 |
| VIF | 1.16 | 1.54 | 1.54 | 1.17 | 1.41 | 1.43 |
| Breusch-Pagan test | 20.53*** | 29.24*** | 0.01*** | 0.34*** | 104.34** | 0.11** |
| Endogenous regressors | No | No | No | No | No | No |
| Wald x ² test | 1,483.71 | 4.76 | 175.99 | 624.15 | 14.57 | 503.03 |
| Hausman test | Random | Random | Fixed | Random | Random | Random |

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Source: Created by authors

Table 7.
Result of the
robustness analysis:
excluding 2020 and
the USA

tend to have higher ESG performance. Thus, investments in R&D not only impact on greater product innovation but also influence the socio-environmental issues of companies, for example, by creating a system to reduce effluents and carbon in the atmosphere. Investing in R&D can also result in better social performance, as innovations can bring benefits to the community around the industry.

The results also confirm *H2*, that is, companies that have greater socio-environmental concern, performing better ESG, tend to have higher economic and financial performance. Therefore, a high level of environmental and social performance and strong corporate governance help organizations maintain stable profitability and less volatile stock prices (Shakil *et al.*, 2019).

The findings of this research are in line with the assumptions of the Stakeholder Theory, to the extent that it is possible to state that companies perform well economically and financially by doing good for society through their ESG performance. To achieve greater ESG performance, organizations must invest in innovation through investments in R&D. Therefore, investing in innovation increases ESG performance and consequently increases the creation of economic and financial value for shareholders. Thus, aligning innovation and ESG is fundamental for a greater corporate reputation before shareholders, as well as it improves the corporate image before other stakeholders.

5. Conclusions

This study aimed to investigate the effect of innovation on ESG performance and, consequently, its influence on the economic and financial performance of companies. To achieve this purpose, the panel data regression model was applied. Investment in R&D was used as a proxy for corporate innovation. To measure ESG performance, indexes collected from the Thomson Reuters Eikon[®] database were used, which presents information on ESG performance of companies worldwide. To measure economic and financial performance, revenue and ROA were used and to measure innovation, investments in R&D were considered.

As a basis for the analyses, the findings showed that companies that tend to invest more financial resources in R&D tend to have higher ESG performance, confirming the research *H1*. This shows that investment in R&D is not necessarily for innovation in products, that is, a company investing in innovation can also improve its production processes, which facilitates the further development of new ideas for the ESG dimensions.

The results of the research also showed that companies that have higher ESG performance tend to have higher economic and financial performance, confirming the research *H2*. This may suggest that the additional costs of investing in ESG activities is lower than the gains that a better ESG performance can bring to the organization. Investing in ESG indicates that the company cares about all its stakeholders and reduces shareholders' risks while investing in an ethical company.

The findings of this paper present important implications for the literature and practice. At the academic level, the results enable us to reconfirm the basis of the Stakeholder Theory, showing that companies which meet the needs of all stakeholders tend to have higher economic and financial performance. ESG practices can include keeping employees motivated to work, customers with a better image of the organization, more satisfied suppliers and community and environment aligned with management. Therefore, these ESG initiatives are instrumental in protecting organizational objectives as well as increasing shareholder value.

Managers may consider investing more resources in R&D to achieve higher ESG performance. The results suggest that energy companies that better allocate their resources

for innovation have better ESG and economic–financial performance. Managers should be aware that ESG is a strategic tool for creating financial and non-financial value for the organization. More than the traditional preparation of a financial report, stakeholders demand another type of information: ESG information.

This need for ESG information on behalf of the stakeholders shows, however, that ESG score elaborated by databases alone is not enough. Therefore, these results invite managers to invest more resources in the preparation of their ESG reports. The results of this research also alert to the possible use of ESG only as *greenwashing*, that is, when a company increases its investments in social and environmental marketing to increase its competitive advantage, but in fact it is not environmentally responsible.

Therefore, policymakers can develop standards that standardize ESG performance in large companies. Policymakers should take into account the importance of this information for stakeholders and the balance between costs and competitive advantage for companies. *Research findings also indicate that there is a negative association between ESG and the country's degree of development. In practice, this means that energy companies are replacing institutional voids in emerging countries with socially responsible practices. In this regard, policymakers can work to strengthen emerging market norms.*

This study is not free of limitations. A limited period of time, within five years, was analyzed, and the information was collected from a single database. In addition, companies based in countries with a certain adherence to global challenges were analyzed. *This research selected certain economic-financial variables. New studies may examine other variables such as market capitalization, Tobin's Q and share price.*

Additionally, future studies may include more years in their analyses, as well as investigate how this adjustment among innovation–ESG–economic and financial performance occurs specifically in companies of emerging countries. *The promotion and dissemination of ESG activities is different in developed and emerging countries.* The geographical context can also be expanded, including institutional-level variables. *Studies may include other theoretical streams to explain ESG performance, for example, Institutional Theory and Varieties of Capitalism Approach.*

References

- Aras, G. and Crowther, D. (2008), "Governance and sustainability: an investigation into the relationship between corporate governance and corporate sustainability", *Management Decision*, Vol. 46 No. 3, pp. 433-448.
- Baran, M., Kuźniarska, A., Makiela, Z.J., Ślawik, A. and Stuss, M.M. (2022), "Does ESG reporting relate to corporate financial performance in the context of the energy sector transformation? Evidence from Poland", *Energies*, Vol. 15 No. 2, p. 477.
- Chen, C.D., Su, C.H. (Joan) and Chen, M.H. (2022), "Understanding how ESG-focused airlines reduce the impact of the COVID-19 pandemic on stock returns", *Journal of Air Transport Management*, Vol. 102, p. 102229.
- Costa, A.J., Curi, D., Bandeira, A.M., Ferreira, A., Tomé, B., Joaquim, C., Santos, C., Góis, C., Meira, D., Azevedo, G., Inácio, H., Jesus, M., Teixeira, M.G., Monteiro, P., Duarte, R. and Marques, R.P. (2022), "Literature review and theoretical framework of the evolution and interconnectedness of corporate sustainability constructs", *Sustainability (Switzerland)*, Vol. 14 No. 8, pp. 1-23.
- Costa, C., Lages, L.F. and Hortinha, P. (2015), "The bright and dark side of CSR in export markets: its impact on innovation and performance", *International Business Review*, Vol. 24 No. 5, pp. 749-757.
- Du, K. and Li, J. (2019), "Towards a green world: how do green technology innovations affect total-factor carbon productivity", *Energy Policy*, Vol. 131, pp. 240-250.

- Eccles, R.G., Ioannou, I. and Serafeim, G. (2014), "The impact of corporate sustainability on organizational processes", *Nber Working Paper Series*, pp. 1-35, doi: [10.1007/s13398-014-0173-7](https://doi.org/10.1007/s13398-014-0173-7).
- El Khoury, R., Nasrallah, N., Harb, E. and Hussainey, K. (2022), "Exploring the performance of responsible companies in G20 during the COVID-19 outbreak", *Journal of Cleaner Production*, Vol. 354, p. 131693.
- Erdoğan, S., Yıldırım, S., Yıldırım, D.Ç. and Gedikli, A. (2020), "The effects of innovation on sectoral carbon emissions: evidence from G20 countries", *Journal of Environmental Management*, Vol. 267, pp. 1-10.
- Erhart, S. (2022), "Take it with a pinch of salt - ESG rating of stocks and stock indices", *International Review of Financial Analysis*, Vol. 83, p. 109008.
- European Commission (2015), "A map of social enterprises and their eco-systems in Europe", Synthesis Report, available at: <https://ec.europa.eu/social/BlobServlet?docId=12987&langId=en> (accessed 13 December 2022).
- Freeman, R.E. (1984), *Strategic Management: A Stakeholder Approach*, 1st ed., Pitman/Ballinger, Boston.
- Galbreath, J. (2018), "Is board gender diversity linked to financial performance? The mediating mechanism of CSR", *Business and Society*, Vol. 57 No. 5, pp. 863-889.
- Grushina, S.V. (2017), "Collaboration by design: stakeholder engagement in GRI sustainability reporting guidelines", *Organization and Environment*, Vol. 30 No. 4, pp. 366-385.
- Harrison, J.S. and Freeman, R.E. (1999), "Stakeholders, social responsibility, and performance: empirical evidence and theoretical perspectives", *Academy of Management Journal*, Vol. 42 No. 5, pp. 479-485.
- Hassan, A. and Kouhy, R. (2015), "From environmentalism to corporate environmental accountability in the Nigerian petroleum industry do green stakeholders matter?", *International Journal of Energy Sector Management*, Vol. 9 No. 2, pp. 204-226.
- Hughes, M., Chang, Y.Y., Hodgkinson, I., Hughes, P. and Chang, C.Y. (2021), "The multi-level effects of corporate entrepreneurial orientation on business unit radical innovation and financial performance", *Long Range Planning*, Vol. 54 No. 1, p. 101989.
- Kalia, D. and Aggarwal, D. (2023), "Examining impact of ESG score on financial performance of healthcare companies", *Journal of Global Responsibility*, Vol. 14 No. 1, pp. 155-176.
- Katsikeas, C.S., Morgan, N.A., Leonidou, L.C. and Hult, G.T.M. (2016), "Assessing performance outcomes in marketing", *Journal of Marketing*, Vol. 80 No. 2, pp. 1-20.
- Kehrel, U. and Sick, N. (2014), "Economic and technological forecasting competencies of German energy companies: empirical insights from annual reports", *International Journal of Energy Sector Management*, Vol. 8 No. 4, pp. 588-610.
- Keupp, M.M., Palmié, M. and Gassmann, O. (2012), "The strategic management of innovation: a systematic review and paths for future research", *International Journal of Management Reviews*, Vol. 14 No. 4, pp. 367-390.
- Kumar, A., Gupta, J. and Das, N. (2022), "Revisiting the influence of corporate sustainability practices on corporate financial performance: an evidence from the global energy sector", *Business Strategy and the Environment*, Vol. 31 No. 7, pp. 3231-3253.
- Li, C., Ba, S., Ma, K., Xu, Y., Huang, W. and Huang, N. (2023), "ESG rating events, financial investment behavior and corporate innovation", *Economic Analysis and Policy*, Vol. 77, pp. 372-387.
- Lokuwaduge, C.S.D.S. and Heenetigala, K. (2017), "Integrating environmental, social and governance (ESG) disclosure for a sustainable development: an Australian study", *Business Strategy and the Environment*, Vol. 26 No. 4, pp. 438-450.

- Lorca, P. and de Andrés, J. (2019), "The importance of cultural factors in R&D intensity", *Cross-Cultural Research*, Vol. 53 No. 5, pp. 483-507.
- Maama, H. (2021), "Institutional environment and environmental, social and governance accounting among banks in West Africa", *Meditari Accountancy Research*, Vol. 29 No. 6, pp. 1314-1336.
- Mishra, D.R. (2017), "Post-innovation CSR performance and firm value", *Journal of Business Ethics*, Vol. 140 No. 2, pp. 285-306.
- Mooneepapen, O., Abhayawansa, S. and Mamode Khan, N. (2022), "The influence of the country governance environment on corporate environmental, social and governance (ESG) performance", *Sustainability Accounting, Management and Policy Journal*, Vol. 13 No. 4, pp. 953-985.
- Nirino, N., Santoro, G., Miglietta, N. and Quaglia, R. (2021), "Corporate controversies and company's financial performance: exploring the moderating role of ESG practices", *Technological Forecasting and Social Change*, Vol. 162, p. 120341.
- Oliveira, J., da S., Azevedo, G.M., do, C. and Silva, M.J.P.C. (2019), "Institutional and economic determinants of corporate social responsibility disclosure by banks: institutional perspectives", *Meditari Accountancy Research*, Vol. 27 No. 2, pp. 196-227.
- Padgett, R.C. and Galan, J.I. (2010), "The effect of R&D intensity on corporate social responsibility", *Journal of Business Ethics*, Vol. 93 No. 3, pp. 407-418.
- Pástor, L., Stambaugh, R.F. and Taylor, L.A. (2021), "Sustainable investing in equilibrium", *Journal of Financial Economics*, Vol. 142 No. 2, pp. 550-571.
- Pedersen, L.H., Fitzgibbons, S. and Pomorski, L. (2021), "Responsible investing: the ESG-efficient frontier", *Journal of Financial Economics*, Vol. 142 No. 2, pp. 572-597.
- Pinheiro, A.B., Oliveira, M.C. and Lozano, M.B. (2022), "The mirror effect: influence of national governance on environmental disclosure in coordinate economies", *Journal of Global Responsibility*, Vol. 13 No. 4, pp. 380-395.
- Pucheta-Martínez, M.C. and Gallego-Álvarez, I. (2019), "Corporate environmental disclosure practices in different national contexts: the influence of cultural dimensions", *Organization and Environment*, Vol. 33 No. 4, pp. 1-27.
- Saenz, C. and Brown, H. (2018), "The disclosure of anticorruption aspects in companies of the construction sector: main companies worldwide and in Latin America", *Journal of Cleaner Production*, Vol. 196, pp. 259-272.
- Shakil, M.H., Mahmood, N., Tasnia, M. and Munim, Z.H. (2019), "Do environmental, social and governance performance affect the financial performance of banks? A cross-country study of emerging market banks", *Management of Environmental Quality: An International Journal*, Vol. 30 No. 6, pp. 1331-1344.
- Shaukat, A., Qiu, Y. and Trojanowski, G. (2016), "Board attributes, corporate social responsibility strategy, and corporate environmental and social performance", *Journal of Business Ethics*, Vol. 135 No. 3, pp. 569-585.
- Sinha Ray, R. and Goel, S. (2023), "Impact of ESG score on financial performance of Indian firms: static and dynamic panel regression analyses", *Applied Economics*, Vol. 55 No. 15, pp. 1742-1755.
- Slacik, J. and Greiling, D. (2020), "Compliance with materiality in G4-sustainability reports by electric utilities", *International Journal of Energy Sector Management*, Vol. 14 No. 3, pp. 583-608.
- Slacik, J., Grüb, B. and Greiling, D. (2022), "New wine in old bottles: governing logics for applying sustainability management control systems in Austrian electric utilities", *International Journal of Energy Sector Management*, Vol. 16 No. 1, pp. 50-77.
- Song, W., Wang, G.Z. and Ma, X. (2020), "Environmental innovation practices and green product innovation performance: a perspective from organizational climate", *Sustainable Development*, Vol. 28 No. 1, pp. 224-234.

- Tan, Y. and Zhu, Z. (2022), "The effect of ESG rating events on corporate green innovation in China: the mediating role of financial constraints and managers' environmental awareness", *Technology in Society*, Vol. 68, p. 101906.
- Tidd, J. and Bessant, J. (2018), "Innovation management challenges: from fads to fundamentals", *International Journal of Innovation Management*, Vol. 22 No. 5, p. 1840007.
- Velte, P. (2017), "Does ESG performance have an impact on financial performance? Evidence from Germany", *Journal of Global Responsibility*, Vol. 8 No. 2, pp. 169-178.
- Widyawati, L. (2020), "A systematic literature review of socially responsible investment and environmental social governance metrics", *Business Strategy and the Environment*, Vol. 29 No. 2, pp. 619-637.
- Wirawan, A.W., Falah, L.J., Kusumadewi, L., Adhariani, D. and Djakman, C.D. (2020), "The effect of corporate social responsibility on the firm value with risk management as a moderating variable", *Journal of Asia-Pacific Business*, Vol. 21 No. 2, pp. 143-160.
- Xu, J., Liu, F. and Shang, Y. (2021), "R&D investment, ESG performance and green innovation performance: evidence from China", *Kybernetes*, Vol. 50 No. 3, pp. 737-756.
- Yang, H. and Zhu, X. (2022), "Research on green innovation performance of manufacturing industry and its improvement path in China", *Sustainability*, Vol. 14 No. 13, p. 8000.

Corresponding author

Alan Bandeira Pinheiro can be contacted at: alanbpinheiro@hotmail.com